ISFL Emission Reductions Monitoring Report Template

Name of the ISFL ER Program and Country:	Oromia Forested Landscape Program (OFLP), Oromia National Regional State Federal Democratic Republic of Ethiopia
Name of the Program Area	Oromia National Regional State
Reporting Period covered in this report	*01-01-2022 to 31-12-2023*
Applicable ERPA Phase and sequence of this Reporting Period *(for example 2nd Reporting period of ERPA Phase 1 that runs from DD-MM-YYYY to DD-MM-YYYY)*	1st Reporting period of OFLP ERPA phase 1
Subcategories included for ISFL Accounting	1. Grass land converted to Forest land 2. Crop land converted to Forest land 3. Forest land converted to Grass land 4. Forest land converted to Crop land
Number of ISFL ERs:	15,078,897 tCO2eq
Quantity of ERs allocated to the Uncertainty Buffer	1,456,898 tCO2eq
Quantity of ERs to allocated to the Reversal Buffer:	1,675,433 tCO2eq
Date of submission	14-*01-2025*

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List of acronyms

AD	Activity Data
AFOLU	Agriculture Forest and Other Land Use
AGB	Above Ground Biomass
AGC	Above Ground Carbon
AGP	Agricultural Growth Program
ANR	Assisted Natural Regeneration
API	Application Programming Interface
AR	Afforestation Reforestation
BAU	Business As Usual
BERSMP	Bale Eco-Region Sustainable Management Program
BGB	Below Ground Biomass
BGC	Below-ground carbon
BioCF ISFL	Bio carbon Fund Initiative for Sustainable Forest landscape
BioCF T3	BioCarbon Fund Tranche Three
BoA	Bureau of Agriculture
BoF	Bureau of Finance
BoL	Bureau of land
BoWE	Bureau of Water and Energy
BSOM	Benefit sharing Operational Manual
BSP	Benefit Sharing Plan
CALM	Climate Action Through Landscape Management
CATS	Carbon Assets Tracking System
CBOs	Community Based Organizations
CDA	Cooperative Development and Association
CDM	Clean Development Mechanism
CEO	Collect Earth Online
CHS	Community Health and Safety
CI	Confidence Interval
CIG	Common Interest Group
CO_2	Carbon Dioxide
CPA	Cooperative Promotion Agency
CPP	Consultation & Participation Plan
CRGE	Climate Resilience Green Economy
CSA	Climate Smart Agriculture
DA	Development Agent
DP	Development Partner
DW	Dead wood
ECFF	Ethiopian Coffee Forest Forum
EDA	Environmental Development Association
EEPA	Ethiopian Environmental Protection Authority
EF	Emission Factor
EFCCC	Environment, Forest and Climate Change Commission
EFD	Ethiopian Forestry Development
ER	Emission Reduction
ERC	Emission Reduction Credit

ERP	Emission Reduction Project
ERPA	Emission Reduction Purchase Agreement
ERPD	Emission reduction Program Document
ESCP	Environmental and social Commitment Plan
ESDDA	Environmental and Social Due Diligence Audit
ESF	Environmental and Social Framework
ESHS	Environmental, Social, Health, and Safety
ESMF	Environmental and social Management Framework
ESMP	Environmental and Social Management Plan
ESRM	Environmental and Social Risk Management
EU	European Union
EWNRA	Ethiopian wetland and Natural Resource Association
FAO’s	Food and Agricultural Organization
FCC	False Color Composite
FCPF	Forest carbon Partner Facility
FGRM	Feedback Grievance Redress Mechanisms
FMC	Forest Management Cooperative
FMP	Forest Management Plan
FMT	Facility Management Team
FREL	Forest Reference Emission Level
FRL	Forest Reference Level
FSD	Forest for Sustainable Development
FSDP	Forest for Sustainable Development Program
GAP	Gender Action Plan
GWDDB	Global Wood Density Database
GDP	Growth Domestic Products
GEE	Google Earth Engine
GHG	Green House Gas
GLI	Green Legacy Initiative
GPG	Good Practice Guidance
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism Manual
GTP	Growth and Transformation Plan
HH	House Hold
ICS	Improved Cook Stove
IDPM	Institute for Development Policy and Management
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ISFL	Initiative for Sustainable Forest Landscapes
ISFL ER	Initiative for Sustainable Forest landscape Emission Reduction
LFSDP	Livestock and Fisheries Sector Development Project
LIFT	Land Investment for Transformation
LLRP	Lowlands Livelihood Resilience Project
LMP	Labor Management Procedure
LUC	Land Use Cover

LUCF	Land Use Change and Forestry
LULC	Land Use Land Cover
LULUCF	Land Use and Land Use Change and Forestry
M&E	Monitoring and Evaluation
MCMC	Markov Chain Monte Carlo
MEFCC	Ministry of Environment, Forest and Climate Change
MELCA	Movement for Ecological Learning and Community Action
MoF	Ministry of Finance
MoPD	Ministry of Planning and Development
MoU	Memorandum of Understanding
MR	Monitoring Report
MRV	Monitoring Reporting and Verification
Mt CO_2eq	Million tons of Carbon dioxide equivalent
NBPE	National Biogas Program of Ethiopia
NDCs	Nationally Determined Contributions
NDFI	Normalized Difference Fraction Index
NDVI	Normalized Difference Vegetation Index
NFI	National Forest Inventory
NFMS	National Forest Monitoring System
NFR	National Forest Regulation
NGO	Non-Government Organization
NICFI	Norway's International Climate and Forest Initiative
NRLAIS	National Rural Land Administration Information System
NRM	Natural Resource Management
NRS	National REDD+ Secretariat
OEFCA	Oromia Environmental Forest and Climate Change Authority
OEPA	Oromia Environmental Protection Authority
OFLP	Oromia Forested Landscape Program
OFLP-ERP	Oromia Forested Landscape Program Emission Reduction Project
OFWE	Oromia Forest and Wildlife Enterprise
ORCU	Oromia REDD+ Coordination Unit
PDF	Probability Distribution Function / Probability Density Function
PDO	Program Development Objectives
PF	Process Framework
PFM	Participatory Forest Management
PPE	Personal Protective Equipment
PSIDP	Participatory Small-scale Irrigation Development Program
QA/QC	Quality Assurance/ Quality Control
rBG/AG:	Below ground biomass/above ground biomass).
REDD+	Reducing Emission from Deforestation and forest Degradation
REL	Reference Emissions Level
RLLP	Resilient Landscape and Livelihood Project
RMIP	Rangeland Management and Investment Plans
RPF	Resettlement Policy Framework
RSC	Regional Steering Committee
RTWG	Regional Technical Working Group

SE	Slandered Error
SEA	Sexual Exploitation and Abuse
SEAH/GBV	Sexual Abuse /Sexual Harassment or Gender Based Violence
SEDA	Sustainable Environmental and Development Action
SEP	Stakeholder Engagement Plan
SESA	Strategic Environmental and social Assessment
SH	Sexual Harassment
SIS	Safeguards Information System
SLLC	Second level land holding certificates
SLMP	Sustainable Landscape Management Program
SLMS	Sustainable Land Management System
SOC	Soil Organic Carbon
SU	Sample Unit
SW	South West
SWC	Soil and Water Conservation
TCC	True Color Composite
TWG	Technical Working Group
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nation Framework Convention on Climate Change
USD	United State Dollar
VCS	Verified Carbon Standard
VHR	Very High Resolution
WB	World Bank
WMP	Watershed Management Plan
WoF	Woreda Office of finance
WUA	Watershed User Association
YCFBR	Yayu Coffee Forest Biosphere Reserve

Executive Summary

Ethiopia is one of the countries in Africa extensively engaged in jurisdictional level REDD+ GHG emission reduction efforts, leading to achieve zero net emissions and promoting sustainable economic development with the role of natural resources conservation, Sustainable Forest Management, and Enhancement of Forest Carbon stock. In line with this, the country signed the Emission Reduction Purchase Agreement (ERPA) on February 9, 2023, with the World Bank. The contract value of the ERPA is US$ 40 million with an additional for excess ERs under call option of about 20 million USD. According to the agreement, the first phase ERPA contract value is US$15 million for emission reduction volume of 1,807,229 tCO_2eq. The Monitoring report for the first reporting period (2022-2023) of the first ERPA phase has been developed following the ISFL ER Monitoring report template. To Evaluate the OFLP-ERP emission reduction performance during the reporting period, activity data (AD) collection and analysis was focused on six key land use change classes. The subcategories were forest to cropland, forest to grassland, forest to shrub land, cropland to forest, grassland to forest and shrub land to forest. Most importantly, the same emission factor (EF) values have been used for both baseline and monitoring period emission reduction assessments. Specifically, EF value of 333.6 tCO2eq per hectare was used for forest to cropland and forest to grassland transitions whereas 342.83 tCO2eq per hectare was used for forest to shrub land transitions. Additionally, for all reforestation/afforestation areas, the emission factors were divided by 20 years to calculate the removal factor. This approach ensures consistency in the emission factor values used across the different assessment periods.

The baseline used to estimate the emission reductions in this report has been updated compared to the baseline contained in the validated ERPD. The updated baseline is detailed in Annex 4 of this report. The collected activity data (AD) and analysis for the updated baseline over the period 2007-2017 indicated significant deforestation during that time: Forest converted to cropland: 234,676.75 hectares (78,303,809.60 tCO_2eq), Forest converted to grassland: 48,857.62 hectares (16,302,158.30 tCO_2eq) and Forest converted to shrub land: 29,234.48 hectares (10,022,552.80 tCO_2eq). In total, the baseline assessment showed 312,768.85 hectares of forest were converted to other land uses during the 2008-2017 periods, corresponding to 104,628,520.79 tCO_2eq of emissions. In the reporting period (2022-2023), significant reduction in deforestation was achieved when compared to the baselines. During this period, the

conversion was only from Forest to cropland: 16,012 hectares (5,342,670.67 tCO2eq). Thus, emission per year during the baseline and monitoring period is 10,462,852.08 tCO2eq and 2,671,335.333 tCO_2eq, respectively.

Total Emission Reductions achieved during the reporting period is 18,211,228 tCO_2eq including emissions reduced through removals from 29,056 ha of land. Emission Reductions estimate after uncertainty buffer (1,456,898 tCO_2eq) and Reversal Risk (1,675,433 tCO_2eq) set-aside is 15,078,897 tCO_2eq. Accordingly, Potential Emission Reductions that can be reported to the ISFL would be 15,078,897 tCO_2eq.

1 Implementation status of the ISFL ER Program

1.1 Implementation status of the ISFL ER Program

The Oromia Forested Landscape Program (OFLP) is the first jurisdictional forest landscape pilot program implemented in Oromia Regional State addressing the drivers of Agriculture Forest and Other Land Use (AFOLU) through targeted on ground interventions and investments on enabling environment ensuring the coordination and collaboration of multi-level and multi-actors financed projects across the region enhancing synergy, improved program outcomes and leveraging other resources to fill financial gaps needed to achieve the Emission Reduction (ER) program goals.

The Program aims to promote integrated low carbon landscape management through on ground investment and creation of enabling environment for addressing of deforestation, reducing land-use based emissions (including emission reduction from livestock), and enhancing forest carbon stocks at statewide level and sustainable forest management through Afforestation, Reforestation (A/R) and Participatory Forest Management (PFM) contributing to Ethiopia's Climate-Resilient Green Economy (CRGE) Strategy goals and its Nationally Determined Contribution (NDC).

As described in the Emission Reduction Program Document (ERPD), the activities leading to the emission reductions are a combination of interventions financed by the OFLP upfront grant provided by the Initiatives for Sustainable Forest Landscape (ISFL) but also due to other relevant investments and interventions across the region.

The Oromia Forested Landscape Program-Emission Reduction Project (OFLP-ERP), is the constitutive of OFLP aimed to contributes to the key national strategies, like the Ten-Year Prospective Development Plan; the updated Nationally Determined Contribution(NDC) of July 2021; the Ethiopian Food System; the Climate Resilient Green Economy (CRGE) Strategy and the 2015 sectoral Climate Resilience Strategies for Agriculture and Forest; the National Forest Sector Development Program; the National Reducing Emission from Deforestation, Forest Degradation, Conservation forest Carbon Stock and Enhancement of Forest Carbon Stock, Sustainable management of Forest, (REDD+) Strategy; and sector strategies for energy, water, and agriculture with Specific goals on economic growth, poverty reduction, jobs, food and water security, forest protection and expansion, climate change adaptation and mitigation, conservation of biodiversity, and development of mechanisms for payment for ecosystems services.

In addition to the World Bank's twin goals of ending extreme poverty and boosting shared prosperity by 2030, the OFLP-ERP directly contributes to the federal government strategies, programs, projects and initiatives through investment activities in natural resource management and in reducing vulnerability to climate shocks. The project also supports the objective of 'Enhanced management of natural resources and climate risks' through improved natural resources and forest management leading to preservation of critical biodiversity resources and national ecosystem assets including soil, water, important flora and fauna, genetic wealth and land resource. The project contributes to the implementation of the World Bank Forest Action Plan (2016) through promoting sustainable forestry and institutional development for measurable improvements of forest management. Furthermore, the project is in line with the implementation of the World Bank Group's Climate Action Plan (2021–2025), in particular towards mobilizing capital and expanding access to green financing, as well as achieving improvements in climate change adaptation and resilience. The rationale for convening resources programmatically for forest landscape management in Ethiopia is to harness the potential of forest and agriculture landscapes, enhance natural wealth and ensure resilient, low carbon growth and poverty reduction. The following table provides an implementation status update of the activities.

Table 1: Interventions addressing drivers of deforestation and forest degradation in Oromia achieved by the OFLP upfront grant and other investments (projects/programs) financed by government and Development Partners.

Interventions	Type of intervention (sector)	Status
OFLP - Forest management investment in deforestation hotspots • Participatory Forest Management and Livelihoods	Forestry	<u>Completed Activities</u> ✓ 210,592ha of natural forest demarcated and managed under PFM ✓ 129 PFM cooperatives established (30% female members) and managing the above 210,592ha of Forest using respective forest management plan (FMP)

Interventions	Type of intervention (sector)	Status
• Afforestation / Reforestation (A/R) activities and Livelihood	Forestry	✓ AR activities completed with restoration of 9, 673.04 Ha of parcel of communal and private pooled lands converted into new forest ✓ 408 coops are organized and legalized to develop and manage the above A/R land of which 394 A/R cooperatives benefited from livelihoods activities. Overall, 514 coops (394 A/R and 120 PFM) have benefited from livelihoods activities with total beneficiaries of 50,686, of which 17, 970 are female beneficiaries. ✓ 27,478(10,327F) members of the above beneficiaries are capacitated on different livelihood intervention/Business skills
REDD+ Investment in Ethiopia (2016 - 2020) Phase I and II ✓ Assisted Natural Regeneration (ANR) ✓ Afforestation/Reforestation (A/R)	Forestry	Completed Activities ✓ 278,296 ha degraded forest land protected through ANR ✓ 23,472 ha of land covered by forest through afforestation and reforestation
✓ PFM (protection)	Forestry	✓ About 516,500 ha of natural forest put under participatory forest management (PFM)
Oromia Forest and Wildlife Enterprise (OFWE)- Forest Resources Development,		Completed Activities ✓ 62,918 ha is t plantation forest (seasonal harvest and re-planting cycles depending on maturity), but OFWE's plantations

Interventions	Type of intervention (sector)	Status
Conservation, and Sustainable Utilization Afforestation/Reforestation ✓ PFM	Forestry Forestry	size within its concession remain the same throughout the years. ✓ 144,854 ha PFM established using the OFLP grant project (already reported above under the OFLP grant PFM investment, i.e. (part of the 210,592 ha). Currently, total PFM in OFWE concession area is 1,678,530 hectares of forest managed by 581 CBOs/Coops signing joint management of forest with OFWE.
Bale Eco-region REDD+ Pilot Project Phase II		Completed Activities
PFM and Enrichment planting	Forestry	• Total area under PFM is 671,397 ha (i.e. 583,823 ha under PFM established prior to year 2017 and 87,574 ha newly established PFM after 2017, mostly in project's second phase operation in Guji forests). Please note, achievements of Bale Eco region project are also counted as achievement of (OFWE) as the two entities develop PFM jointly. • Total number of Community Based Organization (CBOs) established are 127 Total estimate Emission Reduction Credits (ERCs) generated by Bale Ecoregion REDD+ Project from 2012 to 2021 is 13.66 Million tons of Carbon dioxide equivalent (Mt CO2eq)

Interventions	Type of intervention (sector)	Status
National Biogas Program of Ethiopia (NBPE II and NBPE+)	✓ Energy	✓ Around 4,133 biogas digesters are established in Oromia; of these, 57-72% are considered functional. ✓ Oromia Water and Energy bureau have been working on energy technological distributions through constituting different projects ✓ Distributed 3,716,417 Integrated Cook stoves (ICS), SHS 319,940 and 7,571 biogas digesters planted at House Hold (HH) level
Oromia Bureau of Water and Energy (OBWE)	Forestry	Completed Activities ✓ Around 7,571biogas digesters have been established in Oromia through the (National Biogas Program of Ethiopia, (NBPE I) and (NBPE II) of these, 57-72% is considered functional. ✓ Oromia Water and Energy bureau has been working on energy technology distributions through different investments. ✓ Distributed 3,716,417 improved cook stoves (ICS), 319,940 small household solar system (SHS)
REDD+ Joint Forest Management in Five Woredas in Illu Ababora Zone of Oromia Regional State -	Forestry	Completed activities ✓ Since 2017, 27 new PFM cooperatives have been established and registered, managing a total of 56,631 ha of natural forests in four woredas of Southwest

Interventions	Type of intervention (sector)	Status
Phase II Project		(SW) Oromia (Becho, Ale, Didu and Halu). ✓ Before 2017, in adjacent woreda of Sele Nono, 19 PFM cooperatives were registered/legalized and established, managing close 129,590 ha of natural forest under the PFM modality. This brings SW Ethiopia REDD+ project's total PFM achievement to 186,221 ha with total number of registered cooperatives managing these forests to 46 across 5 woredas of Southwest Oromia. ✓ It should be noted though that this project's work is a joint OFWE –at southwest Ethiopia REDD+ Project undertaking. These results are also reflected in OFWE's total PFM result.
FARM AFRICA, SOS Sahel Ethiopia	Land Use Land Cover Change (LULC)	Completed activity ✓ Farm Africa is the pioneer program that laid a robust foundation for sustainable forest management approach (PFM) ✓ Under Farm Africa Forest for Sustainable Development Program (FSDP) has been working on emissions reduction from Deforestation and Forest Degradation (REDD+) phase I and II projects has established the PFM on 671,397.71 ha of natural forest and cooperate under 128 PFM Cooperatives with 63750(14,531F)

Interventions	Type of intervention (sector)	Status
		members.
Digital green foundation and Environmental and coffee forest forum	LULC	<u>Ongoing activities</u> ➢ The project is Working on Deforestation, forest degradation and Biodiversity conservation aiming to improve the livelihood of forest dependent communities with a total budget of 39 mill for the period from August 2022-July 2025
Mass Mobilization for Natural Resource Management (NRM)	AFOLU[1]	<u>Completed activities</u> ➢ Mass mobilization-based water shade development ➢ Government Green Legacy Initiatives (GLI) sustains water shade development and contributed: ✓ 55,032 ha planted in 2022 season ✓ 376,141 ha planted in 2023 season

AFOLU: Agriculture, Forestry and Other Land Use

Interventions	Type of intervention (sector)	Status
		✓ 785,949 ha planted in 2024 season • Total: 1,217,122 hectares planted through the Green Legacy Initiative (GLI) (Source: Oromia Bureau of Agriculture (BoA)
4B tree National Green Development Action Programme of Ethiopia	Forestry	See above Mass Mobilization for NRM section on GLI
Sustainable Land Management Project (SLMP 2)	AFOLU	<u>Completed activities</u> ✓ The project covered 26 woredas in Oromia directly benefiting 73,939 HHs of which, 9,385 were women headed HHs ✓ Area of Land covered by SLMP2 in Oromia was 196,134 hectares. ✓ No. of second Level Land holding certificates (SLLCs) issued under SLMP-2 in Oromia were 118,315, of which, 82,829 were for female holders.
Extension of SLMP 2 - Resilient Landscape and Livelihood Project (RLLP)	AFOLU	<u>Completed activities</u> ▪ RRLP I and RLLP II have targeted and implemented 62 major watershed restorations and 694 micro watersheds in 62 woredas of Oromia from 2019 to the end of 2024. Total rural woredas coverage being about 24%. ▪ The RLLP program has targeted 254,358 households (HH) in Oromia with a range of land restoration activities involving communities with

Interventions	Type of intervention (sector)	Status
		land holding size of more than half a hectare of rural land. 56,745 women benefited from income generation/livelihoods support in Oromia during the two RLLP phases. ▪ 723,089 Second level land holding certificates (SLLCs) are issued to a total of 255,527 HHs, of which 177,311 women are headed HHs in Oromia during the two phases of the project period.
Lowlands Livelihood Resilience Project (LLRP I)	Agriculture/Livestock	Completed activities ✓ 93,182 ha of land is under sustainable landscape management practices ✓ 16.4 % increase in yield of targeted commodities (Livestock and Crop) ✓ 269,363 Project beneficiaries with improved access to key natural resources (of which 40% or 107,332 female and 26 % or 70,179 are youth) ✓ Six Rangeland Management and Investment Plans (RMIPs) under implementation ✓ 90% of Targeted clients satisfied with livestock, veterinary and agricultural extension services ✓ 385,726 Project direct beneficiaries (of which 42% or 162,387 female and 3% or 11,610 are youth)

Interventions	Type of intervention (sector)	Status
Techno Serve Ethiopia	AFOLU	Ongoing activities ✓ Modern coffee management (stamping old coffee trees to improve living incomes for the farmers with a total budget of above 63 Mill ETB for the period of Oct.2021- Sept. 2026
Solidaridad Ethiopia		Ongoing Activities ✓ The project is working on transformation dairy sectors of Oromia through promoting climate smart dairy farming practices Climate Smart dairy from sustenance to running professional for the period of Nov 2022 up to Dec 2025 with the total budget of 50 Mill. ETB
Climate Action Through Landscape Management (CALM) –World Bank (WB) financed	AFOLU	Completed activities ✓ Total number of second level land holding certificates (SLLCs) issued through CALM in Oromia up to March 2024 is 3,078,896 (out of 3,726,111 total demarcated to date) ✓ The National Rural Land Administration Information System (NRLAIS) is established in 157 woredas under CALM up to March 2024 in Oromia. ✓ 867,877 hectares of land area is under sustainable landscape management practices through CALM in Oromia

Interventions	Type of intervention (sector)	Status
		✓ 466,344 (141,134 female) members in the Program watersheds organized as Watershed User Association (WUA), registered, and with approved Watershed Management Plan (WMP). 1430 (WUA) organized through CALM in Oromia.
Environmental Development Association(EDA)Ethiopia	AFOLU	Ongoing activities ✓ Environmental rehabilitation and conservation to improve living conditions and incomes of beneficiaries
Sustainable Environment and development Action (SEDA)	AFOLU	Ongoing activities ✓ The project is working on Improving climate change impacts through adaptation and mitigation actions with a total budget of 21.4 Mil ETB for the period of Nov 2010 up to Nov 2015
MELCA (Movement of Ecological Learning and Community Action) Ethiopia	AFOLU	Ongoing activities The project has been working on sustainably conserving important ecosystems as well as improving the target communities' resilience to climate change and socio-economic challenges for the period of June, 2021 to May, 2026 with a total budget of 25.6 mill ETB.
SLLCs by Land Investment for Transformation (LIFT), government and other	Land Tenure/land Administration	Completed activities First round land Certificate ➢ 294 woredas 6,478 kebele with total of 35,369,000 parcel of land certified for 22,

Interventions	Type of intervention (sector)	Status
Development Partner (DP)		820,000 HHs (4,244,280F) 2^{nd} round' ➢ 125 woreda, 9,774,730 parcel of land for 2,205,928 HHs ➢ In Oromia 10,026,507 parcel of land certified in the region from which 9,525,181.65 parcel of land certified for 2,381,295HH (357,194.31F), 10,026.51 parcel of land under institution and 15,039.76 parcel of land under communal scheme
Ethiopian Coffee Forest Forum (ECFF)- Certified Forest Coffee Production and Promotion Project	LUCF	Completed activities ➢ The project is linked with the protection of the Yayu Coffee Forest Biosphere Reserve (YCFBR-UNESCO registered) ✓ 167,021 ha of the YCFBR maintained and under protection and sustainable managed (buffer and transition zones through sustainable management and PFM) up to Yr. 2023 ✓ Dense forest coverage increased by 8,469 ha from 2010 to 2023, ✓ However, size of disbursed forest and cultivated land increased by 5,233 ha and 3,775 ha respectively between 2010 to 2023. ✓ One coffee producing coop was certified by Rain Forest Alliance for Organic coffee production benefiting a

Interventions	Type of intervention (sector)	Status
		total of 415 farmers (of which 68 are women).
Nespresso-East Africa Coffee Project (Nespresso, International Finance Corporation (IFC), and BioCF support)	AFOLU	Completed activities ✓ During 2017-2018, training was provided to 49, 497 (34% women) farmers on various practices that enhance agricultural productivity such as rejuvenation (stumping), weeding, erosion control, shade, nutrition, IDPM, etc. ✓ In addition, through the new coffee improvement (rejuvenation) project financed by ISFL, additional 20,122 farmers were trained in coffee rejuvenation and sustainable agricultural practices during the 2022- 2023 calendar year. Of these, 6017 are female (43%). To date, in total, 69,619 farmers have been trained. Of these, 25,000 have adopted sustainable practices on their farm.
Participatory Small-scale Irrigation Development Program II (PASIDP II) and IFAD	AFOLU	Completed activities ✓ Covered 25 woredas and reached 15,403 beneficiaries ✓ Climate Smart Agriculture activity conducted on 680 ha with 1,517 beneficiaries ✓ SWC conducted on 19181.5ha

Interventions	Type of intervention (sector)	Status
		✓ Conducted hillside communal land treatments, Area Closures, Gully and Riverbank management ✓ Farmland Soil and Water Conservation (SWC) activities **Agroforestry** ✓ Covered 1195.9ha ✓ Improved forage production conducted on 1310ha **Soil fertility management practices** ✓ Implementation of Vermicomposting 1161ha ✓ 1747 Small scale alternative energy sources implemented
Agricultural Growth Program (AGP) I and II	Agriculture, Irrigation development	• To reduce forest and Natural resource dependency AGP I and II has been working on adoption of improved agricultural technologies, Livelihood Enhancement and large / Small modern irrigation development in 181 woredas from 2010 to 2015
Livestock and Fisheries Sector Support Project (LFSDP)	Climate smart Livestock development	<u>Completed activities</u> ▪ LFSDP operates in 18 zones, 23 woredas and 581 kebeles in Oromia ▪ Total beneficiaries are 115,176 people engaged in livestock production, of these 35,805 are women ▪ 2,456 common interest groups (CIG) were organized across red meat, Dairy,

Interventions	Type of intervention (sector)	Status
		poultry and fishery value chains. ▪ Additionally, the CIGs collectively formed 198 marketing cooperatives and 1350 improved breeders' cooperatives ▪ The project has also been working in improved feed development, livestock genetic improvement, animal health, etc., within 23 woredas in Oromia
Extension of SLMP 2 - Resilient Landscape and Livelihood Project (RLLP)	AFOLU	Completed activities ▪ Rural Resilient Livelihood Program I (RRLP I) and RLLP II have targeted and implemented 62 major watershed restorations and 694 micro watersheds in 62 woredas of Oromia from 2019 to the end of 2024. Total rural woredas coverage being about 24%. ▪ The RLLP program has targeted 254,358 households (HH) in Oromia with a range of land restoration activities involving communities with land holding size of more than half a hectare of rural land. 56,745 women benefited from income generation/livelihoods support in Oromia during the two RLLP phases. ▪ 723,089 Second level land holding certificates (SLLCs) are issued to a total of 255,527 HHs, of which 177,311 women are headed HHs in Oromia

Interventions	Type of intervention (sector)	Status
		during the two phases of the project period.
REDD+ Joint Forest Management in Five Woredas in Illu Ababora Zone of Oromia Regional State - Phase II Project	Forestry	Completed activities ✓ Since 2017, 27 new PFM cooperatives have been established and registered, managing a total of 56,631 ha of natural forests in four woredas of SW Oromia (Becho, Ale, Didu and Halu). ✓ Before 2017, in adjacent woreda of Sele Nono, 19 PFM cooperatives were registered/legalized and established, managing close 129,590 ha of natural forest under the PFM modality. This brings SW Ethiopia REDD+ project's total PFM achievement to 186,221 ha with total number of registered cooperatives managing these forests to 46 across 5 woredas of SW Oromia. ✓ It should be noted though that this project's work is a joint OFWE –SW Ethiopia REDD+ Project undertaking. These results are also reflected in OFWE's total PFM result.
Sustainable Land Management Project (SLMP 2)	AFOLU	Completed activities ✓ The project covered 26 woredas in Oromia directly benefiting 73,939 HHs of which, 9,385 were women headed HHs ✓ Area of Land covered by SLMP2 in Oromia was 196,134 hectares.

Interventions	Type of intervention (sector)	Status
		✓ No. of second Level Land holding certificates (SLLCs) issued under SLMP-2 in Oromia were 118,315, of which, 82,829 were for female holders.
Climate Action Through Landscape Management (CALM) - World Bank (WB) financed	AFOLU	<u>Completed activities</u> ✓ Total number of second level land holding certificates (SLLCs) issued through CALM in Oromia up to March 2024 is 3,078,896 (out of 3,726,111 total demarcated to date) ✓ The National Rural Land Administration Information System (NRLAIS) is established in 157 woredas under CALM up to March 2024 in Oromia. ✓ 867,877 hectares of land area is under sustainable landscape management practices through CALM in Oromia ✓ 466,344 (141,134 female) members in the Program watersheds organized as Watershed User Association (WsUA), registered, and with approved Watershed Management Plan (WMP). 1430 Watershed user Associations (WsUA) organized through CALM in Oromia.
4B tree National Green Development Action Programme of Ethiopia	Forestry	See above Mass Mobilization for NRM section on GLI
SLLCs by LIFT - Land	Land	<u>Completed activities</u>

Interventions	Type of intervention (sector)	Status
Investment for Transformation (LIFT) Program, government and other Development Partner (DPs)	Tenure/land Administration	First round land Certificate ➢ 294 woredas 6,478 kebele with total of 35,369,000 parcel of land certified for 22, 820,000 HHs (4,244,280F) 2nd round' ➢ 125 woreda, 9,774,730 parcel of land for 2,205,928 HHs ➢ In Oromia 10,026,507 parcel of land certified in the region from which 9,525,181.65 parcel of land certified for 2,381,295 HH (357,194.31F), 10,026.51 parcel of land under institution and 15,039.76 parcel of land under communal scheme
Ethiopian Coffee Forest Forum-(ECFF)-Certified Forest Coffee Production and Promotion Project	LUCF	Completed activities ➢ The project is linked with the protection of the Yayu Coffee Forest Biosphere Reserve (YCFBR-UNESCO registered) ✓ 167,021 ha of the YCFBR maintained and under protection and sustainable managed (buffer and transition zones through sustainable management and PFM) up to Yr. 2023 ✓ Dense forest coverage increased by 8,469 ha from 2010 to 2023, ✓ However, size of disbursed forest and cultivated land increased by 5,233 ha and 3,775 ha respectively between 2010 to 2023.

Interventions	Type of intervention (sector)	Status
		✓ One coffee producing coop was certified by Rain Forest Alliance for Organic coffee production benefiting a total of 415 farmers (of which 68 are women).
Nespresso-East Africa Coffee Project (Nespresso, International Finance Corporation **(IFC), and BioCF support)**	AFOLU	Completed activities ✓ During 2017-2018, training was provided to 49, 497 (34% women) farmers on various practices that enhance agricultural productivity such as rejuvenation (stumping), weeding, erosion control, shade, nutrition, Institute for Development Policy and Management (IDPM), etc. ✓ In addition, through the new coffee improvement (rejuvenation) project financed by ISFL, additional 20,122 farmers were trained in coffee rejuvenation and sustainable agricultural practices during the 2022- 2023 calendar year. Of these, 6017 are female (43%). To date, in total, 69,619 farmers have been trained. Of these, 25,000 have adopted sustainable practices on their farm.
Lowlands Livelihood Resilience Project – (LLRP) I	Agriculture/Livestock	Completed activities ✓ 93,182 ha of land is under sustainable landscape management practices

Interventions	Type of intervention (sector)	Status
		✓ 16.4 % increase in yield of targeted commodities (Livestock and Crop) ✓ 269,363 Project beneficiaries with improved access to key natural resources (of which 40% or 107,332 female and 26 % or 70,179 are youth) ✓ Six Rangeland Management and Investment Plans (RMIPs) under implementation ✓ 90% of Targeted clients satisfied with livestock, veterinary and agricultural extension services ✓ 385,726 Project direct beneficiaries (of which 42% or 162,387 female and 3% or 11,610 are youth)
Participatory Small-scale Irrigation Development Program II (PASIDP II) and International Fund for Agricultural Development (IFAD)	AFOLU	Completed activities ✓ Covered 25 woredas and reached 15,403 beneficiaries ✓ Climate Smart Agriculture activity conducted on 680 ha with 1,517 beneficiaries ✓ Soil and Water Conservation (SWC) conducted on 19181.5ha ✓ Conducted hillside communal land treatments, Area Closures, Gully and Riverbank management ✓ Farmland SWC conservation activities **Agroforestry**

Interventions	Type of intervention (sector)	Status
		✓ Covered 1195.9ha ✓ Improved forage production conducted on 1310ha **Soil fertility management practices** ✓ Implementation of Vermicomposting 1161ha ✓ 1747 Small scale alternative energy sources implemented

Regarding the organizational structures and partner involvement:

The OFLP-ERP is hosted by Oromia Environmental Protection Authority (OEPA), that was created by regional Proclamation no. 242/2021 taking the role and responsibilities of the previous Oromia Environment, Forest and Climate Change Authority (OEFCCA). The Oromia REDD+ Coordination Unit (ORCU) is housed within OEPA and is the implementing unit that has been coordinating all the landscape initiatives that contributes for OFLP Emission reduction project.

ORCU gets strategic and tactical guidance from the Oromia National Regional State's Vice President, vital for coordinating among` relevant regional sectors institutions (forest, agriculture, livestock, land use and land administration, water, energy, and finance) and the OFLP-ERP Steering Committee. The OFLP-ERP Steering Committee is chaired by the Regional Vice President and brings together the relevant government structures like Bureau of Agriculture (BoA), Bureau of Water and Energy (BoWE), Bureau of Land (BoL), Cooperative promotion Agency (CPA) and the Oromia Forest and Wildlife Enterprise (OFWE). These bureaus and agencies are also the implementing bodies of a lot of the activities implemented under the OFLP-ERP with various roles of coordinating activities on the ground through their woreda offices and kebele DAs (extension agents).

At the federal level, the Ethiopian Forestry Development (EFD) has been established as an autonomous federal institution with a mandate to support forest research and the forestry sector in general. EFD is hosting the National REDD+ Secretariat and the national Forest monitoring and forest inventorying desk. Through the National REDD+ Secretariat and the national Forest monitoring carbon measurement desk, EFD provides technical oversight and a supervisory role over ORCU and the OFLP-ERP, particularly concerning MRV issues and the policy dimensions of the program.

The above mentioned Bureaus, agencies and other relevant sectors are effectively participating in developing strategies, plans and policies that helps to integrated land management system while improving the economic condition of the country with minimum or zero net emissions. To this end, a Memorandum of Understanding (MoU) has been signed among federal and regional entities towards the implementation of the OFLP-ERP. The MoU defines the shared roles and responsibilities of stakeholders and each institution's obligations and mandates in rolling out the OFLP-ERP activities and also serving as a coordination platform to achieve OFLP goals. It is to be recalled that a similar type of MOU was signed solely among regional sector institutions those responsible for implementing the OFLP upfront grant activities completed in June 2023.

1.2 Update on major drivers and lessons learned

Ethiopia’s remaining forest (to which Oromia contributes the largest part) is considered a safety net for those whose livelihoods depend on it and is an asset for its development, ecosystem service provisioning and climate change regulation. A study in 2012/13 estimated the contribution of the forest sector to Growth Domestic Product (GDP) to be about 6.1%: considerably higher than the current official statistics of the sector’s contribution of about 4%, with the largest market income benefits associated with wood fuel and fodder. However, deforestation, forest degradation, and other land use changes continue to be the greatest challenges of preserving the resource base so that it continues providing goods and services expected from it including climate change regulation and resilience at local and global level.

The ERPD identified that sources and agents that contribute to emissions from deforestation and degradation in the Oromia Regional State include expansion of agricultural land, use of inorganic fertilizers, increased demand for fuel wood, poor management of forest coffee plantations, unsustainable logging, excessive grazing, the high demand for forest products, lack of restoration of ecosystems (removal), lack of improvement in the livestock value chain, poor livestock management, and inadequate extension services.

Other drivers include a complex combination of economic social and policy related issues, including absence of national level policy direction for land-use planning and enforcement, lack of cross-sectoral policy and investment coordination, technological & climate change factors; unfavorable socio-political situations particularly the recent insecurity and conflict occurrence in some parts of the region affecting policy implementation and enforcement. The implementation of OFLP-ERP is primarily geared to contribute towards the objectives of the Climate Resilient Green Economy (CRGE) Strategies targets in which all sectoral plans and programs are aligned and integrated in the national plan.

The updated Ethiopia NDC (2021) indicates Land Use Change and Forestry (LUCF) have the largest mitigation potential because of highly ambitious reforestation and forest restoration targets of the government's National Forest Sector Development Program and the Green Legacy Initiative (GLI); Oromia being the largest contributor in this. At the same time, LUCF is the second most important driver of emissions under Business As Usual (BAU) assumptions. Policy interventions reduce the emission level in 2030 to -99.9 Mt CO2eq (under the conditional pathway) which turns the entire sector into a significant GHG sink. This equals a relative reduction of emissions of 171% (-240.1 Mt CO2eq) compared to BAU emissions in LUCF by 2030. The unconditional pathway foresees a reduction of emission levels to 91.8 Mt CO2eq, which represents a relative reduction of 34.6% of sectoral BAU emissions in 2030 (48.4 Mt CO2eq).

The potential for net emission removals in LUCF to be realized through massive reforestation and restoration of a total of up to 15 million hectares (ha) as a long-term forestry sector goal, based on Ethiopia´s Forest Sector Development Plan, the Green Legacy Initiative and Reducing Emissions from Deforestation and Forest Degradation (REDD+) strategic actions. This ambitious plan is expected to increase forest cover to 30% of the national territory by 2030. The other most important driver of LUCF emissions is biomass energy use for cooking and baking which according to international inventory guidelines are accounted under LUCF. Thus, replacing or improving household biomass energy use for cooking and baking would lead to substantively reduced pressure on forestry resources. All in all, these portray the policy options of the sector in the coming ten years.

Characterization of subcategory level main (direct) drivers (emission and removal), the mitigation and enhancement measures as identified in the 1st ERPD (Table 5 and Annex 1), remain largely the same. Progresses of actions and interventions are in line with the plans anticipated then, updated with new additional programs emerged since (such as the Climate Action through Land Management (CALM) and new national targets and interventions set through the National Forest Sector Development Program and GLI (see Table-1 above) for all these updates.

2 System for Measurement, Monitoring and Reporting Emissions and Removals occurring within the Monitoring period

2.1 Forest Monitoring System

A comprehensive MRV framework for conducting forest inventory, monitoring, overseeing, documenting, and verifying forest carbon emissions by sources (deforestation and soforest degradation) and removals by sinks (AR, ANR) was established by the Federal Democratic Republic of Ethiopia (FDRE) in 2013 with the launch of the national REDD+ Secretariat.

At the federal level, Ethiopia Forest Development (EFD) is mandated with developing reliable forest resource information for application in creating national forest policies, planning and sustainable development. The national forest monitoring and carbon measurement desk within the EFD is responsible for producing maps, collecting GHG inventory data, and collaborating with federal and regional institutions to carry out MRV activities. It is also is responsible to solidify technical support for regional structures which includes discussing technical options and practical solutions for the generation and dissemination of data, and for supporting domestic momentum toward improved forest monitoring and management. The National REDD+ Secretariat within EFD is mandated with technical back stopping for the National and State level government structures including for MRV activities.

At the regional level, the comprehensive MRV framework expects that regional units will be established that adopt a similar monitoring approach as the one adopted by the national forest monitoring and carbon measurement desk in their activities. This ensures continuity in monitoring and reporting processes between the federal and the regional level and reliability in tracking progress towards emission reduction goals. In addition, relevant government sectors and initiatives operating at both the zonal and woreda levels, are responsible for supporting activity data gathering and delineating forested areas. This includes for example the zonal office and woreda offices of the Environmental Protection Authority. These institutions play a crucial role in enforcing laws and regulations while also focusing on the sustainable development of forest-based cooperatives, associations, and private forest developers. Their proactive involvement and support are instrumental in reducing the risks associated with potential reversals in forest management and conservation efforts. Their actively engagement in Forest monitoring and reporting system, not only ensures compliance with environmental regulations but also fosters the growth of local enterprises that rely on forest resources. Their comprehensive approach to capacity building and risk mitigation is vital for promoting sustainable practices within the community, ultimately contributing to the long-term Emission reduction activities.

Within this framework, the ORCU MRV unit is tasked with gathering both primary and secondary data on the Oromia level, related to program interventions under the OFLP-ERP. This includes collecting geographical information on A/R activities, program-level biomass survey data, and other relevant data sources. In collaboration with National Forest Monitoring desk in EFD, the regional ORCU MRV unit has also collected the activity data on land use and land use change in this report.

On the national level, other institutions that are part of the MRV framework include the Ethiopia Statistical Service (ESS), the Ethiopian Environment and Forest Research Institute (EEFRI) and the Wondo Genet College of Forestry and Natural Resources. The ESS collects, processes, and disseminates official statistical data. EEFRI provides technical support for the OFLP-ERP as part of its mandate to develop national capacities to conceptualize, design and implement a national and regional SLMS for forestry and LULUC and to monitor area changes including the development of NFI. Wondo Genet College of Forestry and Natural Resources is serving as a center of excellence for education, training and research in forestry and other natural resource management areas.

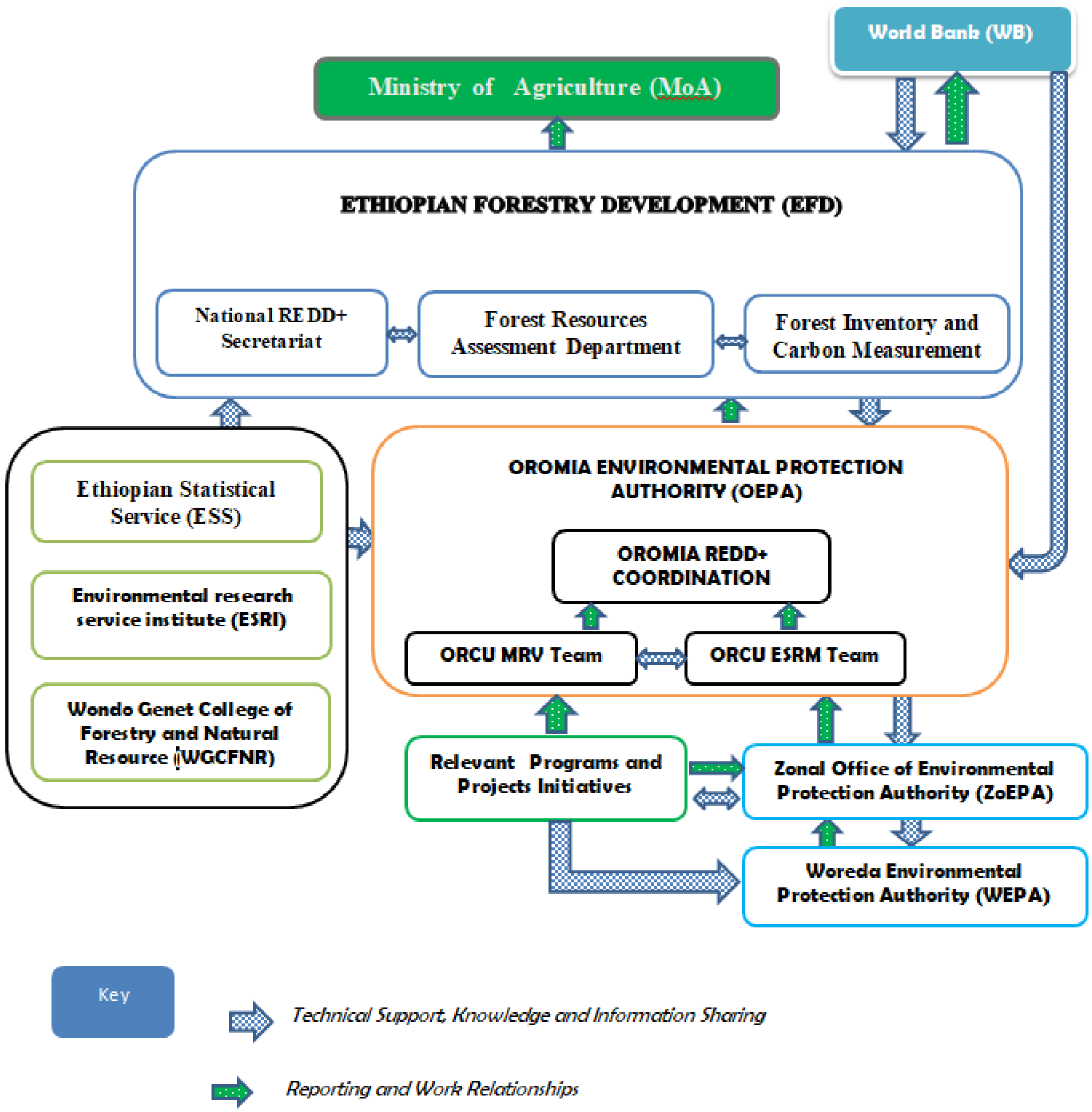

Figure 1 : Institutional arrangement for monitoring and reporting

2.2 Measurement, monitoring and reporting approach

The following figure provides a general overview of the measurement, monitoring and reporting approach. Details of the different steps are provided in the rest of this section.

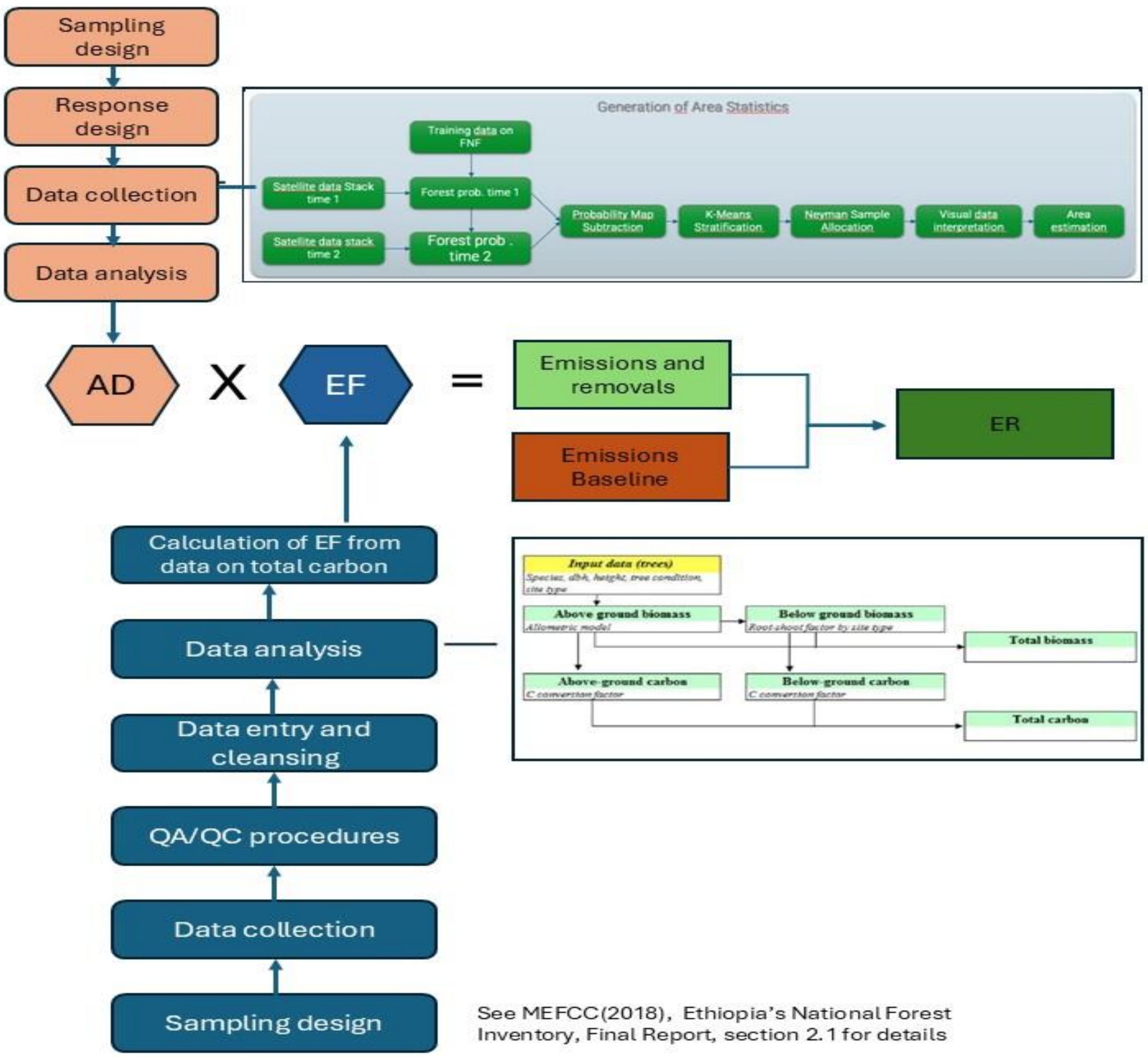

Figure 2 : General line diagram of the measurement, monitoring and reporting approach.

Land use definitions

Ethiopia has adopted a new forest definition in February 2015 that forest defined as a 'Land spanning at least 0.5 ha covered by trees (including bamboo) (with a minimum width of 20 m or not more than two-thirds of its length) attaining a height of at least 2 m and a canopy cover of at least 20% or trees with the potential to reach these thresholds in situ in due course. This definition reduced the tree height criteria from 5m in the previous definition to 2m. The main reason for this change was to capture natural forest vegetation types like the dry-land forests which host woody species that typically reach a height of around 2-3m.

The new definition was used in the land use and land use change analysis that was part of the ERPD of the Oromia Forested Landscape Program. The resulting emissions baseline considered the following categories:

- Forest to cropland
- Forest to grassland
- Cropland to forest
- Grassland to forest

In these categories, grassland included 2 types of vegetation namely (1) 'grassland' which includes both rangelands and pastureland and (2) 'shrubland' which includes ecosystems with vegetation that falls below the threshold used in the forest land category and are categorized under the grassland, the threshold used in the grassland category. Since the first ERPD, improvements have been made to the baseline (see section 3.1 and Annex 4). As part of these improvements, it was decided to have a separate subcategory for shrubland, allowing for a more accurate use of emission factors. This means that the improved baseline and this monitoring report now consider the following subcategories:

- Forest to cropland
- Forest to grassland
- Forest to shrubland
- Cropland to forest
- Grassland to forest
- Shrubland to forest

For this the following definitions were used:

- **Forest land:** 'Land spanning at least 0.5 ha covered by trees (including bamboo) (with a minimum width of 20 m or not more than two-thirds of its length) attaining a height of at least 2m and a canopy cover of at least 20% or trees with the potential to reach these thresholds in situ in due course.[2]
- **Cropland:** This category includes arable and tillage land, and agro-forestry systems where vegetation falls below the thresholds used for the forest land category. Cropland includes all annual and perennial crops as well as temporary fallow land (i.e., land set at rest for one or several years before being cultivated again).
- **Grassland**: This category includes rangelands and pastureland that is not considered as cropland.
- **Shrub land**: includes systems with vegetation that fall below the threshold used in the forest land category and is not expected to exceed, without human intervention, the threshold used in the forest land category.

Data collection approach

Monitoring was performed using these land use definitions. The different steps in monitoring process shown in figure 2 above are explained in more detail in the remainder of this section.

Activity Data Collection

In in line with good practice guidelines of IPCC and GFOI, as well as the ISFL ER program requirements (4.6.2), data on land use and land use change has been collected by applying a ***stratified random sampling*** approach (Cochran (1977)[3], Olofsson (2014)[4], Stehman (2013)[5]).

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[2] All woody vegetation (e.g. agro-forestry system, shrubland) that don't meet this definition are not considered as forest

[3] Cochran W.G. Sampling Techniques. New York: Wiley (1977)

[4] Pontus Olofsson, Giles M. Foody, Martin Herold, Stephen V. Stehman, Curtis E. Woodcock, Michael A. Wulder, Good practices for estimating area and assessing accuracy of land change, Remote Sensing of Environment, Volume 148 (2014)

[5] Stehman S.V. Estimating area from an accuracy assessment error matrix. Remote Sensing of Environment 132, 202-211 (2013)

Stratification

The strata used for the stratified random sampling are derived from a statistically optimized process that relies on a continuous variable of forest change probability instead of a categorical map of forest and forest change.

Forest change detection was performed leveraging multi-sensor (optical and radar) satellite data through "stacked generalization" approach that uses a parametric model for the fusion of algorithm outputs (Healey et al, 2018)[6]. The heterogeneous forest landscape of the Oromia region consists of deciduous as well as evergreen forests that are subject to seasonal variation. Bos et al (2019)[7] have shown that some satellite based time-series analysis algorithms struggle in that type of open dry forests, and deriving change from such algorithms might be misleading as the indication of change mixes with land outside forests and hence does not result in an efficient stratification. Therefore, a simplified, yet effective approach based on annual mosaics has been adopted. This approach is less prone to seasonal variation and default settings of the applied methods do usually result in acceptable wall-to-wall data suitable for allocating a stratified sample.

In detail, the method used is based on the use of 2 multi-sensor stacks, consisting of an annual best-pixel mosaic from optical data of Sentinel-2, a radar data timescan from Sentinel-1 as well as an annual best-pixel mosaic of NICFI's monthly Planet data. All data has been created on FAO's SEPAL platform (sepal.io) and exported at 20-meter resolution to Google's Earth Engine. To further improve classification, an SRTM elevation layer has been added to that stack as an auxiliary layer. The 2 data stacks have been created for 2021 and 2024, so that the data does cover all change events that might have occurred in 2022 and 2023.

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[6] Sean P. Healey, Warren B. Cohen, Zhiqiang Yang, C. Kenneth Brewer, Evan B. Brooks, Noel Gorelick, Alexander J. Hernandez, Chengquan Huang, M. Joseph Hughes, Robert E. Kennedy, Thomas R. Loveland, Gretchen G. Moisen, Todd A. Schroeder, Stephen V. Stehman, James E. Vogelmann, Curtis E. Woodcock, Limin Yang, Zhe Zhu. Mapping forest change using stacked generalization: An ensemble approach. Remote Sensing of Environment, Volume 204,
2018, Pages 717-728,

[7] A.B. Bos, V. De Sy, A.E. Duchelle, M. Herold, C. Martius, N.-E. Tsendbazar. Global data and tools for local forest cover loss and REDD+ performance assessment: accuracy, uncertainty, complementarity and impact. Int. J. Appl. Earth Obs. Geoinf., 80 (2019), pp. 295-311,

In a second step, both stacks have been classified into forest and non-forest, using the Random Forest algorithm (Breiman 2001)[8]. The training data used in this classification process, representing stable forest and non-forest, was available through the ERPA phase 2 data collection process as well as other previous data collection exercises both at national as well as regional level, and consisted of more than 5000 samples. Note that stable forest has not been updated up to 2023, actual training samples of changes were rare and due to the way Random Forests subsets the input samples, the influence of such "outliers" is considered neglectable.

The result of the classification process is two maps of forest probability, ranging from 0 to 100, in 2021 and 2024. Subtracting the 2024 map from the 2021 map can reveal potential areas of change, as forest probabilities may have increased or decreased. For areas of constant forest or non-forest cover, the difference will be close to 0, which is the case for most of the land. This resulting layer reveals a more nuanced way of looking at the classification result and highlights areas of uncertainty that is useful when approaching stratification and defining a strata of stable areas, free of forest change.

The output of this process, referred here to as Probability Map Subtraction (PROMS), serves as a basis for stratification, i.e. dividing the landscape into more homogenous areas likely to be subject to forest change or being stable. If the variation within the strata is less than the overall variation, the stratification will be effective, and uncertainties are reduced as opposed to a simple random or systematic grid.

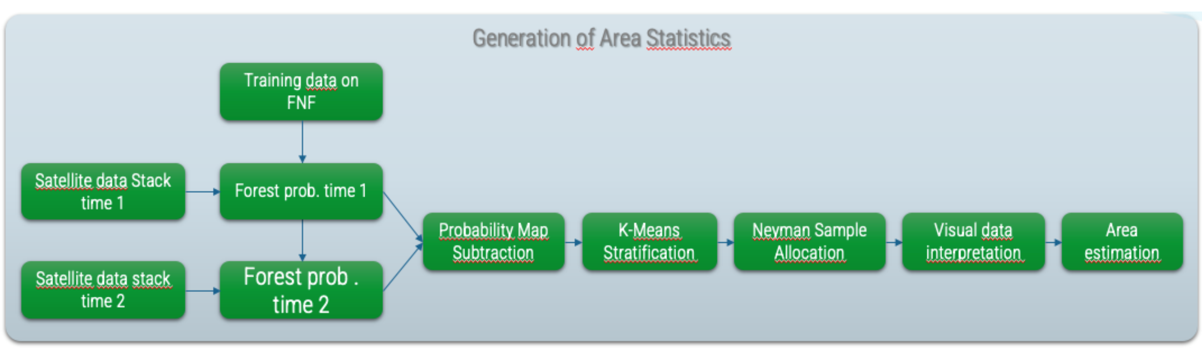

Figure 3: Workflow of the activity data generation, including the PROMS process for a statically optimized *stratification of the land area*

[8] Breiman, L. (2001). Random Forests. Machine Learning. 45. 5-32. 10.1023/A:1010950718922.

The actual stratification follows a 2-step approach to optimize the sample allocation for reducing uncertainties around the change estimates. In a first step, an inclusive forest mask has been applied to capture all existent forest in both times. This mask is much larger than the actual forest area but is assumed to not have missed a single forest area. It has been derived by removing areas that in none of the 2 forest probability layers exhibit a value of more than 5% probability of being a forest. This results in a further reduced area to look for forest change, which is beneficial in the estimation process, as the proportion of forest change over the reduced area increases.

In a second step, the remaining land was stratified using the K-Means algorithm over the PROMS layer, dividing the area into 5 strata from low to high forest change likelihood. K-Means uses the underlying statistics to derive optimal strata boundaries (Kozak 2011)[9]. The process can be replicated on the Google Earth Engine platform using:
https://code.earthengine.google.com/639d7d5197fe73f6a456bb276e6ba398

In a subsequent step, an optimal sample allocation scheme has been employed using Neyman allocation with a total of 3000 samples. The formula for the Neyman allocation is provide below

$$nh = n * (N_h * \sigma h / [\Sigma(Ni * \sigma i)]$$

where:

nh: The sample size for stratum *h*

n: The total sample size

σh: The standard deviation of stratum *h*

The Neyman allocation uses both, strata boundaries and in-strata variation of the PROMS layer to allocate the optimal number of samples and ensures effectiveness in reducing the uncertainty around the final estimates. The process can be replicated using.

https://code.earthengine.google.com/931a36015bf934e8bc511459bbf14fb7

[9] Kozak, Marcin. (2011). Comparison of efficiency of geometric stratification and K-means algorithm in univariate stratification of skewed populations. 7. 341-344.

As area statistics were necessary also for categories falling outside the inclusive forest mask, an additional stratum of stable non-forest has been manually added and additional 332 samples were selected for this specific stratum. The spatial distribution of samples is depicted in Figure 4

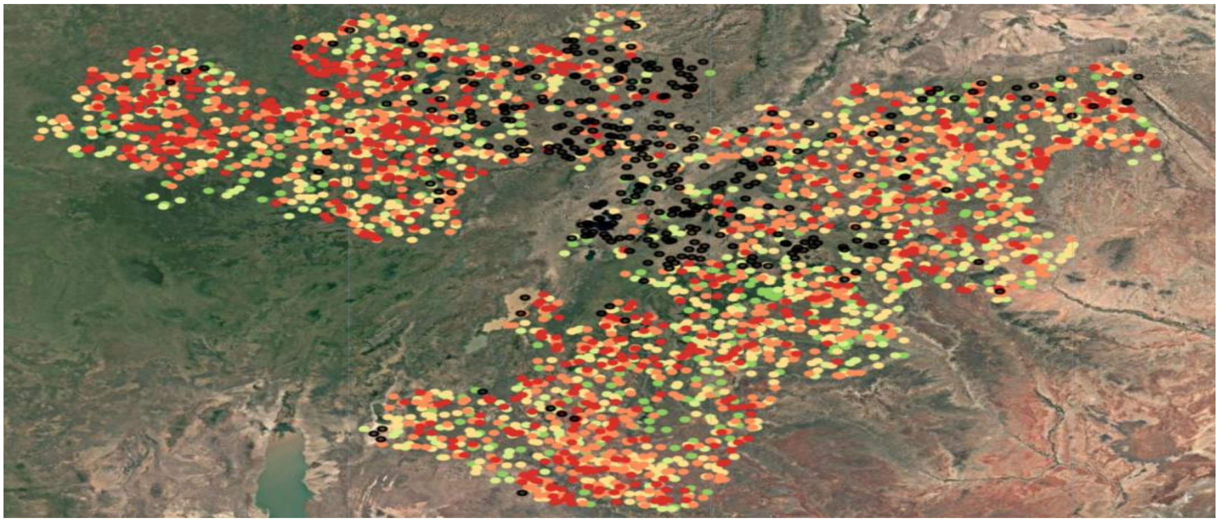

Figure 4 Spatial distribution of the 3332 samples selected over the Oromia region.
Coloured samples indicate potential change, ranging from low (green) to high (red) likeihood of forest change.
Black dots indicate samples outside the inclusive forest mask

Response design

This refers to how to handle and interpret the data collected from the sample points. It involves the methods and rules that used to classify and analyze the information from those points.

Key aspects include:

- **Data Interpretation:** For the monitoring report of forest change detection between 2022 and 2023, the response design involved a systematic interpretation of the data collected, using predefined criteria and survey questions. This structured approach ensured consistency and reliability across all sample points. Key components of our response design included:
- **Majority Land Use Land Cover (LULC) Type in 2022:** Each sample point was categorized based on the predominant land use observed in 2022. This included identifying the main land use land cover categories mainly; forestland, shrubland, Grassland, wetland, Other land and Cropland (crop type)

- **Majority Land Use Land Cover (LULC) Type in 2023**: Similarly, each sample point was reassessed for 2023 to identify any changes in the predominant land use type, using the same categories as the previous year.
- **First LULC Change Disturbance:** If any changes were detected between 2022 and 2023, the first disturbance event was noted. This could include deforestation, agricultural expansion, urban development, or other significant changes in land cover.
- Second LULC Change Disturbance: For sample points where multiple disturbances occurred, the second disturbance event was also recorded, providing a detailed timeline of changes.
- **First LULC Change Event Type:** The nature of the first disturbance was classified according to the type of event, whether it was a natural disaster, human activity, or other factors that caused the initial change in land use.
- **Second LULC Change Event Type:** For subsequent changes, the second event type was similarly categorized to capture the progression and impact of different disturbances on the land cover.
- **Year of LULC Change:** The specific year in which each LULC change event occurred was documented. This helped in tracking the temporal aspects of land use changes and understanding their patterns over time.

By adhering to these predefined criteria, our response design ensured a structured and accurate interpretation of the collected data, providing a comprehensive analysis of forest changes within the specified period.

- **Use of Tools**: For the Land Use Land Cover (LULC) change detection between 2022 and 2023, we utilized advanced tools and methodologies. Specifically, we employed the Collect Earth Online (CEO) platform for data collection and interpretation. This process was further enhanced by integrating high-resolution satellite imagery, including Landsat, Google Earth time series, Norway International Climate and Forest Initiatives (NICFI), Normalized Difference Vegetation Index(NDVI), and Normalized Difference Fraction Index (NDFI)

- **Consistency:** Consistency: To maintain uniformity across the dataset, all interpreters followed standardized guidelines. Comprehensive training and awareness programs on Ethiopian interpretation key were provided to all interpreters.

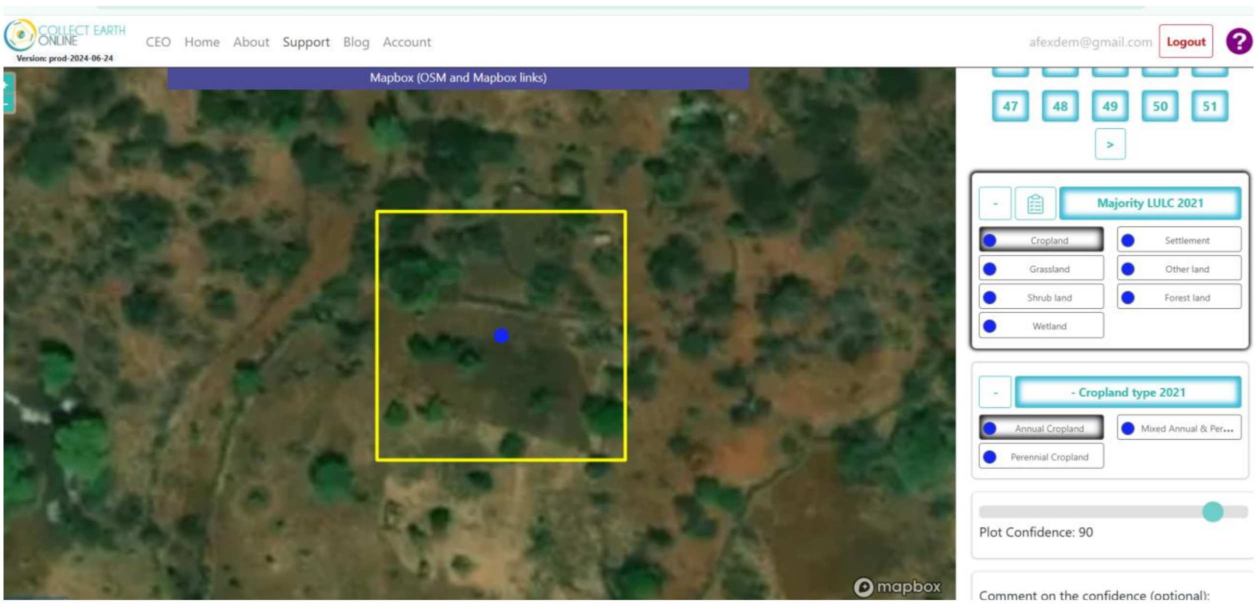

Figure 5: sample of activity data on CEO

Data collection

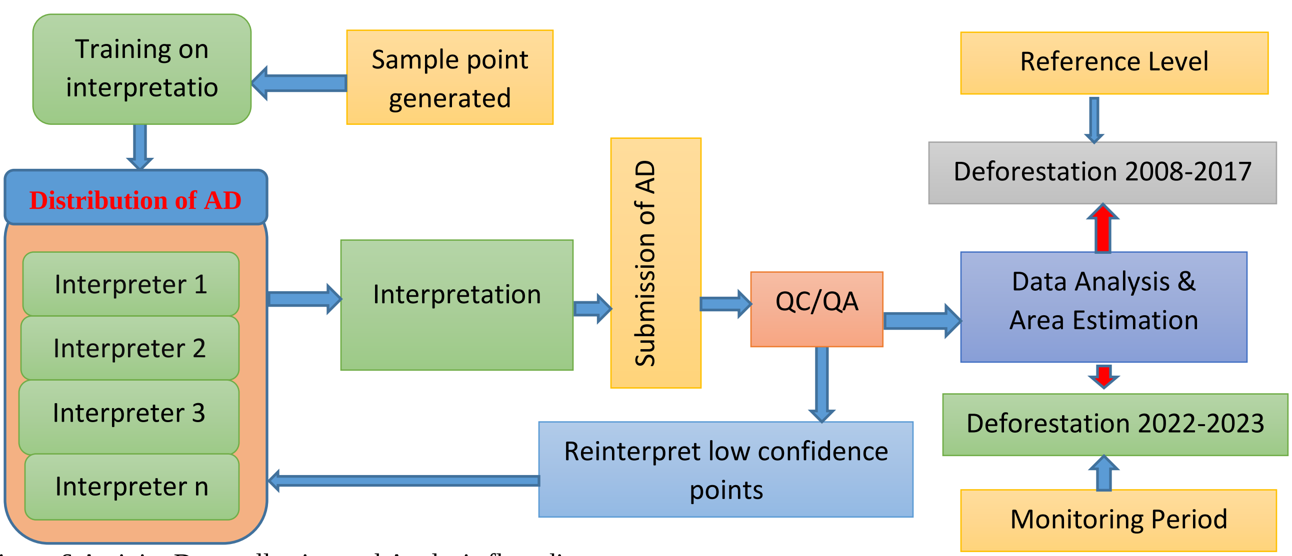

Figure 6 Activity Data collection and Analysis flow diagram

Appropriate sample plots, each measuring 0.5 hectares, were generated across the region using a stratified random approach for AD collection. This method ensures that the samples are representative of the different land-use categories and changes across the entire study area. The optimal sample size generated by Neyman allocation was 2,998. As area statistics were also necessary for categories falling outside the inclusive forest mask, an additional stratum of stable non-forest was manually added, and 332 additional samples were selected for this specific stratum. The spatial distribution of samples is depicted in Figure 4 above.

Two Collect Earth Online (CEO) projects were created under the "REDD+ OROMIA" institution, one for 2,998 samples and another for 332 additional samples covering the 2021-2024 period. Collect Earth online is a free and open-source image viewing and interpretation platform suitable for projects requiring information on land use and cover, including forest area change, particularly for AD collection to estimate emission reductions (FAO, 2019).

A total of 3,330 sample points were distributed among seven interpreters. After training on Ethiopian land use and land cover interpretation keys, the data was collected, interpreted, and submitted.

The sample plots were classified into seven LULC classes: Forest, Cropland, Grassland, Settlement, Wetland, Shrubland, and Other Land. Different satellite imagery sources were integrated into the CEO platform, including Sentinel (10m), Planet NICFI (4.77m), and Landsat (30m), as well as Google Earth/Mapbox, considering their resolution.

The assessment of sample points was conducted through visual interpretation of available high-resolution images and by interpreting vegetation indices derived from medium and high-resolution images. To help with the interpretation of the points, the option to 'Show GEE Script Link on the Collection Page' (GEE stands for Google Earth Engine) was activated. This allows users in to open a new tab with a series of Landsat and Sentinel time series images and charts including vegetation indices such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI) (see image below for general example from CEO documentation).

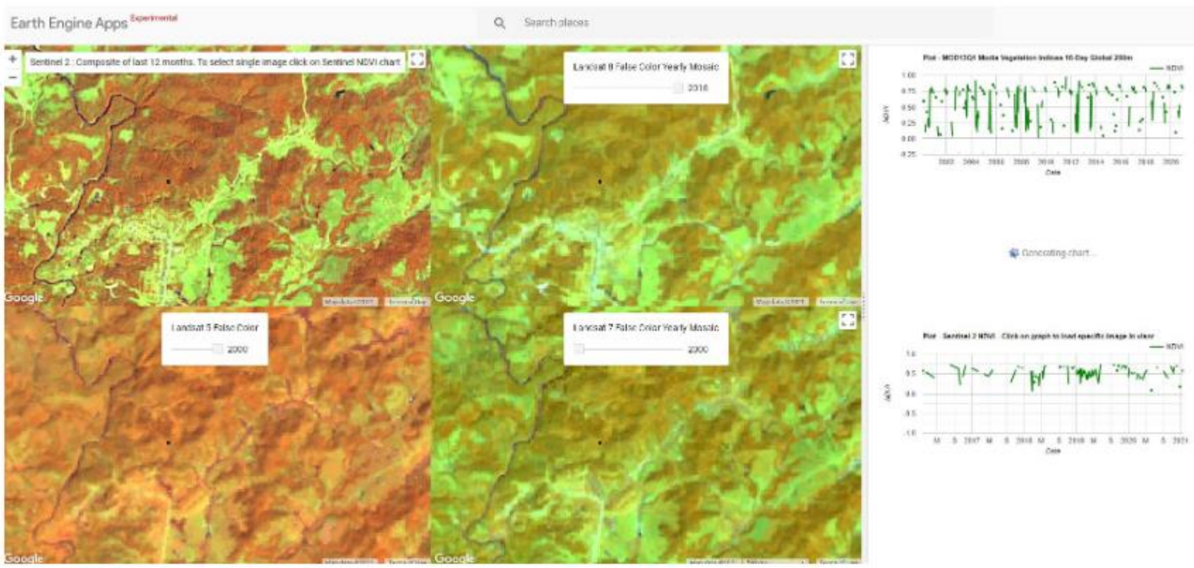

Figure 7: CEO interface showing GEE script results

Furthermore, historical trends in land use/cover from 2021 to 2024 were assessed and labeled for each change and unchanged land use/cover class. This comprehensive methodology ensures accurate, reliable data for emissions reduction and land use management in the Oromia Region.

Quality Control/Quality Assurance

A centralized data collection team facilitated a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues were held regularly.

The quality control team conducted cross-checking activities using multiple data sources and local knowledge. This team, comprising two specialists (one from EFD and one from ORCU MRV), oversaw the entire data collection process to ensure data quality. Consequently, a total of 316 sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were reinterpreted by two experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Of these sample points, 287 (90.8%) yielded results consistent with the initial interpretations, while 29 (9.2%) showed discrepancies. The discrepancies were resolved through discussions with all team members.

Data Analysis

After data collection, the area estimates, and uncertainty calculation used standard estimators for stratified area estimation as described in Cochran 1977, Olofsson (2014) and Stehman (2013). Calculations have been done for all relevant land use categories and change classes, including the unbiased sample estimate as well as the surrounding uncertainty.

Table 2: Transition matrix of AD analysis result

2021 2023	Cro	For	Gra	Oth	Set	Shr	Wet	2023 total
Cro	12946271	16012	121259	17046	0	17027	0	13117616
For	14008	8968928	4009	0	0	11039	0	8997984
Gra	9009	0	6930868	0	0	6014	4999	6950890
Oth	0	0	2005	92372	0	0	0	94376
Set	6014	0	0	0	415849	0	0	421863
Shr	4999	0	0	0	0	2214793	0	2219792
Wet	0	0	2005	0	0	0	496367	498372
2021 total	12980301	8984940	7060147	109418	415849	2248873	501367	32300894

Emission and Removal Factors

The values of the emission factors have been updated compared to the validated ERPD. The updated value is calculated using the final report(MEFCC, 2018)[10] of the National Forest Inventory (NFI) that was conducted between 2014 and 2016. In the validated ERPD, four carbon pools were considered: aboveground and belowground biomass, deadwood and soil organic carbon. It was shown in the ERPD that litter could be excluded from the accounting since the contribution of the litter carbon pool is insignificant. The NFI report covers three of the four carbon pools: aboveground biomass, belowground biomass and deadwood. For soil organic carbon, the same values were used as those used in the ERPD.

The NFI was conducted using a stratified systematic cluster sampling approach. Because the NFI design is a stratified sampling approach, each stratum has a different sampling intensity defined

[10] Ministry of Environment, Forest and Climate Change (MEFCC). 2018. Ethiopia's National Forest Inventory, Final Report. Ministry of Environment, Forest and Climate Change, Addis Ababa, Ethiopia

by the inclusion probability π_k (of each plot). The π_k has been computed by dividing the number of hectares sampled in each stratum by the total area of the strata (when the sampling intensity is higher, inclusion probability is higher). All the equations related to this can be found in section 2.7 of the NFI report (MEFCC, 2018).

Using available geospatial layers of Ethiopia and large-scale ecological studies the whole country was classified into five strata. Based on these strata, a total of 627 sampling units were created, of which 221 were located in Oromia. Every sampling unit had an area of 1 km^2 and was composed of 4 plots (with cumulative plot area of 2 ha). The details of the sample unit and plot design can be found in section 2.1 of the NFI report (MEFCC, 2018). Out of the 627 planned sampling units, 539 were found to be accessible. The remaining 88 SUs were inaccessible due to different factors including excessive remoteness, topography and temporary security problems. Within the accessible sample units, a total of 2,077 accessible sample plots were visited in which about 49,829 trees and 2,029 stumps were recorded and analyzed.

For all the trees and stumps measured, the following variables were collected:

- Position in the plot;
- Tree/stump;
- Species name (scientific names and vernacular names);
- Diameter at 0.3 m level;
- DBH and top height (for trees and stumps greater or equal DBH 10 cm in outside forest and greater or equal to DBH 20 cm in forest);
- Bole height;
- Stem quality;
- Tree Health;
- Causative agents;
- Decomposition status.

In 2015 the stratification scheme was changed because Ethiopia decided to adopt a classification that better describes the vegetation characteristics of the country. With this change, the following biomes were adopted as basis for the NFI:

- Acacia-Commiphora
- Combretum-Terminalia
- Dry Afromontane
- Moist Afromontane

This change resulted in the adoption of more specific analysis methods. All the NFI results are thus presented by biome, and not by original NFI strata. Since the biome stratification was introduced when the NFI was already in progress, a post-stratification methodology was applied in order to correctly estimate the results by the biomes. The number of SUs by biomes and strata is presented in table 2-5 of the NFI report (MEFCC, 2018) and reproduced below.

Table 3 Distribution of the sampling units per biome and strata (Table 2-5 from the NFI report)

	Acacia-Commiphora	*Combretum-Terminalia*	Dry Afromontane	Moist Afromontane	Others	Total
Stratum I	5	13	18	59	-	**95**
Stratum II	107	-	-	-	-	**107**
Stratum III	1	93		6	1	**101**
Stratum IV	36	38	114	29	1	**218**
Stratum V	15	2	-	-	1	**18**
Total	**16 4**	**14 6**	**13 2**	**94**	**3**	**539**

As part of the NFI, extensive training events were organized in order to secure that the field crews correctly collected the field data. Quality Assessment/Quality Control (QA/QC) procedures were implemented in order to ensure an adequate standard in the data collection and data entry procedures. Based on a random sub-sampling, 10% of the SUs were re-measured by a semi-independent team composed of experts not involved in the field campaign and specifically trained for QA/QC. At least one randomly selected plot per SU was re-measured entirely and the results were compared with the original values. The QA/QC team used the original data forms to check any irregularities in the records. An error tolerance (10% difference in results between the measured and re-measured sampling units) was introduced and applied in order to reject or accept the collected data. The data was entered into a database and then subject to cleansing procedures in order to filter all the records considered potentially erroneous.

A robust statistical procedure was applied to analyze the data based on the biomes. The method used was based on the one described by Sarndal et al. (1992)[11]. The details and equations are described in section 2.7 of the NFI report (MEFCC, 2018).

The data analysis of the field data results has been done using R language scripts and R scripts in OpenForis Calc[12]. In the data analysis, the following assumptions and equations have been used:

- Because field conditions do not always allow field crews to successfully determine tree height, a tree height model has been applied for trees who's heights are not measured in the field. Three different models were tested for the Ethiopia NFI dataset. Curtis' model (1967) was ultimately selected as the better fit which uses the follow equation:

h = estimated top height [m];

$$h = 1.3 + a * \left(\frac{dbh}{1 + dbh}\right)^{b}$$

dbh = diameter at the breast height (DBH)[cm];
a, b = parameters.

- In the absence of applicable biomass models for every Ethiopian ecosystem/biome consistent with international requirements, the pantropical model of Chave et al. (2014) was used:

$$AGB = 0.673\,(WD \cdot dbh2 \cdot h)^{0.976}$$

Where:

AGB = Above ground biomass [kg];

WD = Dry wood density [t m−3];

[11] Sarndal, C-E., Swensson, B. and Wretman, J. (1992). "Model assisted survey sampling".
[12] Calc is a legacy tool that is part of the OpenForis tool kit. More information and access to the source code can be found at https://openforis.org/solutions/legacy/

The default value41 for the WD is 0.615 t · m^{-3}.

- To compute the below-ground biomass (BGB) estimates, root-shoot ratios from the Intergovernmental Panel on Climate Change (IPCC) (2006) by the ecological zones have been adopted. Table 2.6 of the NFI report (MEFCC, 2018) shows the distribution of SU by biomes and Table 2.7 of that same report shows the applied conversion factors correspondent to each ecological zone.

- Wood density data of over 400 tree species found in Ethiopia has been analyzed. For the NFI analysis, the ones with the highest quality have been selected and applied (see section labelled as '2.2 wood densities' on page 35 of the NFI report for details). Low quality values and tree species inventoried in Ethiopia and missing in the country databases, have been taken from the Global Wood Density Database (GWDDB)13. The result was that out of 360 species identified during the NFI cycle, wood densities of 341 species have been selected using a validated value.

- For the fallen deadwood volume, De Vries formula (De Vries, 1986)[14] was used. Details on the application of this formula can be found in the section labelled '2.1 Deadwood' on page 35 of the NFI report.

Calculation of Emission Reductions and Removals

Emission reductions and removals are calculated as

$$ER = E_{Baseline} - E_{RP}$$

were

ER = Net Emission Reductions during the Reporting Period (tCO2-e)

$E_{Baseline}$ = Total net Emissions Baseline during the Reporting Period (tCO2-e)

[13] Zanne, A.E. et al. (2009). "Global wood density database". DRYAD. URL: http://hdl.handle.net/10255/dryad 235.
[14] de Vries P. Sampling Theory for Forest Inventory: a Teach-Yourself Course1986. Springer

E_{RP} = Actual net GHG emissions from the ISFL ER Program during the Reporting Period (tCO2-e)

$$E_{Baseline} = E_{B\_FC} + E_{B\_FG} + E_{B\_FS} + E_{B_{CF}} + E_{B\_GF} + E_{B\_SF}$$

Were

$E_{Baseline}$ = Actual net GHG emissions from the ISFL ER Program during the Reporting Period (tCO2-e)

E_{B_FC} = Baseline net emissions for forest converted to cropland during the Reporting Period (tCO2-e)

E_{B_FG} = Baseline net emissions for forest converted to grassland during the Reporting Period (tCO2-e)

E_{B_FS} = Baseline net emissions for forest converted to shrubland during the Reporting Period (tCO2-e)

E_{B_CF} = Baseline net emissions for cropland converted to forest during the Reporting Period (tCO2-e)

E_{B_GF} = Baseline net emissions for grassland converted to forest during the Reporting Period (tCO2-e)

E_{B_SF} = Baseline net emissions for shrubland converted to forest during the Reporting Period (tCO2-e)

And

$$E_{RP} = E_{RP\_FC} + E_{RP\_FG} + E_{RP\_FS} + E_{RP\_CF} + E_{RP\_GF} + E_{RP\_SF}$$

Where

E_{RP} = Actual net GHG emissions from the ISFL ER Program during the Reporting Period (tCO2-e)

E_{RP_FC} = Actual net emissions for forest converted to cropland during the Reporting Period (tCO2-e)

E_{RP_FG} = Actual net emissions for forest converted to grassland during the Reporting Period (tCO2-e)

E_{RP_FS} = Actual net emissions for forest converted to shrubland during the Reporting Period (tCO2-e)

E_{RP_CF} = Actual net emissions for cropland converted to forest during the Reporting Period (tCO2-e)

E_{RP_GF} = Actual net emissions for grassland converted to forest during the Reporting Period (tCO2-e)

E_{RP_SF} = Actual net emissions for shrubland converted to forest during the Reporting Period (tCO2-e)

For each subcategory the emissions and removals are determined for all relevant pools.

$$E_i = (\Delta C_{i\_ABG} + \Delta C_{i\_BGB} + \Delta C_{i\_Mineral} + \Delta C_{i\_DOM}) * (\frac{44}{12})$$

Were

ΔC_{i_ABG} = changes in carbon in above ground biomass (tC)

ΔC_{i_BGB} = GHG emissions from changes in below ground biomass (tC)

$\Delta C_{i\_Mineral}$ = GHG emissions from changes in soil organic carbon in mineral soils (tC)

ΔC_{i_DW} = GHG emissions from changes in dead wood (tC)

i = land category i

Above and below ground biomass

For the three subcategories involving changes from forest to other land uses, the emissions from changes in the above ground and below ground biomass have been calculated as

$$\Delta C_{conversion,i} = EF_{i\_ABBG} \cdot \Delta A_i$$

Where:

$\Delta C_{conversion,\ i}$ = change in carbon stocks on land converted from forest to land category *i*, tonnes C

EF_{i_ABBG} = Emission factor for changes in above ground and below ground biomass in the conversion of forest to land use *i* , tonnes Cha^{-1}

ΔA_i = = area converted from forest to land category *i*

The values of EF_{i_ABBG} are calculated as the difference between the carbon values of the above ground and below ground biomass before and after the change.

$$EF_{i\_AGBG} = (C_n - C_o)$$

Where:

EF_{i_ABBG} = Emission factor for changes in above ground and below ground biomass in the conversion of forest to land use *i*

C_n = above ground and below ground carbon stock under the new land-use category, tonnes C ha^{-1}

C_o = above ground and below ground carbon stock under the old land-use category, tonnes C ha^{-1}

44/12 = factor to convert carbon units to CO_2e

As described above, the NFI provided the basis for the emission and removal factors used for above and below ground biomass. The NFI report (MEFCC, 2018) provides a summary of the information from the NFI per biome, major land use/land cover type and regions. For the purpose of determining the emission and removal factors, the level 1 classification from the NFI has been used since this most closely matches the IPCC categories used in the ISFL (see table A.1.1 of the NFI report for the level 1 categories and description).

Table A2.3 of the NFI report provides area estimates by regions, biomes and FRA classes. The FRA classes are based on the classification system developed by the Forest Resource Assessment (FRA) Programme of FAO to ensure harmonization between countries for regional or global assessments. These global FRA classes consist of Forests, Other Wooded Land, Other Land and Inland Water.

Table 4: Area estimates by regions, biomes and FRA classes (source: table A2.3 of the NFI report (MEFCC, 2018))

Region	Biome	FRA Class	Area
Oromia	*Acacia-Commiphora*	*Forest*	431 237
		Other Wooded Land	11 149 959
		Other Land	3 728 188
	Combretum-Terminalia	*Forest*	205 087
		Other Wooded Land	645 693
		Other Land	3 116 631
	Dry Afromontane	*Forest*	488 946
		Other Wooded Land	694 253
		Other Land	7 029 220
		Water	0
	Moist Afromontane	*Forest*	1 643 917
		Other Wooded Land	867 005
		Other Land	2 747 305
		Water	6 252
	Other	*Other Land*	0
		Water	0

Table A9.7 of the NFI report provides values for above ground biomass per Region, Biome and FRA class. Using the IPCC root-shoot ratios, the below-ground biomass of the different FRA classes can be estimated as follows:

$$C_{cl\_BG} = C_{i,AG} \cdot R$$

Where:

$C_{cl,\,BG}$ = below ground carbon stock of FRA class *cl*, tonnes C ha^{-1}

$C_{cl,\,AG}$ = above ground carbon stock of FRA class *cl*, tonnes C ha^{-1}

R = Root to shoot ratio, dimensionless

The table below provides an overview of the different Oromia specific values and provides reference to the source tables in the NFI report.

Table 5: Area and above ground/ below ground biomass values per biome and FRA Class for Oromia (including the relevant source tables from the NFI report (MEFCC, 2018))

Biome	FRA class	Area (ha)	ag_biomass (t /ha)	bg_biomass (t /ha)	root-shoot
Acacia-Commiphora	Forest	431,237	80.3	28.3	0.4
	Other wooded land	11,149,959	9.3	3.3	0.4
	Other land	3,728,188	15.4	5.5	0.4
Combretum-Terminalia	Forest	205,087	46.8	19.2	0.4
	Other wooded land	645,693	25.0	9.4	0.4
	Other land	3,116,631	15.2	5.1	0.3
Dry Afromontane	Forest	488,946	69.4	18.7	0.3
	Other wooded land	7,029,220	9.0	2.5	0.3
	Other land	7,029,220	8.9	2.4	0.3
Moist Afromontane	Forest	1,643,917	217.4	57.8	0.3
	Other wooded land	2,747,305	17.8	4.8	0.3
	Other land	2,747,305	27.8	7.5	0.3
Sources		***NFI report table A.2.3***	***NFI report table A9.7***		***Derived from NFI report table A8.2***

A weighted region-specific value region for tree biomass and carbon per FRA category was calculated. For each FRA class (for example forest), the area of each biome (see table 4) was multiplied with regional biome specific biomass value (see table 5). The total biomass was divided by the total area of the FRA class in the region to give the weighted value. To estimate carbon, a carbon fraction of 0.5 tonne C (tonne d.m$^{.)-1}$ was used. Table A8.4 of the National Forest Inventory Report (MEFCC, 2018) provides the results of this calculation as shown below.

Table 6 Tree biomass and carbon by region and level FRA class (table A.8.4 of the NFI report (MEFCC, 2018))

Region	FRA Class	AG biomass (t ha^{-1})	BG biomass (t ha^{-1})	Biomass (t ha^{-1})	AG carbon (t ha^{-1})	BG carbon (t ha^{-1})	Carbon (t ha^{-1})
Afar	Other Wooded Land	1.6	0.6	2.2	0.8	0.3	1.1
	Other Land	0.3	0.1	0.4	0.1	0.1	0.2
	Water	2.6	1.0	3.6	1.3	0.5	1.8
Amhara	Forest	170.2	47.8	218.1	85.1	23.9	109.0
	Other Wooded Land	10.9	4.2	15.2	5.5	2.1	7.6
	Other Land	10.5	3.4	13.9	5.3	1.7	7.0
	Water	4.1	1.1	5.2	2.1	0.6	2.6
Benishanglul-Gumuz	Forest	65.8	33.1	98.9	32.9	16.5	49.4
	Other Wooded Land	35.5	16.6	52.0	17.7	8.3	26.0
	Other Land	8.6	3.2	11.9	4.3	1.6	5.9
	Water	8.6	2.3	10.9	4.3	1.2	5.5
Gambela	Forest	240.5	49.2	289.7	120.3	24.6	144.9
	Other Wooded Land	7.4	2.1	9.4	3.7	1.0	4.7
	Other Land	11.6	3.1	14.7	5.8	1.6	7.4
Oromia	Forest	157.3	43.8	201.1	78.6	21.9	100.5
	Other Wooded Land	10.6	3.3	13.9	5.3	1.7	7.0
	Other Land	14.7	4.3	19.0	7.3	2.2	9.5
	Water	244.2	65.9	310.2	122.1	33.0	155.1
SNNPR	Forest	122.1	33.0	155.0	61.0	16.5	77.5
	Other Wooded Land	13.0	3.3	16.3	6.5	1.6	8.1
	Other Land	44.7	12.1	56.9	22.4	6.1	28.4
Somali	Forest	13.5	5.4	19.0	6.8	2.7	9.5
	Other Wooded Land	3.5	1.4	4.9	1.8	0.7	2.5
	Other Land	0.4	0.2	0.6	0.2	0.1	0.3
Tigray	Forest	24.9	9.5	34.4	12.5	4.8	17.2
	Other Wooded Land	14.9	5.5	20.4	7.5	2.8	10.2
	Other Land	4.8	1.7	6.5	2.4	0.9	3.3

Using the results presented in this table, the value used in this monitoring report for the carbon stock of above ground and below ground biomass of forest in Oromia National Regional state is 100.5 tons C per hectare. For the calculation of the emission factors used for conversions of forest to cropland and grassland, the difference between the carbon stock of forest and that of 'other land' was used. For the conversion of forest to shrubland, the difference between the carbon stock of forest and that of 'other wooded land' was used.

For the subcategories involving removals, the removals are calculated using the approach outlined in the ISFL 'Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period. The guidance note suggests that for change in biomass carbon stocks (above-ground biomass and below-ground biomass) it can be assumed that during the conversion from non-forest to forest, carbon stocks will go from average carbon stocks in non-forest to average carbon stocks in forests during a default period of 20 years. Therefore, the removal factors used were calculated as the emission factors (as described above) divided by 20.

The final report of the NFI provides more details of the approach used in the NFI. Although Ethiopia has planned to revise the carbon stock by conducting national forest inventory every five year, currently the previous assessment report announced in 2018 was not changed. This is because the country did not undertake the national forest inventory as planned due to some challenging factors. A new NFI is currently being conducted and the results of this new NFI will be incorporated in phase 2 of the ERPA when the baseline is expanded with additional subcategories.

Dead wood

The emission and removals from deadwood have been calculated according to the ISFL Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period (Version 1.0). In line with this guidance note, equation 2.23 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories has been used as the basis to estimate annual change in carbon stocks in dead wood due to land conversion.

EQUATION 2.23
ANNUAL CHANGE IN CARBON STOCKS IN DEAD WOOD AND LITTER DUE TO LAND CONVERSION

$$\Delta C_{DOM} = \frac{(C_n - C_o) \bullet A_{on}}{T_{on}}$$

Where:

ΔC_{DOM} = annual change in carbon stocks in dead wood or litter, tonnes C yr^{-1}

C_o = dead wood/litter stock, under the old land-use category, tonnes C ha^{-1}

C_n = dead wood/litter stock, under the new land-use category, tonnes C ha^{-1}

A_{on} = area undergoing conversion from old to new land-use category, ha

T_{on} = time period of the transition from old to new land-use category, yr. The Tier 1 default is 20 years for carbon stock increases and 1 year for carbon losses.

In line with the ISFL guidance note, it has been assumed that the average annual rate of conversion during the Baseline Period would have applied during the ISFL ERPA Phase. The emission reductions are then calculated as the difference between the expected emissions or removals under the Emissions Baseline and the actual emission or removals. Therefore, instead of applying IPCC equation 2.23 directly, a change factor has been calculated (ΔCF_{DOM}) which is used in combination with the projected baseline area change and the actual monitored area change.

$$\Delta CF_{DOM} = \frac{(C_n - C_o)}{T_{on}}$$

Where:

ΔCF_{DOM} = annual change in carbon stocks in dead wood, tonnes C ha^{-1} yr^{-1}

With the other factor as defined for IPCC equation 2.23 above

Since there are no data to distinguish between the dead wood stocks immediately after the land-use conversion and the later transition period, it is assumed that the changes in the dead wood from one value to another happen in a linear fashion over the IPCC default period of 20 years.

Table 3-24 of the NFI report provides values for carbon in deadwood for different land use/land cover types on the national level as shown below.

Table 7 Carbon in deadwood by Major LUCC types (Table 3-24 of the NFI report (MEFCC, 2018))

FRA class	Major LUCC	Carbon (t ha^{-1})
Forest	Natural regenerated forest	15.8
Forest	Plantation	0.5
Other Wooded Land	Other wooded land	1.9
Other Land	Cultivated	2.6
Other Land	Natural	0.9

Since no region-specific values for dead wood are provided in the NFI, the national values have been used for the emission and removal factors.

According to the ISFL guidance note, the values for litter and dead wood pools can be assumed zero in all non-forest categories and dead organic matter in Forest Land shall be assumed to have the value of mature forests at the beginning of the Baseline Period. Since values are available from the NFI, the following emission and removal factors have been as outlines in the table below.

Table 8: Dead wood change factors applied

Baseline subcategory	Corresponding change from LUCC clases in figure 7 above	Change factor (t C ha^{-1} yr^{-1})
Forest to cropland	Natural regenerated forest to Other land-cultivated	-0.66
Forest to grassland	Natural regenerated forest to Other land-natural	-0.745
Forest to shrubland	Natural regenerated forest to other wooded land	-0.695
Cropland to forest	Other land-cultivated to plantation	-0.105
Grassland to forest	Other land-natural to plantation	-0.02
Shrubland to forest	Other wooded land to plantation	-0.07

Soil organic carbon

Changes in the Soil Organic Carbon pool in mineral soils associated with conversion from and to forest were calculated according to the ISFL Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period (Version 1.0). In line with this guidance note, formulation B from box 2.1 in the 2006 IPCC Guidelines, Volume 4, Chapter 2 was used as below.

Formulation B (Approaches 2 and 3 for Activity Data Collection)

$$\Delta C_{Mineral} = \frac{\sum_{c,s,p} \left[\left\{ \begin{array}{l} \left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,s,p}} \bullet F_{MG_{c,s,p}} \bullet F_{I_{c,s,p}} \right)_0 - \\ \left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,s,p}} \bullet F_{MG_{c,s,p}} \bullet F_{I_{c,s,p}} \right)_{(0-T)} \end{array} \right\} \bullet A_{c,s,p} \right]}{D}$$

Where:

$\Delta C_{Mineral}$ = annual change in carbon stocks in mineral soils, tonnes C yr^{-1}

SOC_0 = soil organic carbon stock in the last year of an inventory time period, tonnes C

$SOC_{(0-T)}$ = soil organic carbon stock at the beginning of the inventory time period, tonnes C

T = number of years over a single inventory time period, yr

D = Time dependence of stock change factors which is the default time period for transition between equilibrium SOC values, yr.

c = represents the climate zones, s the soil types, and i the set of management systems that are present in a country.

SOC_{REF} = the reference carbon stock, tonnes C ha^{-1}

F_{LU} = stock change factor for land-use systems or sub-system for a particular land-use, dimensionless

F_{MG} = stock change factor for management regime, dimensionless

F_I = stock change factor for input of organic matter, dimensionless

A = land area of the stratum being estimated, ha.

p = parcel of land

As discussed above, the NFI report does not provide updates values on soil organic carbon. Therefore, the value for national soil organic carbon stocks for forest that was used in the ER Program inventory in the validated ERPD is also used for this monitoring report. This national value was obtained from the "Evaluation of the forest carbon content in soil and litter in Ethiopia"[15] which was implemented by Natural Resources Finland (LUKE) and Ethiopia Environment and Forestry Research Institute (EEFRI). The national value was based on biome specific values as shown in the table below.

Table 9: Soil organic carbon in forest in Ethiopia

Soil type - Biome	SOC ref (tC/ha)	N	Standard deviation (tC/ha)	Source
Acacia Commiphora	**34.245**	11	17.01197	Evaluation of the forest carbon content in soil and litter in Ethiopia, Implementing agency: Natural Resources Institute Finland (LUKE) and Ethiopia Environment and Forestry Research Institute (EEFRI) Duration of the Report: August 2017 - February 2018. Beneficiaries: FAO, MEFCC, EEFRI
Combretum Terminalia	**41.561**	37	28.25306	Idem above

[15] Some of the results of this study are discussed in Lehtonen A, Ťupek B, Nieminen TM, et al. Soil carbon stocks in Ethiopian forests and estimations of their future development under different forest use scenarios. Land Degrad Dev. 2020; 31: 2763–2774. https://doi.org/10.1002/ldr.3647

Dry Afromontaine	**53.080**	33	34.46676	Idem above
Moist Afromontaine	**83.886**	17	34.65632	Idem above
Average	**51.961**	98	33.58339	Idem above

In line with the guidance note, the Soil Organic Carbon pool in Forest Land was assumed to be in equilibrium at the beginning of the Baseline Period and the average value of 51.96 t C/ha has been used as SOC_{ref} and the equilibrium value for forest.

Following the equation above and equation 2.25 of the 2006 IPCC guidelines, the equilibrium values for each non-forest subcategory was conservatively determined by using the same stock change factors applied in the validated ERPD and the formula below:

$$SOC_i = SOC_{ref} \cdot F_{LU} \cdot F_I \cdot F_{MG}$$

Where:

SOC_i = Equilibrium soil organic C stocks for mineral soils under land use type *i*, tonnes C ha^{-1}

Other factors as defined above

The applied stock change factors and the resulting equilibrium SOC values are shown in the table below.

Table 10: Stock change values applied for estimating equilibrium soil organic carbon content of non-forest land categories

	FLU	FI	FMG	Equilibrium SOC (tC/ha)
Annual cropland	0.48	0.92	1	22.94
Grassland	1	1	0.97	50.40

2.3 Data and parameters

2.3.1 Fixed Data and Parameters

Table 11 Fixed data and parameter

<table>
<tr><td>Parameter:</td><td>EF_{C_ABBG}</td></tr>
<tr><td>Description:</td><td>Emission Factor for loss of above ground and below ground biomass in the conversion from forest to cropland.</td></tr>
<tr><td>Subcategory for which the parameter is used:</td><td>This parameter is used for the subcategory forest land converted to crop land</td></tr>
<tr><td>Data unit:</td><td>tCO_2/ha</td></tr>
<tr><td>Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international) :</td><td>Calculated from the Oromia specific values for tree biomass and carbon by region and level FRA class from table A.8.4 of the NFI report (MEFCC, 2018)).
<table>
<tr><th>Region</th><th>FRA Class</th><th>AG biomass (t ha^{-1})</th><th>BG biomass (t ha^{-1})</th><th>Biomass (t ha^{-1})</th><th>AG carbon (t ha^{-1})</th><th>BG carbon (t ha^{-1})</th><th>Carbon (t ha^{-1})</th></tr>
<tr><td rowspan="4">Oromia</td><td>Forest</td><td>157.3</td><td>43.8</td><td>201.1</td><td>78.6</td><td>21.9</td><td>100.5</td></tr>
<tr><td>Other Wooded Land</td><td>10.6</td><td>3.3</td><td>13.9</td><td>5.3</td><td>1.7</td><td>7.0</td></tr>
<tr><td>Other Land</td><td>14.7</td><td>4.3</td><td>19.0</td><td>7.3</td><td>2.2</td><td>9.5</td></tr>
<tr><td>Water</td><td>244.2</td><td>65.9</td><td>310.2</td><td>122.1</td><td>33.0</td><td>155.1</td></tr>
</table>
The EF is obtained by subtracting from the tree carbon stock of forest the carbon stock of the level 1 FRA class ‘other land’.</td></tr>
<tr><td>Value applied:</td><td>100.5 tC/ha – 9.5tC/ha = 91 t C/ha * 3.66 = 333.06tCO2eq</td></tr>
<tr><td>QA/QC procedures applied</td><td>Carbon stock value obtained through the National Forest Inventory. In the NFI process, Quality Assessment/Quality Control (QA/QC) procedures were implemented in order to ensure an adequate standard in the data collection and data entry procedures. Based on random</td></tr>
</table>

	sub-sampling, 10% of the SUs was re-measured by a semi-independent team (composed of EFD (former MEFCC) experts not involved in the field campaign and specifically trained for QA/QC). At least one randomly selected plot per SU was re-measured entirely and the results were compared with the original values. The QA/QC team used the original data forms to check any irregularities in the records. An error tolerance (10% difference in results between the measured and re-measured sampling units) was introduced and applied in order to reject or accept the collected data. The inventory teams were not aware of which SUs were re-measured. This procedure allowed the QA/QC team to identify the field teams with insufficient or nonstandard performances and contact them to improve their measurements precision in the data collection. The data was entered into a database and then subject to cleansing procedures in order to filter all the records considered potentially erroneous.
Uncertainty associated with this parameter:	*The carbon stocks used to calculate the emission factor are calculated from the literature values of above ground biomass per biome and FRA class provided in table A.9.7 of the NFI document (MEFCC, 2018* *Table A.9.7 of the NFI document also provides literature values for the variance, CI and SE of these above ground biomass values as shown below*

Region	Biome	FRA	AG biomass (t ha^{-1})	AGB Variance	AGB SE	AGB CI (95%)	AGB CI95 relative (%)

Oromia	Acacia-Commiphora	Forest	80.3	2014.8	44.9	142.9	178%
		Other Wooded Land	9.3	3.8	1.9	3.9	42%
		Other Land	15.4	81.1	9.0	18.5	120%
	Combretum-Terminalia	Forest	46.8	108.5	10.4	26.8	57%
		Other Wooded Land	25.0	18.6	4.3	10.0	40%
		Other Land	15.2	14.3	3.8	7.9	52%
	Dry Afromontane	Forest	69.4	848.3	29.1	62.5	90%
		Other Wooded Land	9.0	12.2	3.5	7.4	82%
		Other Land	8.9	3.3	1.8	3.7	41%
	Moist Afromontane	Forest	217.4	892.5	29.9	60.1	28%
		Other Wooded Land	17.8	5.7	2.4	5.2	29%
		Other Land	27.8	36.0	6.0	12.1	44%
		Water	244.2	11089.2	105.3	453.1	186%

For below ground biomass, the root-shoot ratios from the 2006 IPCC guidelines (volume 4, table 4.4) were used as below.

Ecological zone	***Root-shoot ratio***	***IPCC default uncertainty estimate***
Tropical shrubland	0.4	
Tropical desert	0.5	
Tropical mountain system	0.27	0.28 - 0.68
Tropical dry forest	0.56	0.27 - 0.28
Tropical moist deciduous forest	0.2	0.09 - 0.25

Table 7 provides the details on which root-shoot ratio was used for which biome-FRA class combination.

Any comment:	

Parameter:	EF_{G_ABBG}
Description:	*Emission Factor for loss of above ground and below ground biomass in the conversion from forest to grassland.*
Subcategory	This parameter is used for the subcategory forest land converted to grassland

<table>
<tr><td>for which the parameter is used:</td><td></td></tr>
<tr><td>Data unit:</td><td>tCO_2/ha</td></tr>
<tr><td>Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international) :</td><td>Calculated from the Oromia specific values for tree biomass and carbon by region and level FRA class from table A.8.4 of the NFI report (MEFCC, 2018)).

<table>
<tr><th>Region</th><th>FRA Class</th><th>AG biomass ($t\ ha^{-1}$)</th><th>BG biomass ($t\ ha^{-1}$)</th><th>Biomass ($t\ ha^{-1}$)</th><th>AG carbon ($t\ ha^{-1}$)</th><th>BG carbon ($t\ ha^{-1}$)</th><th>Carbon ($t\ ha^{-1}$)</th></tr>
<tr><td rowspan="4">Oromia</td><td>Forest</td><td>157.3</td><td>43.8</td><td>201.1</td><td>78.6</td><td>21.9</td><td>100.5</td></tr>
<tr><td>Other Wooded Land</td><td>10.6</td><td>3.3</td><td>13.9</td><td>5.3</td><td>1.7</td><td>7.0</td></tr>
<tr><td>Other Land</td><td>14.7</td><td>4.3</td><td>19.0</td><td>7.3</td><td>2.2</td><td>9.5</td></tr>
<tr><td>Water</td><td>244.2</td><td>65.9</td><td>310.2</td><td>122.1</td><td>33.0</td><td>155.1</td></tr>
</table>

The EF is obtained by subtracting from the tree carbon stock of forest the carbon stock of the level 1 FRA class ‘other land’.</td></tr>
<tr><td>Value applied:</td><td>100.5 tC/ha – 9.5tC/ha = 91 t C/ha * 3.66 = 333.06tCO2eq</td></tr>
<tr><td>QA/QC procedures applied</td><td>Carbon stock value obtained through the National Forest Inventory. In the NFI process, Quality Assessment/Quality Control (QA/QC) procedures were implemented in order to ensure an adequate standard in the data collection and data entry procedures. Based on random sub-sampling, 10% of the SUs was re-measured by a semi-independent team (composed of EFD (former MEFCC) experts not involved in the field campaign and specifically trained for QA/QC). At least one randomly selected plot per SU was re-measured entirely and the</td></tr>
</table>

	results were compared with the original values. The QA/QC team used the original data forms to check any irregularities in the records. An error tolerance (10% difference in results between the measured and re-measured sampling units) was introduced and applied in order to reject or accept the collected data. The inventory teams were not aware of which SUs were re-measured. This procedure allowed the QA/QC team to identify the field teams with insufficient or nonstandard performances and contact them to improve their measurements precision in the data collection. The data was entered into a database and then subject to cleansing procedures in order to filter all the records considered potentially erroneous.
Uncertainty associated with this parameter:	*The carbon stocks used to calculate the emission factor are calculated from the values of above ground biomass per biome and FRA class provided in table A.9.7 of the NFI document (MEFCC, 2018), also see table 2 above.* *Table A.9.7 of the NFI document also provides values for the variance, CI and SE of these above ground biomass values as shown below*

Region	Biome	FRA	AG biomass (t ha^{-1})	AGB Variance	AGB SE	AGB CI (95%)	AGB CI95 relative (%)
Oromia	Acacia-Commiphora	Forest	80.3	2014.8	44.9	142.9	178%
		Other Wooded Land	9.3	3.8	1.9	3.9	42%
		Other Land	15.4	81.1	9.0	18.5	120%
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		Other Land	27.8	36.0	6.0	12.1	44%
		Water	244.2	11089.2	105.3	453.1	186%

For below ground biomass, the root-shoot ratios from the 2006 IPCC guidelines (volume 4, table 4.4) were used as below.

Ecological zone	***Root-shoot ratio***	***IPCC default***

			uncertainty estimate
	Tropical shrubland	0.4	
	Tropical desert	0.5	
	Tropical mountain system	0.27	0.28 - 0.68
	Tropical dry forest	0.56	0.27 - 0.28
	Tropical moist deciduous forest	0.2	0.09 - 0.25
	Table 7 provides the details on which root-shoot ratio was used for which biome-FRA class combination. *The carbon values per biome have been calculated as an area weighted value using the areas specified in table 7.*		
Any comment:			

Parameter:	EF_{shrub_AGBG}
Description:	*Emission Factor for loss of above ground and below ground biomass in the conversion from forest to shrubland*
Subcategory for which the parameter is used:	This parameter is used for the conversion of forest land to shrubland
Data unit:	tCO_2/ha
Source of data or description of the method	Calculated from the Oromia specific values for tree biomass and carbon by region and level FRA class from table A.8.4 of the NFI report (MEFCC, 2018)).

<table>
<tr>
<td>for developing the data including the spatial level of the data (local, regional, national, international):</td>
<td>
<table>
<tr><th>Region</th><th>FRA Class</th><th>AG biomass ($t\ ha^{-1}$)</th><th>BG biomass ($t\ ha^{-1}$)</th><th>Biomass ($t\ ha^{-1}$)</th><th>AG carbon ($t\ ha^{-1}$)</th><th>BG carbon ($t\ ha^{-1}$)</th><th>Carbon ($t\ ha^{-1}$)</th></tr>
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<tr><td>Water</td><td>244.2</td><td>65.9</td><td>310.2</td><td>122.1</td><td>33.0</td><td>155.1</td></tr>
</table>
The EF is obtained by subtracting from the tree carbon stock of forest the carbon stock of the level 1 FRA class ‘other wooded land’.
</td>
</tr>
<tr>
<td>Value applied:</td>
<td>100.5 tC/ha – 7 tC/ha = 93.5 t C/ha * 3.66= 342.83 tCO2eq</td>
</tr>
<tr>
<td>QA/QC procedures applied</td>
<td>Carbon stock value obtained through the National Forest Inventory. In the NFI process, Quality Assessment/Quality Control (QA/QC) procedures were implemented in order to ensure an adequate standard in the data collection and data entry procedures. Based on random sub-sampling, 10% of the SUs was re-measured by a semi-independent team (composed of EFD (former MEFCC) experts not involved in the field campaign and specifically trained for QA/QC). At least one randomly selected plot per SU was re-measured entirely and the results were compared with the original values. The QA/QC team used the original data forms to check any irregularities in the records. An error tolerance (10% difference in results between the measured and re-measured sampling units) was introduced and applied in order to reject or accept the collected data. The inventory teams were not aware of which SUs were re-measured. This procedure allowed the QA/QC team to identify the field teams with insufficient or nonstandard performances and contact them to improve their measurements precision in the data collection. The data was entered into a database and then subject to cleansing procedures in order to filter all the records considered potentially erroneous.</td>
</tr>
</table>

Uncertainty associated with this parameter:	*The carbon stocks used to calculate the emission factor are calculated from the values of above ground biomass per biome and FRA class provided in table A.9.7 of the NFI document (MEFCC, 2018), also see table 2 above.* *Table A.9.7 of the NFI document also provides values for the variance, CI and SE of these above ground biomass values as shown below*

Region	Biome	FRA	AG biomass (t ha^{-1})	AGB Variance	AGB SE	AGB CI (95%)	AGB CI95 relative (%)
Oromia	Acacia-Commiphora	Forest	80.3	2014.8	44.9	142.9	178%
		Other Wooded Land	9.3	3.8	1.9	3.9	42%
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For below ground biomass, the root-shoot ratios from the 2006 IPCC guidelines (volume 4, table 4.4) were used as below.

Ecological zone	***Root-shoot ratio***	***IPCC default uncertainty estimate***
Tropical shrubland	0.4	
Tropical desert	0.5	
Tropical mountain system	0.27	0.28 - 0.68
Tropical dry forest	0.56	0.27 - 0.28
Tropical moist deciduous forest	0.2	0.09 - 0.25

Table 7 provides the details on which root-shoot ratio was used for which biome-FRA class combination.

The carbon values per biome have been calculated as an area weighted value using the areas specified in table 7

Any comment:	

Parameter:	RF_{C_AGBB}
Description:	*Above ground and below ground biomass removal Factor for the conversion of cropland to forest land.*
Subcategory for which the parameter is used:	This parameter is used to calculate the changes in above ground an below ground biomass in the conversion of cropland to forest land
Data unit:	tCO_2/ha/year
Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):	Calculated from the Oromia specific values for tree biomass and carbon by region and level FRA class from table A.8.4 of the NFI report (MEFCC, 2018)).

Region	FRA Class	AG biomass (t ha^{-1})	BG biomass (t ha^{-1})	Biomass (t ha^{-1})	AG carbon (t ha^{-1})	BG carbon (t ha^{-1})	Carbon (t ha^{-1})
Oromia	Forest	157.3	43.8	201.1	78.6	21.9	100.5
	Other Wooded Land	10.6	3.3	13.9	5.3	1.7	7.0
	Other Land	14.7	4.3	19.0	7.3	2.2	9.5
	Water	244.2	65.9	310.2	122.1	33.0	155.1

As per the ISFL guidance note, the removal factor is calculated by assuming that during the conversion from cropland to forest, carbon stocks will go from average carbon stocks in non-forest to average carbon stocks in forests during a period of 20 years. So, factor is the difference between *9.5tC/ha and 100.5 tC/ha –= 91 t C/ha*

91 / 20 = 4.55 t C/ha/year

*4.55 * (44/12) = 16.68 CO2eq/ha/yr*

Value applied:	16.68
QA/QC	*See* EF_{C_AGBG}

procedures applied	
Uncertainty associated with this parameter:	*See $EF_{C\text{-}AGBG}$*
Any comment:	

Parameter:	*RF_{G_AGBB}*
Description:	*Above ground and below ground biomass removal factor for the conversion of cropland to forest land.*
Subcategory for which the parameter is used:	This parameter is used to calculate the changes in above ground and below ground biomass in the conversion of grassland to forest land
Data unit:	tCO_2/ha/year
Source of data or description of the method for developing the data including the spatial level of the data (local,	Calculated from the Oromia specific values for tree biomass and carbon by region and level FRA class from table A.8.4 of the NFI report (MEFCC, 2018)) using the difference between the forest class and 'other land'.

Region	FRA Class	AG biomass (t ha^{-1})	BG biomass (t ha^{-1})	Biomass (t ha^{-1})	AG carbon (t ha^{-1})	BG carbon (t ha^{-1})	Carbon (t ha^{-1})
Oromia	Forest	157.3	43.8	201.1	78.6	21.9	100.5
	Other Wooded Land	10.6	3.3	13.9	5.3	1.7	7.0
	Other Land	14.7	4.3	19.0	7.3	2.2	9.5
	Water	244.2	65.9	310.2	122.1	33.0	155.1

As per the ISFL guidance note, the removal factor is calculated by assuming that during the conversion from grassland to forest, carbon

regional, national, international):	stocks will go from average carbon stocks in non-forest to average carbon stocks in forests during a period of 20 years. So, factor is the difference between *9.5tC/ha and 100.5 tC/ha –= 91 t C/ha* *91 / 20 = 4.55 t C/ha/year* *4.55 * (44/12) = 16.68 CO2eq/ha/yr*
Value applied:	16.68
QA/QC procedures applied	See EF_{G_AGBG}
Uncertainty associated with this parameter:	See EF_{G-AGBG}
Any comment:	

Parameter:	RF_{shrub_AGBB}
Description:	*Above ground and below ground biomass removal factor for the conversion of shrubland to forest land.*
Subcategory for which the parameter is used:	This parameter is used to calculate the changes in above ground and below ground biomass in the conversion of shrubland to forest land
Data unit:	tCO_2/ha/year
Source of data or description of	Calculated from the Oromia specific values for tree biomass and carbon by region and level FRA class from table A.8.4 of the NFI report (MEFCC, 2018)) using the difference between the carbon stock

the method for developing the data including the spatial level of the data (local, regional, national, international) :	of forest class and 'other wooded land'.. (see table below) As per the ISFL guidance note, the removal factor is calculated by assuming that during the conversion from grassland to forest, carbon stocks will go from average carbon stocks in non-forest to average carbon stocks in forests during a period of 20 years. So, factor is the difference between 7 tC/ha and 100.5 tC/ha –= 93.5 t C/ha *91 / 20 = 4.675 t C/ha/year* *4.675 * (44/12) = 17.14 CO2eq/ha/yr*
Value applied:	*17.14*
QA/QC procedures applied	*See* EF_{shrub_AGBG}
Uncertainty associated with this parameter:	*See* $EF_{shrub\text{-}AGBG}$
Any comment:	

Region	FRA Class	AG biomass (t ha^{-1})	BG biomass (t ha^{-1})	Biomass (t ha^{-1})	AG carbon (t ha^{-1})	BG carbon (t ha^{-1})	Carbon (t ha^{-1})
Oromia	Forest	157.3	43.8	201.1	78.6	21.9	100.5
	Other Wooded Land	10.6	3.3	13.9	5.3	1.7	7.0
	Other Land	14.7	4.3	19.0	7.3	2.2	9.5
	Water	244.2	65.9	310.2	122.1	33.0	155.1

Parameter:	ΔCF_{DOM}
Description:	annual change in carbon stocks in dead wood
Subcategory for which the parameter is used:	Conversion from and to forest
Data unit:	tonnes C ha^{-1} yr^{-1}
Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):	For deadwood, table 3-24 of the NFI report (MEFCC, 2018) provides values for carbon in deadwood for different land use/land cover types on the national level as shown below. FRA class / Major LUCC / Carbon ($t\ ha^{-1}$): Forest / Natural regenerated forest / 15.8 Forest / Plantation / 0.5 Other Wooded Land / Other wooded land / 1.9 Other Land / Cultivated / 2.6 Other Land / Natural / 0.9 Since no region-specific values for dead wood are provided in the NFI, the national values have been used for the emission and removal factors. The emission and removals from deadwood have been calculated according to the ISFL Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period (Version 1.0). In line with this guidance note, equation 2.23 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories has been applied to estimate annual change in carbon stocks in dead wood due to land conversion by comparing dead wood stock, under the old land-use category and under the new land-use category. Since there are no data to distinguish between the dead wood stocks immediately after the land-use conversion and the later transition period, it is assumed that the changes in the dead wood from one value to another happen in a linear fashion over the IPCC default period of 20 years.
Value applied:	According to the ISFL guidance note, the values for litter and dead wood pools can be assumed zero in all non-forest categories and dead organic matter in Forest Land shall be assumed to have the value of mature forests at the beginning of the Baseline Period. Since values are available from the NFI, the following emission and removal factors have been as outlines in the table below.

Nested table (deadwood carbon by class):

FRA class	Major LUCC	Carbon ($t\ ha^{-1}$)
Forest	Natural regenerated forest	15.8
Forest	Plantation	0.5
Other Wooded Land	Other wooded land	1.9
Other Land	Cultivated	2.6
Other Land	Natural	0.9

Baseline subcategory	Corresponding change from table 3-24 of the NFI report	Change factor (t C ha^{-1} yr^{-1})
Forest to cropland	Natural regenerated forest to Other land-cultivated	-0.66
Forest to grassland	Natural regenerated forest to Other land-natural	-0.745
Forest to shrubland	Natural regenerated forest to other wooded land	-0.695
Cropland to forest	Other land-cultivated to plantation	-0.105
Grassland to forest	Other land-natural to plantation	-0.02
Shrubland to forest	Other wooded land to plantation	-0.07

QA/QC procedures applied	
Uncertainty associated with this parameter:	No uncertainties have been provided in the NFI report for the deadwood values. Due to the very small contribution of deadwood biomass to the overall total biomass (above and below ground), its effect on the overall uncertainty is considered negligible and this factor was excluded from the Monte Carlo analysis.
Any comment:	

Parameter:	SOC_{ref}
Description:	reference soil organic C stocks for mineral soils under native forest (in 0-30 cm depth)
Subcategory for which the parameter is used:	Conversion from and to forest
Data unit:	tonnes C ha^{-1}
Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):	"Evaluation of the forest carbon content in soil and litter in Ethiopia" which was implemented by Natural Resources Finland (LUKE) and Ethiopia Environment and Forestry Research Institute (EEFRI). The national value was based on biome specific

<table>
<tr><td></td><td>values as shown in the table below.
<table>
<tr><th>Soil type - Biome</th><th>SOC ref (tC/ha)</th><th>N</th><th>Standard deviation (tC/ha)</th></tr>
<tr><td>Acacia Commiphora</td><td>34.245</td><td>11</td><td>17.01197</td></tr>
<tr><td>Combretum Terminalia</td><td>41.561</td><td>37</td><td>28.25306</td></tr>
<tr><td>Dry Afromontaine</td><td>53.080</td><td>33</td><td>34.46676</td></tr>
<tr><td>Moist Afromontaine</td><td>83.886</td><td>17</td><td>34.65632</td></tr>
<tr><td>Average</td><td>51.961</td><td>98</td><td>33.58339</td></tr>
</table></td></tr>
<tr><td>Value applied:</td><td>51.96 (average value)</td></tr>
<tr><td>QA/QC procedures applied</td><td></td></tr>
<tr><td>Uncertainty associated with this parameter:</td><td>See above for standard deviation</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

<table>
<tr><td>Parameter:</td><td>SOCi</td></tr>
<tr><td>Description:</td><td>Equilibrium soil organic C stocks for mineral soils under land use type i</td></tr>
<tr><td>Subcategory for which the parameter is used:</td><td>Conversion from and to forest</td></tr>
<tr><td>Data unit:</td><td>tonnes C ha^{-1}</td></tr>
<tr><td>Source of data or description of the method for developing the data including the spatial level of the data (local, regional, national, international):</td><td>Calculated from the reference SOC value for forest and applying the stock change factors applied from the validated ERPD as shown in the table below.
<table>
<tr><th></th><th>FLU</th><th>FI</th><th>FMG</th></tr>
<tr><td>Annual cropland</td><td>0.48</td><td>0.92</td><td>1</td></tr>
<tr><td>Grassland</td><td>1</td><td>1</td><td>0.97</td></tr>
</table></td></tr>
<tr><td>Value applied:</td><td>
<table>
<tr><th></th><th>Equilibrium SOC (tC/ha)</th></tr>
<tr><td>Annual cropland</td><td>22.94</td></tr>
<tr><td>Grassland</td><td>50.40</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures applied</td><td></td></tr>
<tr><td>Uncertainty associated with this parameter:</td><td>Calculated from SOC_{ref} . Standard deviation for SOC_{ref} provided in table above</td></tr>
</table>

Any comment:	

2.3.2 Monitored Data and Parameters

The key data and parameters monitored during the 2022-2023 reporting period focused on land use/cover change, particularly, total forest area within the project boundary, Annual changes in forest area (deforestation, afforestation/reforestation). These monitored parameters were crucial in assessing the extent of deforested and afforested areas within the emissions reduction program area. Additionally, the estimation of the forest carbon stock potential in the region was carried out by utilizing national forest inventory results to calculate greenhouse gas emissions and removals.

Table 12: Monitored Data and Parameters

Parameter:	$\Delta A_{F\text{-}C}$
Description:	area converted from forest to cropland category during the monitoring period
Subcategory for which the parameter is used:	Forest to Cropland
Data unit:	Hectares
Source of data and description of measurement/calculation methods and procedures applied:	Analysis of remote sensing images using stratified random sampling. The data was generated using Collect Earth Online and SEPAL platform to integrate the different satellite imagery. 3330 sample points were analyzed across the project area, with each sample plot measuring 0.5 hectares. Sample points were analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat from December 2021 to January 2024.
Frequency of monitoring/recording:	Two years
Value monitored during this Reporting Period:	*16012*
Quality Assurance/Quality Control procedures applied:	A centralized data collection team facilitated a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group

	discussions on challenging issues were held regularly. The quality control team conducted cross-checking activities using multiple data sources and local knowledge. This team, comprising two specialists (one from EFD and one from ORCU MRV), oversaw the entire data collection process to ensure data quality. Consequently, a total of 316 sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were reinterpreted by two experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Of these sample points, 287 (90.8%) yielded results consistent with the initial interpretations, while 29 (9.2%) showed discrepancies. The discrepancies were resolved through discussions with all team members.
Uncertainty for this parameter:	Margin of error: 12938.176 ha (for a relative MoE of 80.805%)
Any comment:	

Parameter:	$\Delta A_{F\text{-}G}$
Description:	area converted from forest to grassland category during the monitoring period
Subcategory for which the parameter is used:	Forest to grassland
Data unit:	Hectares
Source of data and description of measurement/calculation methods and procedures applied:	Analysis of remote sensing images using stratified random sampling, the data was generated using Collect Earth Online and SEPAL platform to integrate the different satellite imagery. 3330 sample points were analyzed across the project area, with each sample plot measuring 0.5 hectares. Sample points were analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat from December 2021 to January 2024.
Frequency of monitoring/recording:	Two years
Value monitored during this Reporting Period:	*0*

Quality Assurance/Quality Control procedures applied:	A centralized data collection team facilitated a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues were held regularly. The quality control team conducted cross-checking activities using multiple data sources and local knowledge. This team, comprising two specialists (one from EFD and one from ORCU MRV), oversaw the entire data collection process to ensure data quality. Consequently, a total of 316 sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were reinterpreted by two experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Of these sample points, 287 (90.8%) yielded results consistent with the initial interpretations, while 29 (9.2%) showed discrepancies. The discrepancies were resolved through discussions with all team members.
Uncertainty for this parameter:	*N/A (change not observed)*
Any comment:	

Parameter:	$\Delta A_{F\text{-}shrub}$
Description:	area converted from forest to shrubland category during the monitoring period
Subcategory for which the parameter is used:	Forest to shrubland
Data unit:	Hectares
Source of data and description of measurement/calculation methods and procedures applied:	Analysis of remote sensing images stratified random sampling. The data was generated using Collect Earth Online and SEPAL platform to integrate the different satellite imagery. 3330 sample points were analyzed across the project area, with each sample plot measuring 0.5 hectares. Sample points were analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat from December 2021 to January 2024.

Frequency of monitoring/recording:	Two years
Value monitored during this Reporting Period:	*0*
Quality Assurance/Quality Control procedures applied:	A centralized data collection team facilitated a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues were held regularly. The quality control team conducted cross-checking activities using multiple data sources and local knowledge. This team, comprising two specialists (one from EFD and one from ORCU MRV), oversaw the entire data collection process to ensure data quality. Consequently, a total of 316 sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were reinterpreted by two experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Of these sample points, 287 (90.8%) yielded results consistent with the initial interpretations, while 29 (9.2%) showed discrepancies. The discrepancies were resolved through discussions with all team members.
Uncertainty for this parameter:	*N/A (change not observed)*
Any comment:	

Parameter:	$\Delta A_{C\text{-}F}$
Description:	area converted from cropland to forest category during the monitoring period
Subcategory for which the parameter is used:	Cropland to forest
Data unit:	Hectares
Source of data and description of measurement/calculation methods and procedures applied:	Analysis of remote sensing images using stratified random sampling. The data was generated using Collect Earth Online and SEPAL platform to integrate the different satellite imagery. 3330 sample points were analyzed across the project area, with each sample plot measuring 0.5 hectares. Sample points were analyzed through visual

	interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat from December 2021 to January 2024.
Frequency of monitoring/recording:	Two years
Value monitored during this Reporting Period:	*14008*
Quality Assurance/Quality Control procedures applied:	A centralized data collection team facilitated a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues were held regularly. The quality control team conducted cross-checking activities using multiple data sources and local knowledge. This team, comprising two specialists (one from EFD and one from ORCU MRV), oversaw the entire data collection process to ensure data quality. Consequently, a total of 316 sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were reinterpreted by two experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Of these sample points, 287 (90.8%) yielded results consistent with the initial interpretations, while 29 (9.2%) showed discrepancies. The discrepancies were resolved through discussions with all team members.
Uncertainty for this parameter:	*Margin of error: 12514.768 ha (for a relative MoE of 89.342%)*
Any comment:	

Parameter:	$\Delta A_{G\text{-}F}$
Description:	area converted from grassland to forest category during the monitoring period
Subcategory for which the parameter is used:	Grassland to forest
Data unit:	Hectares
Source of data and description of measurement/calculation methods and procedures applied:	Analysis of remote sensing images using stratified random sampling. The data was generated using Collect Earth Online and SEPAL platform to integrate the different

	satellite imagery. 3330 sample points were analyzed across the project area, with each sample plot measuring 0.5 hectares. Sample points were analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat from December 2021 to January 2024.
Frequency of monitoring/recording:	Two years
Value monitored during this Reporting Period:	*4009*
Quality Assurance/Quality Control procedures applied:	A centralized data collection team facilitated a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues were held regularly. The quality control team conducted cross-checking activities using multiple data sources and local knowledge. This team, comprising two specialists (one from EFD and one from ORCU MRV), oversaw the entire data collection process to ensure data quality. Consequently, a total of 316 sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were reinterpreted by two experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Of these sample points, 287 (90.8%) yielded results consistent with the initial interpretations, while 29 (9.2%) showed discrepancies. The discrepancies were resolved through discussions with all team members.
Uncertainty for this parameter:	*Margin of error: 4656.474 ha (for a relative MoE of 116.139%)*
Any comment:	

Parameter:	$\Delta A_{shrub\text{-}F}$
Description:	area converted from shrubland to forest category during the monitoring period
Subcategory for which the parameter is used:	Shrubland to forest
Data unit:	hectares

Source of data and description of measurement/calculation methods and procedures applied:	Analysis of remote sensing images using stratified random sampling. The data was generated using Collect Earth Online and SEPAL platform to integrate the different satellite imagery. 3330 sample points were analyzed across the project area, with each sample plot measuring 0.5 hectares. Sample points were analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat from December 2021 to January 2024.
Frequency of monitoring/recording:	Two years
Value monitored during this Reporting Period:	*11039*
Quality Assurance/Quality Control procedures applied:	A centralized data collection team facilitated a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues were held regularly. The quality control team conducted cross-checking activities using multiple data sources and local knowledge. This team, comprising two specialists (one from EFD and one from ORCU MRV), oversaw the entire data collection process to ensure data quality. Consequently, a total of 316 sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were reinterpreted by two experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Of these sample points, 287 (90.8%) yielded results consistent with the initial interpretations, while 29 (9.2%) showed discrepancies. The discrepancies were resolved through discussions with all team members.
Uncertainty for this parameter:	Margin of error: 15213.167 ha (for a relative MoE of 137.808%)
Any comment:	

3 Quantification of emission reductions

3.1 Emissions Baseline for the Reporting Period covered in this report

The Emissions Baseline for the period 2007 and 2017 has been updated compared to the validated ERPD. The details of the updated Emission Baseline and the underlying calculations can be found in Anex 4.

Table 13 Oromia Regional State baseline emissions

Year of reporting period t	Baseline emissions							
	Subcategory 1	Subcategory 2	Subcategory 3	Subcategory 4	Subcategory 5	Subcategory 6	Subcategory 7	Total Emissions Baseline (tCO_2e)
	Forest – Cropland	*Forest – Grassland*	*Forest - shrub*	*Cropland -forest*	*Grassland - forest*	*Shrubland - forest*	*SOC*	
2022	*7,887,173*	*1,643,562*	*1,009,705*	*-78,977*	*-23,281*	*-58,829*	*1,100,587*	*11,479,940*
2023	*7,943,964*	*1,656,908*	*1,017,155*	*- 157,954*	*-46,563*	*-117,658*	*1,200,640*	*11,496,492*
Total net Emissions Baseline during the Reporting Period								*22,976,432*

3.2 Estimation of emissions by sources and removals by sinks included in the ISFL ER Program's scope

The table below provides the combined value for 2022 and 2023 for the different subcategories. The emission and removals have been calculated using the equations discussed in section 2. A spreadsheet with the detailed calculations is attached.

Table 14: Oromia Regional state Emissions during monitoring period (2022-2023)

Year of reporting period t	Emissions/removals							
	Subcategory 1	Subcategory 2	Subcategory 3	Subcategory 4	Subcategory 5	Subcategory 6	Subcategory 7	Total emissions / removals (tCO_2e)
	Forest-Cropland	*Forest-Grassland*	*Forest-Shrubland*	*Cropland -forest*	*Grassland -forest*	*Shrubland* - forest	*SOC*	
2022	*2,700,397*	0	0	*-114,154*	*-33,295*	*-93,197*	*56,280*	*2,516,031*

2023	2,700,397	0	0	*-228,307*	*-66,589*	*-186,394*	*30,065*	*2,249,172*
Actual net GHG emissions from the ISFL ER Program during the Reporting Period								*4,765,204*

3.3 Calculation of emission reductions

The emission reductions were calculated as the difference between the baseline emissions and the actual emissions during the monitoring period. The emission reductions from removals are calculated as the difference between the expected removals under the Emissions Baseline and the actual removals.

Table 15: Calculation of emission reductions

Actual net GHG emissions from the ISFL ER Program during the Reporting Period (tCO_2-e)	4,765,204.57
Total net Emissions Baseline during the Reporting Period (tCO_2-e)	22,976,432.39
Net Emission Reductions during the Reporting Period (tCO_2-e)	18,211,227.82

3.4 Results for Monitoring, Evaluation and Learning (MEL) Framework

Table 16 Monitoring, Evaluation and Learning (MEL) Framework

Result	*Unit*	*Year (please state the year of the reporting)*
Area of forest remaining forest in ISFL program areas (corresponding to T2.O1.1 on MEL Framework)	*8,968,928 Ha*	*2023*
Area of conversions from forest to other land uses in ISFL program areas (corresponding to T2.O1.2a on MEL Framework)	*16,012 Ha*	*2022-2023*
Area of other land uses converted to forest in ISFL program areas (corresponding to T2.O1.2b on MEL Framework)	*29,056 Ha*	*2022-2023*
Emission reductions from forest remaining forest as compared to a	*Not applicable,*	

reference level in ISFL program areas (corresponding to *T2.O1.3* on MEL Framework)	*forest remaining forest not included in the accounting scope for this ERPA phase*	

4 Uncertainty of the estimate of Emission Reductions

4.1 Initial identification and assessment of sources of uncertainty

Uncertainties arise in baseline setting and Measurement, Monitoring and Reporting. Uncertainty (the lack of knowledge of the true value) is due to both random and systematic errors. Uncertainties can be addressed in a number of ways. Systematic errors (bias) should be avoided by good Measurement practices. Random errors tend to cancel each other out and can be managed by sampling.

Some sources of uncertainty linked to sampling protocols (sample size, spatial representativeness of sampled areas, measurement errors) or to the extrapolation from the sample to the entire Oromia region cannot be assessed directly, as this requires specific studies and dedicated experimental designs to compare different protocols with each other. Nevertheless, the uncertainties associated with an unsuitable protocol are expected to be significant. This is what is reported in table 11. However, we assume that the sampling protocols implemented in this study are robust, allowing a precise description of the variability of the variable under consideration and providing accurate estimates of the population mean and standard deviation from the sample. For the other sources of uncertainty associated with the input variables (Biomass, Activity Data) and parameters (carbon fraction, root/shoot ratio, etc.), the sensitivity analysis described in section 4.5 and results in tables 34, 35 and 36, assess the effect of the uncertainty of each parameter on the annual net emission level for the baseline period (2007-2017), for the monitoring period 2022-2023 and on net emission reduction.

Table 17: Uncertainties sources and assessment

Sources of uncertainty	Parameters and applicable subcategories affected by this sources of uncertainty	Analysis of contribution to overall uncertainty
Activity data during the baseline period		
Interpretation of sample points	*All parameters representing area changes between land use categories under the baseline*	Significant effect since these are the main data underlying the land use and land use change analysis. 92,820 sample points were collected for a sample-based area estimation and classified into seven land use/land cover (LULC) classes: Forest, Cropland, Grassland, Settlement, Wetland, Shrubland, and Other Land. The assessment of the sample points was done through visual interpretation of available high-resolution images and by interpreting vegetation indices derived from medium and high-resolution images.
Sampling	*All parameters representing area changes between land use categories under the baseline*	Significant effect. a systematic random sample of 92,820 plots was analyzed using a 2x2 km systematic grid across Oromia. The Oromia Region was analyzed to determine seven LULC classes (Forest, Cropland, Grassland, Settlement, Wetland, shrub land and other land) and the historical trends in land use for the years 2007–2017 have been assessed and labeled for each change and unchanged classes.
Extrapolation to Oromia region	*All*	Significant effect
Activity data during the monitoring period		

interpretation of sample points	*All parameters representing area changes between land use categories (ΔA)*	3,330 plots across the Oromia Region were classified into seven land use/land cover (LULC) classes: Forest, Cropland, Grassland, Settlement, Wetland, Shrubland, and Other Land. The assessment of the sample points was done through visual interpretation of available high-resolution images and by interpreting vegetation indices derived from medium and high-resolution images. Contribution to overall uncertainty is high since these are the main data underlying the land use and land use change analysis. To ensure the quality of the AD collection, various vegetation indices were used, such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI). Furthermore, historical trends in land use/cover from 2021 to 2024 were assessed and labeled for each change and unchanged land use/cover classes. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling, but interpretation errors can still occur
Sampling	*All parameters representing area changes between land use categories (ΔA)*	Contribution to uncertainty is very high Estimation of area changes is derived from a stratified random sampling approach where the likelihood of change is used to determine the strata. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling, but errors can still occur. Sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were

		reinterpreted by two experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Discrepancies were resolved through discussions with all team members.
Extrapolation to Oromia region	*All*	High Integrated in the methodology where the results of the interpretation of sample plots is used to extrapolate the results to the total area of the Oromia region
Emission Factor		
Sampling	*All EF and RF parameters*	High (but not evaluated in Sensitivity analysis)
Allometric models	*All EF and RF parameters*	Allometric equations have been used in the NFI, in particular from Chave, et al. (2014)[16] and Henry et all (2013)[17] Contribution is high (but not evaluated in Sensitivity analysis
Above ground biomass (ABG)	*All EF and RF parameters*	Derived from Oromia specific values in the NFI. Variance. CI and SE provided in table A9.7 of the NFI report (MEFCC, 2018) Contribution very high (The most important factor in uncertainty based on Sensitivity analysis 4.5)
Below ground biomass (BBG)	*All EF and RF parameters*	Very high. Calculated from ABG using BBG to ABG ratio below
Sampling of ABG	*All EF and RF parameters*	Sampling was applied to estimate ABG. The Variance. CI and SE provided for AGB

[16] Chave, J. et al. (2014). "Improved allometric models to estimate the aboveground biomass of tropical trees". In: Global Change Biology, pp. 3177–3190. ISSN: 13541013. DOI: 10.1111/gcb.12629.
[17] Henry, M. et al. (2013). "GlobAllomeTree: international platform for tree allometric equations to support volume, biomass and carbon assessment". iForest - Biogeosciences and Forestry 6.5, pp. 326– 330.

		incorporates the sampling approach
BBG to ABG ratio (rBG_AB)	*All EF and RF parameters*	Low The data of BBG provided correspond to slightly different rBG_AB coefficients for the four biomes considered (Acacia Commiphora Combretum-Terminalia Dry Afromontane Moist Afromontane). However, the standard deviations of these coefficients are not provided. These were estimated from the review by Mokany et al. 2006 (Table 6)
Carbon fraction	*All EF and RF parameters*	Low. Not measured but sourced from literature. The value used is 0.5 which corresponds to default value of CF in IPCC 2006: 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The standard deviation required to estimate uncertainty on this parameter is not provided. The review by Martin et al. 2018 was used to estimate the standard deviation of carbon fraction (Table 1).
Extrapolation of EF	*All*	Very high EF is determined from above-ground biomass measurements in the four biomes. Extrapolation to all Oromia forests was carried out by weighting the emission factor determined per biome by the relative surface area of the biome. The relative surface area is considered without error.
Carbon removal factor		
Carbon removal factor	*All*	Very high. The carbon removal factor is calculated by dividing the emission factor (EF)

		by 20. The uncertainty on this factor is therefore the same as that calculated for EF

4.2 Selection of methods and development of Standard Operating Procedures and Quality Assurance/Quality Control procedures

Activity data

Process Overview:

- Sample Generation: A total of 3,330 sample points were generated using keyman allocation.
- Training and Awareness: Comprehensive training sessions were conducted on the LULC nature, particularly the 'Ethiopian LULC interpretation key'. These sessions also covered potential errors in image interpretation during activity data collection.
- Data Distribution: The generated sample points were equally distributed among seven interpreters.

Data Collection and Interpretation:

- Platform Utilized: The Collect Earth Online (CEO) platform was employed for data collection and real-time quality assurance, supported by two experts overseeing the process.
- Satellite Integration: High-resolution satellite images from sources such as Planet, Sentinel, Google Earth, Landsat, and NDVI values were integrated into the CEO platform, enhancing the confidence of data collectors.
- Quality Control: A centralized data collection team facilitated a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues were held regularly.
- Independent Assessment: The quality control team conducted cross-checking activities using multiple data sources and local knowledge. This team, comprising two specialists (one from EFD and one from ORCU MRV), oversaw the entire data collection process to ensure data quality. A total of 316 sample points were randomly selected for Quality Control/Quality Assurance (QC/QA). These points were reinterpreted by two experts with extensive

knowledge of LULC changes in Oromia and Ethiopia. Of these sample points, 287 (90.8%) yielded results consistent with the initial interpretations, while 29 (9.2%) showed discrepancies. The discrepancies were resolved through discussions with all team members.

Standard Operating Procedures (SOPs):

- Guidelines: Detailed SOPs were followed to maintain consistency in data collection and interpretation.
- Assessment Interpretation: All interpreters adhered to the same guidelines, and training was provided on Ethiopian LULC interpretation to ensure uniformity.
- Independent Assessment Percentage: Regular independent assessments were conducted to verify the accuracy of the collected data.

By following these procedures and leveraging advanced tools, the team ensured high-quality, reliable data for the LULC change detection.

Emission factors

As discussed above, the emission factors are estimated using values from the national forest inventory.

Section 2.2 of the NFI report (MEFCC, 2018) outlines the data collection approach used in the NFI while section 2.3 of the same report outlines the Quality Assessment / Quality Control procedures. A series of best practices on the importance of data collection (including double measurement) were compiled and explained to the experts in the field in order to increase the accuracy of the measurements. Three critical tree attributes subject to errors were identified: DBH, height and scientific names.

Based on this, specific training material was prepared by EFD (former Ministry of Environment, Forest, and Climate Change) and training was provided for the national forest inventory team in order to improve the correct identification of the forest land use/cover type, by following the definition of forest and by taking into account canopy cover estimates, number of trees per hectare, and other relevant site type indicators. In addition to this, based on a random sub-sampling, 10% of the SUs were re-measured by a semi-independent team (composed of MEFCC experts not involved in the field campaign and specifically trained for QA/QC). At least one randomly selected plot per SU was re-measured entirely and the results were compared with the original values. An error tolerance (10% difference in results between the measured and re-measured sampling units) was introduced and applied in order to reject or accept the collected data. An independent botanist was assigned to evaluate, correct and improve upon the tree names assigned by the teams during the field data collection. The data entered into the database was submitted for cleansing procedures in order to filter all the records considered potentially erroneous. Several indicators have been used to identify possibly erroneous values which fall out of the expected range of results (as ratios between DBH - Height, Diameter at 30cm - DBH, DBH – Branches diameter).

4.3 Residual uncertainty of Activity Data and Emission Factors

The general methodology for calculating uncertainty is based on the Markov Chain Monte Carlo (MCMC) Monte Carlo method. The Monte Carlo method is one of the probabilistic algorithmic methods based on repeated random draws (trials). These random, independent draws are made to simulate observations from a finite or infinite set of true observations. The MC method differs from so-called Bootstrap methods in that these draws are carried out according to the known or assumed probability density functions (PDFs) of the variables under consideration. When the number of draws is large (several thousand), random draws enable the theoretical distribution of the variable to be described faithfully, and give access to precise estimates of its statistical characteristics, such as their mean, standard deviation, confidence interval, etc. Its main interest lies in its ability to solve complex problems, in particular its capacity to propagate uncertainties associated with input variables and parameters, to assess uncertainty on one or more output variables when the relationships linking output variables to input variables cannot be described in one or a few simple analytical equations. Indeed, when these relationships are complex, or when their number becomes large, the propagation of uncertainties by means of partial differential propagation laws, which relate in analytical forms the uncertainties of a model's inputs to uncertainties of its outputs, becomes extremely tedious.

Quantification of the uncertainty of Activity data, Emission factor, carbon removal factor and emissions during the baseline period (2007-2017) using Monte Carlo methodology

The data used in the calculation of activity data and factors of carbon emission and removal during the baseline period are:

- **Activity data (AD) during the period 2007-2017:**

In this monitoring report, only deforestation and reforestation divided over the following 6 subcategories are considered: deforestation due to conversion of (1) *Forest to cropland* (2) *Forest to grassland* (3) *Forest to shrubland* (4) and reforestation due to conversion of *Cropland to forest* (5*) Grassland to forest* and (6) *Shrubland to forest*.

Activity data (LUCs) are provided by region. They have been checked and cleaned for certain errors. Small differences can therefore appear when comparing these areas of changes to the areas provided in older documents. LUCs are provided for the 21 regions of the state of Oromia. For each region, the available data are the number of samples, the proportion of samples in LUC category, Area in ha calculated from the proportion and total area of the state of Oromia, standard deviation and 95% confidence interval.

- The uncertainties on activity data are then calculated by region using the Monte Carlo method (MC, 10000 trials) and for the whole state of Oromia after cumulating of MC simulated areas of changes by region. Uncertainties are calculated for a 90% confidence interval. The distribution of the area of change is considered to follow a truncated normal distribution having the parameters, mean and standard deviation, of the sample of the region under consideration. Indeed, MC simulations based on a normal distribution of activity data resulted in negative DA estimates. To avoid this inconsistency, we opted for a positive truncated normal distribution. As underlined below, the choice of one or the other PDF has a negligible impact on the estimated uncertainty on net emission. We have compared the effect of the use of the two distributions on uncertainties. The results show a negligible effect, reflecting the fact that despite the negative values, the uncertainty estimated under a normal DA distribution remains very close to the uncertainty estimated using a truncated normal distribution (see "**Emissions during the baseline period 2007-2017" section).**

Also note that MC simulations are random trials, and the results may vary from one run to another.

Activity data for the entire state of OROMIA and distinguishing between losses of forest area (deforestation) and gains (reforestation) are given in Table 18. Note: the "reference value" columns that appear in all tables given below correspond to calculations using the standard formulas applied to the filed data and not to the simulated data. The comparison of the mean using the observed data (inputs), and the mean (or the median) determined from the MC simulations make it possible to estimate the robustness of the MC simulations (number of trials and relevance of the choice of the PDF function with the considered parameters). Generally, the deviations between observed and simulated data are of the order of 1 to 3% maximum, which shows that 10000 trials and chosen PDFs are able to produce very faithfully the parameters of the observed data.

Table 18 Activity data for the baseline period 2007-2017 in ha.

The first column (reference value) is the area calculated from the field data. The other columns are the summary statistics calculated from the MC simulations of the areas (10000 trials per region to simulate statistical distribution of the area of LUC). The activity data in this table is given for the entire state of Oromia. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median)

Activity data (Area in ha)	Mean reference value	MC Mean	MC Median	MC Standard deviation	MC mean-based Uncertainty (%)	MC median-based Uncertainty (%)
Forest loss	307504	309564	309618	10862	5.7	5.7
Forest gain	88798	91411	91479	5533	10.0	10.0
Net Deforestation	218706	218152	218003	12178	9.3	9.3

- **Emission and removal factors of emission and of carbon removal during the period 2007-2017**

Above-ground biomass data (ABG) of forests and other lands were provided for four biomes: *Acacia-Commiphora*, *Combretum-Terminalia*, *Dry Afromontane* and *Moist Afromontane*. Field data available by biome are the sampled area occupied by the biome, the above-ground biomass, the variance, the standard deviation, the 95% confidence interval, and the ratio of the confidence interval to the mean. Biomass data can be found in Table 9.7 of the NFI 2018 (MEFCC, 2018).

Below-Ground biomass (BGB) was estimated from the BGB/AGB ratio (denoted *rBG_AB in R-Code*). Above-ground biomass data and other parameters (described in 4.4.1) were used to calculate the net emission factor (EF) by biome according to the following expression:

- Emission Factor (EF): Emission Factor of Forests – Emission Factor of other lands

This formulation allows for the carbon still present after conversion of forests to other types of lands. Extrapolation to all Oromia forests was carried out by weighting the emission factor determined per biome by the relative surface area of the biome. It should be noted that the carbon of dead wood, of the order of 1.5 tons of carbon/ha on average over the four biomes, was not considered. Due to the very small contribution of deadwood biomass to the total biomass (above and below ground), its effect on the overall uncertainty of the emission factor is considered negligible.

Regarding carbon removal factor used to estimate avoided emissions due to reforestation (forest area gains), we assume that the removal factor is the emission factor divided by 20. The uncertainty on this factor is therefore identical to that calculated on the emission factor.

The emission factors for the forests and other lands as well as the net emission factor (EF) are given in Table *19*19.

Table 19 Emission factors in tons of carbon /ha of "Forests" and "Other Lands".

Emission factor is given by: EF = FE of Forests – FE of Other lands. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median)

Emission factor	Mean Reference	MC Mean	MC Median	MC Standard	MC mean-based	MC median-based

(tons of C/ha)	value			deviation	Uncertainty (%)	Uncertainty (%)
Forests	101	102.77	100.65	28.86	45.9	46.9
Other Lands	9.56	9.82	9.51	3.83	63.8	65.8
Emission Factor (EF)	91.44	92.96	91.14	25.03	44.1	44.9

The carbon removal factor is given below.

Table 20 Carbon removal factor in tons of carbon /ha, calculated as (FE of Forests – FE of Other lands)/20. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median)

Carbon removal factor (tons of C/ha)	Mean Reference value	MC Mean	MC Median	MC Standard deviation	MC mean-based Uncertainty (%)	MC median-based Uncertainty (%)
Carbon removal factor	4.56	4.65	4.56	1.25	44.1	44.9

- **Emissions during the baseline period 2007-2017**

Activity data, emission factor and carbon removal factor are used to estimate emissions during the baseline period of ten years (2007-2017). Summary statistics are given in Table *21*21. Emissions are expressed in the amount of CO_2 (the conversion of carbon unit to CO_2 unit is obtained by multiplying carbon unit by molar mass ratio of CO_2 and carbon (44/12).

Table 21 Total net Carbon Emission in tons of CO2 /ha for the period 2007-2017 due to loss of forest area (deforestation) and gain (reforestation).
Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median)

Emissions in tons of CO_2 /ha	Mean (reference value)	MC Mean	MC Median	MC Standard deviation	MC mean-based Uncertainty (%)	MC median-based Uncertainty (%)

Forest loss	103098792	105807254	103556311	29821311	46.1	47.1
Forest gain	1488594	1558426	1529053	432930	45.2	46.1
Total net emission	101610198	104248827	102041872	29403051	46.1	47.1

Annual Activity data and annual net emission in tons of CO_2 **per ha and per year** over the period 2007-2017 are summarized in Table 2222.

Table 22 Annual activity data (ha/year) and annual net emission by source in tons of CO2 per ha and per year during the baseline period 2007-2017.

Monte Carlo (MC) Uncertainty is: (upper IC 90% - lower IC 90%)/ (2* mean) (or 2*median)

	Mean (reference value)	**MC Mean**	**MC Median**	**MC Standard deviation**	**MC mean-based Uncertainty (%)**	**MC median-based Uncertainty (%)**
Annual Activity data in ha/year						
Annual Forest loss	30750	30956	30962	1086	5.7	5.7
Annual Forest gain	8880	9141	9148	553	10.0	10.0
Annual net deforestation	2871	21815	21800	1218	9.3	9.3
Annual emissions in tons of CO_2/ha/year						
Annual emissions due to forest loss	10309879	10580725	10355631	2982131	46.1	47.1
Annual avoided emissions due to forest gain (carbon removal)	148859	155843	152905	43293	45.20	46.10
Annual Net emission	10161020	10424883	10204187	2940305	46.1	47.1

As mentioned above, the use of a normal probability distribution or a truncated normal probability distribution for areas of LUC affects very slightly the overall uncertainty (the uncertainties on the annual net emission during the baseline period are 45.9% and 47.0% using a normal distribution and 46.1% and 47.1%, not shown).

Quantification of the uncertainty of Activity data, Emission factor, carbon removal factor and emissions during the monitoring period (2022-2023) using Monte Carlo methodology

- **Activity data during the monitoring period 2022-2023**

Activity data (LUCs) during the monitoring period are provided regardless of region. For the three subcategories of LUC, the data provided are: the type of change (forest degradation, forest loss, forest gain and unchanged LU), the number of samples, the area of LUC in ha and the margin of error (half the 95% confidence interval).

The same assumptions used in MC simulations for the ADs during the baseline period were applied for the monitoring period (truncated normal probability distribution). Activity data from data and from MC simulations are given in Table *23*23.

Table 23 Activity data during the monitoring period (two years: 2022 and 2023) in ha.

Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median). * Note that during the monitoring period 2022-2023, the area of reforestation (gain of forest area) is greater than the area of deforestation (loss of forest area)

Activity data (Area in ha)	Mean (reference value)	MC Mean	MC Median	MC Standard deviation	MC mean-based Uncertainty (%)	MC median-based Uncertainty (%)
Area of Forest loss	16012	16130	15991	6432	66.0	66.6
Area of Forest degradation	65785	66701	65968	28455	71	71.7
Area of Forest gain	29056	29113	28963	10205	57.9	58.2
Unchanged	74034	74176	73797	25863	57.6	57.9

non-forest areas						
Net Reforestation*	13044	12982	13028	11897	150.5	149.9

In this report, we recall that only changes corresponding to deforestation (loss of forest area) and reforestation (gain of forest area) are considered in the calculation of emission reductions.

- **Factors of emission and of carbon removal during the monitoring period**

Factor of emission and of carbon removal used in the calculation of emissions during the monitoring period (2002-2023) are those used in the calculation of emissions during the baseline period 2007-2017.

- **Emissions during the monitoring period (2022-2023)**

The emissions, expressed in tons of CO_2 per ha, during the monitoring period are given in Table 24**Error! Reference source not found.**.

Table 24 Annual activity data in ha and annual net emission by source during the monitoring period (two years: 2022 and 2023) in tons of CO2 per ha.
Monte Carlo (MC) Uncertainty is: (upper IC 90% - lower IC 90%)/ (2* mean) (or 2*median)

Emissions in tons of CO2/ha	**Mean (reference value)**	**MC Mean**	**MC Median**	**MC Standard deviation**	**MC mean-based Uncertainty (%)**	**MC median-based Uncertainty (%)**
Forest loss	5368552	5519103	5164521	2789872	81.4	87.0
Forest gain	487096	503836	471877	244829	77.2	82.5
Total Net emission	4881457	5015267	4689533	2701247	87.0	93.1

Annual Activity data and annual net emission in tons of CO2 per ha and per year over the period 2022-2023 are summarized in **Error! Reference source not found.**5.

Table 25 Annual activity data (ha/year) and annual net emission by source in tons of CO2 per ha and per year during the monitoring period.

Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower IC 90%)/ (2* mean) (or 2*median). * Note that during the monitoring period 2022-2023, the area of reforestation is greater than the area of deforestation

Emissions in tons of CO2/ha/year during 2022-2023	Mean (reference value)	MC Mean	MC Median	MC Standard deviation	MC mean-based Uncertainty (%)	MC median-based Uncertainty (%)
Annual Activity data in ha/year						
Annual Forest loss	8006	8065	7995	3216	66.0	66.6
Annual Forest gain	14528	14556	14482	5102	57.9	58.2
Annual net reforestation*	6522	6491	6514	5949	150.4	149.9
Annual emissions in tons of CO_2/ha/year						
Annual emissions due to forest loss	2684276	2759551	2582260	1394936	81.4	87.0
Annual avoided emissions due to forest gain (carbon removal)	243548	251918	235939	122415	77.2	82.5
Annual Net total emission	2440728	2507634	2344767	1350623	87.0	93.1

4.4 Uncertainty of the estimate of Emission Reductions

4.4.1 Parameters and assumptions used in the Monte Carlo method

The Monte Carlo Method was applied to assess uncertainties of emissions and removals estimates in reference level (baseline 2007-2017) and the reporting period (2022-2023). In this analysis, parameters and variables involved in Monte Carlo simulations are:

- Data of above-ground biomass of forests and other lands of four biomes (A.C. *Acacia Commiphora*, C.T. *Combretum-Terminalia*, D.A *Dry Afromontane* and M.A. *Moist Afromontane*)
- Below-ground biomass determined from above-ground biomass and the theoretical ABG to BGB ratio (rBG_AB : below ground biomass/above ground biomass). The variance of rBG_AB is determined from the scientific literature.
- Activity data by region and considering only land use changes (deforestation due to conversion of (1) Forest to cropland (2) Forest to grassland (3) Forest to shrubland (4) and reforestation due to conversion of Cropland to forest (5) Grassland to forest and (6) Shrubland to forest.)
- Carbon fraction determined from scientific literature.

Table 26 Parameters and Assumption used in the Monte Carlo Methods

Parameter included in the model	Parameter values	Error sources quantified in the model (e.g. measurement error, model error, etc.)	Probability distribution function	Source of assumptions made
Above-ground biomass of forests and other lands	See Table 9.7 of the NFI 2018 (MEFCC, 2018) and table 19 above	Overall variance measuring variability including sampling, inter-specific variability measurement and model errors	Normal distribution	IPCC 2006 Guidelines
ABG to BGB ratio (rBG_AB)	rBG_AB by biome A.C. (0.387), C.T (0.273), D. A. (0.286) and M. A. (0.274)	Overall variance measuring variability including sampling, Inter-specific variability and measurement errors based on Mokany et al. 2016.	Normal distribution	*Mokany et al. 2016*
Below-	BGB determined	Overall variance as for above-	Product of	Default

ground biomass	from ABG	ground biomass as well as the variability of the ABG to BGB ratio	two normal laws (ABG and rBG_AB)	Assumption IPCC 2006 Guidelines
Carbon fraction	0.5	Intra, inter-specific variability, sampling and measurements errors from Martin et al. 2018	Normal law (μ=0.5, σ =0.03)	Martin et al. 218
Activity data	Area (see data in table 23 above)	Overall variance including sampling and measurement errors.	Normal law	IPCC 2006 Guidelines

** Default Assumption: The mean and standard error of the available sampled data are used to define a normal distribution, when the true distribution cannot be determined precisely as recommended by "Guidance note on estimating uncertainty of ERs using Monte Carlo simulation, 2021." (https://www.forestcarbonpartnership.org/resources).*

4.4.2 Quantification of the uncertainty of the estimate of Emission Reductions

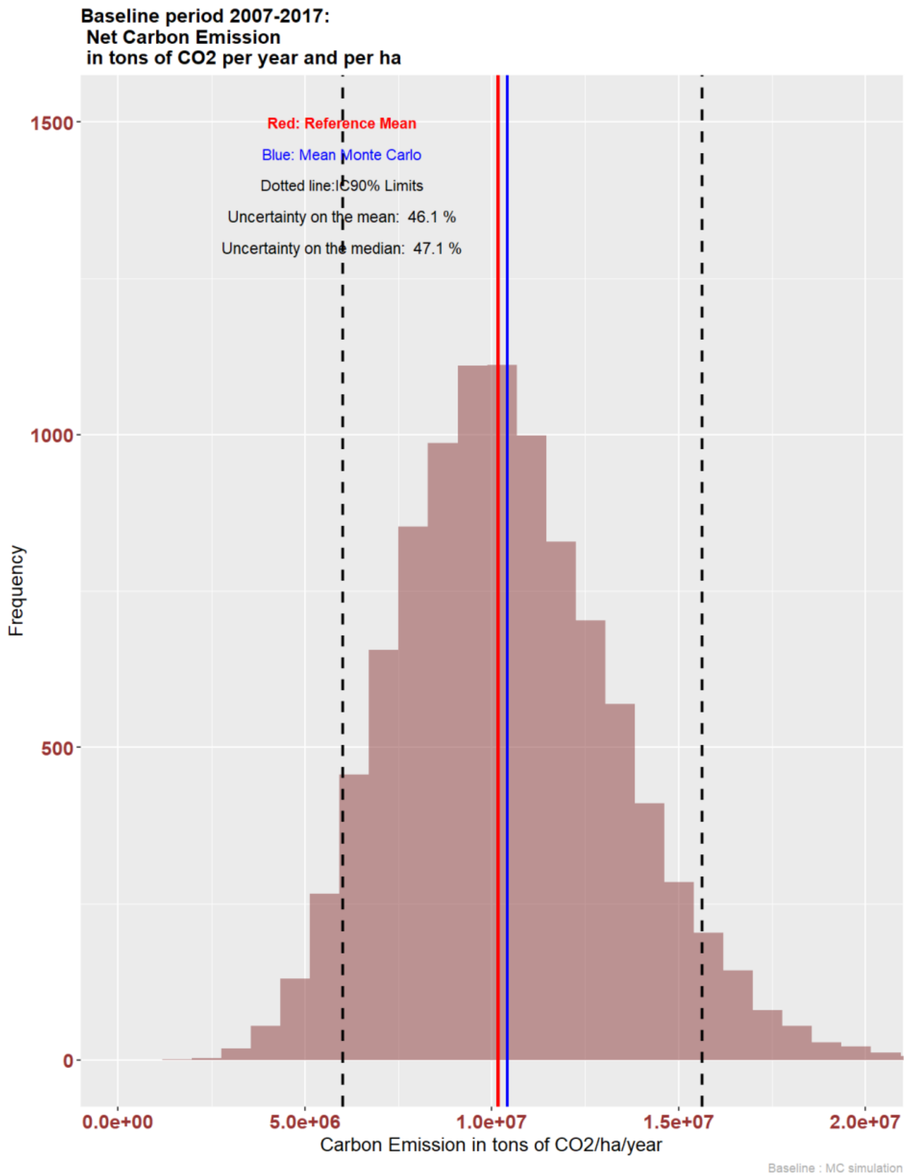
The emission reduction is calculated by the difference between the annual net emission in tons of CO_2/ha/year (emissions from deforestation - emissions from reforestation) during the period 2007-2017 and that of the period 2022-2023.

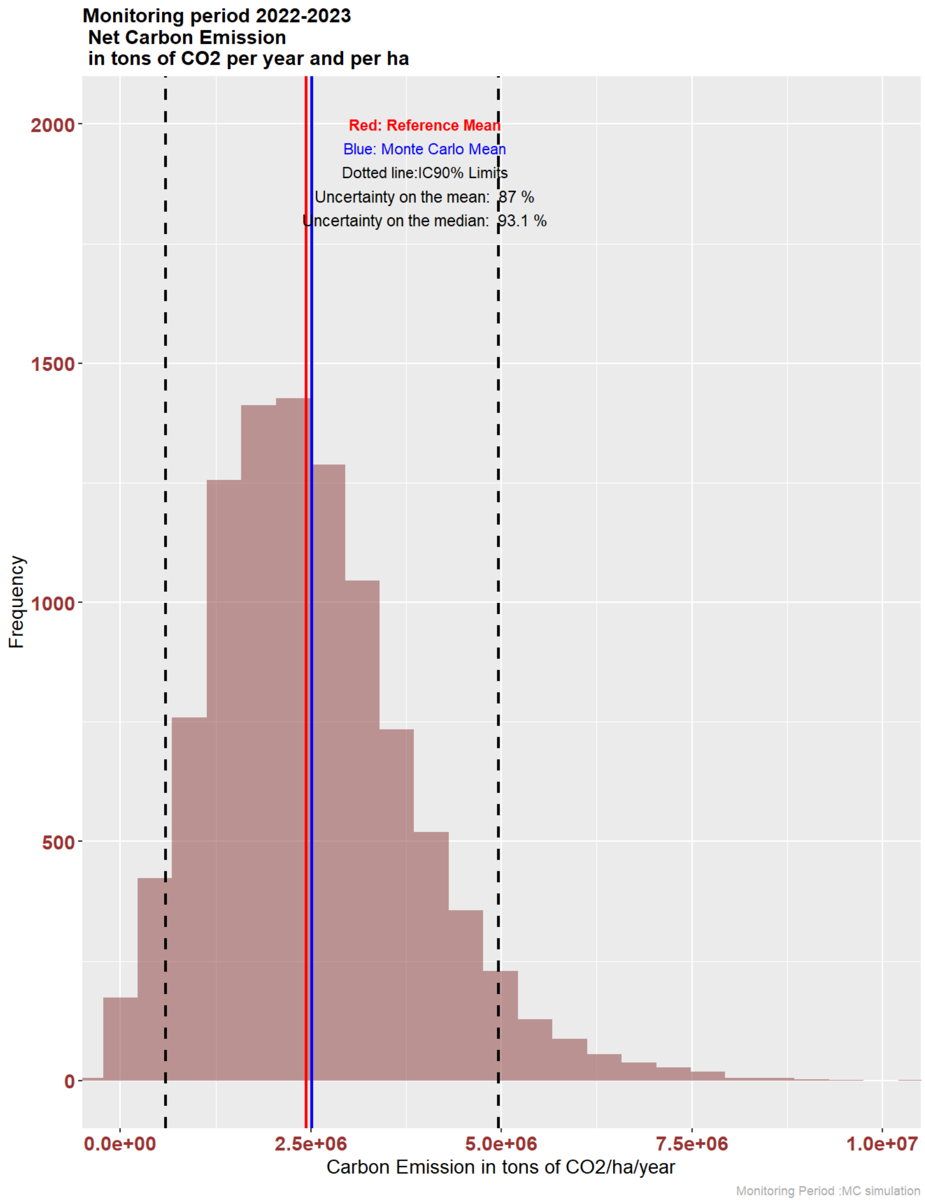
Error! Reference source not found.27 gives summary statistics of emission reduction in tons of CO_2 per ha and per year.

Table 27 Annual emission reduction in tons of CO2 per ha and per year. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median).

Emissions in tons of CO2/ha/year	Mean (reference value)	MC Mean	MC Median	MC Standard deviation	MC mean-based Uncertainty (%)	MC median-based Uncertainty (%)
Annual net	7720292	7917249	7681953	2516550	**52.2**	**53.8**

emission reduction						




Monitoring period 2022-2023
Net Carbon Emission
in tons of CO2 per year and per ha
Red: Reference Mean
Blue: Monte Carlo Mean
Dotted line:IC90% Limits
Uncertainty on the mean: 87 %
Uncertainty on the median: 93.1 %
Frequency
2000
1500
1000
500
0
0.0e+00
2.5e+06
5.0e+06
7.5e+06
1.0e+07
Carbon Emission in tons of CO2/ha/year
Monitoring Period :MC simulation

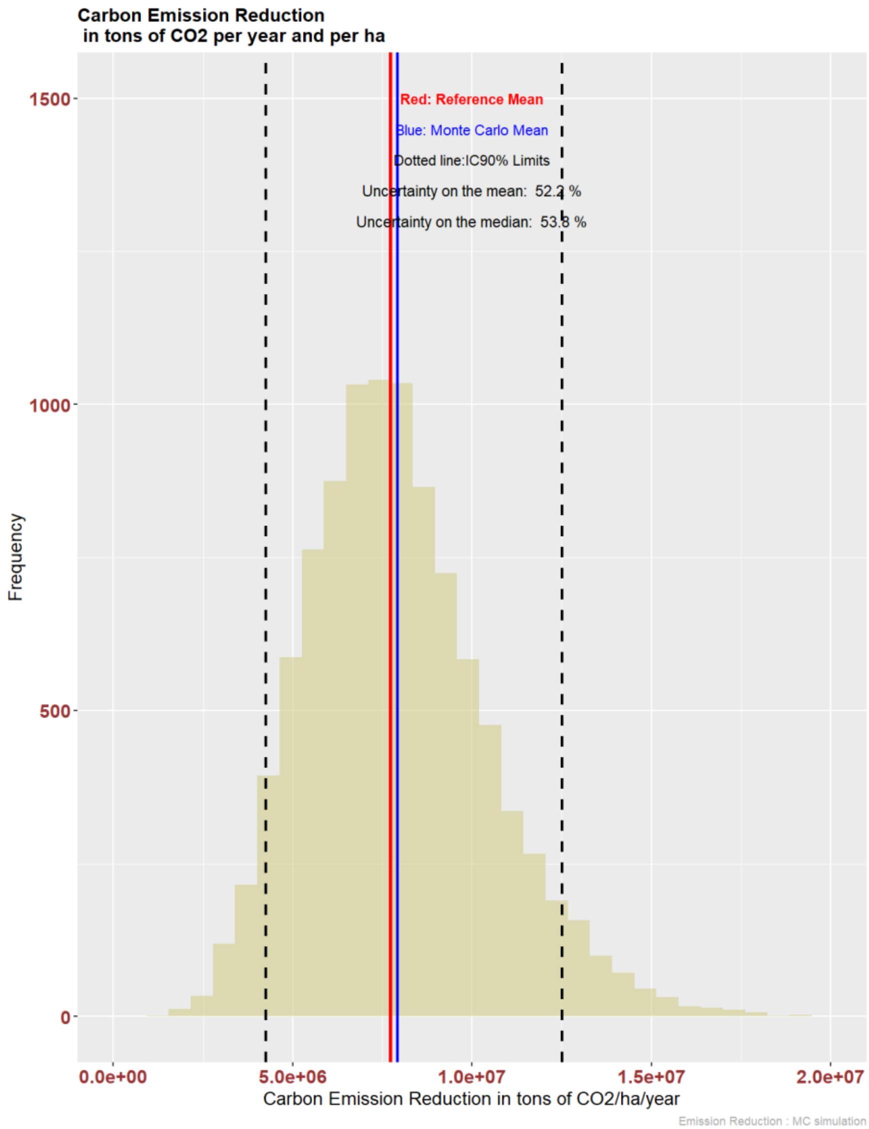
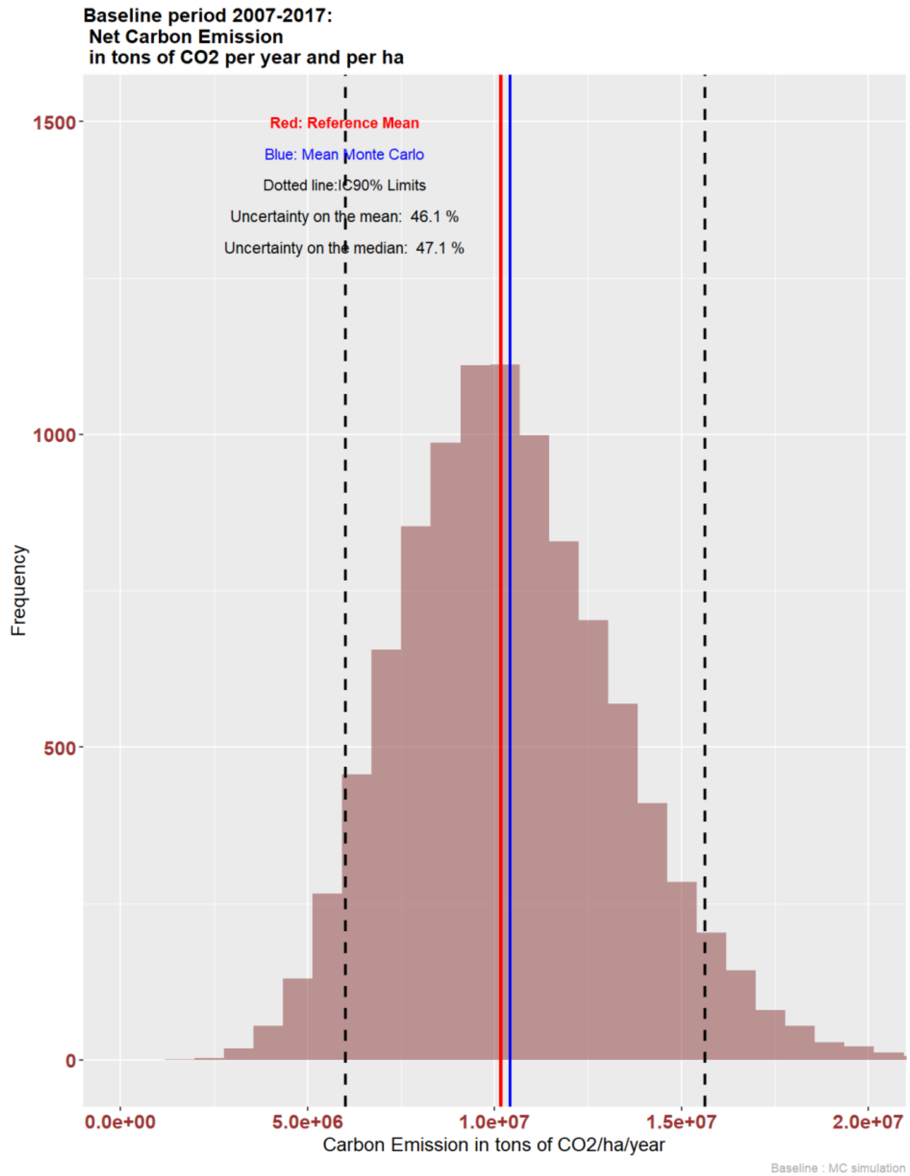
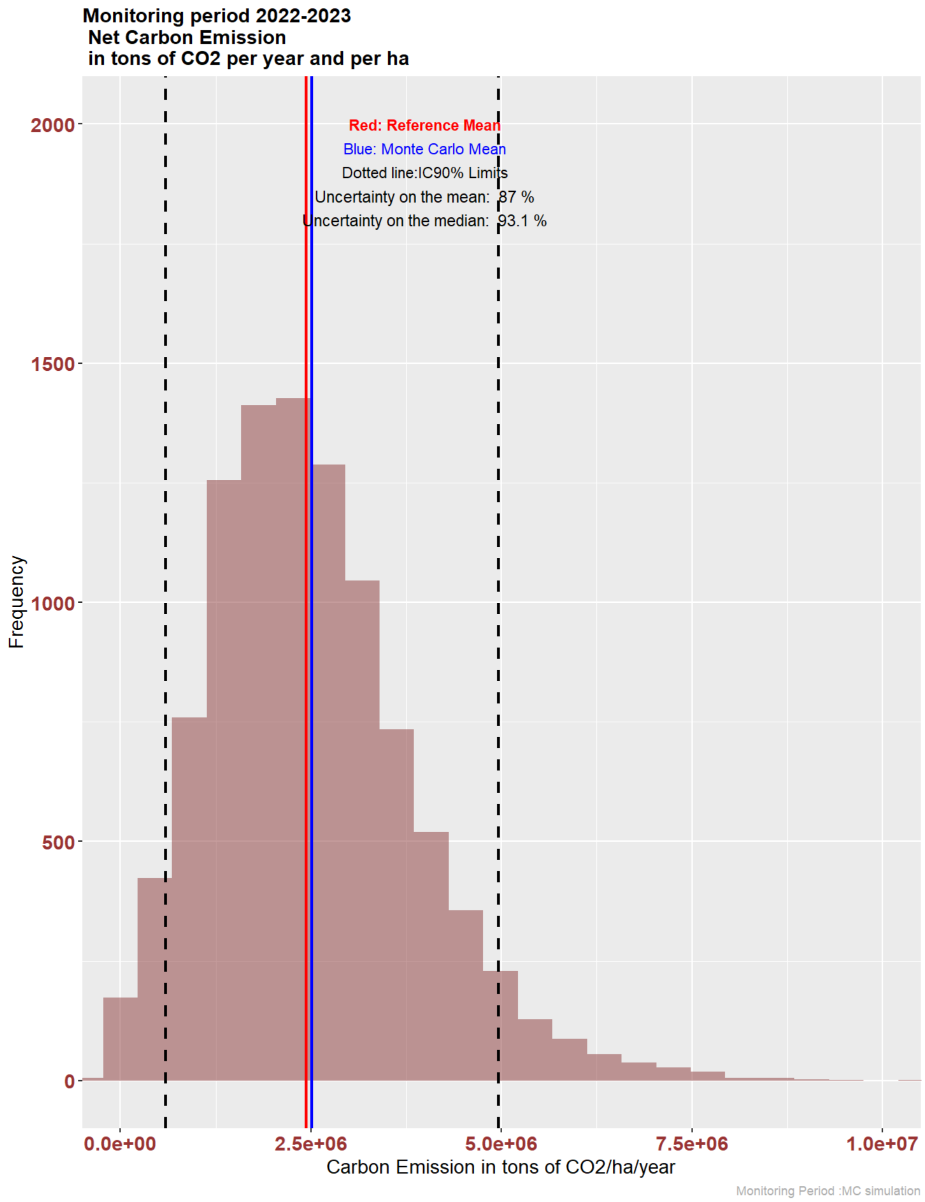


Figure 88 illustrates the annual net emission distributions during the reference period (2007 - 2017), the monitoring period (2022-2023) and the resulting net emission reduction.


Baseline period 2007-2017:
Net Carbon Emission
in tons of CO2 per year and per ha
Red: Reference Mean
Blue: Mean Monte Carlo
Dotted line:IC90% Limits
Uncertainty on the mean: 46.1 %
Uncertainty on the median: 47.1 %
1500
1000
500
0
Frequency
0.0e+00
5.0e+06
1.0e+07
1.5e+07
2.0e+07
Carbon Emission in tons of CO2/ha/year
Baseline : MC simulation


Monitoring period 2022-2023
Net Carbon Emission
in tons of CO2 per year and per ha
Red: Reference Mean
Blue: Monte Carlo Mean
Dotted line:IC90% Limits
Uncertainty on the mean: 87 %
Uncertainty on the median: 93.1 %
Frequency
2000
1500
1000
500
0
0.0e+00
2.5e+06
5.0e+06
7.5e+06
1.0e+07
Carbon Emission in tons of CO2/ha/year
Monitoring Period :MC simulation

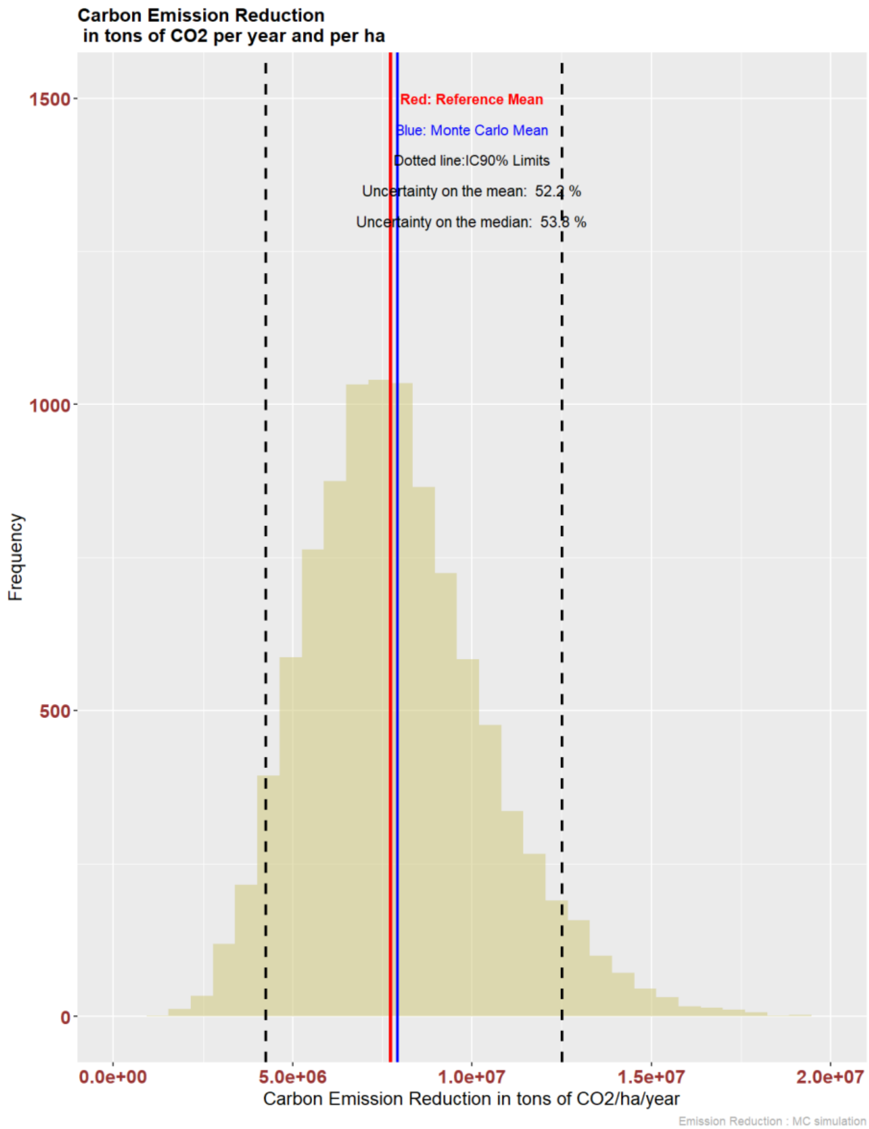


Figure 8 Histograms of annual net emissions and emission reduction in tons of CO2/ha/year. Vertical red line: mean from field data; Blue line = mean from MC simulated data using PDFs. Dotted lines: confidence limits of mean at 90% level. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2 mean) (or 2*median)*

The reductions of emissions by type of source (deforestation and reforestation) are detailed in **Error! Reference source not found.**8:

Table 28 Annual activity data, annual emission by source during the baseline and monitoring periods and emission reduction in tons of CO2 per ha and per year.

Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median).

	Mean (reference value)	**Mean**	**median**	**Standard deviation**	**Mean-based Uncertainty (%)**	**Median-based Uncertainty (%)**
Emissions during the baseline period 2007-2017 in tons of CO2 ha^{-1} year^{-1}						
Forest loss	10309879	1058072 5	10355631	2982131	46.1	47.1
Forest gain	148859	155843	52905	43293	45.20	46.10
Emissions during the monitoring period 2022-2023 in tons of CO2 ha^{-1} year^{-1}						
Forest loss	2684276	2759551	2582260	1394936	81.4	87.0
Forest gain	243548	251918	235939	122415	77.2	82.5
Emission reduction in tons of CO2 ha^{-1} year^{-1}						
Decrease of deforestation	7625603	7821174	7588117	2481138	52.1	53.7
Increase of carbon removal	94 689	96075	85767	98005	162.0	181.5

The reductions of emissions by land use change category are detailed in **Error! Reference source not found.**9:

Table 29 Annual activity data for Cropland/Forest LUC category. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2 mean) (or 2*median).*

	Mean (reference value)	**Mean**	**median**	**Standard deviation**	**Mean-based Uncertainty (%)**	**Median-based Uncertainty (%)**
Activity data during the baseline period 2007-2017 in ha/year						
Forest loss	23710	23747	23745	965	6.6	6.6
Forest gain	4880	4938	4942	414	13.7	13.7
Deforestat ion	18831	18809	18798	1050	9.2	9.2
Activity data during the monitoring period 2022-2023 in ha/year						
Forest loss	8006	8065	7995	3216	66.0	66.0
Forest	7004	7109	7027	3059	71.5	71.5

gain						
Deforestation	1002	957	979	4409	759	741

It should be noted that the high uncertainty in deforestation area is due to the fact that the loss of forest area is close to the gain of forest area and the area of deforestation is relatively low. The uncertainty calculated as the ratio of CI to average area of deforestation increases. Note that the standard deviations of areas of forest loss, forest gain and deforestation are relatively close.

- **Land Use Change: Cropland to Forests and Forests to Cropland**

The emissions corresponding to the activity data in the Cropland/Forest LUC category during the baseline period and the monitoring period are described in **Error! Reference source not found.**30.

Table 30 Annual activity data (in ha/year),

Annual emission for Cropland/Forest LUC category during the baseline and monitoring periods and emission reduction in tons of CO2 per ha and per year. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/(2* mean) (or 2*median).

	Mean (reference value)	**Mean**	**median**	**Standard deviation**	**Mean-based Uncertainty (%)**	**Median-based Uncertainty (%)**
Cropland/Forest **LUC: Emissions during the baseline period 2007-2017 in tons of CO2 ha^{-1} year^{-1}**						
Forest loss	7949492	8123982	7934479	2323422.95	46.8	47.9
Forest gain	81800	84235	82383	24094	46.6	47.6
Net Emission	7867692	8039747	7852049	2300723	46.8	47.9
Cropland/Forest LUC: Emissions during the monitoring period 2022-2023 in tons of CO2 ha^{-1} year^{-1}						
Forest loss	2684276	2759551	2582260	1394936	81.4	87.0
Forest gain	117410	121192	113779	63205	83.6	89.1

Net Emission	2566866	2638359	2465632	1377053	83.9	89.8
Cropland/Forest LUC: Emission reduction in tons of CO2 ha^{-1} year^{-1}						
Emission reduction	5300826	5401388	5184446	1931556	58.7	61.2

- **Land Use Change: Grassland to Forests and Forests to Grassland**

Table 31 Annual activity data (ha/year) for Grassland/Forests. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median)

	Mean (reference value)	**Mean**	**median**	**Standard deviation**	**Mean-based Uncertainty (%)**	**Median-based Uncertainty (%)**
Grassland/Forests **LUC: Activity data during the baseline period 2007-2017 in ha/year**						
Forest loss	4720	4828	4826	419	14.2	14.2
Forest gain	1080	1170	1164	189	26.5	26.7
Deforestation	3640	3658	3658	464	20.7	20.7
Grassland/Forests **LUC: Activity data during the monitoring period 2022-2023 in ha/year**						
Forest loss	0	0	0	0	NaN	NaN
Forest gain	2004.7	2124.866	2064.311	1072.297	83.3	85.7
Reforestation	2004.7	2124.866	2064.311	1072.297	83.3	85.7

The emissions corresponding to the activity data in the Grassland/Forest LUC category during the baseline period and the monitoring period are described in **Error! Reference source not found.**32.

Table 32 Annual activity data (ha/year), annual emission for Grasslands/Forests LUC during the baseline and monitoring periods and emission reduction in tons of CO2 per ha and per year.

Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower IC 90%)/ (2 mean) (or 2*median). Note the emission reduction is greater than annual emission during the baseline period due to the transition from CO2 source to CO2 sink of Grassland/Forest LUC category*

	Mean (reference value)	Mean	median	Standard deviation	Mean-based Uncertainty (%)	Median-based Uncertainty (%)
***Grassland/Forests* LUC: Emissions during the baseline period 2007-2017 in tons of CO_2 ha^{-1} $year^{-1}$**						
Forest loss	1582365	1645439	1608799	466204	46.1	47.2
Forest gain	18106	19939	19287	6362	51.5	53.3
Net Emission	1564260	1625500	1588688	461123.6	46.2	47.3
***Grassland/Forests* LUC: Emissions during the monitoring period 2022-2023 in tons of CO_2 ha^{-1} $year^{-1}$**						
Forest loss	0	0	0	0	NaN	NaN
Forest gain	33606	36263	33405	21364	95.0	103.1
Carbon removal	33606	36263	33405	21364	95.0	103.1
***Grassland/Forests* LUC: Emission reduction in tons of CO_2 ha^{-1} $year^{-1}$**						
Emission reduction	1597866 *	1661763	1625511	470815	46.3	47.4

- **Land Use Change: Shrubs to Forests and Forests to Shrubs**

Table 33 Annual activity data for Shrubs /Forests. Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median).

	Mean (reference value)	Mean	median	Standard deviation	Mean-based Uncertainty (%)	Median-based Uncertainty (%)
***Shrubs /Forests* LUC: Activity data during the baseline period 2007-2017 in ha/year**						
Forest loss	2321	2403	2400	294	20.3	20.3
Forest gain	2920	3034	3031	325	17.7	17.7
Reforestation	600	632	633	441	114.7	114.7
***Shrubs /Forests* LUC: Activity data during the monitoring period 2022-2023 in ha/year**						
Forest loss	0	0	0	0	NaN	NaN
Forest gain	5520	6131	5874	3358	90.0	94
Reforestation	5520	6131	5874	3358	90.0	94

The emissions corresponding to the activity data in the Shrubs/Forest LUC category during the baseline period and the monitoring period are described in **Error! Reference source not found.**34.

Table 34 Annual activity data, annual emission for Shrubs/Forests LUC during the baseline and monitoring periods and emission reduction in tons of CO2 per ha and per year.

Monte Carlo (MC) Uncertainty is: (upper CI 90% - lower CI 90%)/ (2* mean) (or 2*median). Note the emission reduction is greater than annual emission during the baseline period due to the transition from CO_2 source to CO_2 sink of Shrubs/Forest LUC category

	Mean (reference value)	**Mean**	**Median**	**Standard deviation**	**Mean-based Uncertainty (%)**	**Median-based Uncertainty (%)**
***Shrubs /Forests* LUC: Emissions during the baseline period 2007-2017 in tons of CO2 ha^{-1} year^{-1}**						
Forest loss	778022	819438	797370	245911	49.4	50.8
Forest gain	48954	51703	50448	15006	47.4	48.5
Net Emission	729068	767736	746340	233500	49.9	51.3
***Shrubs /Forests* LUC: Emissions during the monitoring period 2022-2023 in tons of CO2 ha^{-1} year^{-1}**						
Forest loss	0	0	0	0	NaN	NaN
Forest gain	92531	104566	95073	65752	100.6	110.7
Carbon removal	92531	104566	95073	65752	100.6	110.7
***Shrubs /Forests* LUC: Emission reduction in tons of CO2 ha^{-1} year^{-1}**						
Emission reduction	821599	872301	850384	266294	50.1	51.4

The figure below summarizes the contributions of each of the three categories of land-use change to emission reductions in Oromia Regional state and the associated uncertainties.

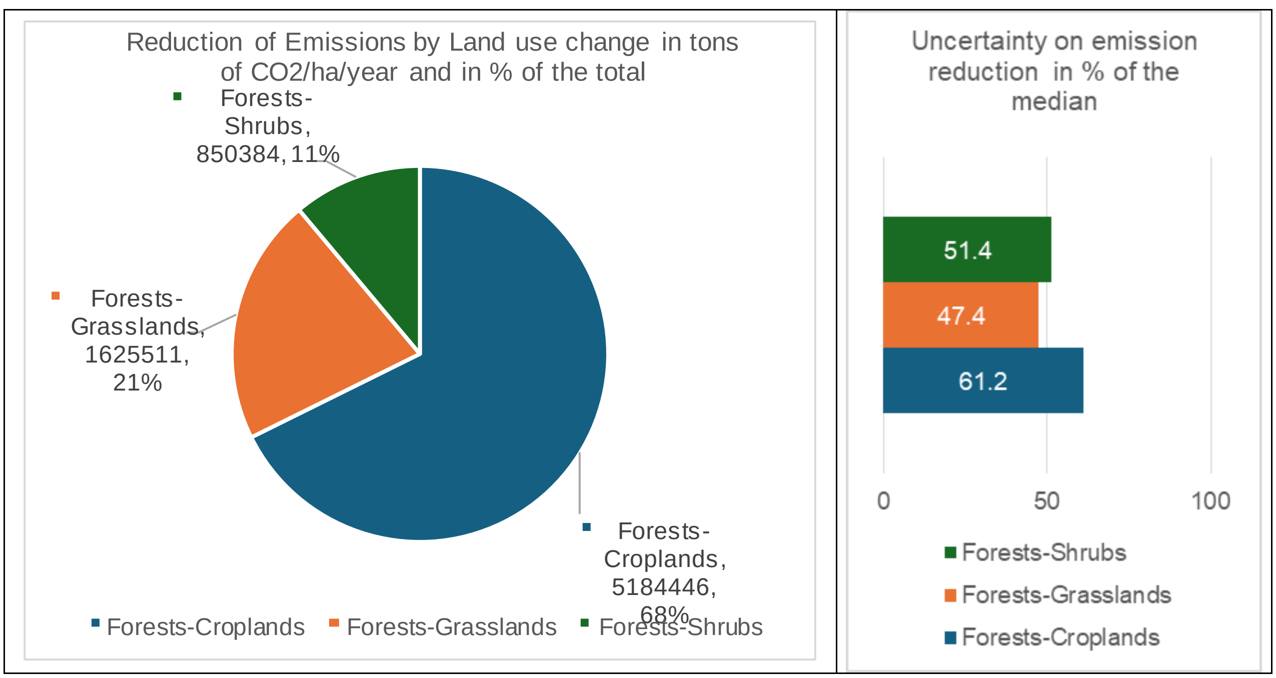


Figure 9 Contribution of each land use change category to the net emission reduction based on MC simulations. Results shown: the type of change, the emission reduction for the LUC category in tons of CO_2/ha/year and in % of the total emission reduction. On the right, the uncertainty associated with the reduction in emissions by the type of LUC

The figure above summarized in the following table:

Table 35: summaries of the contributions of each of the three categories of land-use change to emission reductions in Oromia Regional state and the associated uncertainties

		Cropland / Forest LUC category	**Grassland/ Forest LUC category**	**Shrubs/ Forest LUC category**	**Total**
A	**Median**	5184446	1625511	850384	**7681953**
B	**Upper bound 90% CI** (Percentile 0.95)	8961898	2491348	1352105	**12511612**
C	**Lower bound 90% CI** (Percentile 0.05)	2619057	951810	478138	**4245905**
D	**Half Width Confidence Interval at 90% (B – C / 2)**	3171420	769769	436982.9	**4132853**
E	**Relative margin of error (D / A)**	61.2%	47.4%	51.4%	53.8%
F	**Aggregate uncertainty of emission reductions**				53.8%
G	**Uncertainty set-aside factor**				8%

Note that the median of emission reduction (total in the last column) is determined from the MC simulation without distinction between LUC categories. The median in the total column is slightly different from the sum of the medians by LUC category.

4.5 Sensitivity analysis

Table 36 Sensitivity analysis of annual net emission level of CO2 (tons of CO2/ha/year) for the baseline period (2007-2017). OFF: uncertainty on the parameter considered. ON: without uncertainty. Note that only one parameter is turned OFF each time.

Parameter	**Median MC Baseline (tons of CO_2/year) All OFF**	**Median MC Baseline (tons of CO_2/year) One parameter ON**	**Uncertainty in % of the median (All OFF)**	**Uncertainty in % of the median (one parameter ON)**
Carbon fraction in dry matter	10204187	10201913.5	47.1	42.6
Below ground to above ground biomass ratio	10204187	10201913.5	47.1	42.6

Above ground biomass of forests	10204187	10210774.1	**47.1**	**11.9**
Above ground biomass of other lands	10204187	10198024.4	47.1	52.5
Area	10204187	10127285.7	47.1	44.9

Table 37 Sensitivity analysis on annual net emission level of CO2 (tons of CO2/ha/year) for the monitoring period 2022-2023. OFF: uncertainty on the parameter considered. ON: without uncertainty. Note that only one parameter is turned OFF each time

Parameter	**Median MC Monitoring period (tons of CO2/year) All OFF**	**Median MC Monitoring period (tons of CO2/year) One parameter ON**	**Uncertainty in % of the median (All OFF)**	**Uncertainty in % of the median (One parameter ON)**
Carbon fraction in dry matter	2344767	2355112	93.1	89.7
Below ground to above ground biomass ratio	2344767	2355111.6	93.1	89.7
Above ground biomass of forests	2344767	2432943.0	**93.1**	**74.4**
Above ground biomass of other lands	2344767	2322902.1	93.1	97.3
Area	2344767	2432625.2	93.1	44.9

Table 38 Sensitivity analysis on net emission reduction of CO2 (tons of CO2/ha/year). OFF: uncertainty on the parameter considered. ON: without uncertainty. Note that only one parameter is turned OFF each time.

Variable/parameter	**MC Emission Reduction (tons of CO2/year) All OFF**	**MC Emission Reduction (tons of CO2/year) One parameter ON**	**Uncertainty on the median (All OFF)**	**Uncertainty on the median (One parameter ON)**
Carbon fraction in dry matter	7681953	7675484.3	53.8	49.8
Below ground to above ground biomass ratio	7681953	7675484.296	53.8	49.8
Above ground biomass of forests	7681953	7743065.292	**53.8**	**26.4**
Above ground biomass of other lands		7669567.363	53.8	58.7

Area	7681953	7694660.573	53.8	44.9

Considering the annual emission reduction, the sensitivity analysis shows that the most influencing parameter of variable is the above-ground biomass. Uncertainty is divided by two when biomass is measured without uncertainty. The impact of uncertainty on surface measurements remains limited. The observed uncertainty on emissions is mainly due to the uncertainty on the emission factor.

5 ISFL ER Program Transactions

5.1 Ability to transfer title to ERs

Ethiopia follows the federal system with highly devolved power to regional states vesting the power to raise revenues, plan and implement their own development activities including natural resources management within the framework of the policies and proclamations issued by the federal government. According to the overall policy and legal framework set in the (1995) federal constitution which vests the right to ownership of land and other natural resources, including forests, to the State and people of Ethiopia but does not allow transfer of land rights through sales. However, it guarantees the right of Ethiopian 'farmers' and 'pastoralists 'and the people at large in urban and rural areas free allotment of land for agriculture, settlement and similar purposes.

Nonetheless, details of tenure arrangements differ based on the type of the resources and use modalities (privately or in common) in the specific proclamations defining the rights on these resources. For instance, the current federal forest Proclamation No (1065/2018) recognizes four types of forest Ownership: i, Private Forest, ii, Community Forest, iii. Association Forest and iv, State Forest.

Based on the above proclamation and with the intent of its full application and enforcement, the Council of Ministers issued the Forest Development, Protection and Utilization Regulation No 544/2024 in 2024. The regulation recognizes ownership of carbon assets (ER ownership) belongs to those legal bodies who invested their time, knowledge and resources for the development, protection and management of a given forest land. These legal bodies can be private developers (small and large), communities, associations, cooperatives and institutional developers (including religious institutions and NGOs). The regulation also legislates that those legal bodies who are owners of carbon assets have the right to transfer the ownership titles to third parties through transaction/sell or other means. Moreover, Proclamation No. 922/2015[18] for the Authentication and Registration of Documents shall be used to delegate the right to transferring titles of ownership of ER assets to third parties through transaction/sell or other means. Such delegation entitle relevant governments' institutions or entities to legally represent and act on behalf owners to conclude transactions in accordance with the above law.

In tandem with the Forest Proclamation and Forest Regulation discussed above, the EFD has also prepared a draft Forest Carbon Credit Trading Directive as guiding instrument to help implement the above legislations, among others, to provide more clarity to carbon asset (ER) ownership and the ability to transfer this asset to third party backed by appropriate legal framework(s). The draft directive is still under review by the government and the WB legal team, and the approval date has not been specified yet. In addition to these, the government has agreed to prepare and submit a Legal Opinion Letter as part of fulfillment of conditions of disbursement for 1st ERPA payment. The Program Entity has also signed a MoU with selected regional and federal level institutions and stakeholders as part of fulfillment of Schedule 1, condition of effectiveness (disbursement) of ERPA Phase Agreement and Schedule 6 of ERPA Framework Agreement. The MOU also details corresponding rights and responsibilities as well as obligation of parties in implementing the ER project through ERPA phase one period. The MoU is subject to review and amendment as needed, including during transition from 1st ERPA phase to 2nd ERPA.

5.2 Participation under other greenhouse gas (GHG) initiatives

The OFLP ERPA has established that the 1st ERMR of the first ERPA phase (Jan 2022 -Dec 2023) accounts ERs generated due to measures taken for avoided deforestation and new forest developments through afforestation, reforestation and ANR programs (removals). In section 3.2 and section 3.3 above, it is indicated that the number of ERs generated due to avoided deforestation in this RP constitute 17,489,293 tCO2e from the total of ERs generated due to both avoided deforestation and removals of 18,211,227 tCO_2e (preliminary ERs result before

[18] https://chilot.wordpress.com/wp-content/uploads/2016/04/proclamation-no-922-2015-authentication-and-registration-of-documents_-proclamation.pdf

deductions). This signifies, close to 96 % of the ERs are generated as a result of avoided deforestation, and only about 4 % was due to removals.

During this RP (2022-2023) of 1st ERPA, no known part of the ISFL ER Program, or any known part of the ISFL ER Program Accounting Area, has transferred, or is planning to transfer, any ERs to, or received or is planning to receive payment for ERs generated as a result of **avoided deforestation** from any other GHG mitigation initiative. In addition, no known parts of the ISFL ER Program Accounting Area have registered or are seeking registration under project or program level standards such as the Clean Development Mechanism (CDM), the Verified Carbon Standard (VCS), the Green Climate Fund (GCF) or others for ERs generated due to **avoided deforestation**. However, in table 30 below, a few small and micro scale ER projects are identified that are seeking registration or registered (certified) under VERRA and Gold Standards; most of these being energy efficient cook stove projects and only one as A/R project (this last one is at development stage – no credit issued yet), all operating in Oromia. Some of the cook stoves projects have already issued CERs/VERs and some of these credits are already retired, and some are transiting from CDM to VERRA or GS registration. Apparently, these small-scale energy efficiency projects will not have significant impact on results of this first ERPA reporting period, as change in rate deforestation (mitigation) hardly occurs due to cook stove introduction. Wider cook stove use is expected to alleviate the main driver of forest degradation, which is excessive use of fuel wood as main source of energy for cooking.

The only known ER program in Oromia that generated ERs (VERs) both through avoided deforestation and forest development (removals) is the Bale Eco-region REDD Project which is registered under the VERRA Standards (ID # 1340). The Bale REDD ER Project is developed by the Oromia Government (OFWE supported by Farm Africa) and has been generating ERs since 2012 -the last accounting period being from 2019 -2021 (VERs not yet issued or transacted for this last period). It was decided by the Oromia Regional Government that the Bale REDD ER project merges with the OFLP-ERP starting January 2022 and ceases issuing VERs starting this period until the end of the ISFL ERPA period.

However, there are actions not included in the ISFL ER Program but address the drivers of land use change, deforestation, and forest degradation within the ISFL ER Program Accounting Area and that are generating ERs but are not transacting any ER, seeking any payment, transferring any generated ERs to other mitigation initiatives during the ISFL 1st ERPA period nor in the whole of the OFLP-ERP ERPA period (2022-2029). These arrangements have been extensively consulted, agreed upon and fully established during the OFLP design and the ERPA negotiations processes. The OFLP-ERP leverages on all actions in the jurisdiction that help generate ERs, including from on-going and on pipeline non-ER initiatives financed by government, development partners, private sector, NGOs, communities, and the WB.

Table 39: Other **projects listed/registered under the VERRA and Gold Standards**

Project Name and ID	**Project Type**	**Region**	**Credit tCO_2e**		**Credit period**	**Main characteristics**	**Status and carbon standard**
			Issued	**Retired**			
Other Projects listed/registered under VERA Standard							

1. Catalyzing community resilience through carbon finance in Ethiopia Afromontane forests –VERA 5191	Agriculture forestry and other land uses	Oromia & Sidama Munesa and Kore woreda in Oromia)	Pipeline-listed		June 01, 2024 – May 31, 2054	the project aims to adopt Afforestation, Reforestation and Revegetation activities in Oromia and Sidama regions that cover tropical mountain ecosystems of Ethiopia. The project activity includes plantation of native tree species and highland bamboo Yushania Alpina. The project activities will cover 12,120 hectares. Various native species will be planted to improve soil fertility and productivity and sequester carbon from the environment, ultimately reducing GHG emissions	Underdevelopment-VERA Standard

2. Distribution of fuel efficient improved cookstove - VERA 4386	Energy efficiency improvement projects	Geographic boundary of Ethiopia	Pipeline - listed		Oct 01, 2023 – Sept 30, 2030	it aims to reduce greenhouse gas emissions by distributing 400,000 fuel-efficient improved cookstoves (ICS) to households in Ethiopia which replaces traditional cookstoves 3-stone fire, thereby reduce fuel consumption & indoor air pollution, thereby improving the health situation especially of women and children.	Under validation VERA standard

3. Energy efficient stove program – CER conversion-VERA 4657	Energy Efficient Stoves Project	Oromia (Adaberga, Nono wonchi, yaya gulele, boset, Jeju, Digeluna Tijo,shashemene, Tullo)	Issued 128,214 tCO2e	Expired	Oct 17, 2013-Oct 16, 2023	this small scale PoA involves the distribution of energy efficient cooking stoves to households in The Federal Democratic Republic of Ethiopia. Most households in rural areas of The Federal Democratic Republic of Ethiopia cook over open fires1, and this leads to a very significant consumption of wood, as well as a major health risk.	Units Transferred from Approved GHG Program VERA standard (has expired)
Other Projects listed/registered under Gold Standard							
4. West Wellega Multipurpose Cookstove Distribution Project – GS	Energy efficiency-domestic	Wellega, Gimbi, Guliso and Aira	No issuance, total ex-ante estímate is		2023 - 2028	West Wellega Multipurpose Cook Stove (MPCS) Distribution Project is a small-scale project activity initiated	Listed -GS

ID-12134			194,285 tCO2e			by Ethiopian Evangelical Church Mekane Yesus – Development & Social Services Commission West Wellega, Oromia region, Ethiopia. The area is highly subjected to forest degradation triggered by anthropogenic activities. To reduce the use of non-renewable biomass for household cooking, EECMY DASSC designed a project aimed to disseminate highly efficient locally produced multipurpose cook stove.	
5. West Guji Improved Cook Stove	Energy Efficiency Domestic	Bule Hora, Oromia	No issuance, total ex-	-	2022 — 2027	Oromia Coffee Farmers' Cooperative Union's West Guji improved cook stove	Listed -GS

Distribution Project -GS ID-11187			ante estimate is 173,368 tCO_2e			distribution project is a small-scale project that will disseminate locally produced improved stoves to target communities. The technologies shall reduce the non-renewable biomass consumption required to provide thermal energy for domestic cooking requirements.	
6. Vita Green Impact Programme – Ethiopia Stove Project-GS12476	Energy Efficiency Domestic	Southern, Central, Southwestern, Sidama, Amhara and Oromia	No issuance, total ex-ante estímate is 5,226,815 tCO_2e	-	2023 - 2028	Applying the GS methodology for reduced emissions from cooking and heating – technologies and practices to displace centralized thermal energy consumption. Distributing improved cooking systems to reduce energy	Listed -GS

						consumption.	
7. Jimma improved cook stove Distribution Project - GS-12498	Energy Efficiency Domestic	Jimma, Oromia Region	No issuance, total ex-ante estimate is 287,530 tCO_2e	-	2023 - 2028	Jima improved cook stove distribution project is a small-scale project activity that will introduce Improved Cook Stoves within Jimma Zone of Oromia Region. The ICSs shall reduce the non-renewable biomass consumption required to provide thermal energy for domestic cooking requirements	Listed-GS
8. Bunno Bedele and Ilu Ababora improved cook stove Distribution Project - GS-	Energy Efficiency Domestic	Bedelle -Metu, Oromia	No issuance, total ex-ante estimate is 287,530	-	2023 - 2028	Bunno Bedele and Ilu ababora improved cook stove distribution project is a small-scale project activity that will introduce Improved Cook Stoves within Bedelle-Metu area	Listed -GS

12499			tCO2e			of Oromia	
9. Improved Cookstoves for Environmental Conservation in Southern Ethiopia-GS - 10989 and GS - 10988	Energy Efficiency Domestic	Bale (Goba and Sinana), Welisso (Wonchi and Welliso) - Oromia	15198 tCO2e 18,405 tCO2e	15,075 tCO2e 18,384 tCO2e	2021 - 2026	Distribute fuel-efficient cookstoves in Oromia Region in Southern Ethiopia (COOPI -Italian NGO)	GS-Certified
10. Improved Cookstoves for Environmental Conservation in Southern Ethiopia – GS-10873, GS-10872 and GS-7556	Energy Efficiency Domestic	Guji and Bale zones of Oromia (Goro Dola, Liben, Delo mena and Meda Welabu)	24,966 tCO2e 24,875 tCO2e 28,120 tCO2e	24,966 tCO2e 24,875 tCO2e 28,120	2020 – 2025 2019 - 2024 (for GS-7556)	Distribute fuel-efficient cookstoves in Oromia Region in Southern Ethiopia (COOPI -Italian NGO)	GS-Certified

				tCO2e			
11. Oromia Cookstove Distribution Project- GS-5463	Energy Efficiency Domestic	West Wellega, Oromia (Nole Kaba, Haru, Lalo Asabi and Homa)	99,115 tCO2e	65,639 tCO2e	2016-2022	Introduce Improved Cook Stoves within the project area.	GS-Certified

5.3 Implementation and operation of Programs and Projects Data Management System.

Ethiopia has one national forest MRV system to which sub-national jurisdictions report to avoid double counting. That means that the OFLP's Measurement, Reporting and Verification (MRV) system is an integral part of the national forest MRV system. It is not envisaged to be independent to the national forest MRV to ensure consistency in the reported results for both the OFLP and the national level (see fig 12 below the institutional arrangement for national forest MRV).

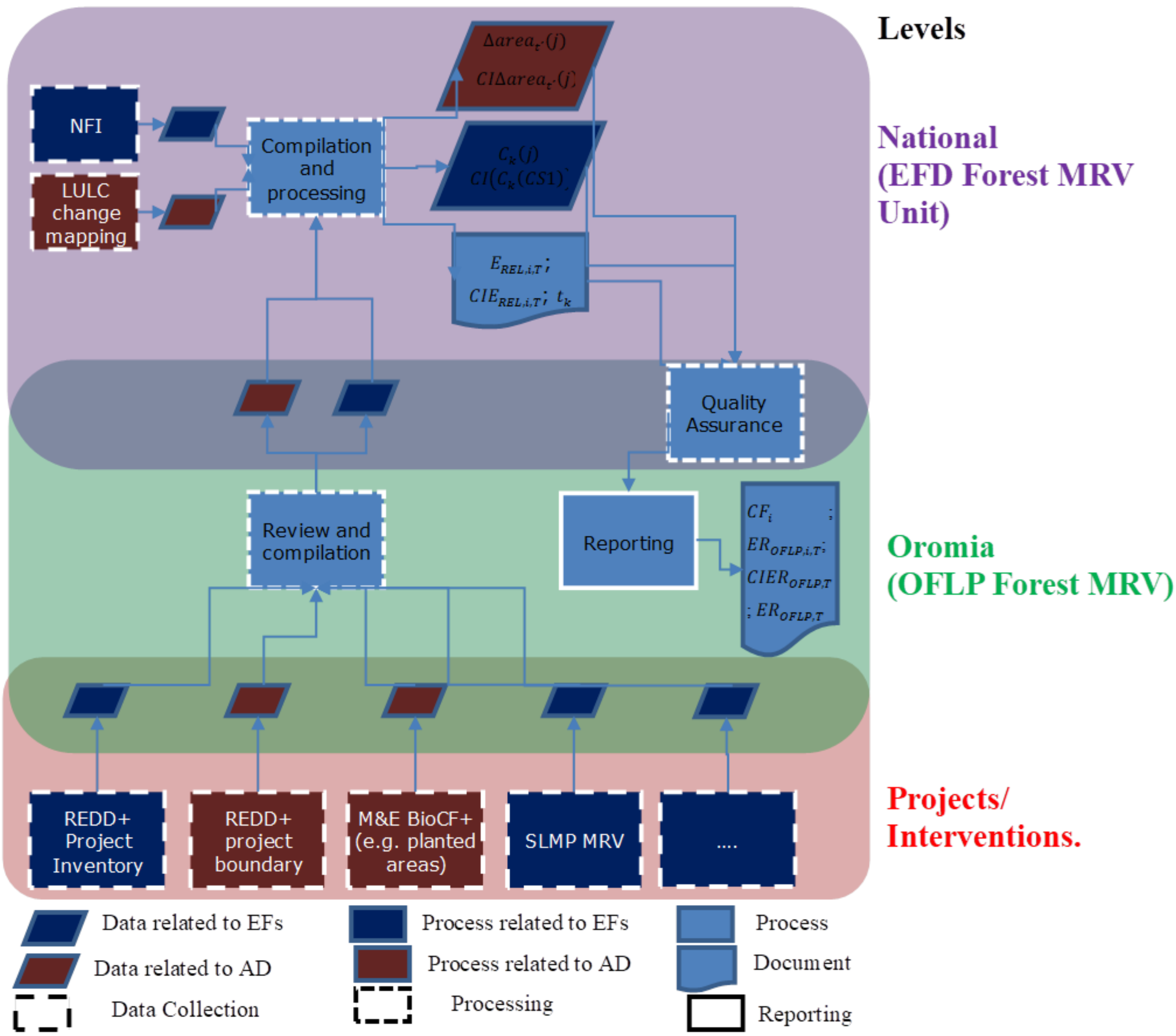


Figure 10 Programs and Project Data Management System

Data captured through the national forest MRV system is collected and analyzed at different levels. The lower levels collect important information and feed into the OFLP forest MRV system. The national level collects primary data and compiles primary and secondary data. The design of data collection, selection of data generation methodologies, analysis, preparation of maps and reporting is led by the National Forest MRV Unit in full participation of the regional forest MRV unit. Data sets of the project produced for outside reporting and those produced for benefit sharing allocation and distribution purposes are stored, retrieved and used from the data repositories (data bases) existing both in national and regional forest MRV units. Data from all sources is used to produce AD, EFs, and revised baselines for the entire program area. These data and values are used to calculate the ERs by the national forest MRV team in collaboration with the OFLP forest MRV team. OFLP shall calculate the performance and ER benefits assigned to each zone, woreda and kebele.

The national and regional MRV units have been continuously strengthened with required data storage and management facilities and manpower assisted by resources through OFLP grant financing and the Norway Government grant. The OFLP MRV Unit has organized all projects, programs and initiatives' information in the MRV lab, including on ERs generated, geographic boundaries, and information on Environmental and Social risk Management activities. Data gathering consistency was ensured for those generated from primary and secondary sources including those acquired at national and regional levels.

The initial plan to have one national MRV system under one institution at central level coordinating all key CRGE sectors including those outside of the AFOLU sectors as indicated in the ERPD did not materialize. This is because of the institutional reorganization and split of the Environment, Forest and Climate Change Commission (EFCCC) into two separate entities (the EFD and the EPA). This has brought changes in mandates in the sphere of climate change and forestry at national level. The EPA, now under the Ministry of Planning and Development (MoPD) oversees all aspects of climate change issues including the roles of a designated entity to assemble the national MRV through coordination of all sectoral reduction programs of the CRGE and designing and institutionalizing a national transaction registry system.

These tasks of establishing the national registry and the MRV system (for all CRGE sectors including forest) is expected to take sometimes.

The OFLP-ERP is responsible for overseeing and coordinating the ER Program at the sub-national level. The OFLP grant served as the overarching program that facilitated coordination and support among multiple partners and sectors engaged in emission reduction initiatives, while also establishing a centralized forest management system at a regional scale.

The program has been designed and operated the following main issues:

- Develop and implement the essential elements of the Regional Monitoring, Reporting, and Verification (MRV) System to ensure its effective functioning Establish, operationalize and ensure the maintenance of the components of the Regional MRV System.
- Develop and endorse criteria and technical approaches for determining reference levels.
- Monitor, evaluate of emission reductions, documentation, verification, and confirmation processes associated with REDD+ initiatives and projects.
- Monitor the reduction of greenhouse gas emissions and the achievements of ERs objectives of REDD+ projects;
- Management of the Safeguards Information System (SIS), including the REDD+ Feedback and grievance Mechanism (FGRM);
- Enable the dissemination of data and relevant information on REDD+ projects, which should be made public respecting the policies of intellectual property privacy established with the different actors;
- Ensure comprehensive communication of all details related to the Programs and Projects, including their social and environmental risk management, the Dialogue Mechanism, and the Complaints process, utilizing current platforms and outlining the benefit-sharing plan effectively.

- Highlight the importance of transparency and accessibility in sharing information about the Programs and Projects, ensuring that all stakeholders are informed about the safeguards and benefit-sharing strategies involved.

- Communicating to the entity in charge of the ER Transactions Registry all information related to ERs generated by REDD+ projects at jurisdictional level

The evidence shows the actual Content of OFLP-ERP Program Data Management System as follow:

- ✓ The Subnational level baseline data (Reference Level) used;
- ✓ The Geographical boundaries of the ER counted from;
- ✓ The proponent of the ER Program or project contributes for ER;
- ✓ Activity data indicate the scope of REDD+ activities and Carbon Pools;
- ✓ MRV data to specific REDD+ projects/programs; and
- ✓ Safeguards plans in specific REDD+ projects/programs
- ✓ For the detail information: https://oflp.et/ and https://drive.google.com/drive/u/1/folders/1iu43-WP5mqdRxVolyhio9x1vqgbBS1DP

5.4 Implementation and operation of ER transaction registry

The monitoring and reporting for the OFLP-ERP is aligned with the national forest MRV system as discussed above and is in line with the implementation of the NDC, and other commitments of the country, including the Paris Agreement. The ERCs of OFLP ER program are issued based on environmental and social integrity (according to the ISFL methodological framework and verified by a third party) and in compliance with the national Environmental and Social information system and the EFS. To avoid the risk of double counting of ERCs coming from the Oromia jurisdictional program, all ERCs will be registered into the Carbon Assets Tracking System (CATS)—a registry managed by the World Bank and ensuring traceability of each ERC generated by the program. The CATS will be used as the transaction registry system until a potential national registry system could become operational that could perform the same function.

5.5 ERs transferred to other entities or other schemes

No ERs from the ISFL Program are sold, assigned or otherwise used by any other entity for sale, public relations, compliance or any other purpose including as ERs set-aside to meet Reversal management requirements under other GHG accounting schemes to date.

6 Reversals

6.1 Assessment of the level of risk of Reversals

Based on the assessment conducted the level of risk of Reversals in the "ISFL Buffer requirements" with no distinction of subcategories, covering forest-related and non-forest-related categories result presented as the following table.

Table 40 Assessment of the level of risk of Reversals

Risk Factor	*Risk indicators*	*Level of risk*	*Associated reversal risk set-aside percentage*
A. Lack of long-term effectiveness in addressing the key drivers of AFOLU emissions and removals	*Based on the reference level indicators, the major risk factors identified were: Large and small scale agricultural expansion, illegal logging due to weak institutional arrangement and coordination, weak law enforcement, conventional agricultural practice (Open grazing), un intensified agricultural inputs, population growth pressure and natural disturbance such as wildfire were the common one* *The OFLP-ERP has prioritized those risk factors and has been implementing different mitigation strategies:* ✓ *OFLP effectively coordinates and supports a number of forest conservation, management and development programs/ project that are sustainable*	*(15%)*	*5%*

	working on forest management that contributes for ER beyond ERP periods. ✓ *Deforestation and forest degradation avoidance activities through improving coordination between law enforcement agencies and forest sectors, institutional capacity enhance forest conservation and management.* ✓ *The adoption of an integrated landscape management approach to natural resource management under the OFLP through coordinated efforts and support by stakeholders will lead to improved landscape management and land use plan at regional state landscapes level.* ✓ *The presence of consultative forums and platforms that engage a diverse range of stakeholders can lead to a tangible and immediate recognition of benefits. This heightened awareness is likely to transform consultation into a sustained priority, extending beyond the confines of the ERPA Period.* ✓ *The REDD+ strategy and the ERPD give a clear direction on the implementation of the program beyond the ERPA period up to 2050's in complement with CRGE strategy to meet NDC of the country on sustainable bases.* ✓ *The County's Climate Smart Agriculture (CSA) strategy focused on Creation of relevant incentives for adoption of sustainable agricultural practices and working on the decoupling deforestation and degradation for economic activities* ✓ *The country and the regional state structures Experienced in multi-sectorial*		

	project implementation and acquaint collaboration between different levels of government that were empowered during ER Program implementation goes beyond the ERPA period. ✓ *Through widespread community consultation resulted in wider community support, the effectively managed community expectations, increased sense of ownership, ensured inclusivity, motivated participation in forest management decision making, and sustainable utilization.* ✓ *The signing of a Memorandum of Understanding (MoU) with other implementing partners marks a significant milestone in our collaborative efforts. This agreement not only formalizes our partnership but also establishes a robust Feedback and Grievance Redress Mechanism that will be operational throughout the implementation of the ER Project. The presence of such a mechanism is anticipated to foster a culture of accountability and responsiveness, ultimately leading to the development of sustainable and effective practices that extend well beyond the duration of the ERPA period. This proactive approach ensures that the voices of all stakeholders are heard and addressed, thereby enhancing the overall impact and longevity of the initiatives undertaken.* ✓ *Experience in multi-sectorial project implementation and Signed Memorandum of Understanding with partner institutions that generate the implementation of long-term efficient practices beyond the project lifetime*		

	The successful implementation of a large-scale and effective land titling and boundary delineation initiative is vital for ensuring the enduring stability of land rights. Such a process must be designed to address the complexities of land ownership and usage, providing a clear framework for legal recognition and protection of property. By investing in this critical infrastructure, we can create a more equitable and secure land tenure system that supports both individual landowners and the broader community, ultimately leading to enhanced economic opportunities, social cohesion and Ensure stability of land rights in the long run that respect free from expansion into forest areas. During this progression, OFLP_ERP has played a crucial role in establishing a robust institutional framework that supports forest governance at various administrative levels. By extending its focus beyond the national scope, the initiative aims to ensure that governance mechanisms are effectively implemented and tailored to the specific needs and contexts of sub-national regions, thereby promoting more localized and responsive forest management practices ✓ *Benefit Sharing Plan (BSP) and BSOM, which increases community trust and community commitment*		
B. Exposure and vulnerability to natural	✓ *A well-defined and empowered organizational framework is crucial for the successful implementation of the Emergency Response Program. This framework must possess the requisite authority and resources to facilitate*	*15%*	*5%*

disturbances	*the program's operations, ensuring that all relevant activities are carried out in a systematic and effective manner* • *The presence of Environmental and Social Risk Management (ESRM) tools plays a crucial role in directing and ensuring the effective implementation of strategies aimed at mitigating environmental and social risks beyond the duration of the Operational OFLP_ERP period. These instruments are essential for assessing the appropriateness of various programs and projects at the landscape level, ensuring that they align with established environmental and social standards. The Environmental and Social Commitment Plan (ESCP) of the program and binding international agreements will serve as a guiding framework for these initiatives, promoting sustainable practices and compliance with risk management protocols.* • *Signing of agreements between Forest based cooperatives and respective government structures ensures the continuation of the Participatory forest management beyond ER Program* • *The Oromia regional state has initiated a significant transformation in its administrative structure at the kebele level, moving away from representatives chosen by the community to appointing qualified government experts who maintain a strong connection with the local population. This change presents a valuable opportunity to bolster both technical and*		

	administrative assistance at the grassroots level, thereby promoting a more progressive and inclusive approach to forest management. Such a strategic move is crucial for addressing the challenges associated with reversals and linkages, as the facility is equipped to provide a range of services, including technical support, law enforcement, capacity building, and collaborative efforts across the province. ➢ *This risk associated with natural disturbances remains low. The main natural risk in the OFLP_ERP accounting area is forest fires. Generally, the occurrence of uncontrolled forest fires may happen as a result of illegal practices related to, land clearing, charcoal production, and as a result of dry years (El Nino events).* ➢ *The programme has mitigated the risk of forest fires by strengthening fire management and control units at the Forestry Commission, district assemblies, and fire volunteers etc.* ➢ *The government has invested a numbers of investment programs on forest development and management and implemented law enforcement to control forest conversion that helps to manage vulnerability to natural disturbances.* ➢ *Better land use planning is crucial for maintaining the health of forests and reducing the risk of fires. By developing and implementing management plans OEPA has ensured that forests are managed in a way that promotes their well-being. These plans can help identify potential risks to forest health*		

	and take proactive measures to prevent them. By prioritizing the health of forests in land use planning that creates a more sustainable environment for both the trees and the wildlife that call them home. • *For Effective management of natural hazards, such as wildfires, a comprehensive approach that encompasses prevention, preparedness, response, and recovery strategies. This involves not only the implementation of robust fire management practices but also the integration of community education and engagement to raise awareness about fire risks. Additionally, collaboration among various stakeholders was developed, including government agencies, local communities, and environmental organizations that developed and helped to enforce policies that mitigate the impact of wildfires. By engaging different Programs/projects utilizing advanced technology for monitoring and early detection, as well as investing in sustainable land management practices, we can significantly reduce the likelihood and severity of natural hazards. The country has developed and undertaking the following mechanisms To Manage landslide and increase the productivity of land at watershed level (community watershed development through the regional state,) Progrmas /project interventions for Watershed management (AGP, SLMP,CALM)* • *Land tenure certification Securing land tenure for private farmers that restrict farmers illegal intervention and expansion of agricultural land in*		

	to forest designation that worse the natural disturbances. • *Government and development initiatives have invested on a sets of forest fire extinguisher and distributed for all zones by focusing on wildfire prone area through providing for communities and stakeholders on how predict forest fires occurrence that helps proactively manage fire hazardous.* *Through all these mechanisms and strategies the county has built long- term effectiveness in addressing the key drivers of LULUC/AFOLU emissions and removals permanence of the Program ER.*		
Actual Reversal Risk Set-Aside Percentage: (Result A+ Result B)			*10%*

6.2. Occurrence of major events or changes in ER Program circumstances that might have led to the Reversals during the Reporting Period compared to the previous Reporting Period(s)[19]

This is the first monitoring report, so no reversals have occurred.

6.3. Quantification of Reversals during the Reporting Period[3]

A.	**Total net Emissions Baseline during the Reporting Period (tCO_2-e)**	*from section 3.1*			
B.	**Sum of net Emissions Baselines for all previous Reporting Periods in the ERPA (tCO2-e).**	*from previous ISFL ER Monitoring Reports*			**+**
C.	**Cumulative Emissions Baseline for all Reporting Periods [A + B]**				
D.	**Estimation of net GHG emissions from the ISFL ER Program during this Reporting Period (tCO_2-e)**	*from section 0*			
E.	**Estimation of net GHG emissions for all previous Reporting Periods in the ERPA (tCO_2-e)**	*from previous ER Monitoring Reports*			
F.	**Cumulative net GHG emissions including the current reporting period (as an aggregate accumulated since beginning of the ERPA) [D + E]**				**–**
G.	**Cumulative quantity of Emission Reductions estimated including the current reporting period (as an aggregate of ERs accumulated since beginning of the ERPA) [C – F]**				
H.	**Cumulative quantity of Emission Reductions estimated for prior reporting periods (as an aggregate of Emission Reductions accumulated since beginning of the ERPA)**	*from previous ER Monitoring Reports*			**–**
I.	**[G – H], negative number indicates**				

[19] This section should only be completed starting from the second Reporting Period

	Reversals			
If I. above is negative and reversals have occurred complete the following:				
J.	Amount of Emission Reductions that have been previously transferred to the ISFL, as Contract ERs and Additional ERs			
H.	Quantity of Emission Reductions to be canceled from the Reversal Buffer account [J / H × (H – G)]			

7. Emission Reductions available for transfer to the ISFL

Quantify the Emission Reductions available for transfer to the ISFL by completing the white cells in the table below.

A.	**Emission Reductions during the monitoring period (tCO_2-e)**	*from section 0*		18,211,228
B.	**If applicable, number of Emission Reductions calculated using Activity Data Proxies and methods (use zero if not applicable)** ***[Corresponds to ISFL ER Program Requirement 4.6.5]***		0	
C.	**Number of Emission Reductions estimated using measurement approaches (A-B)**		18,211,228	
D.	**Conservativeness Factor to reflect the level of uncertainty from non-proxy-based approaches associated with the estimation of ERs during the Term of the ERPA**	*from section 4.4.2*	8%	

E.	**Calculate (0.15 * B) + (C * D)**			1,456,898
F.	**Emission Reductions after uncertainty set-aside (A – E)**			16,754,330
G.	**Number of Emission Reductions for which the ability to transfer Title is unclear or contested**	*from section 5.1*		0
H.	**Emission Reductions sold, assigned or otherwise used by any other entity for sale, public relations, compliance or any other purpose including Emission Reductions that have been set-aside to meet Reversal management requirements under other GHG accounting schemes**	*From section* ***Error! Reference source not found.***		0
I.	**Potential ERs that can be transferred to the ISFL (F – G – H))**			16,754,330
J.	**Total reversal risk set-aside percentage applied to the ISFL ER Program during this Reporting Period**	*From section 0*	10%	
K.	**Quantity of ERs to allocated to the**			1,675,433

	ISFL Reversal Buffer (multiply J and l)	
L.	**ISFL ERs (I – K). This should be equal or greater than zero**	15,078,897

8. Annex

Annex 1: Information on the implementation of the Safeguards.

I. ISFL Requirements for Managing the Environmental and Social Aspects of ER Programs

Environmental and Social Aspects of ER Programs

From 2017-2022, the REDD+ program, OFLP Project is linking communities, local authorities, the national government, and the private sector to jointly address the drivers of forest conversion and degradation in Oromia regional state. The Project has designed, developed and implemented Environmental and social issues while working to prevent carbon emissions from the conversion and degradation of natural forests, improve carbon sequestration through better management of plantation forests, and improve the quality, diversity, and productivity of natural production forests in the area.

The projects developed ESRM instruments like Strategic Environmental and social Assessment (SESA), Environmental and social Management Framework (ESMF), Resettlement Policy Framework (RPF) and Process Framework (PF) were developed and implemented during OFLP grant Period. To comprehensibly sustaining the ESRM during the OFLP_ERPA period additional instruments LMP, SEP, ESCP, ESMF, RF, and PF, are also developed and under implementation. These investment activities are funded during the OFLP grant period through various World Bank projects, including the Forest Investment Project activities (AR and PFM). The principles outlined in the guidelines for compliance with environmental and social safeguards, such as respecting local culture, promoting transparency, and ensuring meaningful participation of affected stakeholders, are integral to the successful implementation of these investment activities. By adhering to these principles, Ethiopia aims to protect and conserve forests while enhancing multiple forest functions for sustainable development.

The Parent OFLP projects represent the REDD+ activities within the ER program area and they have the following safeguard instruments:

Table 1: List of safeguards instruments approved and in place (Documents available in the link):

OFLP Gant Period SG instruments	Duration
SESA (Strategic Environmental and Social Assessment)	2017-2022
ESMF (Environmental and Social Management Framework)	2017-2022
C & P (Consultation & Participation Plan)	2017-2022
GRM (Grievance Redress Mechanism) Manual	2017-2022
PF (Process Framework)	2017-2022
RPF(Resettlement Policy Framework)	2017-2022

The World Bank has recently adopted a new ESF approach to admit the significance of tackling development demands and challenges. This includes strengthening and updating requirements, ensuring comprehensive coverage, effectively monitoring and managing risks and impacts, and offering a systematic planning tool. As part of the new ESRM instrument for OFLP ERP period, several key components have been introduced. Besides, the listed "Instruments", the ESMF, SESA, PF, and Gender Mainstreaming Guidelines, as well as the Action Plan, were updated based on the ESF requirement for the ERP period.

Both of the tools were meticulously designed to offer support in implementing the OFLP and other REDD+ projects. These ESRM instruments were crafted using the insights and data gathered while developing the SESA and the National REDD+ Strategy, which received financial backing from the Ethiopia FCPF REDD+ Readiness Preparation Support. It is crucial to highlight that each of these instruments has been subjected to rigorous evaluation and has been efficiently disseminated at the national, regional, and local levels. Moreover, they are readily available online through both the OFLP website and the World Bank website. The development of these instruments was done through community consultation, a collaborative effort involving federal, regional and local level expertise and experiences in the field, ensuring that they are tailored to meet the specific needs of the OFLP and REDD+ initiatives. The information and data gathered during the formulation of the SESA and the National REDD+ Strategy served as the foundation for creating these tools, guaranteeing their relevance and effectiveness in the context of Ethiopia's environmental conservation efforts. Through the support of the Ethiopia Forest Carbon Partnership Facility (FCPF) REDD+ Readiness phase; these instruments have been refined and fine-tuned to align with the country's goals and objectives. Accessing these tools is now more convenient than ever, thanks to their availability online through the OFLP website and the World Bank info shop. This accessibility ensures that stakeholders at all levels, from the central government to local communities, can benefit from the resources and guidance provided by these instruments. By making these tools easily accessible, the aim is to enhance the implementation of the OFLP and REDD+ initiatives, ultimately contributing to the sustainable management of Ethiopia's forests and natural resources.

The effective handling of issues and complaints from individuals or groups affected by project activities is crucial for managing operational risks and meeting the requirements of the Forest Carbon Partnership Facility (FCPF). To ensure a transparent and participatory approach that helps mitigate conflicts in the implementation of REDD+ initiatives, the OFLP has developed Grievance redress manuals (GRM) that guides the establishment of "Grievance Redress Committee" and the process of grievance resolution according to the project's ESRM instruments, including the ESMF, SESA, and others. This mechanism is specifically designed for receiving and facilitating resolution of queries and grievances from affected communities or stakeholders engaged in REDD+ activities, policies or programs at community, woreda, zonal, regional, and national level address questions and complaints from those impacted by the project and program activities. It serves as a tool to foster a harmonious relationship between affected parties and stakeholders involved in the project implementation. During the OFLP grant period safeguards coordinator and woreda coordinators based at zonal and woreda cluster level act as the focal points and capacitating for the Grievance Redress Committee in the regional state. They are responsible for receiving, processing, investigating, and responding to grievances reported in their respective villages. The safeguards team has already prepared a manual of procedures, a communication strategy, and a monitoring system to track grievances and assess the progress made in resolving them. Additionally, there is an ongoing process of local community consultation and engagement, which involves various stakeholders through the multi-stakeholders coordination platform.

The link presents information on different phases and levels of consultations, trainings, workshops on safeguard plans and BSP where uploaded on google drive: https://docs.google.com/spreadsheets/d/1CYM0QmQbBJgohTyiMmtXnCSbPdYdulzDdplLxsozWr4/edit?gid=2057322565#gid=2057322565.

II. Monitoring and Reporting Requirements

1. Entities that are responsible for implementing the Safeguards Plans are adequately resourced to carry out their assigned duties and responsibilities as defined in the Safeguards Plans.

OFLP has established monitoring and reporting procedures along with templates that have been approved by the WB and utilized in the projects forming the Bank's Integrated Landscape Management Portfolio mentioned earlier. The monitoring process involves field visits and the creation of quarterly evaluation reports that are then submitted to the World Bank. The OFLP ESRM team and the Woreda coordinators at district levels have been assigned the responsibility for overseeing this task. Presently, at all zones and woreda levels, the respective sectors' focal persons are accountable for the implementation of program activities and meeting the requirements of the ESRM instrument including the ESMF, SESA, LMP, SEP, ESCP and others. The OEPA plays a crucial role in coordinating efforts in collaboration with the ORCU team. Furthermore, the World Bank conducts supervision visits and Mid-Term Reviews every six months to ensure the smooth progress of the projects. In order to ensure transparency, information is made readily available, easily accessible, and disseminated among all stakeholders involved. The investment activities are carried out in compliance with the environmental and social risk management set in place. The REDD+ initiatives sub project activities under the program area encompass activities such as integrating land use plans for households into sustainable agriculture and forest-based value chains, restoring degraded areas, and implementing PFM for sustainable forest management through forest cooperative developments.

OEPA and other relevant sectors are responsible for carrying out the activities, while the Oromia REDD+ Coordination Unit (ORCU) oversees and monitors the implementation with a team of MRV and SG specialists. The district government plays a role in supervising civil works to ensure compliance with labor, health, and safety contract requirements. The Regional Steering Committee (RSC) was established for the implementation of REDD+ activities, and a REDD+

secretariat was appointed as the National MRV team. Their responsibilities include enhancing community participation in Integrated Landscape Management, building capacities for Community-forest resource management, and managing, monitoring, and evaluating the project. Community project proponents receive support in refining and detailing pre-selected projects, as well as conducting environmental and social screenings for REDD+ initiatives. All REDD+ investment activities undergo a thorough review and screening process to determine the required level of environmental and social assessment. The screening and project categorization phase helps identify the appropriate site specific environmental and social risk management instruments needed for each activity, such as an Environmental and Social Management Plan (ESMP).

As indicated in Table 2 bellows a list of activities carried out between January 2018 to January 2022 in the program area, highlighting their status and preparatory safeguard instruments. It is worth noting that the majority of activities, particularly AR, PFM, ANR and Green legacy Forest Plantations, commenced in 2018, with the number of beneficiaries increasing steadily over the years. All screening and licensing procedures undergo validation by the WB safeguards team to ensure alignment with their guidelines

Table:2 Environmental and social subproject screening and prepared site specific instruments (January 2018 to January 30 2022)

No	Initiative	Investment type	Area	Number sites	Safeguard instruments			Category	Implementation
					Eligibility	Screening	ESMP		
1	OFLP	AR	10835	1625	1625	1625	558	c	Anticipated risks were managed
		PFM	217,522.659	191	191	191	189	c	Anticipated risks were managed
		Livelihood		312	312	312	80	c	Anticipated risks were managed
2	RIP	AR	19810.03		1596	1596	141	c	Anticipated

									risks were managed
		ANR	275,095		997	997	428	c	Anticipated risks were managed
		PFM	424,000		345	345	202	c	Anticipated risks were managed
3	Bale Eco region	PFM	60,924		17	17	17	c	Anticipated risks were managed
	EU	AR	76.68		5	5	5	c	Anticipated risks were managed
		PFM	5727.6		6	6	6	c	Anticipated risks were managed
4	SOS (Farm Africa)	PFM	14498.2		7	7	7	c	Anticipated risks were managed
5	GLP	AR	35233		3002	3002	362	c	Anticipated risks were managed
6	EWNRA	PFM	195,506	47	47	47	47	c	Anticipated risks were managed
7	ECFF				6	6	6	c	Anticipated risks were managed

Safeguard Compliance levels.

The World Bank's and ORCU safeguard team supervision and technical missions have consistently found that the safeguards instruments put in place to address environmental and social risks and impacts in REDD+ initiatives sub projects have been effectively implemented. In cases where there have been constraints, such as delays in submitting safeguards sub-instruments, the team has been proactive in improving compliance by submitting timely reports and coordinating with the World Bank. As part of the project preparation, an independent third party conducted a mid-term environmental and social audit to assess the performance of the ESRM component.

OFLP_ERP commenced retroactive Environmental and social due diligence audit (ESDDA) for retroactive carbon accounting. The scope of ESDDA for retroactive carbon accounting of the OFLP-ERP piloted between periods of June 2022 to February 2023, which insurances ER for the period before the ERPA signing Agreement. The Environmental social due diligence audit (ESDDA) revealed OFLP, RIP, green legacy, and two REDD+ legacy activities compliances in line with the parent OFLP ESRM instruments. The Audit evaluates and categorized the compliances of the environmental, social, health, and safety (ESHS) performance of the Project, the status of implementation of E&S instruments SESA, ESMF, RPF, PF stakeholder engagement plan, sexual exploitation at working area, sexual abuse /sexual harassment or gender based violence (SEAH/GBV) prevention and response plan, gender action plan (GAP), and functioning of the grievance redress mechanisms requirements. The retroactive carbon accounting audit labor management (labor influx, child labor), community health and safety (OHS,/PPE), gender-based violence (GBV) specifically sexual exploitation and abuse (SEA)/sexual harassment (SH) in workplaces specifically assessed and finally those issues were categorized as fully comply, comply with minor issues , and fully comply respectively.

The report indicates a Corrective mitigation action plan implementation in compliance with WB safeguard policies, including sub-project licensing, monitoring processes, Grievance Redress Mechanism, and pesticide management.

The training aspect of the assessment was also deemed satisfactory, with a score of 7467 experts of different relevant institutions which were covers 102% of the program target. Overall, the findings of the ESDDA demonstrate the commitment of the project team to safeguarding the environment and minimizing social risks, while also highlighting the importance of ongoing monitoring and continuous improvement in compliance.

Project supervision missions have confirmed that all works have commenced with the necessary Environmental and Social Management Plans (ESMPs) and other safeguard preparatory instruments such as community consultation, DA eligibility check, Screening ,Land donation format and kebele administrative approvals. Additionally, OFLP serves as an umbrella program, addressing the challenges posed by fragile local environments and intricate social cultures. It encompasses a range of initiatives at the Oromia landscape level, all of which contribute to the reduction of emissions. Moreover, the program is committed to fulfilling all the ESRM requirements should be implemented consistently throughout the project period. Besides those the GRM should be functional and strengthened throughout the project implementation period.

The introduction of ESRM and REDD+ in the OFLP is relatively new, presenting its own set of challenges to the local communities and implanting sectors. One of the main obstacles is the low literacy level among the majority of beneficiaries, necessitating ongoing awareness campaigns to actively involve them in ESRM compliance. Another challenge lies in the need to communicate in the clearest and simplest language possible, ensuring that all stakeholders can understand and participate effectively. This proactive approach aims to ensure that all parties involved are well-informed and engaged in safeguard implementation to achieve the desired project outcomes.

Table: 3 Summary information of the safeguards action during OFLP grant and yet in the ongoing activities.

Activity	**ESRM action on the ground**	**Compliances**
Nursery operation and production exotic and indigenous seedling over 79 woreds of hot spot and other initiatives contribution seedling production for enrichment planting and AR ,Green legacy initiatives . A total 6422 daily laborers recruited over 79 nursery sites.	Community seed selection , identification seedling site match , labour management, personal protection equipment (PPE), child labour protection	Completed
AR site selection, community	Mapping and ground-truth sensitive habitats for	Ongoing

consultation on site specific safeguard issues, Eligibility checking and Screening and ESMP	identifying protection and rehabilitation activities (critical habitats, forest, water bodies, steep slopes, etc.) Assessing anticipated potential impacts and mitigation action implementation	
Land donation form filled and approved by land administration	The household voluntarily contributed land or collectively pooled private lands for the purpose of plantation, adhering to the established land donation format and the authorized land administration office approved the land donation process.	Completed of all privately pooled lands
Community consultation on SGI implementation and BSP	More than 2.4 rural community were consulted on ESRM ,climate change impact adaptation and Benefit sharing plan	Ongoing
Vulnerable and disadvantaged individuals affected by the program implementation. Identification and mitigation action implemented	Forest dependent local communities were identified and supported though Livelihood support.	Ongoing
Community organization: Community Creation and legalization of AR and PFM based (Gender inclusion, CIG establishment and capacitating on decision making power of women in the cooperatives	Training and raising awareness on environmental and social aspects; Reinforcement of gender mainstreaming and participatory governance. Training on the operationalization of the Dialogue and Grievance Mechanism and dissemination of spots through Radio and leaflets, info graphs Over 800 cooperatives established at Oromia landscape level by different institutions and aware on BSP	Ongoing

Grievance Redress Mechanism

A grievance redress committee was formed in 6523 rural kebeles during the OFLP grant period to guarantee that locals have a dependable mechanism in place to handle their complaints.

The functionality of this mechanism depended on the level of program activity and intervention, particularly with regards to REDD+ initiatives. It was noted that the intervention of REDD+ initiatives led to a more pronounced focus on grievance registration and resolution, resulting in a more active performance in addressing community grievances. Within these rural kebeles, a specific Grievance Redress committee was put in place to oversee the process. This committee played a crucial role in ensuring that grievances were properly registered, investigated, and resolved in a timely manner. By having a dedicated committee in place, community members felt more confident in the grievance redress process and were more likely to come forward with their concerns. The effectiveness of the Grievance Redress Mechanism in these rural kebeles was evident in the increased trust and participation of community members. By having a structured system in place, grievances were addressed promptly and fairly, leading to a more harmonious relationship between the community and program implementers. The success of this mechanism highlighted the importance of having a reliable grievance redress system in place to ensure the well-being and satisfaction of all stakeholders involved.

Table:4 Summary of Compliant Registered During OFLP and OFLP-ERP Period

Registered cases	**# of Years 2018-2024**	**Stages**	
		Resolved	Ongoing
Claims	8	8	
Land /boundary Conflicts	14	14	
Livelihood	18	18	
Suggestions on accelerated benefit sharing and additional livelihood support	5	5	
Total	44	44	

The Complaints were about land conflicts, in particular about the boundary conflict and resources utilization on communal lands especially grazing and access restriction. Until June 2024 almost 44 cases were registered and of the conflicts were resolved at local levels using kebele level GRC and community elders.

Safeguard Information system and Documentation

The online platform for the Safeguards Information System (SIS) is fully developed and operational, providing comprehensive information on safeguards. The platform provides information on the ESRM instruments in the context of the forest program in the Oromia regional state landscape level, highlighting how ESRM are being addressed and respected during the implementation of REDD+ activities. The SIS is designed to be simple, accessible, auditable, and in line with national legislation, as well as the requirements of the World Bank ESF.

OFLP program activities and other subprojects aim to integrate rural households into sustainable forest management and development, forest-based livelihood improvement, restore degraded areas, and establish nurseries and new planted forests. These efforts are in line with the GTP and CRGE are the implementation of Afforestation and Reforestation, and the establishment of new-planted areas are key elements in the Action Plan of the REDD+ National Strategy. The SIS plays a crucial role in operationalizing these protocols and ensuring their effective implementation.

Safeguards information in line with national legislation and the World Bank ESF and donor requirements presents the following.

1. **Complementarity or consistency with national forestry programs and relevant international agreements;** - OFLP, OFLP ERP initiatives and other subprojects aiming at the integration of rural communities into sustainable Forest management and development and forest-based value chains, restoration of degraded areas, establishment of nurseries and new planted forests and promotion of AR and PFM cooperative establishment in line with the CRGE and GTP. It should also be noted that the implementation of AR and the establishment of new-planted areas are key elements in the Action Plan of the REDD+ National Strategy, CRGE National Strategy and the Policy of the country and forest regulation and proclamation of Oromia regional state. The operationalization of the regulation for

preventing critical habitat conversion is an approach to comply with the national policy of biodiversity conservation and the convention of biological diversity

2. **Transparent and efficient national forestry governance structures** – National and Regional MR is supporting the assessment of forest monitoring to ensure their activities comply with national logging rules and propose correction measures when necessary. In addition, the OFLP.REDD+ investment and the two REDD+ legacy projects are supporting the establishment and strengthening of the Communities Based in PFM cooperatives committees. These community organizational structures aiming at the sustainable management of forest resources. In the Oromia landscape, over 800 forest cooperatives have been established as part of the OFLP, OFLP ERP initiatives, and other subprojects. These initiatives aim to promote sustainable forest management and enhance the livelihoods of local communities. Through the establishment of these cooperatives, the Oromia region has taken significant steps towards conserving its forests and ensuring the active participation of community members in forest-related activities. These cooperatives play a crucial role in fostering collaboration, knowledge sharing, and collective decision-making among the local communities, ultimately contributing to the overall conservation efforts in the region.

3. Respect for the knowledge and rights of local communities: All efforts made are designed with careful consideration for the traditional customs and practices of the local population. The Land Law and its accompanying regulations in Ethiopia outline specific guidelines that must be followed to ensure that the rights and traditions of local communities are respected during activities related to forest exploration and exploitation, especially in cases involving private sector investments in forest concessions or other land-use projects. During the orientation training provided to employees and technical staff who interact directly with local communities, a strong emphasis is placed on fostering positive "community relations." This includes educating staff on the appropriate ways to communicate with community members, such as identifying suitable locations for meetings and understanding and respecting local norms and customs. 3. By prioritizing community engagement and respecting local traditions, the initiatives aim to build trust and cooperation between project stakeholders and the affected communities. This approach not only ensures compliance with legal

requirements but also promotes sustainable development practices that benefit both the environment and the local population in the long term.

4. **Full and effective participation of stakeholders, in particular local communities:** Effective participation in REDD + initiatives needs strong information and awareness raising campaigns, public consultations for subprojects and specific training programs. The landscape has an Integrated Development Platform where sustainable and integrated landscape development models and initiatives are discussed and harmonized among different stakeholders (representatives of local communities, civil society, local NGOs, provincial and district government) in regular meetings. The GRM is also an instrument that contributes to the full and effective participation of program participants.
5. **Consistency with natural forests and biological diversity governance:** The forest policy is currently being updated to improve the sustainable management of forest. Conversion of native forests to any activity, whether forest plantations, agriculture or other initiatives, is not eligible for receiving funding or grants by the projects in this landscape and the conversion of any natural habitat is strictly prohibited. The critical habitat conversion prevention protocol was developed to guide this particular aspect.
6. Actions to address risks of reversals: The adoption of new conservation agriculture techniques and the implementation of agroforestry systems allow the farmers to remain in the same area for several years. It is expected that the landscape approach to integrated development contributes to the harmonization of sustainable practices of different landscape initiatives coordinated by different stakeholders.
7. Actions to reduce emissions displacement: Monitoring and follow-up of activities is carried out with the support of the MRV unit which produces maps of landscape deforestation leading the different actors and stakeholders to know the deforestation stage particularly in their jurisdictional area and buffer zone.

Annex 2: Information on the implementation of the Benefit Sharing Plan

I. ISFL Requirements for Benefit Sharing Plans

1.1. What are the agreed commitments in the BSP?

The benefits received as a result performance in ER generation shall be shared among beneficiaries eligible for sharing. The BSP involves a two-tier process: vertical and horizontal sharing. Vertical share refers to the sharing of the benefit between the community and private forest developers on one side and governments (Federal and Regional) on the other side. Horizontal share refers to the distribution of community's allotted share among the communities across the forested landscapes in Oromia. The main eligible beneficiaries identified are (i) communities residing nearby and inside forest whose livelihoods depend on forest and who have been contributing in ER generation, and (ii) Federal and Regional government bodies responsible for policy and administrative oversight and provide operational and technical support (see Annex Table 5 below), and (iii) private forest developers those contributing in ER generation.

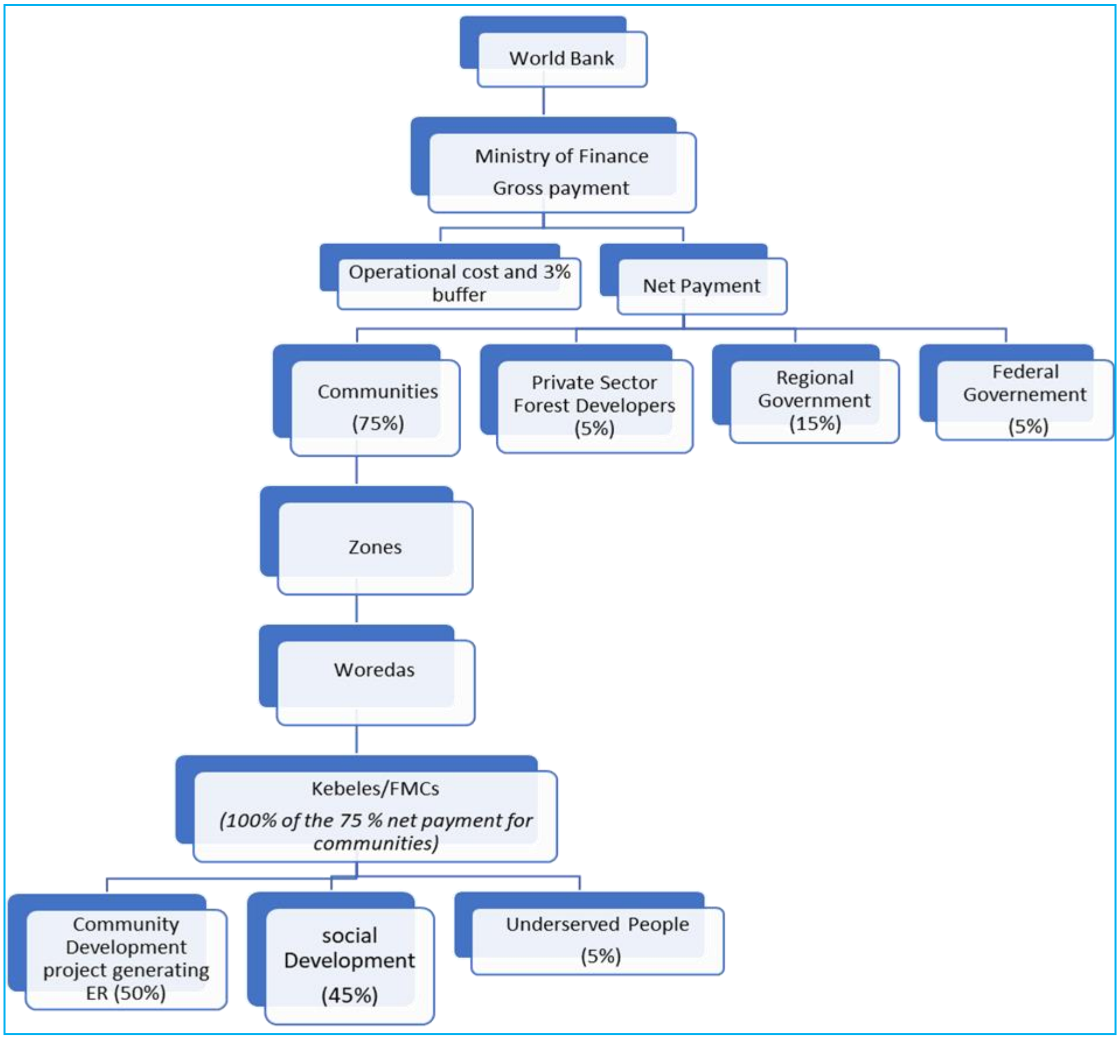
Annex 2, Table.1: Eligible beneficiaries, proposed share, and their rights, roles and responsibilities

Main categories of eligible beneficiaries (current and future)	Percept share of the beneficiaries	Rights, roles, and responsibilities
Communities refer to those who live within the boundaries of Kebele and engage in development and management of forests either legally or customarily	75%	Customary and constitutional right of ownership, cultural and social responsibility of managing, protecting, and developing the forest, and customary right of use and/or legally granted user right through PFM along with responsibility of managing and developing forests. Community will be represented by kebele which is the lowest unit of government's administration.

Federal government (Represented by Ethiopian Forest Development (EFD)	5%	Constitutional right to own forests; responsibility to enact policies, regulations, develop national strategies; representation in international negotiations and giving technical back-up to OFLP on fiduciary support, safeguards management and MRV process.
Regional government (Sectoral bureaus in the land use sector)	15%	Constitutional responsibility to administer forests; responsible for developing regional policies (forest, land use, etc.), provide technical support on forest management including MRV process, budget (carbon fund) management, law enforcement, organizing and supporting communities and private forest developers,
Private forest developers (these could be individuals, or other beneficiaries – e.g., private investors)	5%	Investing in new forest development and/or management of existing forest in A/R or area enclosure.

The 75% community share will be dispensed among the communities across Oromia. The horizontal benefit share involves a three-step process: first is the share among administrative zones; second is share among woredas in each zone and the third is share among kebeles in each woreda. Performance (avoided deforestation, forest enhancement and new forest development) and existing total forest area are selected as criteria to determine sharing of benefits among zones. Whereas existing total forest area in the woreda, new forest development size and number of established forest management cooperatives (FMC) are criteria for benefit distribution among woredas in each zone. Likewise, the existing total forest area in a kebele/FMC and area size of new forest development (A/R) of a kebele/FMC are criteria for benefit distribution among kebeles in each woreda.

Annex 2, Figure 1: Beneficiaries of the Program



Regarding disbursement and fund flow, the Ministry of Finance (MoF) receives the ERC payment in an independent account and keeps the 3% performance buffer for risk management and deducts the operational cost as described in the BSP. ORCU/OEPA officially communicates the the Oromia Bureau of Finance (BoF) detailing share of all eligible beneficiaries from the net payment as per the OFLP monitoring result. Accordingly, the BoF transmits this disbursement request to MoF. Then MoF transfers the share of federal government to the account of EFD and the remaining net benefit and the operational cost to Oromia BoF. The Oromia BoF, being officially communicated on the amounts of shares to each entity in the region (by ORCU/OEFA) as decided by the OFLP Steering Committee, disburses operational cost to OEPA's account. Moreover, Oromia BoF disburses the shares of FMCs to their respective account and the shares of kebeles without FMCs to the respective Woredas' Office of Finance. The share of private forest developers (5% of the net) will be kept at BoF and will be disbursed to eligible private sector, after being officially communicated by OEPA as decided by the OFLP Steering Committee. The BoF will release the portion of the share of Oromia regional state (15%) to respective eligible sector bureaus implementing the winning proposals based on the decision of OFLP Steering Committee which determines the specific activities and sectors that lead them. OEPA's lower administrative units will oversee the proper disbursement and utilization of the shares at the respective sector administrative level.

The Woreda Office of Finance funds community action plans in accordance with the instruction provided by ORCU/OEPA for the respective kebele. Sector offices related to the approved action plans (as decided by the Woreda Steering Committee) will oversee the implementations of the community action plans that fall under their mandate in a coordinated manner. The Woreda Cooperative Promotion and Development Office is responsible to supervise the utilization of the FMC money through evaluating FMCs' business plan jointly with relevant sectors. The Woreda Cooperative Promotion and Development Office has mandated to examine and audit expenditure of FMC against their business plan and report the findings to the next higher administrative level (Zonal Cooperative and Development Office). Furthermore, it provides the required financial management training such as bookkeeping and other skills for FMCs and kebele offices as needed.

1. 2. To what extent have these commitments been met

Since 1st ER payment has not been disbursed, the above commitments in the BSP are not met yet. As soon as ER payment is released the BSP will be implemented fully.

1.3. Are the agreed benefit sharing arrangements in the BSP effective?

Effectiveness of the agreed BSP is yet to be tested due to the same reason indicated above

1.4. Should any aspects of the BSP be changed to ensure that the agreed commitments will be achieved?

Changes to BSP arrangements (if required) would be determined after testing them at the ground level.

II. Monitoring and Reporting Requirements

1. Benefit Sharing Plan Readiness

The benefit sharing plan has successfully been completed and endorsed by all pertinent parties. Throughout the OFLP-ERPA preparation period and before that during the upfront grant implementation period, the document had been subject to extensive review and consultation processes where all gaps and concerns were addressed, resulting in full agreement, no outstanding issues and endorsements and approval by stakeholders at the end. It is evident that no further improvements are necessary at this time, with the exception of enhancements to be made during the second ERPA phase transitioning to a more Comprehensive BSP that also integrates beneficiaries and benefit allocation modalities coming from the livestock sector. The approved final and disclosed version of the BSP is found at:

https://documents1.worldbank.org/curated/en/099711401032435292/pdf/IDU1b0afc83010a28142391a2ba1afcc36b02bc6.pdf

Capacity building and community consultation on BSP

The BSP development process of the OFLP has taken capacity building actions as part of its integral development process where stakeholders were given awareness training, encouraged to have full participation in formulating benefit sharing arrangement and fund flow mechanism and decision making in these to enhance transparency, inclusiveness and effectiveness in the overall implementation of the benefit sharing plan. Consultations on the program overall, on the benefit sharing arrangement and related ESRM requirements and compliance in particular were conducted across all zones, woredas, and local communities, engaging over 2.4 million individuals. Constant capacity building and consultation are to continue going forward for sustainability and to continuously addressing beneficiary concerns, disagreements and complaints that may arise during this ERPA phase and subsequent phases.

As this is the first ER monitoring report period and the first ER payment to be received, there are no changes to be made to the benefit sharing arrangements at hand, endorsed on both sides.

2. Institutional Arrangements

The distribution of payments for emission reductions and fund flow mechanism utilize the current government structure and institutional arrangement already in place financed by regular operation budget allocated from the government own source. The ER payment fund flow will follow government's "channel one" system, the Ministry of Finance (MoF) receives all payments of ERCs and channel allocated funds vertically and horizontally as per the agreed BSP and arrangements (see figure2 below), and employs its fund flow mechanism in use for a long time. Receiving and fund managing entities at federal, regional and local levels (including EFD, OBoF, OEPA, and woreda of office of finance (WoF)) are well equipped, adequately resourced and with considerable experiences in fiscal and special funds management, including in auditing and controlling systems, ORCU using its own finance team and supported by OEPA finance unit coordinates and ensure proper flow and use of funds at Oromia level overall (including from private sector beneficiaries) and reports to the OBoF, EFD, and to the WB. The OBoF, using government's reporting modality reports to the MoF. For more details on these, please refer to the approved BSP given in the link above.

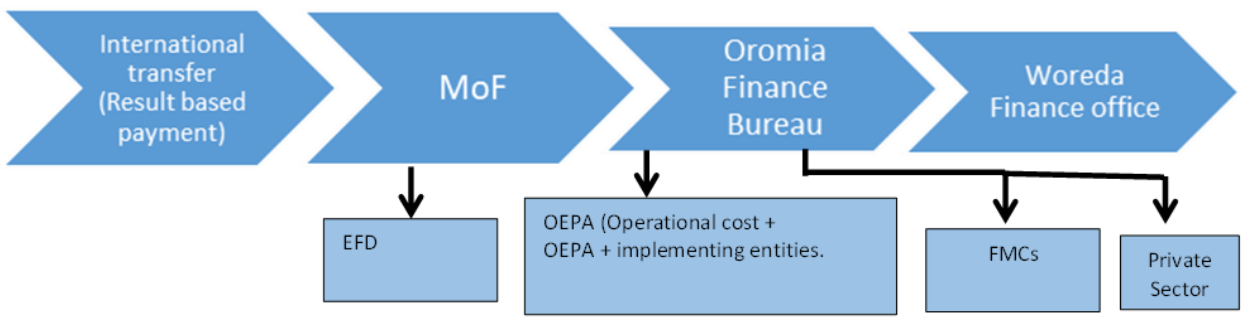


Figure 2: Flow of share of ER payment and fund channeling modality

Regulatory or Administrative Approvals Required for Implementing the BSP

Both the BSP and the BSP Operational Manual (a detail technical document prepared to guide the step-by-step implementation of the BSP) were extensively reviewed and consulted with the OFLP technical Working Group (TWG) and endorsed up on satisfactory completion of the these both quality and content wise, Following TWG endorsement, these were referred to the OFLP Steering Committee chaired by the Oromia Vice President for Rural Development Cluster for final check and approval. Approval was granted and the final BSP was submitted to the FMT for further review and endorsement by the ISFL Contributors. Final endorsement of the OFLP 1st ERPA phase BSP by ISFL came in November 2023 and disclosed at the same time. The core principle of this BSP agrees with the recently issued National Forest Regulation (Regulation No. 544/2024), where 80% of the net benefits received due to generation of ERCs at jurisdiction level is allocated to communities and the private sector (75% to communities and 5% to private sector beneficiaries).

Stakeholders understanding on their obligations, roles and responsibilities.

All BSP stakeholders (beneficiaries and administrators) clearly understand their obligations, roles and responsibilities associated with the BSP. This assertion is based on findings and feedback received during field implementation support missions, during interviews with beneficiaries, issues raised through public consultation meetings, beneficiary monitoring and the feedback and grievance redress mechanism laid down at ground level.

The roles and responsibilities towards the implementation including closer monitoring and oversight of the BSP by government institutions such as the Oromia Environmental Protection Authority (OEPA), Oromia Bureau of Agriculture (OBoA), Oromia Bureau of Land (BoL), Oromia Cooperative Promotion and Development Agency (OCPDA), Oromia Bureau of Water and Energy(OBoWE) the Oromia Forest and Wildlife Enterprise (OFWE) and the Ethiopian Forest Development (federal level) are detail elaborated and agreed upon, signed and issued in the form MOU very recently. The MoU dictates that these stakeholders should play a crucial role in ensuring that the benefits are shared equitably, efficiently, and in a transparent manner, and investments made using funding from ER payment meets environmental and social risk management requirements including the FGRM established for the ER program(for more on ESRM requirements and FGRM see Annex 1 above) The feedbacks obtained from beneficiaries and the extensive consultations and discussions held so far reaffirm that all stakeholders, including government administrative bodies, possess a thorough understanding of their roles and responsibilities. This shared understanding serves as a critical tool ensuring efficient and effective distribution of Emission Reduction payments to all beneficiaries.

A system is in place for recording the distribution of benefits and associated obligations to eligible beneficiaries.

The government has established a comprehensive structure for payment information systems, payment tracking and monitoring systems, bank accounts, accounting and financial control mechanisms, and payment modalities at the woreda level, extending from the Ministry of Finance (MOF) at federal level to each woreda (district) level, known as “Channel One Disbursement Mechanism”. OFLP’s ERC benefit distribution totally adopts this financing system from federal down to woreda level, using the same disbursement, financial recording, monitoring, reporting, and auditing procedures. Government’s woreda finance offices supported by woreda level cooperative promotion and development offices regulate financial accounting and fund utilization at FMC and Kebele levels.

At the woreda level, the government has established a robust financial management system to ensure that payments are processed efficiently and transparently, with mechanisms in place to track and monitor payments effectively.

Bank accounts have been set up to facilitate secure transactions, while accounting and financial control mechanisms have been established to ensure accountability and prevent any misuse of funds. The payment modalities put in place are designed to meet the specific needs of the woredas and are fully operational with the support of the government's financial system already in place and functional. .

Agreed accountability mechanisms are in place and functional.

The BSP and the benefit sharing operational manual (BSOM) have formulated in detail the accountability mechanisms to ensure transparency and effective governance system for benefit allocation and distribution. Stakeholder participation arrangements have been established, allowing relevant parties to actively engage in decision-making processes. Furthermore, agreed public information disclosure procedures have been elaborated to ensure that necessary information is shared with the public. Independent third-party monitoring and performance audit mechanisms were also laid down to assess the performance and adherence according to the agreed mechanisms. Additionally, dispute resolution and grievance redress mechanisms are formulated within structures of FMCs and Kebeles (principal beneficiaries) to address any conflicts or grievances that may arise.

Feedback and Grievance Redress Mechanisms (FGRM) is functional to record and address feedback and grievances related to the implementation of the BSP.

No complaints have been filed to date specifically on the implementation of the benefit sharing plan and benefit allocation since payment for ERC has not yet been received. However, the Feedback and Grievance Redress Mechanisms (FGRM) has already been laid down and fully structured as a system from communities' GRC level to the federal level with compliant hearing bodies in place to handle and address feedback and complaints related to the implementation of the BSP. It functions as an operational framework that effectively documents and resolves any issues or concerns raised by stakeholders involved in the BSP process. The FGRM plays a crucial role in ensuring transparency, accountability, and fairness in the execution of the BSP by providing a platform for individuals to voice their feedback and grievances.

In the OFLP Jurisdicción, 6653 GRCs (Grievance Redress Committees) were set up across all kebeles during the OFLP grant implementation period (2017 – 2023). Over 3122 grievance registration logbooks for the OFLP and other initiatives' intervention areas were delivered. These committees played an instrumental part in receiving, reviewing, and eventually addressing a wide range of concerns, with 41 different categories of complaints already filed and successfully addressed but not related to benefit allocation due the reason indicative above. The establishment and implementation of the kebele level GRCs has allowed prompt and efficient treatment of complaints, contributing to the development of a more efficient and transparent FGRM system.

Human and financial resources are allocated and maintained for implementing the BSP.

Within the framework of the OFLP-ERP, adequate levels of human resource capacity have been built and staffs were recruited to ensure effective implementation and management of the BSP. These include specialists in environmental and social risk management, experts in MRV (Measurement, Reporting, and Verification), specialists in M&E, policy and institutional development and financial management are staff costs are covered by a transitional grant allocated by the ISFL until ER payment received (expected end of June 2015). Once ER payment is made, staff and related operational costs will be covered (deducted) from the ER fund as per the arrangement in the BSP. Moreover, other staff from regional line bureaus, zonal and woreda offices as well as partnering non-governmental organizations will also be engaged extensively in the implementation of the BSP as outlined in the BSPOM and as agreed through the MoU signed between regional and federal entities towards the successful fulfillments of the OFLP-ERP objectives. The BSP has also allocated 20% share from net ER payment for regional and federal implementing entities to support the ER program implementation including executing activities of the BSP. This financial allocation will play a crucial role in sustaining program activities and ensuring that the necessary resources are available to monitor and manage environmental and social risks and undertake MRV related tasks effectively.

3. Status of Benefit Distribution

Since this is the first ER monitoring report for OFLP-ERPA, the volume of ER achieved given in the report is yet to be verified and based on this, ER payments are yet to be made. Neither monetary nor non-monetary payments were distributed to beneficiaries yet, therefore, no experiences whatsoever are gained yet in benefit distribution due to ER achievements.

4. Implementation of the Environmental and Social Management Measures for the BSP

ER payments are yet to be made, and the BSP principle must be applied on the ground to assess the performance of the ESRM measures for the BSP (please see the response given above)

5. Recommendations for BSP Improvement or Modifications

Payment is yet to be made and distributed. Therefore, no on ground experiences gained on the implementation of the BSP.

Annex 3: Summary of Program Results, including non-carbon Benefits

Result	*Unit*	*Achievement*	*Year (please state the year of the reporting)*
Land users who have adopted sustainable land management practices (% women) as a result of ISFL support, including in the following sectors where relevant: Forestry, Agriculture, Other (corresponding to T2.O1.5 on MEL Framework)	Persons	97,789 (35.32%F)	*2022-2023*
Number of people reached with benefits (assets and/or services) from ISFL Emission Reduction programs (% women) (corresponding to T1.1b on MEL Framework)	Persons	92,576 (35.45%) Or 32,818 Female	*2022-2023*
Number of communities or other organizations that have received benefits (assets and/or services) from emission reduction payments (details to be provide in Annex 2) (corresponding to T2.O2.1 on MEL Framework)	*No. of Communities/ Organizations*		
Number of people involved in income generation activities due to ISFL support (% women) (corresponding to T2.O2.2 on MEL Framework)	*Persons*		
Number of people in private sector schemes adopting sustainable practices (% women) (corresponding to T2.O3.3 on MEL Framework)	*Persons*	*25,000* *(36% F)*	*2022-2023*
Volume of for-profit private sector finance leveraged (corresponding to T2.O3.1 on MEL Framework)	*Million USD*		
Volume of not-for-profit finance (public or private) leveraged (corresponding to T2.O3.2 on MEL Framework)	*Million USD*	*11,881,441.00*	*2022-2023*

Annex 4: Updated baseline

1. Summary of updates

In the assessed ERPD, the Emissions Baseline was estimated for the period 2007 and 2017. The activity data for this Emissions Baseline was collected using a sample-based data collection approach to analyze changes in land use and land cover. Land use and land use change were assessed using 3,745 samples distributed across Oromia using a 10km grid (see annex 6, section 3.2.1 of the ERPD for details). It was decided to improve this analysis of land use and land use change because of different reasons:

- The land use change matrix produced only covered 29.9 million ha and not the full area of Oromia
- Definitions of land use classes used (see subsection on land use classes in section 2.2 above)
- It was felt more intense sampling was required, alsIn the Benefit Sharing Plan, benefit distribution is based on different indicators including performance against sub-jurisdictional, o to be able to develop zonal level baselines. In order to develop credible zonal level baselines, more intensive sampling was required than what was done for the Oromia level baseline. 92,820 samples were analyzed to develop the 21 zonal baselines using a systematic sampling design involving a 2 x 2 km grid for Oromia Regional State With the information derived from this intensified sampling being available, it was decided this could also be used to also update the Oromia level Emissions Baseline since it would provide a higher quality result then the original 3,745 samples (see Annex 4 for details) needed as part of the Benefit Sharing plan

In addition, updated values on biomass of different land use categories in Oromia, was available from Ethiopia's National Forest Inventory. For the categories involving conversions from other land uses to forest and for the pools 'dead wood' and 'soil organic carbon', the ISFL 'Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period' was fully applied in this updated baseline.

2. ISFL ERPA Phase

This updated baseline is valid for the first phase of the ERPA which covers the period 2022-2024.

3. Updates to the Program Emissions Baseline

i. Approach for estimating Emissions Baseline

3.1 Land use definitions

Ethiopia has adopted a new forest definition in February 2015 that forest defined as a 'Land spanning at least 0.5 ha covered by trees (including bamboo) (with a minimum width of 20 m or not more than two-thirds of its length) attaining a height of at least 2 m and a canopy cover of at least 20% or trees with the potential to reach these thresholds in situ in due course. This definition reduced the tree height criteria from 5m in the previous definition to 2m. The main reason for this change was to capture natural forest vegetation types like the dry-land forests which host woody species that typically reach a height of around 2-3m.

The new definition was used in the land use and land use change analysis that was part of the ERPD of the Oromia Forested Landscape Program. The resulting emissions baseline considered the following categories:

- Forest to cropland
- Forest to grassland
- Cropland to forest
- Grassland to forest

In these categories, grassland included 2 types of vegetation namely (1) 'grassland' which includes both rangelands and pastureland and (2) 'shrubland' which includes ecosystems with vegetation that falls below the threshold used in the forest land category and are categorized under the grassland, the threshold used in the grassland category. For this updated baseline, it was decided to have a separate subcategory for shrubland, allowing for a more accurate use of emission factors. This also responds to one of the observations made during the validation of the ERPD.

This means that the improved baseline and this monitoring report now consider the following subcategories:

- Forest to cropland
- Forest to grassland
- Forest to shrubland
- Cropland to forest
- Grassland to forest
- Shrubland to forest

For this the following definitions were used:

- **Forest land:** 'Land spanning at least 0.5 ha covered by trees (including bamboo) (with a minimum width of 20 m or not more than two-thirds of its length) attaining a height of at least 2m and a canopy cover of at least 20% or trees with the potential to reach these thresholds in situ in due course.
- **Cropland:** This category includes arable and tillage land, and agro-forestry systems where vegetation falls below the thresholds used for the forest land category, consistent with the selection of national definitions. Cropland includes all annual and perennial crops as well as temporary fallow land (i.e., land set at rest for one or several years before being cultivated again).
- **Grassland**: This category includes rangelands and pastureland that is not considered as cropland.
- **Shrub land**: includes systems with vegetation that fall below the threshold used in the forest land category and is not expected to exceed, without human intervention, the threshold used in the forest land category.

3.2 Data collection approach

3.2.1 Activity data

The methodology used is a systematic sampling approach to target potential areas of change and assess the land use and land use changes of the samples.

Sampling design

According to IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (IPCC GPG LULUCF) (Chapter 5.3.4) areas and changes in areas can be estimated using sampling (sample-based activity data (AD) estimation) i.e., estimation via proportions. This approach requires that the total area of the survey region is known, and that the sample survey provides only the proportions of different land-use classes. IPCC GPG LULUCF (Chapter 5.3.3.2) also states that 'it is efficient to use systematic sampling, since in most cases this will increase the precision of the estimates. Systematic sampling also simplifies the fieldwork'. Therefore, systematic sampling design was adopted for this survey (Figure 1). A 2 x 2 km grid for Oromia Regional State.

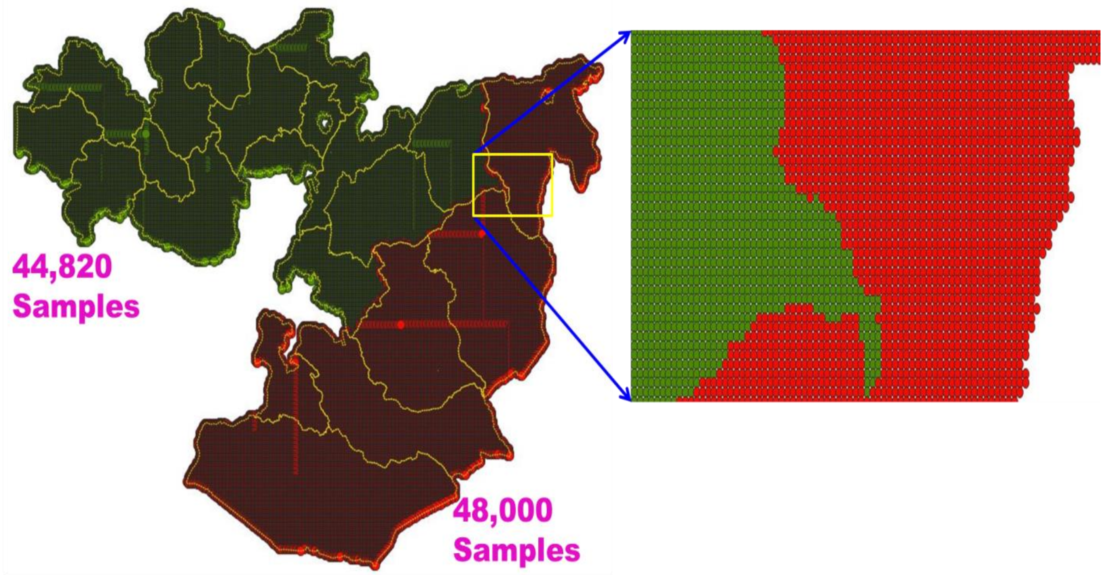


Figure 11 A 2 x 2 km grid sampling for Oromia Regional State and number of sample points for the two CEO projects.

Sample based activity data (AD) estimation.

After generating sample plots at 2x2 km systematic grid across Oromia, those reference sample plots were assessed using Collect Earth Online (CEO). CEO is a tool for collecting reference data from very high, high and medium resolution satellite imageries. It was developed by Food and Agriculture Organization of the United Nations (FAO) under the Open Foris Initiative. CEO is a free and open-source image viewing and interpretation tool, suitable for projects requiring information about land cover and/or land use. CEO enables simultaneous visual interpretations of satellite imagery, providing global coverage from MapBox and Bing Maps, a variety of satellite data sources from Google Earth Engine.

Using CEO a systematic random sample of 92,820 plots in 21 Zones across Oromia Region was analyzed to determine seven LULC classes (Forest, Cropland, Grassland, Settlement, Wetland, shrub land and other land) at point level. Historical trends in land use for the years 2007–2017 have been assessed and labeled for each change and unchanged classes. Online imageries (Mapbox, Planet, spot, Landsat imageries photo) indexed to CEO platform have been used to assess land use types.

The wall-to-wall mapping was needed for visualizing where each land use land cover (LULC) is spatially located and to increase the understanding of readers of the locations of forests. In order to classify the LULC for the year 2017 for Oromia and each zone (21 zones), high spatial resolution Planet NICFI level-1 imagery was acquired for the years 2017 covering the boundary of Oromia regional state. Planet NICFI level 1 imagery is a product of Norway's International Climate and Forests Initiative (NICFI) satellite program. It has a spatial resolution of 4.77 m. Therefore, there was a chance to capture most trees and smaller patches as small as about 25 m^2 in size or with a length/width of 4.77 m. Very high resolution (VHR) imagery from Google Earth was also used as auxiliary data for better visualization.

A total of 1098 Planet NICFI level 1 quads for the year 2017 (Figure 5) were downloaded and mosaicked for regional level using System for Earth Observation Data Access, Processing, & Analysis for Land Monitoring (SEPAL) considering a relatively low cloud cover period of the year, the month of March (Figure 5). For example, Planet NICFI level 1 image mosaics (false colour composite) ready for analysis for Oromia. The same procedure was applied for each Zone in order to assess AFOLU status of each Zones. SEPAL is a web-based cloud computing platform designed by the United Nation's Food and Agriculture Organization (FAO) to support the remote sensing and satellite-based forest monitoring efforts of developing countries (Figure 5).

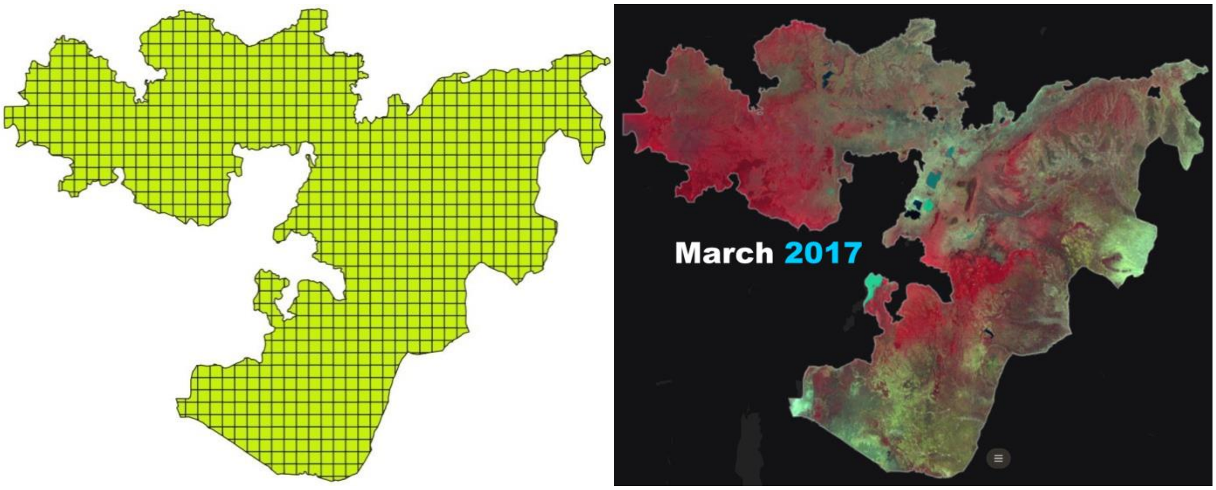


Figure 5 Quads of Planet NICFI covering the regional boundary of Oromia (left) and mosaic of NICFI Planet on SEPAL platform (right)

CEO collected 92,820 sample points collected from sample-based area estimation using visual interpretation of VHR imagery from Google Earth using SEPAL were used as training points for random forest classification algorithm during classification (Figure 6).

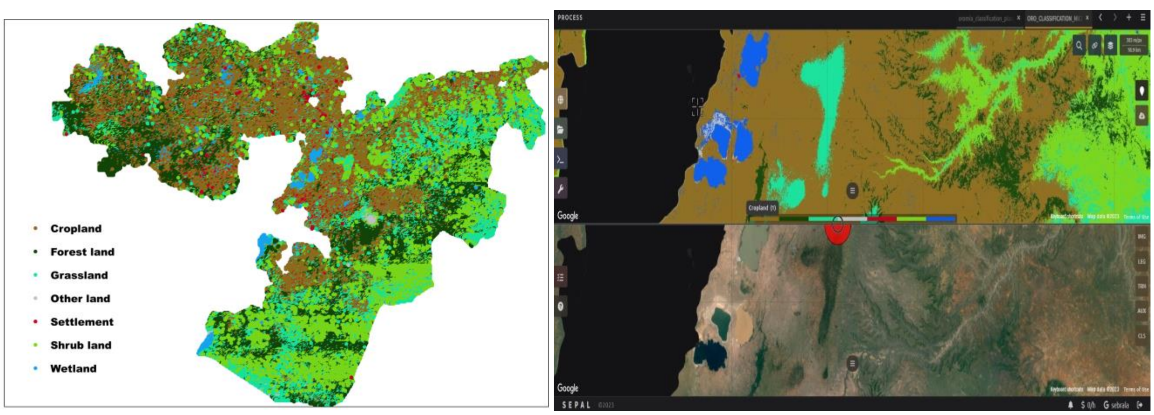


Figure 6 Training points per LULC (Left) and SEPAL interface showing the classification processes of LULCs (right).

The mapping process includes imagery data acquisition, training data collection, pre-processing (image stacking, clipping, enhancement and mosaicking), image classification through SEPAL and post-processing. Random forest machine learning algorithm was applied for classification.

The approach chosen to classify LULC was a supervised classification. In this a supervised classification of imagery the user identifies representative spectral samples for each of the classes in the digital image. The representative spectral samples are used as a dictionary and the classification algorithm uses this dictionary to classify all objects/pixels depending on what their spectral signature resembles most in the dictionary. The process assessed one Planet mosaic for the year 2017 to classify LULC. A target day is fixed in order to get the maximum vegetation cover and least cloud cover as possible. All the data collection, correction and composition are implemented within Google Earth Engine (GEE) API (Application Programming Interface) integrated with SEPAL. Downloading was performed using RStudio integrated with SEPAL. As supervised classification is dependent on the quality of samples, about 92,820 training points were used for the seven classes. Sample training data collection for the LULC classes was demonstrated below in SEPAL (Figure 7).

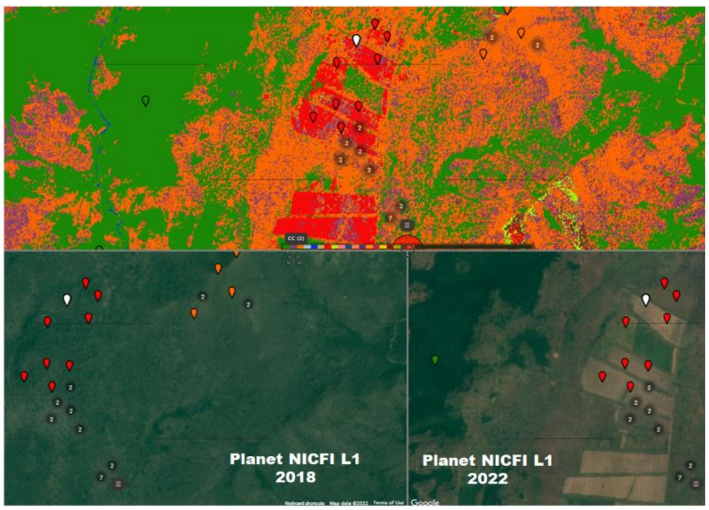


Figure 7 Additional Training data collection for the LULC classes in SEPA

The six IPCC land-use categories including shrub land and their transitions (subcategories) from IPCC 2006 Guidelines have been used for AFOLU sector activity data generation. Each land-use category is further subdivided into land remaining in that category and land converted from one category to another (e.g., forest land converted to cropland). Related to forest, the assessment tried to to harmonize and incorporate the national forest definition, which is an area of at least 0.5 hectares, with tree canopy cover of at least 20% and trees of at least 2m, in situ, including bamboo and tree plantations.

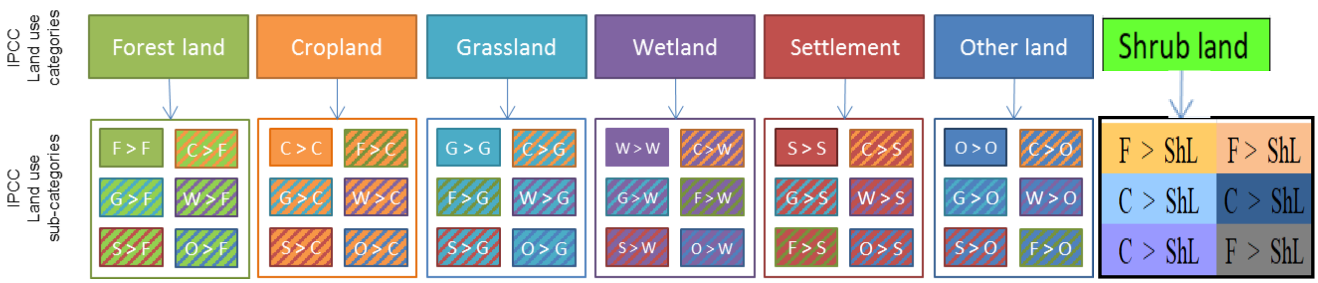


Figure 12: IPCC land use categories and change categories.

A three days training was provided before data collection to have common understanding on each LULC labeling including collecting sample points and sharing information why specific LULC class is assigned to specific class. Training was provided to all data collectors and analysts regarding the data collection process, interpretation and how to differentiate between each land use class categories and subcategories, use of Collect Earth online and online imagery interpretation modalities and procedures use of interpretation key while assigning sample plots to each land cover classes. In order keep consistency of data collection, training also covered how regional level reference level data was collected and produced for the same years at regional level for Emission Reduction Program Document development. It provided a common understanding between all data collectors and analysts on interpretation keys used during data collection and analysis, minimizing risk of inconsistent definition of land use classes and subcategories between analysts. Before data collection, about 250 other sample points were provided to all and their labeling result was compared and cross checked for common understanding. In addition, one key person was assigned to randomly control the label of LULC classes by other data collectors online and offline. Before data analysis, about 2900 sample points related to forest were extracted and re-data collection was done assigning randomly to different data collectors to check the accuracy and consistency.

For this specific regional and zonal land use land cover change assessment way of interpreting and labeling to specific land use was provided to data collectors adopting interpretation key described by FAO 2021. Specifically, each LULC class was characterized based on their interpretation key among which some are; i) tone or color variation during use of True Color Composite (TCC) and false color Composite (FCC) (E.g. light green or light red colors indicate objects healthy condition), ii) texture variation based on each LULC classes smoothness and roughness (E.g. Smoothness for plantation and roughness for natural forest), iii) shape - which includes form, structure or outline of individual land cover classes (E.g. rectangular shape can be Plantation forest and irregular shape for natural forest, small or large rectangular shape for farm lands), iv) location – which indicate arrangement of land cover class respected to one another, v) Shadow - visible shadow of trees/objects like building, vi) Pattern – spatial arrangement of objects (E.g. Rectangular pattern – most probably plantation if forest class), vii) size – size of objects like small and large sized rectangular farm parcels, viii) Association – relationship between other recognizable objects (E.g. what can be mostly exist around water body or riverine) are main interpretation keys used during data collection for class labeling including visual assessment of each objects and expert judgments discussed.

For this specific task, a Collect Earth Online (CEO) institution called 'REDD+ OROMIA' was created (Figure 7). The 92,820 reference samples were collected from visual interpretation using Very High Resolution (VHR) imagery from Google Earth. Two CEO projects were created under the CEO institution called 'REDD+ OROMIA', one for 44,820 samples and the other for 48,000 samples. This is because CEO cannot allow sample size more than 50,000 per one CEO project. Survey design was created for each CEO project.

Figure 13 Collect Earth Online institution (left) and CEO data collection interface (Right)

Each sample plot was assessed using visual interpretation of available high-resolution images, as well as aided by interpreting vegetation indices derived from available low, medium and high-resolution images. Collect Earth online automatically generates time series of the NDVI, from each Landsat and Moderate Resolution Imaging Spector Radiometer (MODIS) images available from 2007 onwards. First, the data collector should visually review all high-resolution historical imagery available. If there is historical high-resolution imagery available, use this imagery to determine the land use category and land uses sub-division and year of change. If only one date of high-resolution imagery is available or if it is difficult to determine the sub-category or year of change, view the Landsat and Sentinel data imagery and Vegetation indices time series trend available in Google Earth Engine, and then determine the category, subcategory and year of change (if available).

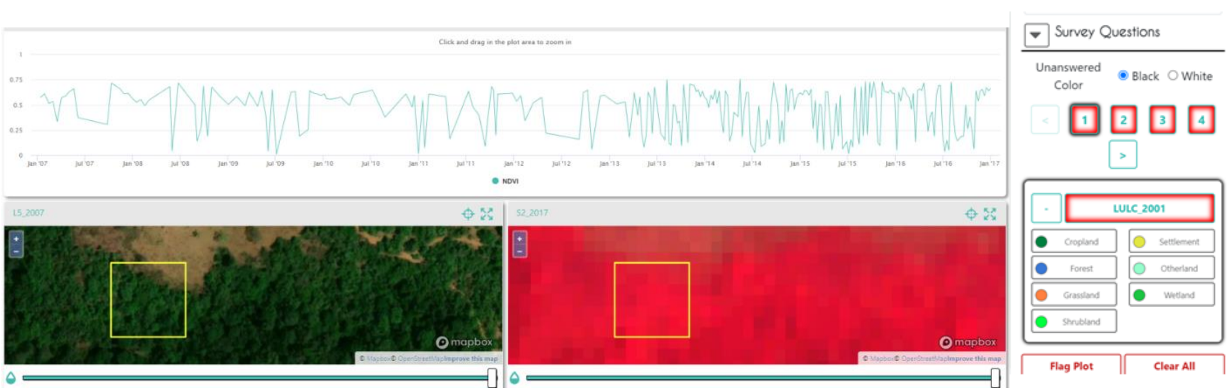


Figure 14 Collect Earth interface for data collection and Google Earth Engine platform for enabling time series imagery for sample plots using Landsat, MODIS and other available imageries.

The Collect Earth online interface used for collecting information about the AFOLU classes is shown in figure 8. There are 5 parameters to fill in this interface: land use category, land use category accuracy, land use sub-category, land use sub-category accuracy and year of change. The land use accuracy refers to the confidence of the classification. Is the interpreter sure of the land covering class they assigned? Yes, if they are confident about their classification and no if there is doubt about the classification. The same principle applies for the land use sub-category accuracy. The reference period for the analysis was already defined to ease the time trend of the sample plots, i.e., 2007-2017. As shown on figure, two vegetation indices namely Normalized Vegetation Index (NDVI) and Normalized Difference Fraction Index (NDFI) were used to assess vegetation status of each sample plot in addition to assessing high resolution imageries visually since 2007. NDFI was used a new spectral index for enhanced detection of forest canopy damage caused by selective logging and/or forest fire (forest degradation) and deforestation. On the first NDVI plot from 2007 to 2017 the density of greenness was low before 2013 and get very green after and its respective NDFI showed canopy damage due to forest degradation within the same period.

Out of the 29,589 samples (32%) extracted for the forest class and randomly re-interpreted and labeled by data collectors for QA/QC, 3882 sample (13%) were found to be misinterpreted as forest land but they were non-forest (Figure 11). These samples were corrected and replaced the old version for final analysis.

Figure 11 Misinterpreted sample points and corrected after quality assessment.

All collected data was processed and analysed using Microsoft Excel (Functions like ‘IF’, ‘Pivot’, ‘VLOOKUP’, ‘LEFT’, etc). Moreover, visualization was performed using R-Statistical software version 3.5.3 (R Development Core Team, 2020) with RStudio version 1.1.456 (RStudio team, 2022). The geospatial analysis was carried out using QGIS and Arc GIS software.

The sample-based area estimation analysis protocol involves transplantation of sample based information collected using CEO from diverse types of data, including very high-resolution imagery in to proportional area estimates. Most of the calculations are based on the transition of one land use land cover class in to other land cover classes. The analysis of the samples to calculate stratified area estimates was used on Excel sheet, where proportion matrix and estimating area of each land use land cover has been analysed. Sample based area estimation give an indication of the occurrence of land use/land use change classes and the number of samples needed to adequately capture those classes. This approach requires that the total area of the survey region is known, and that the sample survey provides only the proportions of different land-use classes. The proportions of different land uses have been estimated for the entire study area of the region. The proportions were then converted to areas and the standard errors of the estimates have been calculated. In a similar fashion, changes were estimated by comparing the interpretations between the years at the point level. The results should be reported in hectares with confidence intervals for each class.

To quantification the area changes methodology suggested by Puyravaud (2003) and also applied by Souza et al. (2013) was used to calculate the annual percentage rate of forest cover lost. Then the percentage rate of forest loss normalized (r) between the two monitoring periods was used to calculated annual deforestation rate (in ha/year) for a given reference period following equation: Dt = At-1 * (1-e rt-1, t), where At-1 and At-2 are the forest areas mapped in times t1 and t2, expressed in years, beginning with an initial year. The result, r (t,t-1), represents the percentage rate of forest loss normalized for the period between t1 – t2 (2007-2017) and expressed in years.

3.2.2 Emission and removal factors

The values of the emission factors have been updated using the final report with the results of the National Forest Inventory (NFI) that was conducted between 2014 and 2016 (MEFCC, 2018)[20]. In the validated ERPD, four carbon pools were considered: aboveground and belowground biomass, deadwood and soil organic carbon. It was shown in the ERPD that litter could be excluded from the accounting since the contribution of the litter carbon pool is insignificant. The NFI report covers three of the four carbon pools: aboveground biomass, belowground biomass and deadwood. For soil organic carbon, the same values were used as those used in the ERPD.

The NFI was conducted using a stratified systematic cluster sampling approach. Using available geospatial layers of Ethiopia and large-scale ecological studies the whole country was classified into five strata. Based on these strata, a total of 627 sampling units were created, of which 221 were located in Oromia. Every sampling unit had an area of 1 km^2 and was composed of 4 plots (with cumulative plot area of 2 ha). The details of the sample unit and plot design can be found in section 2.1 of the NFI report (MEFCC, 2018). Out of the 627 planned sampling units, 539 were found to be accessible. The remaining 88 SUs were inaccessible due to different factors

[20] Ministry of Environment, Forest and Climate Change (MEFCC). 2018. Ethiopia's National Forest Inventory, Final Report. Ministry of Environment, Forest and Climate Change, Addis Ababa, Ethiopia

including excessive remoteness, topography and temporary security problems. Within the accessible sample units, a total of 2,077 accessible sample plots were visited in which about 49,829 trees and 2,029 stumps were recorded and analyzed.

For all the trees and stumps measured, the following variables were collected:

- Position in the plot;
- Tree/stump;
- Species name (scientific names and vernacular names);
- Diameter at 0.3 m level;
- DBH and top height (for trees and stumps greater or equal DBH 10 cm in outside forest and greater or equal to DBH 20 cm in forest) ;
- Bole height;
- Stem quality;
- Tree Health;
- Causative agents;
- Decomposition status.

In 2015 the stratification scheme was changed because Ethiopia decided to adopt a classification that better describes the vegetation characteristics of the country. With this change, the following biomes were adopted as basis for the NFI:

- Acacia-Commiphora
- Combretum-Terminalia
- Dry Afromontane
- Moist Afromontane

This change resulted in the adoption of more specific analysis methods. All the NFI results are thus presented by biome, and not by original NFI strata. Since the biome stratification was introduced when the NFI was already in progress, a post-stratification methodology was applied in order to correctly estimate the results by the biomes. The number of SUs by biomes and strata is presented in table 2-5 of the NFI report (MEFCC, 2018) and reproduced below.

Figure 15: Distribution of the sampling units per biome and strata (Table 2-5 from the NFI report)

	Acacia-Commiphora	*Combretum-Terminalia*	Dry Afromontane	Moist Afromontane	Others	Total
Stratum I	5	13	18	59	-	**95**
Stratum II	107	-	-	-	-	**107**
Stratum III	1	93		6	1	**101**
Stratum IV	36	38	114	29	1	**218**
Stratum V	15	2	-	-	1	**18**
Total	**164**	**146**	**132**	**94**	**3**	**539**

As part of the NFI, extensive training events were organized in order to secure that the field crews correctly collected the field data. Quality Assessment/Quality Control (QA/QC) procedures were implemented in order to ensure an adequate standard in the data collection and data entry procedures. Based on a random sub-sampling, 10% of the SUs were re-measured by a semi-independent team composed of experts not involved in the field campaign and specifically trained for QA/QC. At least one randomly selected plot per SU was re-measured entirely and the results were compared with the original values. The QA/QC team used the original data forms to check any irregularities in the records. An error tolerance (10% difference in results between the measured and re-measured sampling units) was introduced and applied in order to reject or accept the collected data. The data was entered into a database and then subject to cleansing procedures in order to filter all the records considered potentially erroneous.

A robust statistical procedure was applied to analyze the data based on the biomes. The method used was based on the one described by Sarndal et al. (1992)[21]. The details and equations are described in section 2.7 of the NFI report (MEFCC, 2018).

The data analysis of the field data results has been done using R language scripts and R scripts in OpenForis Calc[22]. In the data analysis, the following assumptions and equations have been used:

- Because field conditions do not always allow field crews to successfully determine tree height, a tree height model has been applied for trees who's heights are not measured in

[21] Sarndal, C-E., Swensson, B. and Wretman, J. (1992). "Model assisted survey sampling".
[22] Calc is a legacy tool that is part of the OpenForis tool kit. More information and access to the source code can be found at https://openforis.org/solutions/legacy/

the field. Three different models were tested for the Ethiopia NFI dataset. Curtis' model (1967) was ultimately selected as the better fit which uses the follow equation:

h = estimated top height [m];

$$h = 1.3 + a * \left(\frac{dbh}{1 + dbh}\right)^{b}$$

dbh = diameter at the breast height (DBH)[cm];
a, b = parameters.

- In the absence of applicable biomass models for every Ethiopian ecosystem/biome consistent with international requirements, the pantropical model of Chave et al. (2014) was used:

$$AGB = 0.673\ (WD \cdot dbh2 \cdot h)^{0.976}$$

Where:

AGB = Above ground biomass [kg];

WD = Dry wood density [t m−3];

The default value41 for the WD is $0.615\ t \cdot m^{-3}$.

- To compute the below-ground biomass (BGB) estimates, root-shoot ratios from the Intergovernmental Panel on Climate Change (IPCC) (2006) by the ecological zones have been adopted. Table 2.6 of the NFI report (MEFCC, 2018) shows the distribution of SU by biomes and Table 2.7 of that same report shows the applied conversion factors correspondent to each ecological zone.

- Wood density data of over 400 tree species found in Ethiopia has been analyzed. For the NFI analysis, the ones with the highest quality have been selected and applied (see section labelled as '2.2 wood densities' on page 35 of the NFI report for details). Low quality values and tree species inventoried in Ethiopia and missing in the country databases, have been taken from the Global Wood Density Database (GWDDB)23. The

[23] Zanne, A.E. et al. (2009). "Global wood density database". DRYAD. URL: http://hdl.handle.net/10255/dryad 235.

result was that out of 360 species identified during the NFI cycle, wood densities of 341 species have been selected using a validated value.

- For the fallen deadwood volume, De Vries formula was used. Details on the application of this formula can be found in the section labelled ‘2.1 Deadwood’ on page 35 of the NFI report.

3.3 Calculations of emissions and removals

Above and below ground biomass

For the three subcategories involving changes from forest to other land uses, the emissions from changes in the above ground and below ground biomass have been calculated as

$$\Delta C_{conversion,i} = EF_{i\_ABBG} \cdot \Delta A_i$$

Where:

$\Delta C_{conversion,\, i}$ = change in carbon stocks on land converted from forest to land category *i*, tonnes CO_2

EF_{i_ABBG} = Emission factor for changes in above ground and below ground biomass in the conversion of forest to land use *i* , tonnes CO_2 ha^{-1}

ΔA_i = = area converted from forest to land category *i*

The values of EF_{i_ABBG} are calculated as the difference between the carbon values of the above ground and below ground biomass before and after the change.

$$EF_{i\_AGBG} = (C_n - C_o) \cdot \frac{44}{12}$$

Where:

EF_{i_ABBG} = Emission factor for changes in above ground and below ground biomass in the conversion of forest to land use *i*

C_n = above ground and below ground carbon stock under the new land-use category, tonnes C ha^{-1}

C_o = above ground and below ground carbon stock under the old land-use category, tonnes C ha^{-1}

44/12 = factor to convert carbon units to CO_2

As described above, the NFI provided the basis for the emission and removal factors used for above and below ground biomass. The NFI report (MEFCC, 2018) provides a summary of the information from the NFI per biome, major land use/land cover type and regions. For the purpose of determining the emission and removal factors, the level 1 classification from the NFI has been used since this most closely matches the IPCC categories used in the ISFL (see table A.1.1 of the NFI report for the level 1 categories and description).

Table A2.3 of the NFI report provides area estimates by regions, biomes and FRA classes. Table A9.7 provides values for above ground biomass per Region, Biome and FRA class. Using the IPCC root-shoot ratios, the below-ground biomass of the different FRA classes can be estimated as follows:

$$C_{cl\_BG} = C_{i,AG} \cdot R$$

Where:

$C_{cl,\,BG}$ = below ground carbon stock of FRA class *cl*, tonnes C ha^{-1}

$C_{cl,\,AG}$ = above ground carbon stock of FRA class *cl*, tonnes C ha^{-1}

R = Root to shoot ratio, dimensionless

The table below provides an overview of the different Oromia specific values and provides reference to the source tables in the NFI report.

Table 41: Area and above ground/ below ground biomass values per biome and FRA Class for Oromia (including the relevant source tables from the NFI report (MEFCC, 2018))

Biome	FRA class	Area (ha)	ag_biomass (t /ha)	bg_biomass (t /ha)	root-shoot
Acacia-Commiphora	Forest	431,237			

			80.3	28.3	0.4
	Other wooded land	11,149,959	9.3	3.3	0.4
	Other land	3,728,188	15.4	5.5	0.4
Combretum-Terminalia	Forest	205,087	46.8	19.2	0.4
	Other wooded land	645,693	25.0	9.4	0.4
	Other land	3,116,631	15.2	5.1	0.3
Dry Afromontane	Forest	488,946	69.4	18.7	0.3
	Other wooded land	7,029,220	9.0	2.5	0.3
	Other land	7,029,220	8.9	2.4	0.3
Moist Afromontane	Forest	1,643,917	217.4	57.8	0.3
	Other wooded land	2,747,305	17.8	4.8	0.3
	Other land	2,747,305	27.8	7.5	0.3
Sources		***NFI report table A.2.3***	***NFI report table A9.7***		***Derived from NFI report table A8.2***

From the values above and using a carbon fraction of 0.5 tonne C (tonne d.m$^{.)-1}$, a weighted region specific value region for tree biomass and carbon by region and level 1 category was calculated in table A8.4 of the National Forest Inventory Report (MEFCC, 2018) and as shown below.

Figure 16: Tree biomass and carbon by region and level FRA class (table A.8.4 of the NFI report (MEFCC, 2018))

Region	FRA Class	AG biomass (t ha^{-1})	BG biomass (t ha^{-1})	Biomass (t ha^{-1})	AG carbon (t ha^{-1})	BG carbon (t ha^{-1})	Carbon (t ha^{-1})
Afar	Other Wooded Land	1.6	0.6	2.2	0.8	0.3	1.1
	Other Land	0.3	0.1	0.4	0.1	0.1	0.2
	Water	2.6	1.0	3.6	1.3	0.5	1.8
Amhara	Forest	170.2	47.8	218.1	85.1	23.9	109.0
	Other Wooded Land	10.9	4.2	15.2	5.5	2.1	7.6
	Other Land	10.5	3.4	13.9	5.3	1.7	7.0
	Water	4.1	1.1	5.2	2.1	0.6	2.6
Benishanglul-Gumuz	Forest	65.8	33.1	98.9	32.9	16.5	49.4
	Other Wooded Land	35.5	16.6	52.0	17.7	8.3	26.0
	Other Land	8.6	3.2	11.9	4.3	1.6	5.9
	Water	8.6	2.3	10.9	4.3	1.2	5.5
Gambela	Forest	240.5	49.2	289.7	120.3	24.6	144.9
	Other Wooded Land	7.4	2.1	9.4	3.7	1.0	4.7
	Other Land	11.6	3.1	14.7	5.8	1.6	7.4
Oromia	Forest	157.3	43.8	201.1	78.6	21.9	100.5
	Other Wooded Land	10.6	3.3	13.9	5.3	1.7	7.0
	Other Land	14.7	4.3	19.0	7.3	2.2	9.5
	Water	244.2	65.9	310.2	122.1	33.0	155.1
SNNPR	Forest	122.1	33.0	155.0	61.0	16.5	77.5
	Other Wooded Land	13.0	3.3	16.3	6.5	1.6	8.1
	Other Land	44.7	12.1	56.9	22.4	6.1	28.4
Somali	Forest	13.5	5.4	19.0	6.8	2.7	9.5
	Other Wooded Land	3.5	1.4	4.9	1.8	0.7	2.5
	Other Land	0.4	0.2	0.6	0.2	0.1	0.3
Tigray	Forest	24.9	9.5	34.4	12.5	4.8	17.2
	Other Wooded Land	14.9	5.5	20.4	7.5	2.8	10.2
	Other Land	4.8	1.7	6.5	2.4	0.9	3.3

According to this table the value of carbon stock of above ground and below ground biomass of forest in Oromia National Regional state is estimated as 100.5 tons C per hectare using the weighing of the biomes as described above. For the calculation of the emission factors used for conversions of forest to cropland and grassland, the difference between the carbon stock of forest and that of ‘other land’ was used. For the conversion of forest to shrubland, the difference between the carbon stock of forest and that of ‘other wooded land’ was used.

For the subcategories involving removals, the removals are calculated using the approach outlined in the ISFL ‘Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period. The guidance note suggests that for change in biomass carbon stocks (above-ground biomass and below-ground biomass) it can be assumed that during the conversion from non-forest to forest, carbon stocks will go from average carbon stocks in non-forest to average carbon stocks in forests during a default period of 20 years. Therefore, the removal factors used were calculated as the emission factors (as described above) divided by 20.

The final report of the NFI provides more details of the approach used in the NFI. Although Ethiopia has planned to revise the carbon stock by conducting national forest inventory every five year, currently the previous assessment report announced in 2018 was not changed. This is because the country did not undertake the national forest inventory as planned due to some challenging factors. A new NFI is currently being conducted and the results of this new NFI will be incorporated in phase 2 of the ERPA when the baseline is expanded with additional subcategories.

Dead wood

The emission and removals from deadwood have been calculated according to the ISFL Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period (Version 1.0). In line with this guidance note, equation 2.23 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories has been used as the basis to estimate annual change in carbon stocks in dead wood due to land conversion.

EQUATION 2.23

ANNUAL CHANGE IN CARBON STOCKS IN DEAD WOOD AND LITTER DUE TO LAND CONVERSION

$$\Delta C_{DOM} = \frac{(C_n - C_o) \bullet A_{on}}{T_{on}}$$

Where:

ΔC_{DOM} = annual change in carbon stocks in dead wood or litter, tonnes C yr^{-1}

C_o = dead wood/litter stock, under the old land-use category, tonnes C ha^{-1}

C_n = dead wood/litter stock, under the new land-use category, tonnes C ha^{-1}

A_{on} = area undergoing conversion from old to new land-use category, ha

T_{on} = time period of the transition from old to new land-use category, yr. The Tier 1 default is 20 years for carbon stock increases and 1 year for carbon losses.

In line with the ISFL guidance note, it has been assumed that the average annual rate of conversion during the Baseline Period would have applied during the ISFL ERPA Phase. Instead of applying IPCC equation 2.23 directly, a change factor has been calculated (ΔCF_{DOM}) which is used in combination with the projected baseline area change.

$$\Delta CF_{DOM} = \frac{(C_n - C_o)}{T_{on}}$$

Where:

ΔCF_{DOM} = annual change in carbon stocks in dead wood, tonnes C ha^{-1} yr^{-1}

With the other factor as defined for IPCC equation 2.23 above

Since there are no data to distinguish between the dead wood stocks immediately after the land-use conversion and the later transition period, it is assumed that the changes in the dead wood from one value to another happen in a linear fashion over the IPCC default period of 20 years.

Table 3-24 of the NFI report provides values for carbon in deadwood for different land use/land cover types on the national level as shown below.

Figure 17: Carbon in deadwood by Major LUCC types (Table 3-24 of the NFI report (MEFCC, 2018))

FRA class	Major LUCC	Carbon (t ha^{-1})
Forest	Natural regenerated forest	15.8
Forest	Plantation	0.5
Other Wooded Land	Other wooded land	1.9
Other Land	Cultivated	2.6
Other Land	Natural	0.9

Since no region-specific values for dead wood are provided in the NFI, the national values have been used for the emission and removal factors.

According to the ISFL guidance note, the values for litter and dead wood pools can be assumed zero in all non-forest categories and dead organic matter in Forest Land shall be assumed to have the value of mature forests at the beginning of the Baseline Period. Since values are available from the NFI, the following emission and removal factors have been as outlines in the table below.

Table 42: Dead wood change factors applied

Baseline subcategory	Corresponding change from LUCC clases in figure 7 above	Change factor (t C ha^{-1} yr^{-1})
Forest to cropland	Natural regenerated forest to Other land-cultivated	-0.66
Forest to grassland	Natural regenerated forest to Other land-natural	-0.745
Forest to shrubland	Natural regenerated forest to other wooded land	-0.695
Cropland to forest	Other land-cultivated to plantation	-0.105
Grassland to forest	Other land-natural to plantation	-0.02
Shrubland to forest	Other wooded land to plantation	-0.07

Soil organic carbon

Changes in the Soil Organic Carbon pool in mineral soils associated with conversion from and to forest were calculated according to the ISFL Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period (Version 1.0). In line with this guidance note, formulation B from box 2.1 in the 2006 IPCC Guidelines, Volume 4, Chapter 2 was used as below.

Formulation B (Approaches 2 and 3 for Activity Data Collection)

$$\Delta C_{Mineral} = \frac{\sum_{c,s,p} \left[\left\{ \begin{array}{l} \left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,s,p}} \bullet F_{MG_{c,s,p}} \bullet F_{I_{c,s,p}} \right)_0 - \\ \left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,s,p}} \bullet F_{MG_{c,s,p}} \bullet F_{I_{c,s,p}} \right)_{(0-T)} \end{array} \right\} \bullet A_{c,s,p} \right]}{D}$$

Where:

$\Delta C_{Mineral}$ = annual change in carbon stocks in mineral soils, tonnes C yr^{-1}

SOC_0 = soil organic carbon stock in the last year of an inventory time period, tonnes C

$SOC_{(0-T)}$ = soil organic carbon stock at the beginning of the inventory time period, tonnes C

T = number of years over a single inventory time period, yr

D = Time dependence of stock change factors which is the default time period for transition between equilibrium SOC values, yr.

c = represents the climate zones, s the soil types, and i the set of management systems that are present in a country.

SOC_{REF} = the reference carbon stock, tonnes C ha^{-1}

F_{LU} = stock change factor for land-use systems or sub-system for a particular land-use, dimensionless

F_{MG} = stock change factor for management regime, dimensionless

F_I = stock change factor for input of organic matter, dimensionless

A = land area of the stratum being estimated, ha.

p = parcel of land

As discussed above, the NFI report does not provide updates values on soil organic carbon. Therefore, the value for national soil organic carbon stocks for forest that was used in the ER Program inventory in the validated ERPD is also used for this monitoring report. This national value was obtained from the "Evaluation of the forest carbon content in soil and litter in Ethiopia"[24] which was implemented by Natural Resources Finland (LUKE) and Ethiopia Environment and Forestry Research Institute (EEFRI). The national value was based on biome specific values as shown in the table below.

Table 43: Soil organic carbon in forest in Ethiopia

Soil type - Biome	SOC ref (tC/ha)	N	Standard deviation (tC/ha)	Source
Acacia Commiphora	**34.245**	11	17.01197	Evaluation of the forest carbon content in soil and litter in Ethiopia, Implementing agency: Natural Resources Institute Finland (LUKE) and Ethiopia Environment and Forestry Research Institute (EEFRI) Duration of the Report: August 2017 - February 2018. Beneficiaries: FAO, MEFCC, EEFRI
Combretum Terminalia	**41.561**	37	28.25306	Idem above

[24] Some of the results of this study are discussed in Lehtonen A, Ťupek B, Nieminen TM, et al. Soil carbon stocks in Ethiopian forests and estimations of their future development under different forest use scenarios. Land Degrad Dev. 2020; 31: 2763–2774. https://doi.org/10.1002/ldr.3647

Dry Afromontaine	**53.080**	33	34.46676	Idem above
Moist Afromontaine	**83.886**	17	34.65632	Idem above
Average	**51.961**	98	33.58339	Idem above

In line with the guidance note, the Soil Organic Carbon pool in Forest Land was assumed to be in equilibrium at the beginning of the Baseline Period and the average value of 51.96 t C/ha has been used as SOC_{ref} and the equilibrium value for forest.

Following the equation above and equation 2.25 of the 2006 IPCC guidelines, the equilibrium values for each non-forest subcategory was conservatively determined by using the same stock change factors applied in the validated ERPD and the formula below:

$$SOC_i = SOC_{ref} \cdot F_{LU} \cdot F_I \cdot F_{MG}$$

Where:

SOC_i = Equilibrium soil organic C stocks for mineral soils under land use type *i*, tonnes C ha^{-1}

Other factors as defined above

The applied stock change factors and the resulting equilibrium SOC values are shown in the table below.

Table 44: Stock change values applied for estimating equilibrium soil organic carbon content of non-forest land categories

	FLU	FI	FMG	Equilibrium SOC (tC/ha)
Annual cropland	0.48	0.92	1	22.94
Grassland	1	1	0.97	50.40

3.4 Results of the land use change analysis

Table 1 Oromia National Regional State transition matrix of Land Use Land Cover Changes between base year 2007 and year 2017 in hectares

Row Labels	2007 LULC	

	Cropland	Forest land	Grassland	O/ land	Settlement	Shrub land	Wetland	**Total**
Cropland	10,604,906	234,677	103,322	400	6,808	131,355	4,005	**11,085,473**
Forest land	48,457	8,605,749	14,017	400	801	34,841	400	**8,704,665**
Grassland	20,024	48,858	5,491,276	-	400	34,040	400	**5,594,998**
Other land	801	400	1,201	91,708	400	1,201	400	**96,113**
Settlement	79,294	10,412	15,218	400	730,862	6,808	2,002	**844,996**
Shrub land	15,218	29,234	25,230	1,201	400	4,957,446	400	**5,029,131**
Wetland	3,204	1,201	801	400	8,009	400	868,624	**882,641**
Grand Total	**10,771,903**	**8,930,532**	**5,651,064**	**94,511**	**747,682**	**5,166,092**	**876,233**	**32,238,018**

The transition matrix indicated above showed that from 8,930,532 ha estimated as forest cover class in 2007, about 8,889 ha was converted to other land cover classes between the two-monitoring period, where 234, 677 ha, 48,858 ha, 400 ha, 10,000 ha, 29,234 ha and 1,201 ha has been converted in to cropland, Grassland, other land, settlement, shrub land and wetland respectively. Detailed information about each class and change class activity data is presented in (Table 1).

3.4.1 Uncertainty Estimates

The table below showed the uncertainty of land use land cover area estimation with 95% confidence interval. Statistical error value was calculated both for land remaining land classes and land use change categories.

Table 2 Area estimates for the change and stable LULC classes with 95% confidence Interval uncertainty estimates.

No	**LULC subcategory**	**Area (ha)**	**CI (ha)**		**No**	**LULC subcategory**	**Area (ha)**	**CI (ha)**
1	Cropland-Cropland	10,604,906	104,634		25	Other land-Settlement	400	785
2	Cropland-Forest land	48,457	8,628		26	Other land-Shrub land	1,201	1,360
3	Cropland-Grassland	20,024	5,549		27	Other land-Wetland	400	785
4	Cropland-Other	801	1,110		28	Settlement-	6,808	3,236

	land				Cropland		
5	Cropland-Settlement	79,294	11,031	29	Settlement-Forest land	801	1,110
6	Cropland-Shrub land	15,218	4,837	30	Settlement-Grassland	400	785
7	Cropland-Wetland	3,204	2,220	31	Settlement-Other land	400	785
8	Forest land-Cropland	234,677	18,932	32	Settlement-Settlement	730,862	33,150
9	Forest land-Forest land	8,605,749	98,516	33	Settlement-Shrub land	400	785
10	Forest land-Grassland	48,858	8,663	34	Settlement-Wetland	8,009	3,510
11	Forest land-Other land	400	785	35	Shrub land-Cropland	131,355	14,187
12	Forest land-Settlement	10,412	4,002	36	Shrub land-Forest land	34,841	7,317
13	Forest land-Shrub land	29,234	6,703	37	Shrub land-Grassland	34,040	7,233
14	Forest land-Wetland	1,201	1,360	38	Shrub land-Other land	1,201	1,360
15	Grassland-Cropland	103,322	12,588	39	Shrub land-Settlement	6,808	3,236
16	Grassland-Forest land	14,017	4,643	40	Shrub land-Shrub land	4,957,446	80,337
17	Grassland-Grassland	5,491,276	83,721	41	Shrub land-Wetland	400	785
18	Grassland-Other land	1,201	1,360	42	Wetland-Cropland	4,005	2,482
19	Grassland-Settlement	15,218	4,837	43	Wetland-Forest land	400	785
20	Grassland-Shrub	25,230	6,228	44	Wetland-	400	785

	land					Grassland		
21	Grassland-Wetland	801	1,110		45	Wetland-Other land	400	785
22	Other land-Cropland	400	785		46	Wetland-Settlement	2,002	1,755
23	Other land-Forest land	400	785		47	Wetland-Shrub land	400	785
24	Other land-Other land	91,708	11,861		48	Wetland-Wetland	868,624	36,060
Total							**32,238,018**	

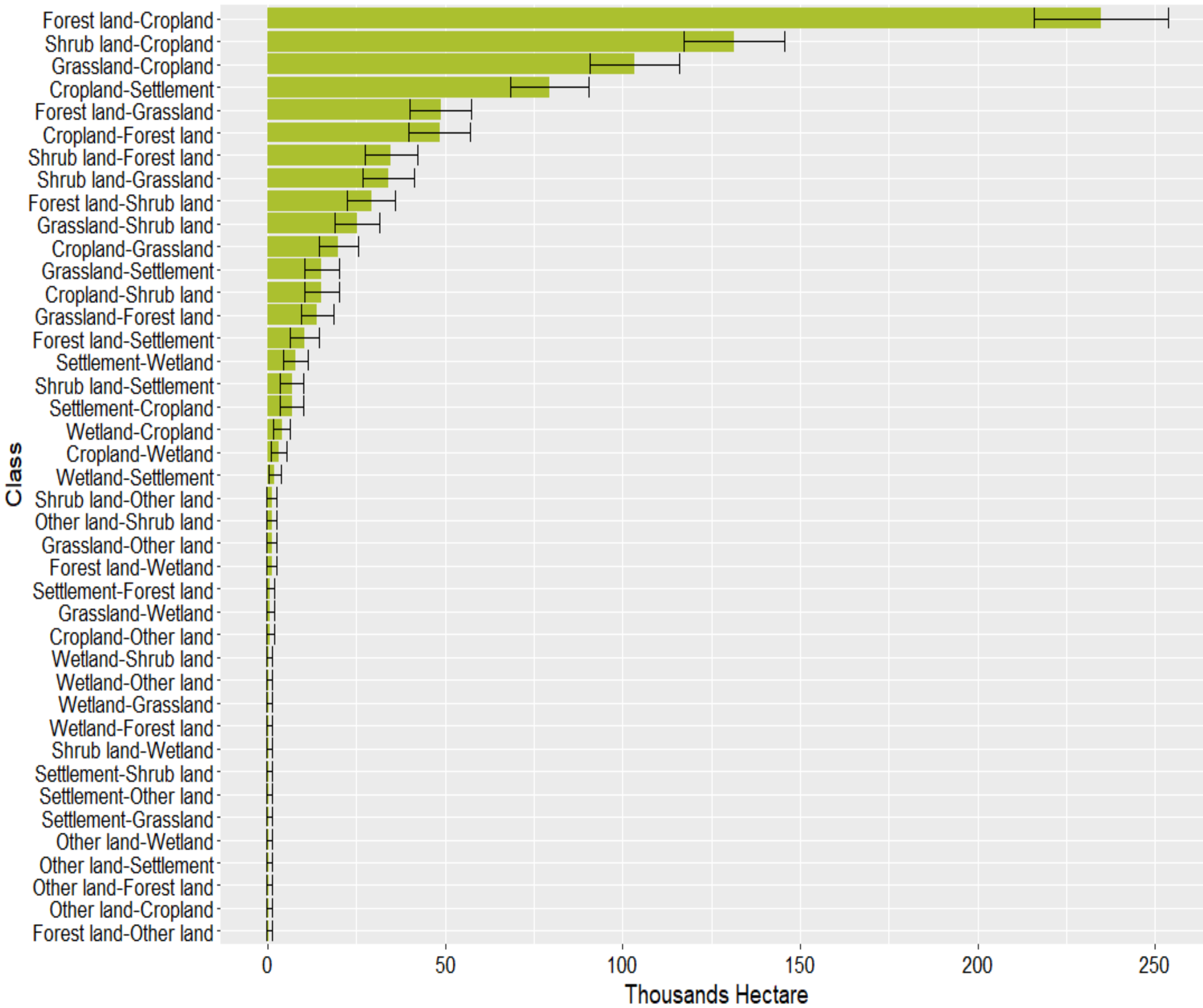


Figure 18: Area estimates for the 41 LULC change and stable classes with uncertainty.

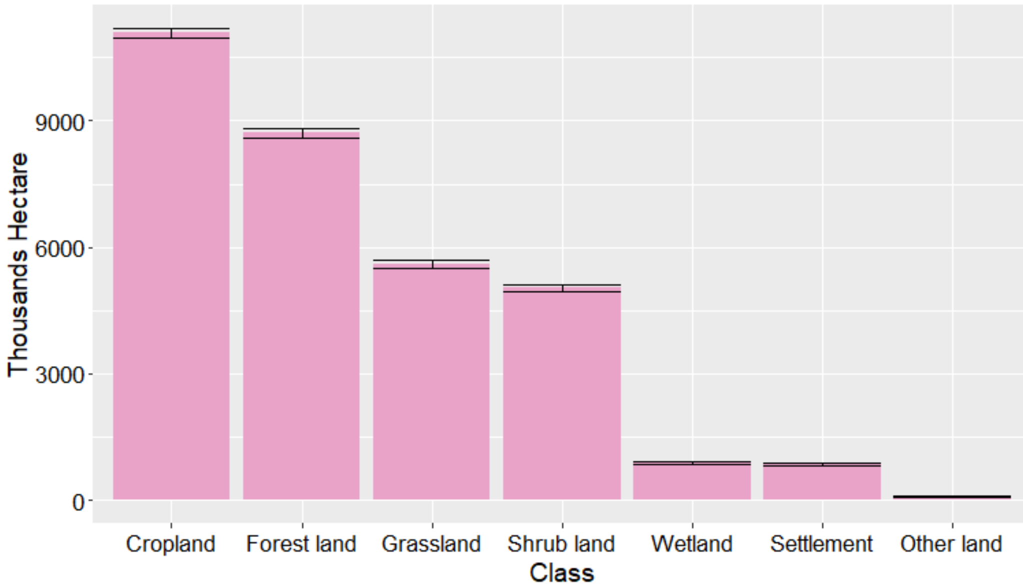


Figure 19: Area estimates for the LULC classes for the year 2017 with uncertainty estimates

3.5 Baseline emissions and removals

Emission reductions and removals

Emission and removals are determined for all the six subcategories and 4 pools. The 'ISFL Guidance note on application of IPCC guidelines for subcategories and carbon pools where changes take place over a longer time period' has been applied for relevant pools and subcategories. This includes changes in dead wood and soil organic carbon for all subcategories and changes in above- and below ground biomass in the subcategories involving conversions from other land uses to forest.

Following this note, for the Emissions Baseline it has been assumed that the average annual rate of conversion from one category to another (in ha/year) during the Baseline Period would have applied during the ISFL ERPA Phase and emissions and removals have been calculated accordingly.

ii. Emissions Baseline estimate

Provide the estimate of the Emissions Baseline in the table below.

Emissions Baseline estimate.

ERPA Phase	Emissions Baseline (tCO_2e)
Phase 1, Reporting period 1 (2022-2023)	**11,734,141.71 tCO2e / year**
Phase 1, Reporting period 2 (2024)	**11,676,996.99 tCO2e / year**

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