Amendment to the ISFL Emission Reductions (ER) Program Document (PD)

ER Program Name & Country: **Oromia Forested Landscape Program (OFLP), Oromia National Regional State, Federal Democratic Republic of Ethiopia**

Date of Submission: November 2025

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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
AR	Afforestation Reforestation
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	Bio carbon 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
cBSP	Comprehensive 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
CO_2	Carbon Dioxide
CPA	Cooperative Promotion Agency
CPP	Consultation & Participation Plan
CRGE	Climate Resilience Green Economy
CSA	Climate Smart Agriculture
CSO	Civil Society Organizations
DA	Development Agent
ECFF	Ethiopian Coffee Forest Forum
EDA	Environmental Development Association
EEPA	Ethiopian Environmental Protection Authority
EEFRI	Ethiopian Environment and Forest Research Institute
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
ESS	Environmental Social Standard
ESS	Ethiopian Statistical Services
EU	European Union
EWNRA	Ethiopian wetland and Natural Resource Association
FAO's	Food and Agricultural Organization
FCPF	Forest carbon Partner Facility
FGRM	Feedback Grievance Redress Mechanisms
FMC	Forest Management Cooperative
FMP	Forest Management Plan
FREL	Forest Reference Emission Level
FRL	Forest Reference Level
FSD	Forest for Sustainable Development
FSDP	Forest for Sustainable Development Program
FSRP	Food System Resilience Program
GAP	Gender Action Plan
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
LFRDA	Livestock and Fisheries Resource Development Agency
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
MoA	Ministry of Agriculture
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
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
PDF	Probability Density Function
PDO	Program Development Objectives
PF	Process Framework
PFM	Participatory Forest Management
PSIDP	Participatory Small-scale Irrigation Development Program
QA/QC	Quality Assurance/ Quality Control
BG/AG :	Below ground biomass/above ground biomass).
REDD+	Reducing Emission from Deforestation, Forest Degradation, Conservation forest Carbon Stock and Enhancement of Forest Carbon Stock, Sustainable management of Forest
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	Standard 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
SWC	Soil and Water Conservation
TCC	True Color Composite
TWG	Technical Working Group
CBD	Convention on Biological Diversity
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nation Framework Convention on Climate Change
UNFSS	United Nations Forum on Sustainability Standards
UNFSSCBD	Unite Nation Framework for Sustainable Solution on Community Based Development
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

Section 2: Executive Summary

2.2. ISFL ER Program Implementation Arrangements

2.2.1. Program entity that is authorized to negotiate/sign the ERPA with the ISFL:

Name of entity: Ministry of Finance
Type and description of organization: Federal Government Ministry
Website: www.mofed.gov.et

Main contact person:

Name: Mr. Ahimed Shide
Title: Minister
Address: P.O.Box: 1037 Or 1905 Addis Ababa, Ethiopia
Telephone: +251111552015
Email: ashide@mofed.gov.et

2.2.2. Organization(s) responsible for managing/implementing the ISFL ER Program (ifmore than one, please list all):

Name of entity: Ministry of Agriculture
Type and description of organization: Federal Government Ministry

Organizational or contractual relationship between the organization and the ISFL ER Program Entity identified above: Joint implementer

Website: http://www.moa.gov.et

Main contact person:

Name: H.E Girma Amente (PhD)
Title: Minister
Address: Addis Ababa
Telephone: 0944198838
Email: girma_an@yahoo.com

Name of entity: Ethiopian Forest Development (EFD)

Type and description of organization: Federal Government Institute

Organizational or contractual relationship between the organization and the ISFL ER Program Entity identified above: Negotiator and Joint implementer

Website: N/A

Main contact person:

Name: H.E. Ato Kebede Yimam
Title: General Director
Address: P.O. Box: 12760 Addis Ababa, Ethiopia
Telephone: N/A
Email: yimam2014@gmail.com

Name of entity: Oromia Environment, Protection Authority (OEPA)
Type and description of organization: Regional Government Authority
Organizational or contractual relationship between the organization and the ISFL ER Program Entity identified above: Joint implementer
Website: N/A
Main contact person:

Name: Mr. Seifudin Mahadi
Title: Director General
Address: P. O. Box 10633 Addis Ababa, Ethiopia
Telephone: +251113852040
Email: seifisham2014@gmail.com

Note: there are five other regional entities with shared roles and responsibilities in rolling out OFLP activities with a coordination platform to achieve OFLP goals, see (section 2.2.2. Organization(s) responsible for managing/implementing the ISFL ER Program (ifmore than one, please list all):

2.2.3. Partner organizations involved in the ISFL ER Program

The following table describes potential partners involved in the OFLP_ERP.

Table 1. Partner organizations involved in the ISFL ER Program.

Royal Norwegian Embassy, Addis Ababa	**Live Jacob -Council** +251 0930100748	Strong and reliable partner in the areas of climate finance and green economy; strong program monitoring and support team. (e.g., REDD+ Investment Program (RIP).

Oromia Forest and Wildlife Enterprise (OFWE)	Mr. Ararsa Regasa - Director General P.O.BOX 6182, Addis Ababa, Ethiopia Tele: (+251)114403550/89 Email: ararsarf@gmail.com	Involved in the design and implementation of the program, manages all state forests and protected areas in Oromia within its concessions; has strong technical and management capacity, with presence in all forest areas of the region.
Farm Africa and SOS Sahel	Shewit Emmanuel – Country Director Tel. No 0911606246 Email: ShewitE@farmafrica.org	Bale Eco-Region REDD+ program activities implementation; Demonstration of participatory Forest Management (PFM) practices; consultation and participation plan preparation. Strong technical and program management capacity; trusted by community and partners alike.
Ethio-Wetlands and Natural Resources Association	Afework Hailu _Executive Director (+251)911635720 ethio.wetland@gmail.com	Implement PFM activities in some districts within the program area. Strong technical capacity and practical experiences.
Japan International Cooperation Agency (JICA)	P.O.Box 5384, Addis Ababa, Ethiopia Tel : (+251)-11-5504755 Fax : (+251)-11-550446	Implement PFM activities in some districts within the program area. Strong technical capacity and practical experiences.
Ministry of Agriculture	H.E Girma Amente (Amente (PhD) Minister Tel no. 0944198838 Email: girma_an@yahoo.com	The Ministry of Agriculture (MoA) is responsible for overseeing policies and management in the livestock sector and will lead the measurement and reporting of livestock emissions. It will also manage the implementation of various initiatives and projects, such as Sustainable Landscape Management Program (SLMP)/ Resilience Landscape and Livelihood Project (RLLP) II, Climate Action Through Landscape Management (CALM) I, Food System

		Resilience Program (FSRP), and climate-smart agriculture programs in both crop and livestock development, including Livestock and Fisher Sector Development Program (LFSDP) and Lowland Livelihood Resilience Project (LLRP). Additionally, the MoA is in charge of livestock emission reduction monitoring for the Oromia Forested Landscape Program-Emission Reduction Project (OFLP-ERP) for the second Emission Reduction Purchase Agreement (ERPA) phase.
Oromia Bureau of Agriculture	Getu Gemechu- Bureau Head P. O. Box 8770 Addis Ababa, Ethiopia Tel: (+251) 11-3717440 (+251) 112717438 Email: gemechugetu@gmail.com	It is implementing different programs like SLMP/RLLP II, CALM I, Land Investment for Transformation (LIFT), FSRP and different climate smart agriculture in both crops and implementing livestock sectors development in the livestock sector including LFSDP and LLRP. It is also leading the livestock ER monitoring for the OFLP-ERP. It is the sector with 2nd highest mitigation potential after forestry.
Oromia Bureau of Water and Energy Resource Development	Ararso Abdulatif- Bureau D/Head P.O. Box 8630 Addis Ababa, Ethiopia Tel: (+251)11 5516938 Email: ararso2011@yahoo.com	The Bureau oversees programs that are relevant for Oromia Forested Landscape Program (OFLP) like promotion of renewable energy and energy saving technologies.
Oromia Bureau of Land Administration and Use	Kedir Mamo – Bureau Head Tel.no. 0908340997 P. O. Box 2273 Addis Ababa, Ethiopia Email:	It oversees administering land in the region, including preparation of land-use plan, developing policy and laws and issuing land right certificates.

	kedir2000@gmail.com Tel: (+251) 11 3690159	
Oromia Cooperative Promotion Agency	Jemal Kedir – Head Tel.no: 0965052666 Email: jkgelyi2020@gmail.com	Provide technical backstopping for forest based cooperatives particularly on resource management, financial management, business plan development and establish new forest based cooperative as necessary.

2.2.4. Description of coordination between entities involved in ISFL ER Programs

The Oromia Forested Landscape Program Emission Reduction Project (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).The implementing institutions will discharge their respective responsibilities and mandates towards the successful implementation of the OFLP-ERP at a landscape level in a coordinated manner by mobilizing staff, providing leadership and required technical support at all levels to achieve the program´s objective of reducing emissions from land use in Oromia through improving the enabling environment for sustainable forest management and investment.

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.

In addition, three lower level (Zonal level) coordination platforms are established to create synergy among implementation of activities by government and other relevant interventions undertaken by NGOs, Civil Society Organizations (CSOs) and the private sector as identified above. The MOU entered among regional stakeholders will also be extended to these clusters, bringing in the platform the government, NGOs, CSOs and the private sector actors to coordinate their activities for the same objectives as outlined above.

For the implementation of related activities, implementing NGOs are working with relevant Bureaus/Authority/Agencies to: (a) prepare, implement, and report on activities in joint annual OFLP-ERP work plans through the coordination, and (b) ensure synergies between existing sector initiatives that affect OFLP-ERP objectives. Similarly, private sector businesses implementing or investing in forested landscape friendly initiatives will coordinate their works with OEPA and ORCU. Such private sector entities include those involved in commercial forest development and livestock farming activities. The present policy environment has become increasingly conducive

to private investment, resulting in a vibrant spectrum of industries experiencing significant growth. This includes a variety of wood processing operations, which range from small-scale enterprises to larger corporations. Moreover, there are numerous stakeholders investing in commercial coffee cultivation and processing, with prominent players like Nespresso alongside various local businesses making their mark. The commercial agriculture sector is also witnessing robust development, with companies dedicated to cattle ranching for both dairy and beef production. In addition, the market features of commercial honey producers and processors, such as Beza Mar, as well as enterprises that specialize in the collection and processing of gum, spices, and other forest-derived products. The trend towards sustainability is further evidenced by the increasing production and distribution of enhanced cook stoves and biogas solutions, highlighting a commitment to environmentally friendly practices. As indicated in the (Figure 1) below the institutional arrangements for the OFLP-ERP, which aims to coordinate interventions by various actors and financed by multiple sources and partners to scale-up action. The OFLP-ERP's programmatic approach requires cross-sectoral coordination with all related policies in other sectors to maximize synergies and mitigate trade-offs. Thus, OFLP-ERP institutional arrangement is anchored in the following principles: (i) the institutional set-up is based on existing federal and state government structures; (ii) clear institutional roles, responsibilities and procedures based on existing institutional mandates; (iii) extensive multi-sectoral coordination to plan and implement related projects and activities critical for OFLP-ERP success; and (iv) coordinating and leveraging selected associated initiatives (financed by the World Bank (WB) and/or others).

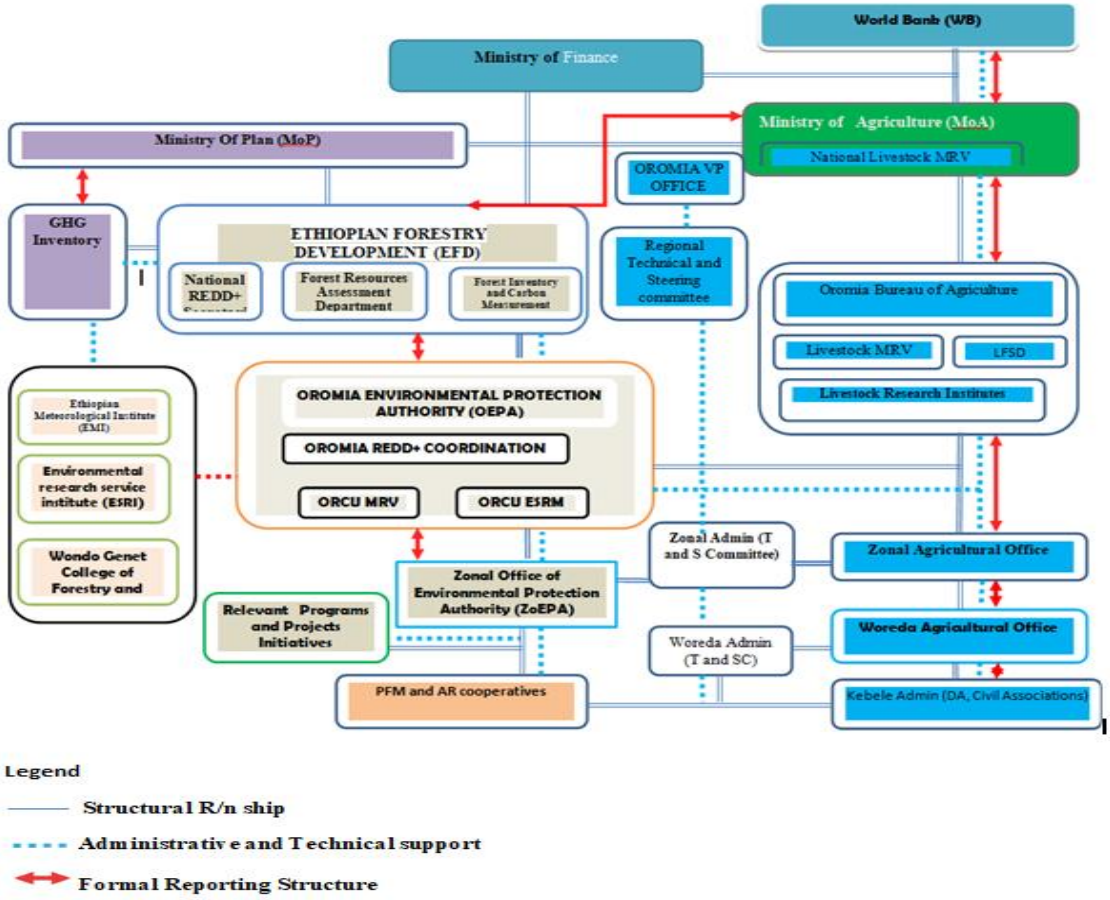


Figure 1: OFLP-ERP Structural Coordination

Federal Level

Mistry of Finance:

The Ministry of Finance (MoF) at the federal level will sign the ERPA and take overall fiduciary responsibility. The MoF is not involved in the reporting but only in the transfer of funds for the Benefit Sharing Plan (BSP). The MoF will receive funds from the Emission Reduction Credit (ERC) purchase based on verified Emission Reduction (ER) amount achieved by the program at the end of each ERPA phase and distribute ER benefits according to the Comprehensive Benefit Sharing Plan (cBSP).

Ministry of Agriculture:

The Ministry of Agriculture will provide technical coordination on Agriculture, Forestry, and Other Land Use (AFOLU) for further emission reduction activities during the Emission Reduction Purchase Agreement (ERPA). Sustainable management of agricultural and livestock-based

emission reduction practices will be achieved through the development of various strategies, plans, and programs.

The MoA will also lead on aspects relating to measuring and reporting of livestock emissions through coordinating with the livestock unit of the OBoA, OEPA/ORCU, ESS, EFD MRV Unit and livestock research centers existing at the national and regional levels, as appropriate. Within the MoA, the LFSDP PIU will coordinate support activities on the MRV system for enteric fermentation.

Additionally, the Ministry regulates livestock cooperatives and associations to ensure they effectively utilize emission reduction benefits for ongoing activities aimed at further reducing emissions. This approach aims to create a structured framework that promotes sustainability while maximizing the impact of emission reduction efforts in the agricultural sector. By fostering collaboration and setting clear guidelines, the Ministry seeks to enhance the effectiveness of these initiatives and support the overall goal of reducing greenhouse gas emissions.

Ethiopian Forestry Development:

The Federal Government of Ethiopia has restructured the Ethiopian Forestry Development (EFD) by merging the Ethiopian Environment and Forest Research Institute (EEFRI) and the forestry sector from the Environment Forest and Climate Change Commission (EEPA) under regulation No. 505/2022)[1]. The EFD is tasked with enhancing funding for forest sector development through collaboration with development partners and ensuring functionality upon approval. Additionally, it aims to improve forest developers' access to business development credit and insurance services. The institute focuses on the protection rehabilitation and sustainable management of natural forests which is crucial for climate change mitigation and reducing its adverse effects on ecosystems people and infrastructure. It actively represents the forestry sector at various international and regional platforms including the Unite Nation Framework Convention on Climate Change (UNFCCC), United Nations Convention to Combat Desertification (UNCCD), Convention on Biological Diversity (CBD), Unite Nation Framework for Sustainable Solution on Community Based Development (UNFSSCBD), United Nations Forum on Sustainability Standards (UNFSS) and others to promote national interests. Additionally, the institute aims to enhance the capacity of Ethiopian Forestry Development (EFD) by building human logistical and infrastructural resources

[1] https://www.moa.gov.et/wp-content/uploads/2024/06/COUNCIL-OF-MINISTER-REGULATION-TO-DETERMINE-THE-POWER-AND-DUTIES-AND-ORGANIZATION-OF-THE-ETHIOPIAN-FORESTRY-DEVELOPMENT-REGUATION-NO-5052022.pdf

to combat deforestation forest degradation, pests, diseases and invasive species while coordinating these efforts effectively across all levels.

The EFD's involves carbon accounting and performance verification for the forest sector. The EFD will lead the overall MRV undertakings of the ER program through its dedicated MRV Unit, including collection of regional-level primary ER performance data and analyzing and reporting of the same to the World Bank/ISFL. The EFD is Ethiopia's coordinating entity for MRV for the forest sector through its MRV Unit. The MRV Unit produces maps, collects and reports GHG inventory data, and undertakes MRV tasks working in collaboration with federal and regional institutions. The OFLP-ERP will follow the same ER monitoring approach and use the same MRV institutional arrangement established for the forest sector at the national level. EFD will carry out fiduciary oversight, quality assurance role and management of the grants, in particular on MRV infrastructure modernization, project monitoring, safeguards, financial management and procurement. EFD will open and manage separate designated US dollar and Birr accounts to receive the two grant funds from the World Bank and funds from this account will then be transferred to a pooled local currency (Ethiopian Birr) account to be held by the EFD.

Specifically, the Ethiopian Forest Development Provide each Regional Project Entity with the ISFL ER program Document, the ER Monitoring Plan, ESRM document development and any other information relevant to the implementation of the Sub-project/ISFL ER program measures (including relevant communication between the Trustee and the Program Entity in relation to the ERPA); EFD takes the leading role on the overall MRV undertakings of the ER program through its dedicated MRV Unit, including collection of regional-level primary ER performance data and analyzing and reporting of the same to the World Bank/ISFL.

National REDD+ Secretariat (NRS)

The National REDD+ Secretariat of the EFD will provide strategic and technical guidance on REDD+ issues, consolidate lessons learned from OFLP-ER and disseminate experience in other regional states, and lead the proper implementation of the REDD+ MRV system which is key in the OFLP ERP implementation. The secretariat will need to work at the technical level with other relevant national stakeholders such as the LFSDP hosted by the Ministry of Agriculture, as needed.

Ethiopian Statistical Services

The Ethiopian Statistical Services (ESS) is the official body responsible for collecting statistical data through various methods, including censuses, sample surveys, administrative records, and

continuous registration. Its functions include processing, compiling, analyzing, publishing, and disseminating statistical results. Additionally, ESS provides advisory services on statistical matters to government agencies, institutions, and private organizations upon request.

ESS also establishes the framework for the collection, compilation, and classification of statistical data, specifying the types of data to be gathered and the timelines for collection. It evaluates and monitors all related activities to ensure that the data obtained from national censuses and surveys fulfill the needs of regional states. Regarding the OFLP, the role of ESS will be to collect headcount data on livestock and the milk and meat products on an annual basis using the newly developed sampling framework for calculating emission intensity from enteric fermentation. The data will then be processed in coordination with the MoA to provide the final data to be used in the monitoring report.

Regional State Level

Executive of the Oromia Regional State (Vice President's Office)

The Executive of Oromia Regional State is the vice President's Office. The Vice President's Office will be the highest-level institution to provide political leadership and decisions to the OFLP-ERP, in particular on multi-sector implementation, policy development and strategy. The existing "advisor designated as bureau head" is the OFLP-ERP focal point assigned by the vice president. A second advisor will serve as a secondary OFLP-ERP focal point. This team will work closely with the OEPA/ORCU to help the OEPA fulfill its mandate to coordinate across sectors and stakeholders on OFLP–ERP implementation, leveraging of existing and future initiatives, strategic planning, funds mobilization and will advise on the functioning of the ORCU.

Oromia Environmental Protection Authority (Regional Lead Project Entity)

The OEPA through ORCU will lead Statewide OFLP-ERP implementation. Specifically, OEPA will: (i) administratively host ORCU; (ii) administer the technical, financial and human resources of OFLP-ERP to be responsible for fiduciary management of OFLP-ERP; (iii) coordinate relevant bureaus, agencies and organizations implementing OFLP-ERP activities at regional, woreda and kebele levels; (iv) hire and maintain OFLP Program Coordinator, four OFLP ESRM specialists, five OFLP-ERP MRV specialists, one Financial Management specialist and three drivers with OFLP-ERP grant funds.

Oromia REDD+ Coordination Unit (ORCU)

The ORCU is OEPA`s OFLP-ER project Implementing Unit. In addition to implementing OFLP-ER Project on a day-to-day basis, ORCU serves as the secretariat for coordinating and aligning various sector initiatives under the OFLP umbrella. ORCU reports administratively to the OEPA and also seeks strategic and tactical guidance from the Oromia National Regional State Vice President Office the OFLP-ERP Steering Committee, given the multi-sector nature of OFLP-ERP's cBSP operationalization. The OEPA/ORCU will be closely working with the National REDD+ Secretariat at EFD and MoA (LFSDP) which will carry out fiduciary oversight, quality assurance role and management of the two grants, in particular on MRV infrastructures modernization, project monitoring, Environmental and social risk management, financial management and procurement; more specifically, the EFD will focus on providing operational guidance to the OEPA to carry out OFLP-ERP related procurement, FM, and ESRM activities.

As part of condition of effectiveness of subsequent ERPA phase activities, ORCU, will facilitate and coordinate submission of the Trustee an Analysis and GHG Inventory Update for the subsequent ERPA Phase, as well as draft versions of the updated ISFL ER Program documentation for the subsequent ERPA Phase, including updated Program Documents, ESRM Plans, transfer of Title to ERs documentation (from livestock and forestry component) and an updates comprehensive Benefit Sharing Plan. All the Updates ISFL ER Program Documentation should be finalized as soon as possible prior to the end of the ERPA Phase two Agreement Negotiation Period, in form and substance satisfactory to the Trustee.

ORCU is responsible for coordinating and maintaining the execution of the OFLP-ERP activities, which encompasses all daily fiduciary obligations. This unit regularly engages in technical discussions with various partner agencies, non-governmental organizations, and private sector stakeholders involved in the OFLP-ERP initiatives.

The management of technical, financial, and human resources for the OFLP-ERP activities will be conducted by ORCU through its Environmental and Social Risk Management (ESRM) team, which will take on the responsibility for fiduciary oversight. This includes the assignment and engagement of personnel across various zones, woredas, and kebeles to ensure that OFLP-ERP activities are executed in alignment with Environmental and Social Risk Management (ESRM) instruments such as the Environmental and Social Management Framework (ESMF), Labor Management Procedures (LMP), Environmental and Social Commitment Plan (ESCP), Strategic

Environmental and Social Assessment (SESA), Stakeholder Management Plan (SMP), Stakeholder Engagement Plan (SEP), and Gender Action Plan (GAP). Collaboration with the National REDD+ Secretariat at the Environment and Forest Directorate (EFD) and the Ministry of Agriculture (MoA) will be essential, as they will oversee fiduciary management, quality assurance, and the administration of the Emission Reduction with the program. Additionally, the ORCU will provide other regional stakeholders involved in this Memorandum of Understanding (MOU) with essential documents such as the ISFL ER Program Document, the ER Monitoring Plan, and the Environmental and Social Risk Management Plans, along with any pertinent information necessary for the effective implementation of the Sub-Project and ISFL ER Program Measures, including communications between the Trustee and the Program Entity regarding the Emission Reduction Payment Agreement (ERPA). The ORCU will also be responsible for gathering and verifying the accuracy of all data required under the Monitoring Plan and applicable E&S Risk Management Plans. Furthermore, the unit will lead the monitoring, reporting, and verification of emissions reductions within the Oromia regional jurisdiction, ensuring compliance with ISFL program requirements, while coordinating with relevant bureaus, agencies, and organizations at regional and woreda levels to implement OFLP-ERP activities, including the Benefit Sharing Plan (BSP) and Comprehensive Benefit Sharing Plan as outlined in the operational manual. Progress reports will be compiled by various stakeholders, including the OFLP-ERP Steering Committee, EFD, and the World Bank. Close coordination with the Oromia Bureau of Finance will be necessary to guarantee timely disbursement of emission reduction proceeds to beneficiaries, alongside effective implementation and reporting. The ORCU will also maintain responsibility for financial accountability, safeguarding assets, and keeping accurate financial records, while providing training to development agents at the zone, Woreda, and kebele levels, as well as to partners involved in the OFLP-ERP initiative. The ORCU/OFLP-ERP team actively engages with officials at the woreda and kebele levels, including woreda administrators and development agents, to ensure effective coordination of the OFLP-ERP across government sectors and the Oromia state landscape, promoting a holistic landscape management approach. Coordination with OFLP-ERP-related initiatives is facilitated by liaising with executive-level focal points and OEPA as necessary. The unit ensures that emissions reduction verification is conducted by a third party and oversees the delivery, implementation, and reporting of the agreed comprehensive Benefit Sharing Plan (cBSP) for the OFLP ERPA. Additionally, it serves as the secretariat for the REDD+ Steering

Committee and the REDD+ Technical Working Group, actively participating in meetings to further the objectives of these groups.

Oromia Forest and Wildlife Enterprise (OFWE)

The OFWE remains a key implementing partner in OFLP-ERP through sustaining its experience on PFM, managing plantations, and large concessions where carbon rich high forest and deforestation hotspots areas exist. The OFWE is engaged in a range of essential duties focused on the sustainable management and implementation of specific elements of the PFM activities funded by the OFLP, strictly within the designated concession areas of the OFWE. This engagement is in accordance with the Memorandum of Understanding established between OEPA and OFWE, which governs the planning, preparation, execution, and reporting of ER activities. Additionally, OFWE will play a crucial role in fostering synergies among existing sector initiatives that impact both the OFLP-ERP emission reduction activities and the wider sector goals. The organizational framework of OFWE helps to continually support OFLP grant period PFM activities, with the Branch level representing the highest administrative tier, followed by district and sub-district offices. The designated focal person for the OFLP-ERP at the regional branch, and district offices will ensure active engagement in the execution of OFLP-ERP initiatives. This individual will be responsible for providing necessary technical assistance and reporting to the ORCU, which includes sharing relevant data as required. Additionally, participation in the regional OFLP-ERP Steering Committee and Technical Working Group is crucial. The focal person will also play a significant role in the Measurement, Reporting, and Verification (MRV) process, which encompasses data collection, analysis, and reporting. Furthermore, they will contribute to the OFLP ER project by implementing sustainable forest management practices within their concession areas, leveraging both internal and external resources as needed. Support for the on-ground execution of BSP activities is also vital, particularly in identifying community development projects funded by ER payments and ensuring that their planning and implementation align with the OFLP-ERP Environmental and Social Risk Management (ESRM) instruments. Lastly, it is important to foster synergies and coordination between existing sector initiatives and OFLP-ERP activities to enhance the overall impact on project and sector objectives.

Oromia Bureau of Agriculture (Regional Project Entity)

The Regional Agricultural Bureau is tasked with the responsibility of formulating strategies, plans, and policies aimed at enhancing intensive crop and livestock production at the regional level. This

includes the implementation of Climate Smart Agriculture (CSA) practices and the integration of modern agricultural technologies, all of which are designed to boost productivity while simultaneously reducing emissions. The designated focal person at respective agricultural offices will take the technical responsibility on forest development and livestock production that ensure active engagement in the execution of OFLP-ERP activities. These individuals will be responsible for providing necessary technical assistance and reporting to the ORCU, which includes sharing relevant data as required. Additionally, participation of the regional focal person in the regional OFLP-ERP Technical Working Group is crucial for fostering collaboration and oversight. The focal person will also play a significant role in the Monitoring, Reporting, and Verification (MRV) process, particularly in data collection, analysis, and reporting, by closely working with the regional livestock MRV unit. Furthermore, at Woreda level, Agricultural office will take the role and responsibilities to support ER activities implementation and coordination on the ground will be facilitated through Development Agents, focusing on the identification of community development projects funded by ER payments, as well as ensuring that planning and execution align with the OFLP-ERP Environmental and Social Risk Management (ESRM) instruments. It is vital to promote synergies and coordination between existing sector initiatives and OFLP-ERP activities to enhance project and sector objectives, while also fulfilling other roles and responsibilities as outlined in the World Bank's OFLP-ERP Project Appraisal Document.

Oromia Bureau of Land (Regional Project Entity)

The Bureau of Land is actively engaged in developing a contemporary land management system aimed at efficiently establishing land tenure ownership rights while also addressing and resolving conflicts related to land and land-based resources. This initiative is crucial for ensuring equitable access to land and promoting sustainable resource management practices**.**

Oromia Bureau of Water and Energy (Regional Project Entity)

The implementation of energy-efficient stoves, alongside the utilization of biogas and effective water resource management, plays a crucial role in addressing climate change while simultaneously decreasing reliance on biomass. These innovative solutions not only enhance energy conservation but also promote sustainable practices that can significantly mitigate environmental impacts. By integrating these technologies, communities can transition towards more resilient energy systems, ultimately contributing to a reduction in greenhouse gas emissions and fostering a healthier ecosystem**.**

The Oromia REDD+ Technical Working Group

The Oromia REDD+ Technical Working Group (RTWG) is tasked with providing technical guidance and support for the design implementation and monitoring of the OFLP-ERP and REDD+-related interventions, ensuring they meet benefit-sharing requirements through a transparent review process. Chaired by the Oromia Environment Protection Authority (OEPA), the group includes members from various sectors such as the Oromia Vice President's Office, Bureau of Agriculture, Bureau of Land, Cooperative Promotion agency and several environmental and research organizations. Additional members from relevant institutions may be included as necessary.

Zone level Institutions and Relevant Sectors

Zonal Administration

Zone administrations include the zone administration offices and sector offices such as Zone office of Agriculture (ZoA); Zone office of Water and Energy (ZoWE); Zone office of Land (ZoL); Zone office of Environmental Protection Authority (ZoEPA). These offices work closely together on day-to-day affairs, such as overseeing the work of their respective woreda offices (agriculture, forests, water, household energy, cooperative promotion and land). Each office will also provide administrative and technical support to respective woreda offices who are directly implementing sector-specific OFLP-ERP activities for further Emission reduction (directly financed by the Regional Government Initiatives, like Green Legacy, OFLP-ERP activates activities as per BSP and Other Program/Projects initiatives). The heads of the ZoEPA and ZoA Office Head will lead the facilitation of the inter-sectoral coordination and benefit sharing activities. Zonal Administrations receive progress reports from each sector office and report to their respective regional line bureaus ensuring smooth implementation of the BSP and ER benefit allocated to each beneficiary is received as per the plan.

Local level (Woreda, Kebele) Institutions and Relevant Sectors

Woreda administrations

Woreda administrations include the woreda administration offices and sector offices such as the WoA, WoWE, WoL, WoEPA and the OFWE district office where relevant. These offices are meant to work together on day-to-day businesses of the woreda, such as overseeing the work of in agriculture (climate smart agriculture and livestock management), water, household energy, and forests, working at the lowest administrative unit called kebele (village level). Each office will

also implement sector-specific activities which will make contribution to managing the risks of reversals and coordinate some of the REDD+-relevant initiatives implemented by CSO/NGO and the Private Sectors for further emission reduction.

The OFWE district office

The OFWE district office which typically oversees two to seven woredas will focus on two main responsibilities: (a) implementing and supporting the OFLP-ERP benefit distribution for forest-based communities including Participatory Forest Management (PFM) within OFWE concessions; and (b) providing progress reports on the implementation of Further ER activities to OEPA/ORCU through OFWE.

Kebele Administration

The Oromia regional state has implemented a reform aimed at reorganizing the administrative framework of kebeles, integrating government functions with politically appointed leadership. This new structure includes Development Agents, community organizations, and other pertinent sectors, which collectively enhance governance at the local level. As a result of these changes, there has been a notable decrease in the risks associated with deforestation and unauthorized encroachments into forested areas. Furthermore, the restructured administration has proven effective in managing community disputes by leveraging established roles and responsibilities, alongside the customary court mechanisms for grievance resolution that have been instituted at each kebele level.

Civil Societies, Unions, and Universities

Civil societies/NGOs, Forest Cooperative unions, Livestock Based Cooperatives Union and universities in the OFLP-ERP structure would; (a) provide services and supports to government institutions to help implement activities or (b) implement activities directly, outside of the ERC. One example of the former is Farm Africa, which is currently implementing the Bale Mountains Eco-regional REDD+ Project on behalf of the FDRE. FARM Africa/SOS Sahel Ethiopia are the second NGO in Ethiopia next to World Vision, in implementing ER forestry projects and accessing payment for verified emission at Southeastern part of the region.

The Private Sector

Private sector entities involved in OFLP-ERP activities include those engaged in commercial forestry, wood processing, coffee plantations, agriculture honey production and forest product collection. Their investments must align with the Oromia Forest and Landscape Program (OFLP)

to ensure sustainability and mutual benefits. A Memorandum of Understanding (MoU) will formalize the commitments and roles of private sector players at various levels including cluster and zonal levels. Analytics from ORCU's Strategic Action Plan for Private Sector Engagement highlight the need for coordinated efforts between private investments and OFLP-ERP for effective outcomes. Value-chain analyses have been conducted for commodities such as coffee, mango, livestock (apiculture, poultry, forage and dairy), bamboo, spices, Improved Cook Stoves (ICS) and charcoal emphasizing the importance of collaboration for achieving desired results.

Private sector in coffee value chain

The Oromia Investment Commission reports that numerous private companies, cooperatives investors and individual farmers benefit from OFLP support in coffee production, processing and marketing, as well as in forest development and livestock production. In the Oromia region medium and large-scale coffee farms, wet coffee pulping companies are engaged in coffee export, and a few are involved in roasting as most coffee is exported as green beans. Since 2016, the ISFL has partnered with Nespresso and Techno Serve through the IFC to invest in Ethiopia's coffee sector.

Dairy/cattle, poultry and feed value chain

In the region, over 95% of milk production is attributed to smallholder farmers, alongside several private and cooperative commercial milk-producing enterprises. The primary commercial milk-producing areas include North Shewa, East Shewa, Arsi, West Shewa, and the Oromia Special Zone surrounding Finfinnee (Addis Ababa). While many corridors in the region are suitable for dairy investments, the Adama-Bishoftu corridor, the Arsi highlands, Selale-Fitche, and West Shewa stand out as particularly promising. The Oromia region alone accounts for approximately 50% of the national milk production, with key milk-shed areas being Adama-Asella, Addis Ababa, Ambo-Woliso, Dire Dawa, and Jimma.

Several private milk production and processing companies operate within the Bishoftu-Adama-Asela belt, including notable players like Holland Dairy, Alema, Genesis, and Alfa Farms and Agro Industries. The Mojo area of Oromia houses most of the country’s export abattoirs, such as Modjo Modern, Helmix, Organic, and Luna. Additionally, international companies like VERDE Beef from the USA and Allana Group from India are establishing meat processing facilities in the Batu (Ziway) area. The primary market for meat and mutton products is the Middle East, although there is significant potential in the domestic market as well.

According to data from the Oromia Investment Commission, several private companies are involved in animal feed production and processing. These include Alema Koudijs Feed PLC, Ethio-Feeds PLC, Feedco Animal Feeds PLC, Koket Dry Feed Complex PLC, European Food and Cattle PLC, Sorga Agro-Industrial Complex PLC, Verde Beef Processing PLC, Alfa Fodder & Dairy Farm PLC, Ethio Agriseft PLC, Wonji Sugarcane Producers' Cooperative Union, Gibe-Dedesa Cooperative Union, Eden Forage Producers, Tibebu Lema Kenaf Farm PLC, and Anatoli Forage and Forest Seed Supply PLC.

In the poultry sector, there are approximately 20 large-scale commercial poultry farms in and around Addis Ababa, with another 20 farms in various stages of development. Numerous small and medium enterprises are involved in poultry production, feed processing, and distribution, with some companies handling both aspects. The supply of inputs such as Day-Old Chicks and premix feed is largely controlled by a few large companies. Key players in the poultry industry include Ethio-feed Import and Feed Ingredient, Elfora Agro-Industries, Alema (which focuses on broiler and layer chickens), Friendship Agro-Industries, Akaki Feed Factory, Genesis, Good Shepherd PLC, Ethiochicken, Astral Foods and Feed Co., Alema Koudijs Feed PLC, SAFE Poultry PLC, Freisian Agro Processing and Farming PLC, Mubarak Dafalla Gabril, Luigi Monsellato, Sadot Agri Food PLC, Jacobs Integrated Farm OLC, and Preconex East Africa PL.

The ISFL Private Sector Engagement Strategy

Through the ISFL additional support and based on grant financed strategic analysis for engaging the private sector, short term to medium term investment priority areas were narrowed down for the program to work on benefiting both program objective and the private sector. The three priority areas identified for short term intervention are: (i) Commercial Forest Plantations (without grower's scheme), (ii) Coffee stumping and income compensation, and (iii) Climate Smart Dairy Production. Private sector engagement in these supply chains that are key to the sustainable socio-economic development of the region is expected to trigger positive impacts in terms of emissions reduction, changes in land use, biodiversity, livelihoods and reduction of pressure on forest over medium to long term. These predicted transformational changes and potential impact over time depends on the evolving opportunities of the private sector in the country and enabling conditions to operate during the transition of Ethiopia towards a more market-based economy. The support to this private sector entry point is meant to catalyze and trigger private investments in these key supply chains, and the transformational change towards more sustainable production systems that

will effect change and impact over time. The ISFL support for the private sector engagement entry points in Oromia can take various modalities including technical assistance for the implementation of policy reforms, feasibility studies, direct grant support to smallholder farmers, design of financial and business models, and training.

Section 3: ISFL ER Program Design

3.1. Planned Actions and Interventions in the Program Area, Including Financing

3.1.2. Description and justification of the ISFL ER Program's planned actions andinterventions

Mitigation measures include creation of an enabling environment at regional (jurisdiction) level while addressing the drivers of AFOLU through targeted interventions. Major interventions to address the drivers of AFOLU include: i) agricultural intensification (CSA, irrigation, coffee plantation & management, etc.), ii) sustainable forest management (Participatory Forest Management, Afforestation/reforestation, Area enclosure), iii) sustainable livestock (cattle) production (improving rangeland management, improving quality and availability of feed resources, improving animal health extension services, improving cattle reproductive performance, improving breeds, enhancing and intensification of animal mix diversification), iv) energy efficient technology (cook stoves & biogas) and v) sound land use planning & tenure security, family planning service & increasing job opportunity, ensuring cross-sectoral coordination for improved outcomes, and effective coordination among investments (AFOLU mitigation measures, planned actions and interventions are described in detail in the **Error! R eference source not found.**of the original ISFL PD for the first phase).

To achieve these broader interventions, OFLP follows a programmatic approach and provides a methodological framework to effectively coordinate all on-going and planned interventions to improve land-use management, livelihoods and to reduce land-use related emissions across Oromia Jurisdiction. To this end, the program implementation ensures multi-level, multi-sector and multi-actor coordination, not only of interventions financed by the OFLP-ERPA 1st phase ER proceeds, but also other relevant interventions across the region for enhanced synergy, improved program outcomes and leveraging the financial gaps needed to achieve the ER program goals.

Table 2 Interventions leading to Emission Reductions per type of intervention

Interventions	Type of intervention (sector)	Remark
OFLP - Forest management investment in deforestation hotspots	Forestry	This grant's interventions were completed in June 2023, but it is assumed past interventions will continue to generate ERs during the entire ERPA period
Participatory Forest Management and Livelihoods (OFLP)	Forestry	
Afforestation/Reforestation (total)	Forestry	
REDD+ Investment in Ethiopia (2016 - 2026) Phase I and II	Forestry	RIP interventions are expected to continue generating ERs in the coming years up to end of ERPA period similar to the OFLP grant project activities as above.
Assisted Natural Regeneration (ANR)	Forestry	
Afforestation/Reforestation (A/R)	Forestry	
PFM (Deforestation)	Forestry	
Oromia Forest Sector	Forestry	No change on ex-ante ERs estimate for interventions by OFWE as no additional investments are expected to happen beyond replacement of old plantations and maintenance of existing PFM areas other than those jointly developed with DPs (Farm Africa, Ethio Wetlands, etc.)
Forest Resources Development, Conservation, and Sustainable Utilization of the OFWE – A/R	Forestry	
PFM	Forestry	
Bale Eco-region REDD+ Pilot Project Phase II	Forestry	The average ex-ante emission reduction and removal estimate provided in the

		Bale ecoregion PDD is 1.9 million tons of CO_2 e/year.
Enrichment planting	Forestry	
PFM	Forestry	
Livestock and Fisheries Sector Support Project	Livestock	Expert estimate
RLLP (Extension of SLMP 2 - Resilient Landscape and Livelihood Project)	AFOLU	Expert estimate
REDD+ Joint Forest Management in Five Woredas in Illu Ababora Zone of Oromia Regional State Phase II Project	Forestry	Expert estimate
Climate Action Through Landscape Management (CALM-I) Project	AFOLU	Expert estimate
Lowlands Livelihood Resilient Project (LLRP) II	Agriculture/ Livestock	The average ex-ante estimate provided in the LLRP two PAD is 664,638 tCO2 eq/yr.
Oromia Dairy Farmers Bounty Project (ODFBP) by Solidaridad	Livestock	estimate not yet done
Jimma Coffee Project (JCP)by Techno Serve (TNS)	Agriculture/ forestry	estimate not yet done
Green Legacy Initiative (GLI) in Oromia	Forestry	estimate not yet done
Other interventions		
RICSP and Sustainable Rural Energy Technologies Project United Nations Development Programme (UNDP)/Global Environmental Facility (GEF)	Energy	estimate not yet done
PSNP 4 - Productive Safety Net Program	Livelihood	estimate not yet done

Eastern and Southern Africa Food systems Resilience Project	Agriculture	estimate not yet done
FEED II - Feed Enhancement for Ethiopian Development	Livestock	estimate not yet done
PAID - Public Private Partnership in Artificial Insemination	Livestock	estimate not yet done
Coffee Forest Development Value Chain Project (FARM Africa)	Agriculture/ Forestry	estimate not yet done

Table 2 above shows the emission reduction potential of activities that are under implementation or just starting projects with impact in the baseline emissions of the program. Some of these projects with unquantified ERs (last 9 initiatives listed in Table 2 above) could also generate some emission reductions (ERs), but it was not possible to quantify the exact magnitude of ERs given complex nature of project activities or lack of methodology to do estimation. As can be seen, the list not only includes forestry-related activities but also other sectors: agriculture, livestock and energy, demonstrating the landscape scope of action of the Program especially AFOLU sectors.

On top of that and considering the risk of not having the expected results from the existing activities, Oromia Region has the intention to make sustainable use of the forest land under OFWE and OEFCCA jurisdiction. The current area under PFM is close to 1.7 million ha but the intention is to put the entire natural forest within OFWE concession under participatory forest management and thus complete the total forest area under OFWE concession: i.e. 3,200,000 ha in 10 years period. Besides this, there is also an intention to implement additional A/R activities (also not yet funded) in the region by adding 10,000 ha per year of new plantation within the same time frame, achieving an additional 100,000 ha at the end.

The already existing interventions and proposed actions are directly addressing Agriculture, Forestry and Other Land Uses´ drivers of emissions, not only during the Program´s lifetime but beyond. Moreover, the vision and the interventions are aligned with Ethiopia´s Climate-Resilient Green Economy, whose strategies focus on four pillars:

• Adoption of agricultural and land use efficiency measures[2]

• Increased GHG sequestration in forestry

• Deployment of renewable and clean power generation

• Use of appropriate advanced technologies in industry, transport and buildings

The successful implementation of the entire ER Program requires addressing the drivers of AFOLU across the regional state with the support of existing and planned interventions from other projects as described below per each category (Table 3).

Table 3 Sub-Category level drivers, mitigation/enhancement measures, and existing planned action & interventions

Sub-Category	Driver (emission & removal)	Proposed mitigation/enhancement measures	Existing interventions
Forestland remaining forestland	Extraction of fuel wood for commercial and subsistence purposes Forest coffee plantation & management Unsustainable logging Overgrazing Ecosystem restoration; Ineffective land use planning &	Small- & large-scale afforestation & reforestation (plantation); PFM; Cook stoves & biogas; Coffee intensification outside the forest area, coffee value chain improvement (processing - marketing), coffee certification;	• OFLP grant; • OFWE regular interventions; • RIP I&II; • LLRP I and II; • RLLP I and II; • PSNP IV; • RICP through regional gov't budget support;

[2] *The CRGE initiative has prioritized the following initiatives to limit the soil-based emissions from agriculture and limit the pressure on forests from the expansion of land under cultivation: 1) Intensify agriculture through usage of improved inputs and better residue management resulting in a decreased requirement for additional agricultural land that would primarily be taken from forests, 2) Create new agricultural land in degraded areas through small-, medium-, and large-scale irrigation to reduce the pressure on forests if expansion of the cultivated area becomes necessary, 3) Introduce lower-emission agricultural techniques, ranging from the use of carbon- and nitrogen-efficient crop cultivars to the promotion of organic fertilizers. These measures would reduce emissions from already cultivated areas.*

To increase the productivity and resource efficiency of the Livestock sector, the following initiatives have been prioritized: 1) Increase animal value chain efficiency to improve productivity, i.e., output per head of cattle via higher production per animal and an increased off-take rate, led by better health and marketing, 2) Support consumption of lower-emitting sources of protein, e.g., poultry. An increase of the share of meat consumption from poultry to up to 30% appears realistic and will help to reduce emissions from domestic animals, 3) Mechanize draft power, i.e., introduce mechanical equipment for ploughing/tillage that could substitute around 50% of animal draft power, which – despite burning fuels – results in a net reduction of GHG emissions. 4) Manage rangeland to increase its carbon content and improve the productivity of the land.

	Forest tenure	Improve value chain of non-timber forest products; Introduce wood industry & environmentally sound non-wood alternative technologies; Rangeland management, feed enhancement & improve livestock value chain Sound land use planning & law enforcement Clarity in forest tenure	• REDD+ Joint Forest Management (EWNRA) • Bale Eco-region REDD+ Pilot Project • Coffee Forest Development Value Chain Project (FARM Africa) • CALM I • CALM II (in pipeline) • JCP (Coffee improvement project by TNS)
Enteric fermentation	• Increase in cattle population; • The productivity of livestock is low, which leads to higher emissions per unit of product. • Inadequate supply of quality feed; • Poor animal health & provision of livestock support services; • Reproductive inefficiency & low livestock genetic makeup; • Limited adoption of improved livestock practices; • poor manure management; weak herd management &	• Improving quality and availability of feed resources; • Land Use and Grazing Management • Improving Feed Efficiency • Improving Productivity and Herd Health • Diversifying the animal mix; Improving animal health and husbandry; • Manure management; • Improving the genetic potential of local breeds & Cattle value chain improvement	• LFSDP I • LFSDP-II (in pipeline) • LLRP I and II; • FSRP (Food System Resilient Program) • SLMP 2/RLLP-II • CALM I and II • ODFBP (Solidaridad)

	low commercial market off take		
Forestland converted to cropland, grassland and Shrubland	Agricultural land expansion (small-scale subsistence, medium to large scale commercial); Increase in livestock population; Socio-economic factors; Ineffective land use planning; Inadequate cross-sectoral policy and investment coordination; Land tenure and Demographic factors	Agricultural intensification; PFM; Sound land use planning & law enforcement; Afforestation/reforestation; Improving rangeland management; Feed enhancement; Family planning services & Multi-sectorial coordination	• OFLP grant Interventions; • OFWE regular interventions; • GLI; • RIP I and II; • LLRP I and II; • RLLP I and II; • PSNP IV; • REDD+ Joint Forest Management (EWNRA) • Bale Eco-region REDD+ Pilot Project & • CALM I&II • Eastern and Southern Food Systems Resilience Project, phase one • JCP –TNS
Grassland, cropland and shrubland converted to forestland	High demand for forest products (fuel wood & timber); High economic return from forest investment; Land degradation; Increased emphases by policy makers & Multiple benefits (ecosystem services)	Small & large scale afforestation & reforestation (plantation) and Area enclosure (rehabilitation) Adopting sound land use planning & tenure	• OFLP grant interventions; • OFWE regular interventions; • GLI; • RIP I&II; • RLLP I&II; • PSNP IV;
Grassland converted to cropland	Farm land (cultivated land) expansion; Increase in total crop production; Growth in synthetic fertilizer use;	Agricultural (crop production) intensification (CSA & irrigation); Sound Land use planning policy and enforcement; Policy intervention in family planning,	• OFWE regular interventions; • RIP I&II; • LLRP I&II; • RLLP I and ; • PSNP IV;

	Increase in manure application; Increase in demographics; Unemployment/poverty, lack of proper land use planning and enforcement; Inappropriate government policy (commune system) and Climate change	Women and youth development initiatives	• Eastern and Southern Africa Food Systems Resilience Project–phase one EWCA • CALM I&II

3.1.3 Financing plan for implementing the planned actions and interventions of the ISFL ER Program

The following (Table 4) presents the financial plan and financial gaps of main interventions that are currently under implementation and those in the pipeline in the region in coordination with the OFLP in order to address the AFOLU drivers as described in (section 3.1.1 of the first phase ERPD).

The financing corresponds to the amount of budget that the OFLP needs to leverage in order to achieve the amount of ER by the end of the program period (2030). In most cases the funding for listed projects/initiatives is from development partner sources, and their implementation period is of short duration. However, there are some cases where some initiatives' funding duration cover the entire program period (through 2030); this is because such initiatives' budget comes from national or regional sources and is a continuous activity, e.g. GLI under NRM program.

There is also a case where funding gaps are shown; this is particularly related to expansion of more PFM (OFWE concessions & outside OFWE concessions by OEPA) and A/R under the GLI program.

Table 4 Financing plan for implementing the planned actions and interventions of the ISFL ER Program.

Planned action/intervention and timing or implementation	Financing required (USD)	Financing identified/secured (USD)	Source of financing	Gap (USD)	Proposed financing/measures to address gap
1. Forestland remaining forestland					
Oromia Forest Coffee Value Chain Development Project – phase II (FCVCP-2)	400,000	400,000	High water global		
Jimma Coffee Project (JCP) by Techno Serve (TNS)	950,000	950,000	BioCF-ISFL		
CALM –I	70,000,000	70,000,000	WB-IDA		Estimate
CALM-2	TBD	TBD	WB-IDA		Project in pipeline
2. Enteric fermentation					
Livestock and Fisheries sector development project (LFSDP)-I	30,000,000	30,000,000	World Bank IDA		Estimate
Livestock and Fishery sector development project (LFSDP)-II	TBD	TBD	WB-IDA		Project in pipeline - Estimate
Feed Enhancement for Ethiopian Development - PHASE III (FEED III)	1,300,000	1,300,000	United States Department of Agriculture (USDA) under its Food for Progress program		
Lowlands Livelihood and Resilience Project –I	55,000,000	55,000,000	IDA &IFAD		
Lowlands Livelihood and Resilience Project –II	65,000,000	65,000,000	IDA & IFAD		Estimate
ODFBP	950,000	950,000	BioCF-ISFL (WB)		
3. Forestland converted to cropland, grassland, and shrubland					

OFLP - Forest management investment in deforestation hotspots Participatory Forest Management and Livelihoods	2,137,785	2,137,785	RETF grant (USDOS Child (47.5% and MoCE Child 52.5%)		Grant closed in June 2023
REDD+ Investment in Ethiopia (2016 - 2026) Phase I& II (Participatory Forest Management & livelihoods; Assisted Natural Regeneration)	12,600,000	12,600,000	Royal Norwegian Embassy		
Forest Resources Development, Conservation, and Sustainable Utilization of the OFWE PFM Bale Eco-region REDD+ Pilot Project Phase II (see line 15) Enrichment planting	195,000,000	195,000,000	Regional Government (OFWE)		
REDD+ Joint Forest Management in Five woredas in IlluAbabora Zone of Oromia Regional State Phase II Project (Ethio Wetlands)	1,100,000	1,100,000	Norwegian Agency for Development Cooperation		
RLLP (Extension of SLMP 2 - Resilient Landscape and Livelihood Project)	8,627,451	8,627,451	International Development Association and Multi-donor Trust Fund		
Integrated Land Use Planning Study (ILUP)	20,000,000	10,000,000	Government budget	10,000,000	Government budget
4. Grassland, cropland, and shrubland converted to forestland					
GLI - NRM (BoA and others)	34,950,000	14,950,000	Fully public government financing and community contributions. No external financing	20,000,000	Bi-lateral/multi-lateral funding agencies

OFLP - Forest management investment in deforestation hotspots (Afforestation/ Reforestation)	15,862,215	15,862,215	RETF grant (USDOS Child (47.5% and MoCE Child 52.5%)		Grant closed in June 2023
REDD+ Investment in Ethiopia (2016 - 2026) Phase II (Afforestation/ Reforestation)	3,400,000	3,400,000	Royal Norwegian Embassy		
5. Grassland converted to cropland					
Eastern and Southern Africa Food Systems Resilient Project	100,000,000	100,000,000	IDA and other DPs		
PSNP IV	500,000,000	500,000,000	World Bank United States Agency for International Development DFID European Commission Government of Canada Government of Ireland Netherlands Development Association Swedish International Development Agency		
OFLP –ERP Operational and Staff Cost					
Staff Cost	2,208,000	-	ERPA ER payment	2,052,000	
Operational Cost	782,000		ERPA ER Payment	782,000	
Subtotal Operational and Staff cost	2,990,000	-	ERPA ER Payment	2,990,000	
Contingency (5%)	149,500	-	ERPA ER Payment	149,500	
Total Operational and staff cost (for 5 years)	3,139,500	-	ERPA ER Payment	3,139,500	ER payment

Grand Total	1,120,416,951	1,087,277,451		33,139,500	

See the complete financing plan below in Annex 2. There are some differences between Table 4 and the financing plan for the ISFL ER Program presented in Annex 2. For example, Table 4 only shows the actions to be implemented at their direct cost, and Annex 2 lists all other costs and revenues.

3.1.5 Risk for displacement

The OFLP-ERP is operating at jurisdictional scale and overarching program that coordinates all land-use related interventions in the regional state. Therefore, the accounting area of the program is the entire region. Due to the jurisdictional scale of the intervention, the resulting displacement and leakage of emission from the program is estimated to be negligible in practice. Within the jurisdiction there are several activities that are being implemented through different initiatives. These include Afforestation/Reforestation, forest conservation, sustainable forest management (PFM). Likewise, in the energy sector, the transition to renewable energy, energy efficient stoves, bio-fuels technologies have been proposed. In the agricultural transformation, agricultural extension, enhancing communities' engagement in transitional income generating activities (alternative livelihoods promotion and supports) and implementing CSA especially for small scale agricultural and livestock production (intensification of agriculture) are the main activities in the region.

Moreover, the enabling policy environment, the legal and institutional improvement, law enforcements, ensure effective inter-sectoral coordination, creating synergy with other projects and programs. Stakeholders' engagement in planning, implementation and monitoring creates broader partnership with private sectors and civil society and communities at landscape level. Regular consultation with stakeholders and communities enhances active participation in the implementation of the program activities.

In addition, to prevent cross-regional leakage, many of the initiatives are investing in regions bordering Oromia, such as Glabella, Beneshangul and Southwest Ethiopia, which together form the southwestern forest block. Given that there could be reduced risk of displacement, a brief risk analysis and practicality for estimation of leakage of emissions is presented as follows:

Forced drivers of deforestation: In the case of forced drivers of deforestation, such as the conversion of forestland to small scale agriculture could be displaced to areas "close" to the

boundary of the OFLP-ERP. It is expected that a mobility analysis would benefit as the land selection criteria are usually not based on opportunity cost but accessibility. Monitoring leakage for the OFLP-ERP could be difficult in Woredas bordering with the Southwestern Ethiopia, Gambella and Beneshangul Gumuz as these would require conducting analysis out of Oromia (with definition of baseline). Furthermore, considering that other initiatives have similar operations in the remaining moist forests of the Southwest bordering OFLP-ERP, there wouldn't be similar forests where to displace, so it is expected that leakage would be negligible.

Unconstrained drivers: Regarding unconstrained drivers, for example, wood extraction for commercial purposes (mainly fuel wood and charcoal production), they could be displaced elsewhere which makes it difficult to monitor and estimate leakage of emissions. However, as the project is implemented jurisdictionally, unconstrained drivers are not expected to be predominant and hence the possible emission sources are negligible.

Possibilities of displacement: Possibility of displacement emissions from other AFOLU sectors (agriculture and livestock) to other regions is expected to be negligible too due to the same factors described above and social limitations. Overall, monitoring of leakage beyond OFLP-ERP's program area (beyond regional borders) would be unrealistic given the existing socio-political limitations mentioned above and its impracticality mainly because occurrence of displacement is expected to be negligible.

At the subcategory level, different drivers have been proposed during the period and corresponding mitigation and enhance measures have been proposed. In the mitigation plan, the following interventions and action are planned as indicated in Table *4*above.

3.4. Description of the Feedback and Grievance Redress Mechanism (FGRM)

Feedback and grievance redress mechanisms (FGRMs) is a mechanism to claim OFLP-ERP based conflicts grievance, queries suggestions and comments raised from project affected communities, institutions, and other relevant stakeholders. As part of risk mitigation measures, the OFLP-ERP would support citizen's complaints or grievances in a formalized, transparent, cost effective, and time bound manner. All program-affected people have been informed about how to register grievances or complaints, including specific concerns on any REDD+ initiatives and OFLP- ERP activities during ERPA period. FGRM is the part of OFLP-ERP Environmental and social risk

management (ESRM) supporting the feedback and grievance redress across the Oromia regional state. The detail procedure of the FGRM developed based on the principles outlined in the OFLP-ERP Environmental and social management framework (ESMF), labor management Procedure (LMP) and stakeholder's engagement plan (SEP).

Following the FGRM, the grievances raised from the community will be actively managed and tracked to ensure appropriate resolution and actions are taken. OFLP-ERP grievance and feedback procedure does not replace existing legal processes. If the grievance procedure fails to provide a result, complainants can still seek legal courts. OFLP-ERP Feedback and grievance redress mechanisms generally compliment with customary court system in which the grievances from the stakeholders follows these steps: (1) receive and register a complaint; (2) screen and validate the complaint; (3) develop a proposed response; (4) communicate the proposed response to the complainant and seek agreement on the response; (5) implement the response to resolve the grievance; (6) close out or refer the grievance; and (7) disclose the feedbacks to the public.

Based on the experience from the OFLP grant period the grievance registration and resolutions process on issues raised from different stakeholders and communities were managed effectively. Currently the Oromia regional state has made structural arrangements that dissolve the community selected kebele administrative and substitute with political appointed leaders. Due to this reason the grant period GRC structures modified to the current customary court represented by the local community to handle the community's social issues which enacted by the proclamation, No. 240/2021. According to this proclamation the members of the customary court selected from the community members at each kebele with a composition of women, youth and elders that are impartial from political and other government issues.

The Customary court system aligned with Oromo Gadaa System in which the Luba (elders) are responsible for redressing grievances within the community or among groups and individuals, and they shall apply the traditional laws dealing with the distribution of resources, criminal fines and punishment, protection of property, theft, etc. The social court is composed of five members representing the OFLP grant GRC. Project-affected communities and individuals may submit their complaint to the social court which determines whether harm occurred or could occur as a result of the program/project interventions. Complaints may be submitted at any time directly to the social court and any member of the social court will receive, register and submit to the court members. The resolution process begins from the village level receive/registration then screen

which called Jinfessu' and extends to the highest level known as the "uplate Court at district level or Ol-dabarfata". If cases are still unresolved, Gadaa has its own court where cases are forwarded, if the issue is still not resolved it will pass to the state court.

At regional level the program Grievance Redress service for individuals and a member of the project contract workers who believe that they are adversely affected by a Bank-supported project may submit complaints to existing project-level FGRMs. The ESRM team ensures that the complaints received are promptly reviewed and addressed at each level on project-related concerns.

3.5. Assessment of land and resource tenure in the Program Area

3.5.2. **Implications of Land and Resource Tenure Assessment for Program Design**

Land resource tenure security has propounding implications for investment, access to benefits and sustainability. During REDD+ implementation, the OFLP has made various preparatory studies, including land and tenure assessments. To address concerns related to weak land and forest tenure security, OFLP has made complement to the GoE's effort on rural land certification by coordinating with related projects to finance relevant activities outside the scope of the OFLP and including both individual land and communal forest land certification. Consequently, in the implementation of REDD+ in the forestry sector by OFLP many improvements have been made in the legal framework of forestry sector tenure rights including carbon rights. During REDD+ implementation, OFLP adopted PFM as one of the forest management investments in prioritized deforestation hotspot woredas in Oromia. PFM has been supported in the Oromia regional proclamation to protect forest managers right to manage develop and sustainably use benefits derived from such actions. The PFM has addressed the perceived lack of tenure security by transferring or promoting joint forest management rights to communities by using defined contracts. PFM is used to describe systems in which communities and government institutions providing technical services in the forest sector work together by defining the rights of forest resource use, identifying and developing forest management responsibilities, and agreeing on how forest benefits will be shared. The PFM approach rests on the premise that people will conserve forest resources if they have secure user rights to the forests, if they gain more benefits by retaining forest resources and if these benefits are directly linked to the existence of the forest. The Program will support efforts to develop legal ground of PFM through adoption of PFM regulation at the

regional state level. Besides, OFLP-ERP continues coordinating with other initiatives in the region including those investing in PFM, green legacy, watershed management and others.

Through implementation of PFM in forested areas and provision of land-use planning support across Oromia, the Project will continue promoting and strengthening the efforts in the REDD+ implementation period to improve forest and land tenure security for individuals, community groups and private forest and livestock investors.

On the other hand, land and resource tenure in the Oromia region of Ethiopia is essential to the sustainability of the livestock sector, which significantly contributes to the local economy and social well-being. Livestock herders depend on both communal and private grazing lands, with traditional practices guiding the usage and sharing of these resources among community members. However, the increasing pressures from agricultural expansion and population growth have escalated competition for these vital resources. Many pastoral communities maintain customary rights to land and water, recognized by local authorities based on historical usage. Despite this, the formal legal framework often overlooks these customary practices, resulting in conflicts over land and resource access.

The Ethiopian government has introduced policies aimed at enhancing livestock productivity and improving resource management. These initiatives may include the demarcation of grazing areas and the provision of modern veterinary services. While such measures can boost productivity, they can also disrupt traditional grazing patterns and undermine community-based resource management systems.

The issue of land tenure security for pastoralists is increasingly pressing. Many herders face uncertainty regarding their rights to graze lands, particularly as government land leases for agricultural development become more common. This insecurity can deter investment in livestock, leading to overgrazing and land degradation. Ensuring secure land and resource tenure is vital for enhancing productivity and economic stability among pastoral communities in Oromia. By recognizing and integrating traditional practices with modern policies, it is possible to create a more sustainable future for livestock herders, fostering both economic growth and cultural preservation.

3.6. Benefit Sharing Arrangements

3.6.1 Summary of benefit sharing arrangements

In the second ERPA phase, the Benefit Sharing Plan for Disbursing Result Based Payments from the proceeds of the ER Program has identified the following criteria to define eligible beneficiaries, through consultative process:

i. Direct contribution to generate GHG emission reductions from avoided deforestation and forest degradation, Afforestation/Reforestation, reduced enteric fermentation, and adoption of other sustainable land use practices.
ii. Willingness to use ERPA benefits to maintain interventions and contribute to the successful ER Program implementation.
iii. Historical contribution to forest conservation or the promotion of other sustainable land uses.
iv. Current engagement in projects and activities that undertake concrete actions to reduce GHG emissions from deforestation, forest degradation, enteric fermentation, and other unsustainable land uses.

Accordingly, the eligible beneficiaries identified are i) government entities responsible in managing the forestry and livestock development; ii) communities/community organizations whose livelihoods depend on forestry and livestock development and adopt practices that contribute to emission reduction; and iii) private sector entities investing in sustainable forestry and livestock development. See Annex 4. Current version of comprehensive Benefit Sharing Plan, for more details on second ERPA phase beneficiaries attached as draft comprehensive benefit sharing plan.

Private forest developers encompass those licensed as individual investors, private corporations, as well as business associations and cooperatives (e.g. SMEs) who have developed forests on their own land or land received for this purpose in the form of lease or other arrangements within the landscape of Oromia. The Federal Forest Proclamation (Proc#1065/2018) defines Private Forest as “forest other than state and community and developed on private or institutions’ holdings. The benefit allocated for private sector is meant to support the establishment of new forest and forest management operations in established forests that enhance delivery of emission removal. The private sector entities from the livestock sector that are eligible to receive benefits include smallholder primary dairy cooperatives, range land management cooperatives, smallholder

feedlots/fattening cooperatives and those contributing to ER generation under OFLP through the implementation of best practices in the livestock sector.

However, to access the benefits, the eligible beneficiaries from regional government entities and private sector should apply call for proposals launched by OEPA. To receive benefits, the beneficiaries should demonstrate that they have successfully participated in ER generation through specific forest and livestock sector activities and contributed to the positive ER performance of the Oromia region, compared with an established baseline. For the private sector both in forest and livestock to benefit from the ER payment, requirements such as allocation of a matching fund, proper application of the OFLP's safeguards instruments, size of job created, livelihood improvement opportunities, women and youth benefitted from the employment opportunity, and adoption of Corporate Social Responsibility (CSR) could be criteria for selection of proposals. Moreover, forest developed by a private sector should fulfil the definition of 'forest' adopted nationally and by OFLP. All other tree planting practices that don't fulfil the definition of forest will not be rewarded. Eligible federal-level government entities and communities do not have to participate in call for proposals; they will receive direct allocation of benefits.

In the BSP context, communities refer to those who live within the boundaries of Kebele (government's smaller local administration unit) and engage in development and management of forests and livestock. Communities have cultural and social responsibility of managing, protecting, and developing the forest, thus can contribute to ER generation through their participation in forestry plantations (A/R), PFM, forest conservation projects, forest coffee within agricultural landscapes, as well as through the adoption of energy efficiency technologies to reduce unsustainable fuel wood use.

Communities are eligible because of:

- their customary and constitutional rights of benefiting from forest, and
- their role in managing and developing forests and livestock.

Forest Management Cooperatives (FMCs) are organized based on their interest and historical relationship with the forest; in Oromia, their boundaries coincide with the kebele's legal boundaries. Community(s) not organized as "PFM/FMC", their boundaries also be that of kebele boundaries. The difference between communities organized as FMCs and communities not organized as FMC/PFM is, the former are legal members of both the FMC and Kebele, while the latter are only legal members of Kebele. For benefits coming as ER proceeds, both are eligible.

However, the National Forest law referred to above legally recognizes communities' rights from the forest they developed and forest under their stewardship. It has legislated; forest developed by community belongs to them including the ER. In addition, it legislates among others: right to share. Benefits from the natural forest including those owned by the government (through PFM arrangement) have a right to be given forest concessions (originally belonging to government) also benefiting out of it.

Livestock management cooperatives are organized based on interest in livestock production systems including small, medium and large dairy production cooperatives, feedlot cooperatives (beef production) and feed, fodder production cooperatives and range land management cooperatives. The boundaries of the livestock communities may not necessarily coincide with the boundaries of the kebele. There may exist several of them within a kebele or their boundary may transcend beyond a kebele boundary depending on their interest. The mixed farming system is the largest livestock resource keeper in the region, which contributes most (91.46% of the GHG emissions during the 1994-2018 according to the Oromia GHG Inventory). The FMCs/PFMs coops as well as communities outside of FMCs under this mixed farming system also practice livestock production including for meat, milk and other animal products alongside forest management and crop production practices.

The government is also eligible due to i) its responsibility to enact policies both in the forest and livestock sector, ii) technical and administrative support, iii) ownership of natural forests as defined in the constitution and relevant laws, and iv) its role in facilitating bilateral agreements, mobilization of funds, responsibility for MRV, environment and social safeguards management and management of the ER payments.

Governments in the context of this BSP comprises the Ministry of Agriculture (livestock sector) and the Ethiopian Forest Development (EFD) at Federal level, and the Oromia Environmental Protection Authority (OEPA) at regional level and other sectoral bureaus in the land use sector of the region, all of which are coordinating OFLP activities at their respective governance hierarchy. Both the federal and regional government entities mentioned above are identified eligible to lead the creation of an enabling environment and provide technical back-ups specifically to the success of OFLP.

The benefit to be shared is the net payment defined as gross ER payment minus operational costs incurred in the management process of the BSP throughout the ERPA period plus 3% as

performance buffer that the recipient would set aside to manage potential risks. The operational cost to be covered by the ER payment includes specifically those expenses related to conducting MRV, ESRM, GRM, finance and audits. The 3% deduction set aside for 'Performance Buffer' will be used (i) to manage potential risks when there is under-performance or non-performance due to force majeure events at state/regional level while performance exist at zone(s) level and ensure performing zones continue participating and contribute to achieving OFLP committed targets under the ERPA; (ii) to manage risks that may occur due to natural factors (drought, fire, land slide, etc.) or other risks related to political instability and the like. The resources in the Performance Buffer will be distributed according to criteria to be established by ORCU and approved by the OFLP Steering Committee. The criteria should be publicly available, in line with the transparency principle that governs this cBSP. The net payment will then be disbursed among the eligible beneficiaries as per the arrangement set in cBSP.

A high-level consultation meeting conducted in December 2021 decided to apportion the ERPA benefits generated from OFLP second ERPA phase in a 70:30 proportion (in %) to the forestry and the livestock sector respectively. This decision considered equity, effectiveness, and efficiency aspects that may affect the OFLP capacity to deliver ERPA commitments. In summary, the decision reflects the sector's relative contribution as sources of GHG emissions in the Oromia region and prioritizes equity considerations by ensuring higher financial support is provided to the sector in most need of investments to generate ERs.

The vertical share of the net ER benefits proposed to be distributed to the community, the federal government, the regional state, and the private forest & livestock developers following consultations conducted at different levels is 75%, 5%, 15% and 5% of the net payment, respectively. The vertical sharing refers to the distribution of net benefits among government entities, private sector, and communities. Totally, the share of the government (national plus regional) from the net benefit is 20%, with the higher share (15%) proposed for the regional state. The higher share for the regional government is based on the constitutional right which grants responsibility of administering natural resources to regional states (Article 52 (2d) of the Constitution). The 20% share of the benefit should be used to promote activities that will generate additional emission reduction and to coordinate activities and policies among sectors.

The regional government entities will use their allocated share of benefit received from the 15% net ER proceeds to undertake the roles and responsibilities given as per their institutional mandate

taking the 70:30 proportion assigned for forestry and livestock related interventions into account. OEPA, in discussion with BoA, will launch a call for proposals to be communicated by OEPA/ORCU to regional sector offices. Successful proposals will be approved by the steering committee. Emission reduction potential and number of employment opportunities created will be among the criteria to evaluate eligible proposals. Implementation of eligible projects from this proceeding will eventually benefit communities, youth and government employees in the form of capacity building.

The federal government entities (EFD and livestock sector in MoA) will use its allocated share of benefit received from the 5% net ER proceeds to undertake the roles and responsibilities given in the institutional mandate. MoA and EFD will prepare annual work plans, which will be approved by their respective higher-level management in coordination with the OFLP Steering Committee.

The grassroots stakeholder consultations also defined the proportion of benefits to be distributed to each category of beneficiaries in both sectors, as presented in

Table 5.

Table 5 Vertical sharing of benefits applicable to the forestry and livestock sectors

Category of beneficiary	Forestry sector (% out of its 70% allocation)	Livestock sector (% out of its 30% allocation)
Federal government entities	5	5
Regional and local government entities	15	15
Private sector	5	5
Communities	75	75

Horizontally, the 75% community share will be disbursed among the forestry and livestock communities across Oromia. The horizontal benefit share involves a three-step process: first, the share among administrative zones; second, the share among woredas in each zone and third, the share among kebeles in each woreda. This approach was chosen due to its suitability for land use sector governance and service provision to the forest and livestock communities.

The grassroots consultations confirmed that they use the different criteria and indicators to assess

the zones' efforts in the forestry sector to contribute to achieving OFLP ER goals. The criteria agreed to be used for sharing benefits among zones during consultations were avoided deforestation, existing forest area and forest development. Avoided deforestation in this context refers to forest area standing that would otherwise have been lost under the reference scenario, while existing forest area refers to the forest coverage that exists in the zone at the time of performance evaluation excluding the newly developed or rehabilitated forest to avoid double counting with forest development. Forest development refers to hectares of forest gain due to A/R, and areas of natural regeneration. The weights given to the criteria are 40% for avoiding deforestation, 40% for existing forests and 20% for the newly developed forest area.

For the livestock sector, the BSP will follow an approach of distributing ERPA benefits among livestock (cattle) cooperatives based on (i) performance in key determinants of GHG emission intensity, and (ii) establishment of silvo-pastoral systems. These are the two indicators used as proxies to measure GHG emission intensity in each productive system. The performance of the different livestock production systems in terms of GHG emission reduction from enteric fermentation depends on herd population, management systems, and animals' performance. Other indicators such as feed digestibility and number of crossbred cows were explored but were finally not considered due to high monitoring cost, difficulties for measurement, or were deemed biased against traditional cattle management systems.

Within each productive system, communities engaged in livestock production are organized into cooperatives. Stakeholders not organized into livestock cooperatives are not eligible to receive ERPA benefits under this BSP. This eligibility criteria reflects that, unlike forestry, livestock is not a common pool resource, but often individual holding. It is also consistent with the livestock sector stakeholders' willingness to be organized into cooperatives to be able to use the ERPA benefits for common ER generating projects and social development and livelihood improvements, as expressed during grassroot consultations.

The type of benefits to be distributed from the sale of ER payment to the beneficiaries will be in the form of monetary or non-monetary (in kind) benefits. Monetary benefits refer to the delivery of cash to beneficiaries, financed through the ERPA revenues from the World Bank. Non-monetary benefits refer to the benefits received by the beneficiaries by way of goods, services or other benefits funded by the payments to be received from the World Bank.

During stakeholder consultations, communities expressed interest in receiving monetary benefits

to be invested in social development and activities that could generate more ERs (e.g., maintenance of school, clinics, water points, tree planting, improvement in coffee production, energy efficient cookstoves, etc.) to be done using community action plans, facilitated by woreda-level government entities. The beneficiary communities are those residing in and around the forests, including youth, women and vulnerable groups. Of the total ER payment that would be received at community level (kebele or FMC level), 45% would be invested on social development and livelihood improvement activities, while 50% will be invested in land-use and related activities that generate more ERs (see Table 6 below). The remaining 5% of the share received is dedicated to supporting undeserved communities, women, and youth, in the form of revolving fund facilitated by Oromia Women and Children Affairs Office. The criteria, parameters, and weights to select beneficiaries from underserved communities, women, and youth will be included in the operations manual.

Table 6 Activities used to generate ERs and social development/livelihood improvement

No	Potential activities among others proposed to generate ERs	Potential activities for social development/livelihood improvement
1	Seedling production for income	Maintenance of school
2	Coffee outside forest	Maintenance of clinic
3	Tree and fruit tree planting for income and own consumption	Maintenance of road
4	Fuel saving stove	Bee keeping
5	Breed and feed improvement	Fattening (small holder commercial intensive and commercial intensive through cutting and carry system)

The benefit disbursement option under consideration is the use of government structure for fiscal budget disbursement. The rational for using this channel (MoF-BOF) is because: (i) it is an established fund channeling system already in place used for government fiscal disbursement, (ii) no additional cost is required for fund channeling, and (iii) as proven and well-established system, would ensure speedy ER fund disbursement to beneficiaries at lower level. Accordingly, the Ministry of Finance (MoF) receives the RBP in an independent account. The MoF keeps the 3% performance buffer deducted from the gross proceeds received from each report for risk mitigation

purposes. Then, (i) it deducts the operational cost including an amount to cover the operational costs associated with remuneration for financial management specialist at MoF and 3% performance buffer from the gross to determine the net benefit; from the net benefits, (ii) it transfers the 5% share allocated to the EFD and MoA applying the 70:30 apportionment for the forestry and livestock sectors respectively; and (iii) it transfers the remaining resources (95%) from the net benefit including the operational cost as determined above to the Oromia Bureau of Finance upon OEPA request, developed in collaboration with BoA, and previously approved by OFLP Steering Committee.

Oromia BoF will distribute 15% of the total net ERPA results-based payment directly allocated to sectors administering the selected proposals; until the selection is completed, the funding will be kept at BoF. The Oromia BoF is officially communicated on the amounts of shares to each entity in the region (by ORCU/OEPA. OEPA, in collaboration with BoA, will develop the call for proposals, which will be included in the operations manual. The proposals will be evaluated by OFLP Technical Committee and approved by OFLP Steering Committee. BoF disburses operational cost to OEPA's account.

BoF will distribute 75% of the net ERPA results-based payments allocated to communities, directly to the Woreda Finance Office (WoF) to be invested in selected social and livelihoods and development projects at well performing kebeles. BoF will channel the resources to FMCs and livestock (cattle) sector cooperatives to their respective accounts with good financial management capacity (subjected to the financial management capacity assessment required by the World Bank). BoF will distribute the funds allocated to FMCs and livestock (cattle) cooperatives without adequate management capacity and the shares of kebeles without FMCs to the respective Woredas' Office of Finance. The Woreda-level Cooperative Office will support funds utilization at kebele, FMCs, and dairy livestock (cattle) sector cooperatives without adequate financial management capacity. WoF and woreda office of cooperative (WoC) will provide technical support to improve the kebeles and cooperatives' financial management capacity. The operations manual will indicate the specific processes and procedures applicable to the flow of funds presented in Figure 2 below.

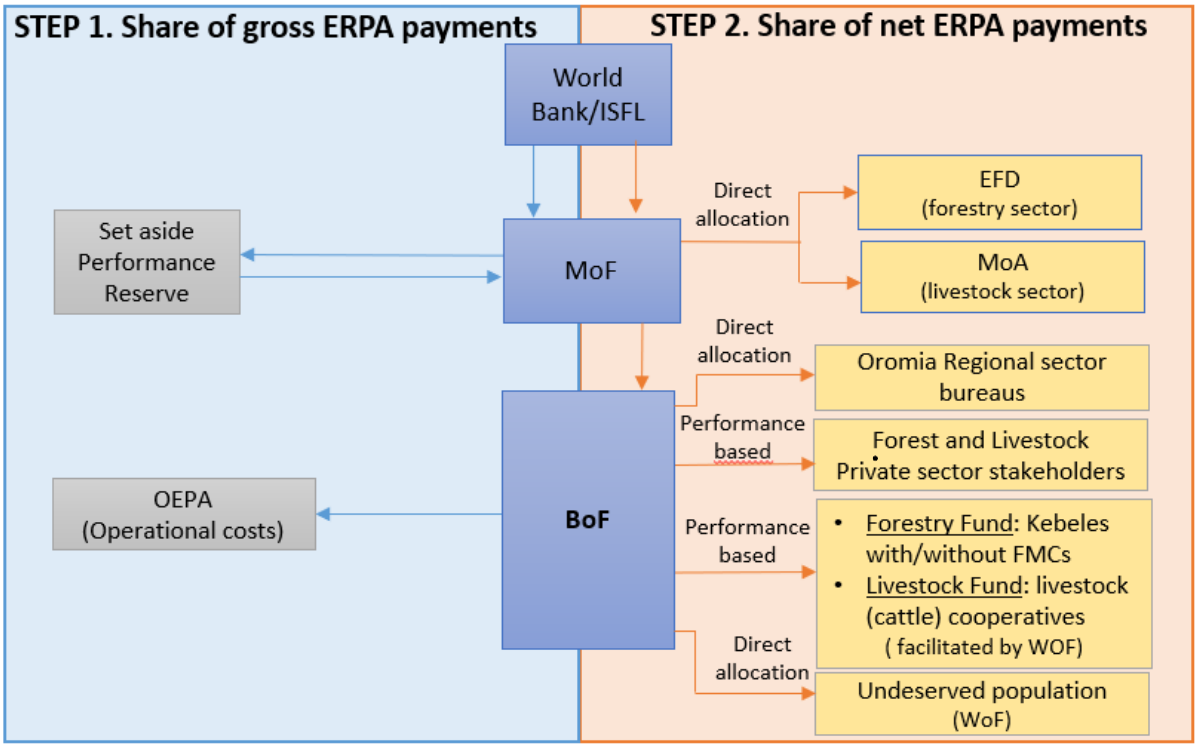


Figure 2 Disbursement mechanism and governance of the cBSP

3.6.2 Summary of the Design Process for Benefit Sharing Arrangements

The comprehensive BSP (cBSP) elaborates an equitable benefit sharing mechanism that is intended to effectively distribute carbon and non-carbon benefits generated by the Oromia Forested Landscape Program (OFLP) under the Emission Reductions Purchase Agreement (ERPA) phase two. The cBSP builds on the benefit sharing arrangements guidance described in the Emission Reduction Program Document (ERPD) and the BSP established for ERPA first phase1, which focuses on deforestation and Afforestation/Reforestation (A/R). The cBSP aims to distribute benefits among OFLP stakeholders involved in ER generation from avoided deforestation and forest degradation, afforestation and reforestation, and enteric fermentation from cattle in the second phase.

The approach of the cBSP is to reward OFLP stakeholders across the Oromia landscape for their effective participation in ER generation. OFLP will measure, monitor, and report ERs at landscape level, applying ISFL carbon accounting methodologies in the forestry and livestock sectors. Up on verification of the emission reductions by the third party, Ethiopia will receive the ERPA results-

based payments which will not be attributable to specific stakeholders; therefore, this cBSP include the agreements reached among relevant stakeholders (federal, regional and local level) who participated in generation of emissions from the landscape to distribute the ER benefits in an equitable, transparent, and cost-effective manner.

The design of the cBSP employed multiple data collection approaches such as in-depth literature review, roundtable discussion with high-level decision makers, key informant interviews with knowledgeable individuals, participatory stakeholder consultations with representatives from different administrative levels and with grassroots communities.

In-depth literature review was conducted to define benefit sharing elements, characterize relevant stakeholders, and investigate quantitative and qualitative information on forestry and livestock sector's contribution to GHG emission reductions and the significance of participation in benefit sharing. Information and data obtained from literature review was also used to inform the technical note for high-level decision on apportionment of benefits between the forestry and livestock sectors, the framework design document, the design of data collection tools, as well as setting criteria and stakeholder analysis. Through literature review, national and international best practice and lessons on benefit sharing from ER initiatives, including other ISFL programs were successfully collated and synthesized. The review also assessed related policies of Ethiopia and Oromia in the forestry and agriculture sectors, and various REDD+ readiness preparatory studies reports. These include federal and Oromia Regional State Forest proclamations, national REDD+ Readiness Proposal (R-PP) , study of drivers of deforestation and forest degradation in Oromia and the strategies to address those, the draft National REDD+ strategy, assessment of legal and policy framework governing forest tenure in Oromia and other related documents, Ethiopian livestock master plan (ELMP), 2015; The Live Animals Marketing Proclamation (No. 8198/2014); Proclamation No. 728/2011 on Veterinary Drug and Feed Administration and Control, updated NDC 2021, CRGE Strategy, the Ten-Year development plan, etc.

Stakeholders' consultation: three categories of stakeholders were consulted: i) Governments – both federal and regional; ii) CSOs and experts of NRM represented by various organizations including academia and research, and iii) the broader rural community in Oromia.

Consultation with high-level decision makers pooled from organizations coordinating forestry and livestock related activities at Oromia regional state level, representative of Oromia regional president office, Oromia region finance bureau, and representative of Oromia regional council

(lawmakers) was conducted in December 2021 to discuss and decide on a broad option to apportion potential revenues from ERPA between the forestry and livestock sectors. This was followed by two rounds of stakeholder consultations conducted on March 25 and April 15/2022 with key stakeholders drawn from federal and regional state level government institutions, NGOs, donors and other development partners. During these forums, the stakeholders thoroughly discussed and provided their feedback on Stakeholder and Engagement Analysis Methodology, and Assessment Criteria to filter Beneficiaries from the broad group of OFLP stakeholders. The third phase of participatory stakeholder consultation was conducted with selected CBOs and representatives of communities at grassroots level and interest groups representing different age, gender, occupational sub-categories and socially underserved community members and had full opportunity to give their opinions and give their suggestions, a base for final decision on issues such as vertical and horizontal benefit distribution, criteria for determine benefit, etc. (see summary of community consultation on BSP in the Annex 4. Current version of comprehensive Benefit Sharing Plan for more details).

3.6.3 Description of the Legal Context of the Benefit Sharing Arrangements

The ERPA benefits should be shared among eligible beneficiaries, which should have legal rights over carbon or ERs. Having clear land and resource tenure is a critical factor to ensure an effective implementation of climate change mitigation actions in the forestry and livestock sectors. In Ethiopia, the Forest Development, Conservation and Utilization Proclamation (No. 1065/2018) defines forest carbon as a non-timber forest product and establishes that forest owner has the right to sell forest products, benefit from carbon sales and transfer of carbon possession rights.

The Oromia Forest Proclamation (2003) recognizes three different types of forest ownership: private, community and State forests. The 2018 FDRE Forest Proclamation, which shall be applicable nationwide, also recognizes four types of forest ownership: Private Forest, community Forest, Association Forest, and State Forest. Both the federal and regional forest proclamations allow community organizations to get community rights over State forests on communal lands. Community organizations have the right to use the forest sustainably and to protect it from encroachment. Besides such legal provisions, rangelands are traditionally owned by community members in pastoralist areas and administered by customary institutions like Gada system (for details on this see Annex 4. Current version of comprehensive Benefit Sharing Plan.

The tenure rights regime is evolving to promote climate change mitigation by facilitating stakeholders engaging in ER generating activities. For example, in recent years, there is increasing trend of issuing individual and communal certificates of managed forests. Coffee forests managed by individuals are also receiving use right certificates with obligations of sustainable forest management practices. Likewise, communally owned/managed lands can receive group certification, giving due recognition to customary rights. The law provides for the provision of certificates to communities and organizations as well as individuals.

Ethiopia has approved a regulation to further clarify ER ownership in the forestry sector, including on ER revenues utilization. A directive on carbon trading which gives details on ER title transfer is under development by EFD, expected to be approved by the minister of minister of agriculture. Some relevant legal provisions in the forestry and livestock sector provide definitions and procedures relevant for determining the eligibility of beneficiaries. These include:

- Forestry sector: the forest proclamation (No. 1065/2018) defines Private Forest as "forest other than state and community and developed on private or institutions' holdings". The same proclamation defines Community Forest as "a forest developed, conserved, utilized and administered by the community on its private or communal possession based on by laws and plans developed by the community". Participatory forest management (PFM) is also defined in the proclamation as "a forest management approach executed through the agreement between the state and the local community that inhabit inside or around the forest area over the management, protection and utilization of forests owned by the state on the basis of predefined responsibilities and benefit sharing mechanisms." Forest Management Cooperative (FMC) is a legally recognized structure where communities are organized based on their interest and historical relationship with the forest. In Oromia, in most cases, FMC's boundaries coincide with the Kebele's legal boundaries. FMC and PFM operators could be organized by government agencies according to the "Cooperative Development and Promotion Law" and in most instances NGOs facilitate the processes of organizing forest communities into cooperatives. Communities organized as FMCs are legal members of both the FMC and Kebele, while communities not organized as FMC/PFM are only members of Kebele.
- Livestock sector: the Live Animals Marketing Proclamation (No. 8198/2014) defines live animals market structure, including live animals' health control and transportation of live animals; rights and obligations of market actors, including breeders, feedlot operators,

exporters, transporters, abattoir operators. Likewise, Proclamation No. 728/2011 on Veterinary Drug and Feed Administration and Control provides definitions and procedures to regulate proper production, distribution, and use of veterinary drugs to ensure safety, efficacy, and quality of the products and to enhance the productivity and health of the livestock population. It also regulates feed administration and control to increase the development of the feed industry and animal production, as well as prevent animal diseases emanating from poor quality and safety of animal feeds to improve the overall productivity and health of livestock population.

3.7 ISFL ER Program Transactions

3.7.1 Ability to Transfer Title to ERs

In Ethiopia, land belongs to the state and people of Ethiopia. The Government/the state oversees administering land on behalf of the people. Within the program areas, the Oromia National Regional State automatically has the right over the natural forest and the forest developed by the state, and it also has the carbon right on natural forest and state plantations. For private forests owned by privates and associations, the carbon right is vested on the respective developers. Based on article 5(1e) and 9(1a) of the Forest Development, Protection and Utilization Proclamation No 1065/2018, Private and Association Forest developers have the right to transfer forest carbon ownership right to a third-party. But the law does not specify how individual forest developers, or the state would enter into such an agreement to do the transfer.

Under the auspices of the above proclamation and with the intention to facilitate the practical application of the proclamation, the council of ministers of the FDRE issued a regulation that elaborate enforcement of the proclamation; through the regulation titled "*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 or delegate the ownership titles to third parties through transaction/sell or other means.

The delegation entitlements to relevant governments' institutions or entity will be governed in accordance with existing appropriate law, relevant civil codes and procedures.

In tandem with the Forest Proclamation and Forest Regulation discussed above, the EFD is preparing a Forest Carbon Credit Trading Directive as a guiding instrument to help implement the above legislation, among others, to provide more clarity to carbon asset (ER) transfer to a third party backed by appropriate legal framework(s).

There are three options available: option 1- legal frameworks, option 2- enter into sub-agreements with right owners to represent them collectively, and option 3- use of a BSP backed by relevant legislation(s). The government prefers to go for option 1, which clarifies the ability to transfer title to ERs using the country's legal frameworks. Therefore, a legal interpretation opinion of such provisions/frameworks would need to be issued before entering into any agreement or transaction. The government will need to provide a letter clarifying which entity has the right to transfer the ERs and why, as well as the documentation to be provided for each issuance of ERs to confirm the ability to transfer.

For ERs generated by sectors outside the scope of the national forest regulation, similar type of legislation is required to clarify ER ownership and title transfer to ERs. The entity leading for clarifying ER title transfer for the livestock sector will be the Ministry of Agriculture (MoA). The Payment for ecosystem services (PES) proclamation currently under preparation, offers perspectives in that regard. The Ministry of Planning (MoP) and Environmental Protection Authority (EPA) are leading the development of this proclamation to guide the implementation of PES within Ethiopia. The MoA in coordination with the MoP will ensure the draft proclamation addresses the ER title transfer issue for the second phase, which would then serve as a policy framework.

3.7.2 Participation under Other Greenhouse Gas (GHG) Initiatives

Two types of landscape management initiatives are distinguished: (a) REDD+ projects that seek to account for and sell ERs, which is the Bale Mountains Eco-regional REDD+ Project (BMERP); and (b) initiatives that contribute to REDD+ goals but are not seeking to account for and sell ERs, such as the Bank-financed SLMP, CALM I & II, RLLP I&II, LLRP I&II, LFSDP I and LFSDP II (pipeline); other non-bank financed projects such as EWNRA Southwest Ethiopia Project, the RIP I& II and others (see **Error! Reference source not found.** above). The Bale Eco-region ER p

rogram is merged into the OFLP during the entire OFLP ERPA period, while the Oromia REDD+ Coordination Unit (ORCU), within the OEPA, and the leadership of the Oromia Steering Committee further coordinates the interventions listed in the **Error! Reference source not found.** a bove across sectors toward the OFLP goals. All the emission reductions obtained in the Oromia Region due to these interventions will only be accounted under the OFLP ER program; there will not be double counting.

However, in Table 7 below, there are few small-scale ER projects 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 Clean Development Mechanism (CDM) to VERRA or GS registration. Wider cook stove use is expected to alleviate the main driver of forest degradation.

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.

Table 7 other projects listed/registered under the VERRA and Gold Standard

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 –	Energy Efficient Stoves	Oromia (Adaberga, Nono	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	Units Transferred from Approved GHG Program

	CER conversion-VERA 4657	Project	wonchi, yaya gulele, boset, Jeju, Digeluna Tijo,shashe mene, Tullo)				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.	VERA standard (has expired)
Other Projects listed/registered under Gold Standard								
4.	West Wellega Multipurpose Cookstove Distribution Project – GS ID-12134	Energy efficiency-domestic	Wellega, Gimbi, Guliso and Aira	No issuance, total ex-ante estímate is 194,285 tCO2e		2023 – 2028	West Wellega Multipurpose Cook Stove (MPCS) Distribution Project is a small-scale project activity initiated 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.	Listed -GS
5.	West Guji Improved Cook Stove Distribution Project -GS ID-11187	Energy Efficiency Domestic	Bule Hora, Oromia	No issuance, total ex-ante estimate is 173,368 tCO_2e	-	2022 — 2027	Oromia Coffee Farmers' Cooperative Union's West Guji improved cook stove 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.	Listed -GS

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 consumption.	Listed -GS
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-12499	Energy Efficiency Domestic	Bedelle - Metu, Oromia	No issuance, total ex-ante estimate is 287,530 tCO2e	-	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 of Oromia	Listed -GS
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 tCO2e	2020 – 2025 2019 - 2024 (for GS-7556)	Distribute fuel-efficient cookstoves in Oromia Region in Southern Ethiopia (COOPI -Italian NGO)	GS-Certified
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

3.7.3 Data management and registry systems to avoid multiple claims to ERs

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 of the national forest MRV to ensure consistency in the reported results for both the OFLP and the national level (see the institutional arrangement for national forest MRV in *Figure 3* below).

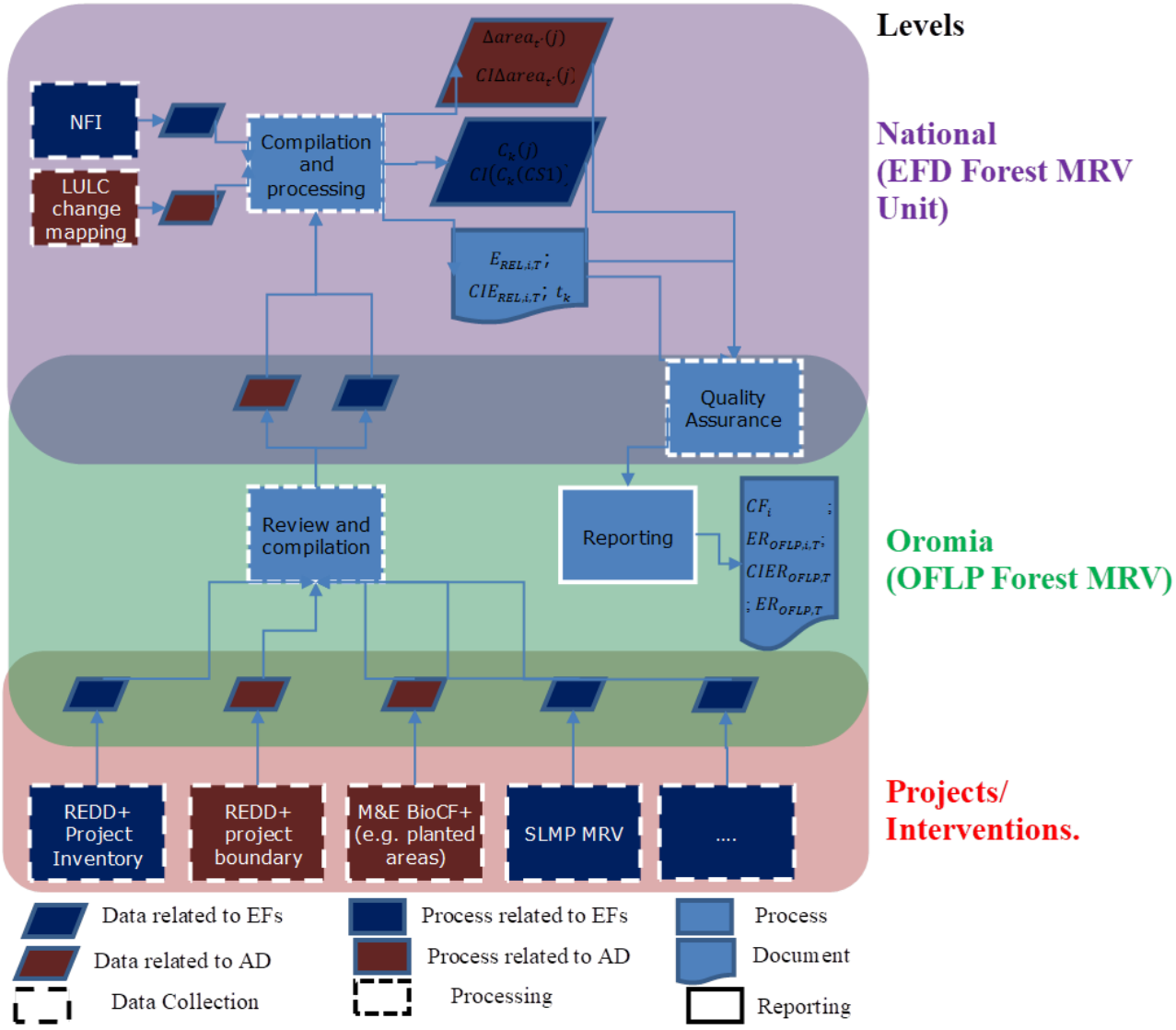


Figure 3 Programs and Project Data Management System

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.

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 becomes operational that could perform the same function. The government will assign the roles in CATS to structures; make transaction processors and the approver. In accordance with the ISFL ER Program Requirements, based on national needs and circumstances, the Transaction Registry might be complemented with the use of a (national) Program and Projects Data Management System that supports registering of and reporting on projects/programs. The initial plan as indicated in the ERPD was to have one national system under one institution at central level coordinating all key CRGE sectors including those outside of the AFOLU sectors. However this did not materialize 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 to the 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. But these tasks of establishing the national registry and the MRV system (for all CRGE sectors including livestock) are expected to be taken sometime.

Section 4: GHG Reporting and Accounting

4.4. Emissions Baseline for ISFL Accounting

4.4.1. Approach for estimating Emissions Baseline

The construction of the Emissions Baseline follows the ISFL requirements. The first step was the preparation of the GHG Inventory for the Agriculture, Forestry, and Other Land Use (AFOLU) sector, applying the methodology, categories, and subcategories from the 2006 IPCC Guidelines (described in detail in Annex 6 of the original ISFL PD for the first phase). Based on this inventory, eligible subcategories for accounting were identified following section 4.3.4 of the ISFL ER Program Requirements.

To estimate the baseline emissions for the second phase of the Emission Reductions Purchase Agreement (ERPA), the MRV team employed the Ensembled Sample-Based Area Estimation (eSBAE) method. A total of 5,003 sample plots were generated for analysis. Two separate institutions were created under the CEO platform one managing 999 sample plots and the other overseeing 4,004 plots specifically for activity data collection in support of the FAO experts.

Each sample plot was interpreted using a land use and land cover key developed specifically for Ethiopia. This interpretation aimed to assess the baseline period covering 2012 to 2021. The Activity Data (AD) interpretation process was carried out thoroughly before advancing to the analytical stage.

Post-interpretation, sample plot analysis was conducted with technical support from a consultant from the Food and Agriculture Organization (FAO). Following this, baseline emissions and

removals were calculated across four primary carbon pools: Above-Ground Biomass (AGB), Below-Ground Biomass (BGB), Soil Organic Carbon (SOC), and Dead Wood. These calculations were performed using Excel, with guidance from senior experts from the World Bank.

To ensure scientific rigor and consistency, Emission Factors (EFs) and Removal Factors (RFs) derived from the 2018 National Forest Inventory were utilized throughout the baseline estimation. The process adhered to established methodologies aligned with REDD+ reporting standards, ensuring transparency and accuracy in establishing emission baselines. Furthermore, to generate the emission and removal factors, the default carbon fraction from the IPCC 2006 Guidelines was applied across the different vegetation types. However, for the purpose of this ERPD, belowground biomass has been recalculated using aboveground biomass values, based on the default values provided in the IPCC 2006 Guidelines for different forest types.

In the ERPD for the first phase of the ERPA, it was found that not all the identified subcategories were meeting the quality requirements. For this second phase of the ISFL ERPA, the OFLP-ERP has implemented the improvement plan contained in the original ISFL PD for the first phase. Therefore, for this second phase, the following subcategories are now included in accounting scope and the Emissions Baseline described in this annex:

1. Forest to cropland
2. Forest to grassland
3. Forest to shrubland
4. Cropland to forest
5. Grassland to forest
6. Shrubland to forest
7. Forest remaining forest
8. Enteric fermentation - cattle

In line with section 4.2.6 of the ISFL ER Program Requirements, the Emission Baseline is constructed based on the average annual historical GHG Emissions and Removals over a historical period (Baseline Period) of approximately 10 years where the end date for the Baseline Period for each ISFL ERPA Phase is a recent date prior to two calendar years before the ISFL Fund

Management Team shares the complete advanced draft ER-PD with an independent third-party firm for Validation. Since it was originally anticipated that the advanced draft ER-PD would be finalized in 2025, the Baseline Period used for the construction of the Emission Baseline for the second phase of the ERPA is period January 2012 - December 2021.

The baseline emissions and removals from the first seven subcategories have been determined separately from the Emissions Baseline for the last subcategory (enteric fermentation – cattle). The following subsections explain the basic approach with the details of the approach being included in Annex 9.

Approach for estimating Emissions Baseline for LULUCF

The basis for the estimation of the baseline emissions and removals for the seven LULUCF categories is a remote sensing-based analysis of land use and land use change. In line with good practice guidelines of IPCC and GFOI, as well as the ISFL ER program requirements (4.6.2), this analysis has been performed by applying a stratified random sampling approach which involved the analysis of 5003 sample points across Oromia. Emission and Removal factors have been determined considering four carbon pools: aboveground and belowground biomass, deadwood and soil organic carbon. The data on the first three pools are calculated using the final report (MEFCC, 2018) of the National Forest Inventory (NFI) that was conducted between 2014 and 2016. For soil organic carbon, the values are obtained from the "Evaluation of the forest carbon content in soil and litter in Ethiopia" which was implemented by Natural Resources of Finland (LUKE) and Ethiopia Environment and Forestry Research Institute (EEFRI). The details of the calculations and the data used can be found in Annex 9 of this document.

The construction of the Emissions Baseline in the current ERPA phase also follows the ISFL requirements, as in the first phase. The first step is the preparation of the GHG Inventory for Agriculture, Forestry and Other Land Use (AFOLU) sector, applying the methodology, categories and subcategories from the 2006 IPCC Guidelines. The best available data was used to provide the historical emissions and reductions of greenhouse gases in the sector. For the case of Land Use, Land Use Change and Forestry (LULUCF), emissions and removals were estimated with activity data generated specifically for this study, and basically two other sources of information: National Forest Inventory (2016) and Woody Biomass Inventory and Strategic Planning Project (2004). ISFL requirements were applied to finally select the subcategories that are eligible for ISFL

accounting at this second ERPA phase, meeting the quality and baseline setting requirements for ISFL accounting: historic data available, at minimum tier 2 method level for estimation of emissions and removals, and approach tiers 2 or 3 levels for spatial information. Forestland remaining forestland and enteric fermentation in cattle are complying with quality requirements at this ERPA phase and are considered in the baseline. The activities considered at this second ERPA phase are "grassland converted to forestland", "cropland converted to forestland" (like afforestation activity) and "forestland converted to cropland", "forestland converted to grassland" (similar to deforestation activity), Forest remaining forest (similar to degradation) and enteric fermentation. The baseline period considered is 10 years, starting from 01.01.2012 and ending in 31.12.2021. Identification and assessment of uncertainty in the determination of the Emissions Baseline are presented in the GHG Inventory report as part of the emissions and reductions calculations. In the agriculture sector the uncertainty analysis is conducted with the use of the IPCC software which uses approach 1.

Approach for estimating Emissions Baseline for Livestock (enteric fermentation)

The baseline for cattle methane (CH_4) enteric fermentation emissions in the Oromia Region has been developed using the IPCC Tier 2 methodology, in alignment with the IFSL ER Program Requirements[3]. This baseline of cattle GHG emissions builds on the Oromia and national GHG inventories for cattle and other ruminants reviewed by national and international experts for compliance with the IPCC principles. It uses the same definitions, categories, and subcategories as the Tier 2 national and regional livestock GHG inventories. Values used for activity data and emission factors are specific to the Oromia Region, and where region-specific data were not available, the assumptions and values applied were the same as in the Tier 2 national inventory (Wassie and Wilkes, 2023[4]) and IPCC 2006 guidelines.

The IPCC Tier-2 approach requires a detailed characterization of cattle populations. This includes detailed information on population structure, animal performance, and feed/dietary characteristics for all applicable animal sub-categories. For instance, the Oromia regional cattle herd is divided into two categories: i) dairy and ii) other cattle (multipurpose cattle), from which 12 sub-categories of dairy cattle and 15 sub-categories of multipurpose cattle (Table 2). Cattle sub-categories,

[3] ISFL ER Program Requirements Booklet.pdf

[4] UNIQUE forestry and land use GmbH, Estimation of baseline emissions from cattle in the Oromia Region (2012-2021)

baseline cattle GHG emission intensity Oromia region) were identified based on breed type, production purpose, sex, age, and physiological status, among others. Animal sub-categories were defined based on IPCC (2006) guidelines on population characterization and the availability of IPCC default coefficients, and the sub-categories presented in annual livestock sample surveys reported by the Central Statistical Agency of Ethiopia (CSA, 2012-2021), currently named as ESS.

Animal management, animal performance, and diet data are used to estimate the gross energy intake (MJ/day) an animal needs for maintenance and metabolic functions such as growth, lactation, and pregnancy as Table 10.3 of the IPCC 2006 guidelines. The following parameters related to animal management, animal performance, and diet are required to estimate gross energy intake

- Average live weight (BW), kg/head
- Average mature weight (MW), kg (the weight at which skeletal development is complete)
- Average weight gain, kg per day
- Average milk production per day (kg/day)
- Fat and protein content (%): average fat and protein content of milk from lactating cows
- Average work performed per day (hours/day) for draft animals
- Percentage of females giving birth annually
- Types/proportions/sources of feed used for different age classes of animals (feed basket) and feed digestibility value (%DE)
- Feeding situation to select activity coefficients corresponding to animal movement
- Methane conversion factor (percentage of feed energy converted to methane)

The gross energy intake is then used to derive emission factors (EF) from 12 sub-categories of dairy cattle and 15 sub-categories of multipurpose cattle using IPCC (2006) Equation 10.21.

According to IFSL ER Program Requirements, the Emission Baseline for enteric fermentation can be based on historic average emissions or it can be based on an emission intensity approach. The Ministry of Agriculture has valuable experience from the Livestock and Fisheries Sector Development Project (LFSDP), which also emphasized the use of GHG emission intensity metrics. This approach prioritizes emission intensity over absolute emissions as one of the key result indicators for livestock GHG management is the reduction in emission intensity. Furthermore, in

accordance with 4.2.2 of the ISFL ER Program requirements, ISFL ER Programs can choose to use an emission intensity approach for estimating emission reductions if the eligible subcategories comply with the following criteria:

i. Criteria: the combined GHG emissions across eligible livestock related subcategories form a significant source of GHG emissions in the ISFL ER Program and are at least 5 percent of GHG inventory of all AFOLU categories as reported.

   Project compliance: The original ERPD presents the GHG inventory results, indicating that enteric fermentation accounts for 17.31% of AFOLU categories emissions (Table 11, page 57).

ii. Criteria: the combined population of the applicable livestock species shows a growing trend in the Program Area during the Baseline Period. The data used to establish this trend shall be a time series covering the whole Baseline Period. The trend showing the growth rate in livestock population should be established using linear regression. Non-linear regression may be used with justification when linear regression is not a best fit to smoothen variations and does not appropriately represent the livestock growth rate and its projected evolution.

   Project compliance: the cattle population in the program area showed a consistent upward trend during the baseline period, as illustrated in Figure 4. A time-series analysis covering the entire Baseline Period established this trend. The linear regression model applied to the data indicates a steady growth rate in the livestock population, with an equation of $y=466480X+2E^{+07}$ and a strong correlation coefficient ($R^2=0.9604$). This high R^2 value suggests a strong fit of the model to the data, reinforcing the observed increasing trend in cattle population over time.

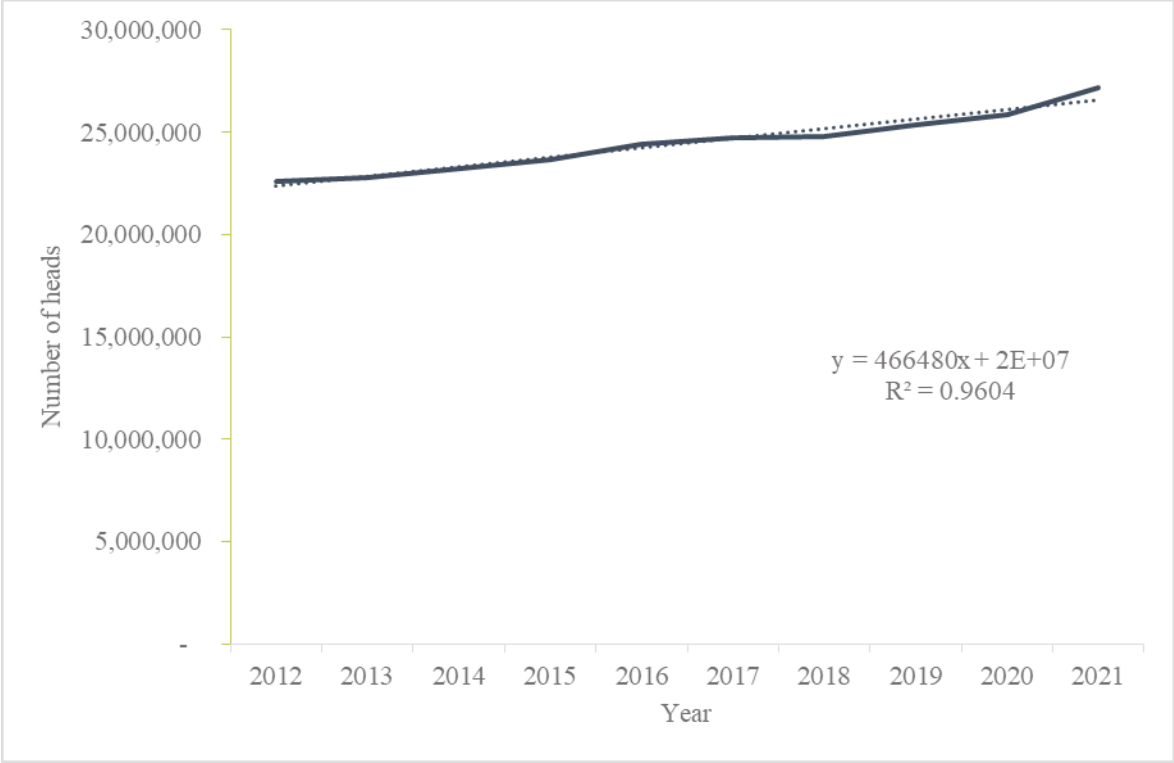


Figure 4 Livestock population in the project area simulated using a linear regression model.

iii. Criteria: ER programs shall implement interventions to reduce emissions from livestock sub-categories in their jurisdictions as part of program implementation

a. Data demonstrating the implementation of interventions to reduce livestock related emissions shall be presented at validation and verification. Evidence will include Government budget, implementation of sector policies, regulations, plans, programs, NAMA, NDC roadmap, and other public and private investment supporting program interventions.

b. Data and evidence on continuation of interventions to reduce emissions from livestock sub-categories beyond the program period shall be presented at validation and verification of programs in each ERPA phase.

Project compliance: The Livestock and Fisheries Sector Development Project (LFDSP-II). The project in Ethiopia has integrated a suite of climate-smart livestock interventions such as improved animal husbandry practices, breed enhancement, nutritional improvements, health services, and waste management (including composting and biogas) that collectively achieved an average 33% reduction in GHG emission intensity across three value chains, dairy, sheep & goats and poultry production systems https://projects.worldbank.org/en/projects-operations/project-detail/P159382.

The World Bank-supported Lowlands Livelihood Resilience Project (LLRP-I) promotes technologies that boost animal productivity, such as improved feed, growth rate enhancements, and reproductive performance, which help reduce enteric methane emissions per unit of meat or milk. The project integrates sustainable rangeland management, water development along cattle corridors, and invasive species control, contributing to healthier grazing systems and lower emission intensity (https://projects.worldbank.org/en/projects-operations/project-detail/P164336).

Oromia Dairy Farmers Bounty Project (ODFBP). The project directly supports interventions that reduce livestock-related emissions by promoting improved feeding practices, particularly through better-quality forage and balanced rations, which enhance productivity and lower emission intensity per unit of milk produced. It also addresses genetic improvement and animal health services, contributing to longer productive lifespans and reduced replacement rates, both of which help curb emissions. Moreover, the project aims to develop climate-resilient dairy systems, thereby integrating climate-smart livestock practices into smallholder systems. These measures demonstrate concrete actions being taken to reduce GHG emissions from the dairy sector in Oromia (https://www.solidaridadnetwork.org/annual_report/global-annual-report-2022/east-and-central-africa-2022/).

Ethiopia's strategy for climate change action is the Climate Resilient Green Economy (CRGE) strategy. The CRGE Strategy was first issued in 2011 and has been updated in 2021. The CRGE Strategy forms the basis for Ethiopia's NDC. The CRGE Strategy identifies priority sectors and priority interventions in those sectors. The livestock sector is included as one of Ethiopia's six priority sectors for greenhouse gas mitigation in Ethiopia's Updated NDC (2021). Within the livestock sector, four main intervention areas were identified in the CRGE (Improve cattle value chain efficiency, increase share of poultry and other low emitting animal, promote mechanization, improve rangeland management). The CRGE Strategy has been mainstreamed into the national development plan, the Growth and Transformation Plan (2016-2020, [GTP II]) and has also been integrated with the ten-year Perspective Development Plan (10YDP). Policy interventions are expected to result in 1.8 million t CO2e of unconditional mitigation potential and 14.8 million t CO2e of conditional potential in 2030. The livestock sub-sector has the second-highest mitigation potential, and a package of interventions is foreseen to address mitigation in combination with efficiency gains and output growth. The 10YDP states that by implementing the climate resilient

green economy strategies (CRGE, the above-mentioned interventions) as an integral part of regular work programs, the animal husbandry subsector will enhance the reduction of GHG from 12.06 million metric tons to 48 million metric tons. Interventions in are designed to align with Ethiopia's NDC (CRGE), and Livestock Master Plan. These interventions in LFSDP-I, LLRP-I and ODFBP align with Ethiopia's wider CRGE and NDC and 10YDP frameworks, demonstrating on-the-ground implementation of low-emission measures such as feed optimization, breed improvement, and manure-based biogas as supported tools for national GHG mitigation goals.

Furthermore, the implementation of LLRP-II (https://projects.worldbank.org/pt/projects-operations/project-detail/P180076) and the ongoing preparation of the project appraisal for LFSDP-II reflect the continued commitment to implementing interventions aimed at reducing emissions from livestock sub-categories beyond the current program period.

Based on the previous assessment, the Oromia Program has decided to select the emission intensity approach for the estimation of the emissions baseline from enteric fermentation in cattle. The emission intensity (EI) is calculated as follows:

1. Combine emissions from eligible subcategories and livestock species, including cattle in the Oromia case.
2. Determine the total protein produced from milk and meat across all included livestock species, expressed in tonnes.
3. Emission intensity is defined as the emissions per unit of protein produced, measured in CO2e per ton of protein.

Once the total emissions and total protein output are established, the emission intensity can be calculated following equation 1 of the ISFL ER Programs section 4.2.7

$$EI = GHGI = \frac{GHG\ emissions\ from\ cattle}{Protein_{cattle\ milk} + Protein_{cattle\ meat}}$$

Table 8 GHG emissions related to enteric fermentation according to time.

Year	Total meat protein (t protein)	Total milk protein (t protein)	Total protein (t protein)	Total enteric fermentation GHG	GHG-Emission intensity

				emission (tCO2e)	(tCO2e / t protein)
2012	8,333	82,781	91,113	27,969,730	307.0
2013	7,720	82,930	90,649	27,975,044	308.6
2014	8,213	81,941	90,153	28,298,431	313.9
2015	9,532	86,599	96,130	28,888,540	300.5
2016	9,443	92,075	101,517	29,708,504	292.6
2017	8,625	88,147	96,771	29,708,061	307.0
2018	9,798	99,863	109,660	29,843,541	272.1
2019	10,825	103,702	114,526	30,782,813	268.8
2020	9,938	107,990	117,927	31,345,826	265.8
2021	9,668	111,166	120,833	33,138,187	274.2
				Historic average	**291.1**

Source: UNIQUE forestry and land use GmbH, Estimation of baseline emissions from cattle in the Oromia Region (2012-2021)

4.4.2. Emissions Baseline estimation

The emissions baseline is divided into the emissions for the 7 LULUCF related subcategories and the emissions from enteric fermentation. The Emission Baseline for LULUCF and enteric fermentation is summarized in Table 9 below.

Table 9 Total emissions baseline for LULUCF.

Year of reporting period t	Baseline Emissions									Total emissions baseline LULUCF (tCO2e)
	Forest to cropland	Forest to grassland	Forest to shrubland	Cropland to forest	Grassland to forest	Shrubland to forest	Forest remaining forest	SOC		
2025	8,709,828	361,917	130,779	(194,138)	(35,293)	(114,020)	1,258,249	1,027,142		11,144,464
2026	8,779,302	364,933	131,837	(388,276)	(70,586)	(228,041)	1,258,249	1,120,518		10,967,936
2027	8,848,775	367,948	132,894	(582,414)	(105,880)	(342,062)	1,258,249	1,213,895		10,791,405
2028	8,918,248	370,964	133,952	(776,552)	(141,173)	(456,083)	1,258,249	1,307,272		10,614,877
2029	8,987,722	373,979	135,010	(970,690)	(176,467)	(570,104)	1,258,249	1,400,648		10,438,347
Total Emissions Baseline LULUCF										**53,957,029**

The baseline GHG emission intensity for enteric fermentation – cattle is 291.1 t CO2e/t protein as calculated in Table 8.

4.5. Monitoring and Determination of Emission Reductions for ISFL Accounting

4.5.1. Description of the Monitoring Approach

The monitoring approach for the second ERPA phase will be similar to the first phase, utilizing a sample-based data collection method. All six area-change categories monitored in the first phase (forestland to cropland, cropland to forestland, forestland to grassland, grassland to forestland, forestland to shrubland, and shrubland to forestland) will continue to be monitored. Additionally, changes in forest land remaining forest land (degradation) and enteric fermentation from livestock will also be included. A brief description is shown below, and more details can be found in Annex 9 of this document.

Processes for Storing, Aggregating, and Collating Land Use Data

To support the development of the emission reduction baseline report under REDD+ Oromia, 5,003 **Activity Data (AD)** points were collected to assess land use changes between **2012 and 2021**. Data collection was executed through two designated CEO institutions established on the REDD+ Oromia CEO platform: **AD_eSBAE_Oromia_1_999**: 999 AD points **AD_eSBAE_Oromia_2_4,004**: 4,004 AD points

These institutions enabled a standardized sampling framework, ensuring representative spatial coverage across Oromia. The Oromia MRV team oversaw interpretation of all AD records.

Survey Integration and Satellite Imagery Sources

Survey instruments within the CEO platform captured responses related to land use types and land cover changes for both **2012 and 2021** reference periods. These surveys were integrated with multiple high-resolution remote sensing datasets, including: Landsat imagery series, Google Earth time-series data, Norway's NICFI satellite datasets, Normalized Difference Vegetation Index (NDVI), Normalized Difference Fraction Index (NDFI). These imagery resources facilitated robust classification and temporal analysis of land use dynamics.

Data Management and Reporting Practices

In alignment with ERPD reporting requirements for LULUCF monitoring, the Oromia MRV team adopted the following data handling protocols:

Storing: All raw and interpreted AD datasets are stored in a centralized, version-controlled repository within the CEO platform to ensure long-term accessibility and integrity.

Aggregating: AD points were aggregated both spatially and thematically to detect regional trends and inform classification outputs.

Collating: Spatial data, survey responses, and imagery-derived classifications were systematically collated into harmonized formats, supporting transparency, traceability, and repeatability in monitoring and reporting workflows.

For cattle enteric fermentation, the monitoring section has now been revised, and a description of the methods and standards for generating, recording, storing, aggregating, collating, and reporting data on monitored parameters, including equations, all the activity data are now incorporated. The methodology used by the project to quantify Emission Reductions (ERs) using the emission intensity approach, in accordance with Section 4.2.4 of the ER Program Requirements, is detailed in Annex 9. Additionally, the approach for applying the cap on ERs is outlined in Section 4.4.1 of the draft ERPD

Approach for estimating monitoring emissions and removals for LULUCF

In line with good practice guidelines of IPCC and GFOI, as well as the ISFL ER program requirements, land use and land use change will be estimated by applying a stratified random sampling approach. The number of sample points will be estimated for each monitoring period to reflect the stratification approach which is based on determining the likelihood that a change has occurred during the applicable monitoring period. Data will then be collected, organized, stored, and analyzed using various tools such as Collect Earth Online (CEO), Google Earth, and other high-resolution satellite images like Planet NICFI. Finally, the results will be reported to the stakeholders concerned. The monitoring activity covers the whole period of the second ERPA phase (2025 up to 2029)

For now, it is assumed that the same Emission and Removal factors used for the Emissions Baseline will be used as. However, a new NFI is currently ongoing and where relevant, the

emissions and removal factors might be updated if updated values are available for the included four carbon pools: aboveground and belowground biomass, deadwood and soil organic carbon.

Approach for monitoring methane emission from enteric fermentation in cattle

Annex 10 contains information on the activity data associated with estimating the methane emission factor, protein production, and emission intensity used to set the baseline and for future monitoring.

The monitoring of enteric methane emissions and emission intensity from cattle production in the Oromia region will use the IPCC Tier 2 methodology, which allows for region-specific emission factors that reflect variations in animal productivity, feeding systems, and management practices.

Emission estimates

Cattle Head: Cattle population data, disaggregated by sub-category and production system, namely smallholder dairy, mixed crop-livestock, and pastoral/agro-pastoral, provide a strong basis for monitoring from 2025 onward. The primary source for this data is the CSA annual livestock sample survey reports, which offer consistent, nationally recognized estimates for the Oromia Region. These reports present time series data by age, sex, purpose, and breed at national, regional, and zonal levels, enabling the calculation of annual average populations by sub-category, an essential input for generating activity data and applying IPCC Tier 2 emission factors. Future monitoring can maintain consistency by adhering to the same sub-category classifications and production system delineations used in the 2012–2021 baseline, as detailed in Section 3 of the report 'Estimation of Baseline Emissions from Cattle in the Oromia Region (2012–2021)', including a customized Excel tool (supplementary sheet baseline cattle GHG emission intensity-Oromia region). For commercial dairy cattle, where CSA data are not yet routinely available, population estimates can be updated using a linear extrapolation method based on the most recent two years of estimates, until CSA begins regular reporting. This approach ensures the continuity and comparability of data essential for emissions monitoring and inventory updates.

Live weight, weight gain, mature weight data: For baseline emissions, estimates for live weight (LW), weight gain, and mature weight were primarily derived from the one-off large-scale survey conducted by JaRco Consulting (2023). Heart girth measurements were collected across different production systems across various sub-categories (e.g., adult cows, bulls, calves, and growing animals). These measurements were converted to LW using regression equations, particularly the

Goopy et al. (2018) Box-Cox transformation. Where necessary, additional transformations (e.g., log10, square root) were applied to ensure normal distribution of the data. For sub-categories where measurements were unavailable, values from relevant literature and previous studies by institutions such as Holeta Research Center and ILRI were used, as detailed in Section 4.2.1 of the report 'Estimation of Baseline Emissions from Cattle in the Oromia Region (2012–2021),' including a customized Excel tool (supplementary sheet baseline cattle GHG emission intensity-Oromia region). Mature weights were determined using animals in good body condition and were assumed to be constant throughout the 2012–2021 baseline period. Daily weight gain was calculated by dividing the difference in LW between adjacent age classes by the number of days between their median ages. For feedlot cattle, LW and weight gain were estimated using weighted averages based on breed composition, duration in feedlot, and backgrounding weights. For future monitoring (2025–2029), given the slow rate of change in these parameters, the fixed values used for the baseline are likely to remain valid, with periodic representative surveys recommended every five years to validate assumptions and maintain consistency.

Percentage of females that give birth and milk yield: For baseline emissions, the percentage of cows pregnant (calving rate) and milk yield were estimated using data from multiple sources. For mixed crop-livestock and pastoral/agro-pastoral systems, estimates of the proportion of cows giving birth annually were derived from the CSA annual livestock sample surveys, as detailed in Section 4.2.2 of the report Estimation of Baseline Emissions from Cattle in the Oromia Region (2012–2021), including a customized Excel tool (supplementary sheet baseline cattle GHG emission intensity-Oromia region). For smallholder and commercial dairy systems, where CSA data were not available, the Oromia GHG inventory improvement survey (JaRco Consulting, 2023) provided calving interval data, which were converted into annual calving rates using the formula:

Calving rate = 365 * (100/calving interval in days).

Milk yield data were also sourced from the CSA for mixed crop-livestock and pastoral/agro-pastoral systems and supplemented by the Oromia survey for smallholder and commercial dairy-intensive systems. The survey collected direct data on daily milk yield from representative sampled households and farms, which were then used to estimate annual average yields. For future monitoring, the CSA annual livestock survey offers consistent time series data on milk yield and percentage of cows pregnant for mixed crop-livestock and pastoral/agro-pastoral systems, and it

is expected to expand coverage to include commercial and smallholder dairy-intensive systems in the near future. Until CSA data for these systems become available, estimates from the Oromia survey will continue to be used. Regular updates from CSA and periodic surveys will ensure robust and consistent data for ongoing emissions monitoring. Furthermore, currently, the milk fat is taken from the IPCC 2006 default value. A representative sample survey could be done for all production systems, but this would not have a major impact on overall inventory uncertainty.

Feed digestibility (DE, %): For baseline emissions, the CSA annual livestock survey provides a consistent time series for feed basket data for mixed crop-livestock and pastoral agro-pastoral systems, and Oromia GHG inventory improvement survey (JaRco Consulting, 2023) for commercial and small-holder dairy-intensive systems, as detailed in Section 4.2.5 and 4.2.6 of the report Estimation of Baseline Emissions from Cattle in the Oromia Region (2012–2021), including a customized Excel tool (supplementary sheet baseline cattle GHG emission intensity-Oromia region). The feed digestibility expressed as digestible energy (DE%) was then estimated based on the composition of the feed basket and the digestibility of each feed type. The process involved identifying typical feed resources used in each production system (e.g., natural pasture, crop residues, industrial by-products) through household surveys and expert consultations. Each feed type was assigned a digestibility value based on published literature and experimental data. For each cattle sub-category within a production system, a weighted average DE% was calculated by multiplying the proportion of each feed type in the diet by its corresponding digestibility and summing the results. This approach was applied consistently across systems (commercial dairy, smallholder dairy, mixed crop-livestock, pastoral/agro-pastoral, and feedlots), and the resulting DE% values were used in the Tier 2 equations to estimate gross energy intake and enteric methane emissions. Where historical data were available (2012–2021), the time series of DE% was constructed to reflect trends or changes in feeding practices. For future monitoring, the CSA annual livestock survey offers consistent time series data on the feed basket for mixed crop-livestock and pastoral/agro-pastoral systems, and it is expected to expand coverage to include commercial and smallholder dairy-intensive systems in the near future. Until CSA data for these systems become available, an annual representative sample survey should be done for the two dairy production systems.

Average number of hours worked per day: In the baseline emission, average work hours for cattle were estimated based on data from the Oromia GHG inventory improvement survey (JaRco

Consulting, 2023), which collected information on the number of hours cattle were used for draft power across different production systems. Data were gathered for specific sub-categories; particularly adult males used for draught in mixed crop-livestock and pastoral/agro-pastoral systems. The survey reported average hours of work per day and the number of working days per year. These values were then used to calculate the average daily work hours applied in the gross energy intake calculations for relevant sub-categories, as detailed in Section 4.2.4 of the report Estimation of Baseline Emissions from Cattle in the Oromia Region (2012–2021), including a customized Excel tool (supplementary sheet baseline cattle GHG emission intensity-Oromia region). Where survey data were limited, expert judgment and national inventory assumptions were used to supplement estimates. To ensure comparability, the resulting work hour estimates remained consistent across the 2012–2021 time series. For future monitoring, the same fixed values will be used, and the assumptions and literature values could be updated with targeted surveys, but the impact on overall inventory uncertainty would not be large.

Protein production estimates: Cattle off-take: In the baseline emission, cattle off-take (slaughter) data from different production systems (mixed crop-livestock and pastoral/agro-pastoral) were estimated using the CSA annual livestock sample survey reports for 2012–2021. These reports provide annual slaughter numbers disaggregated by sex but not by age or number of days alive before slaughter. To address this, assumptions were made: (1) slaughtered females were considered retired multipurpose cows (≥3 years), and (2) slaughtered males were assumed to be retired oxen (adult males used for draught, 3–10 years). The average number of days alive for slaughtered animals was assumed to be 183 (half a year), and their annual average populations were estimated using IPCC Equation 10.1, as detailed in Section 6.1.1 of the report Estimation of Baseline Emissions from Cattle in the Oromia Region (2012–2021), including a customized Excel tool (supplementary sheet baseline cattle GHG emission intensity-Oromia region). Future monitoring should continue using the CSA annual livestock sample survey for mixed crop-livestock and pastoral/agro-pastoral systems as the primary source, ensuring consistent coverage and disaggregation by production system. Off-take data for commercial dairy value can be updated using a targeted sample survey to improve accuracy.

Meat and milk protein, dressing percentage, and bone-free meat: Milk protein is calculated using a constant protein content of 3.5%, as recommended by the IPCC (2006). Meat protein is based on an average protein content of 21.13% in cattle meat, following FAO's GLEAM

methodology. The dressing percentage (the ratio of carcass weight to live weight) is assumed to be 47%, and the bone-free meat percentage (ratio of boneless meat to cold carcass weight) is set at 0.75, both based on FAO GLEAM defaults. For future monitoring, these parameters are assumed to remain constant, unless country-specific values become available through improved data collection.

Emission Factors and Protein Production Estimates

Emission factors for each cattle sub-category were estimated using IPCC Tier 2 equations from the 2006 Guidelines and the 2019 Refinement, following the detailed methods outlined in Annex 9. Protein production is also calculated by production system using the same methodological framework. A customized calculation tool, Baseline Cattle GHG Emission Intensity Report: Oromia Region, was developed to support the estimation of emission factors, total emissions, protein output, and emission intensity across different cattle systems.

Data Recording and Storage: All activity data including cattle population, milk yield, calving rates, and feed basket data from CSA (for mixed crop-livestock and pastoral/agro-pastoral systems), as well as performance data (e.g., live weight, weight gain) from the Oromia one-off survey were recorded using a standardized supplementary sheet. This format supports quality assurance and quality control (QA/QC) by enabling documentation of data sources, cross-checking of intermediate calculations using the baseline tool, verification of aggregated totals, and expert validation. All data are stored in a centralized database with standardized coding and naming conventions to ensure traceability, consistency, and ease of reuse.

Data Aggregation and Collation: Cattle population and other performance data from different agro-ecological zones and production systems were aggregated based on regional cattle distributions. A stratified approach is applied, disaggregating by production system, age, and sex. Annual collation of this data supports trend analysis and identification of changes in emission intensity over time.

Reporting Protocols: Reporting adheres to UNFCCC and IPCC Good Practice Guidelines, following the TACCC principles (Transparency, Accuracy, Consistency, Comparability, and Completeness). Emissions are re-ported both in absolute terms (e.g., kg CH_4/year) and as emission intensity (e.g., kg CH_4/kg of protein). Protein yield is estimated from milk and meat production per animal, applying fixed protein content factors for each product type.

In accordance with 4.2.7 of the ISFL ER Program Requirements, for ISFL ER Programs that use

the emissions intensity approach, the emission intensity will be calculated using equation 1 as follows:

1. Combine emissions from eligible subcategories and livestock species, including cattle in the Oromia case.
2. Determine the total protein produced from milk and meat across all included livestock species, expressed in tones.
3. Emission intensity is defined as the emissions per unit of protein produced, measured in CO2e per tonne of protein.

Once the total emissions and total protein output are established, the emission intensity can be calculated accordingly

$$EI = GHGI = \frac{GHG\ emissions\ from\ cattle}{Protein_{cattle\ milk} + Protein_{cattle\ meat}}$$

In accordance with 4.5.4 of the ISFL ER Program Requirements, for ISFL ER Programs that use the emissions intensity approach for estimating emission reductions from livestock, the emissions reduction of an ER program (ER_{ERP}) of N_{years} will be calculated using Equation 2, as the difference between the average annual emission intensity of an ER Program during implementation (EI_{ERP}) and the average annual emissions intensity of the baseline ($EI_{baseline}$); multiplied by the average annual protein production in an ER Program

$$ER_{ERP} = (EI_{ERP} - EI_{baseline}) \times Average\ Annual\ Protein\ Production_{ERP} \times Nyears$$

In addition, in accordance with 4.5.7 of the ISFL ER Program Requirements, a cap will be applied to the emissions of the combined eligible livestock subcategories for ISFL ER Programs that use the emissions intensity approach. In accordance with 4.5.8 of the ISFL ER Program Requirements, the cap as referred to in 4.5.7, is equal to the average annual emissions of the projected trend in the ERPA phase, based on the continuation of the historical trend in GHG emissions from the eligible livestock sub-categories during the Baseline Period. For determining the trend, the following requirements apply:

Requirement 1: data requirements shall be consistent with data requirements for setting the baseline, i.e. the trend shall be based on a time series covering the whole Baseline Period, combined with Tier 2 emission factors calculated on one or more years.

Project compliance: the trend for the next ERPA phase was determined using the same data as was

used for the baseline period and included Tier 2 emission factors calculated for all years of the baseline period.

Requirement 2: the trend in GHG emissions from the eligible livestock related sub-categories shall be established using a linear regression applicable to the Baseline Period.

Project compliance: for the whole baseline period, a linear regression of enteric emissions against year is "y = 517,564.01x - 1,013,901,962.11" with R2=0.91. Furthermore, the projected emissions for 2025-2029 are shown in the Table 10 below.

Table 10 GHG emissions related to enteric fermentation according to time.

Year	Total meat protein (t protein)	Total milk protein (t protein)	Total protein (t protein)	Total enteric fermentation GHG emission (tCO2e)	GHG-Emission intensity (tCO2e / t protein)
2012	8,333	82,781	91,113	27,969,730	307.0
2013	7,720	82,930	90,649	27,975,044	308.6
2014	8,213	81,941	90,153	28,298,431	313.9
2015	9,532	86,599	96,130	28,888,540	300.5
2016	9,443	92,075	101,517	29,708,504	292.6
2017	8,625	88,147	96,771	29,708,061	307.0
2018	9,798	99,863	109,660	29,843,541	272.1
2019	10,825	103,702	114,526	30,782,813	268.8
2020	9,938	107,990	117,927	31,345,826	265.8
2021	9,668	111,166	120,833	33,138,187	274.2
…					
2025				34,165,158	
2026				34,682,722	
2027				35,200,286	
2028				35,717,850	
2029				36,235,414	
Average (2025-2029)				**35,200,286**	

Source: UNIQUE forestry and land use GmbH, Estimation of baseline emissions from cattle in the Oromia Region (2012-2021). Note: Emissions for 2025-2029 are projected using the linear regression as explained in the text.

Requirement 3: to apply the linear regression for the Baseline Period, the program shall divide the whole Baseline Period into two equal periods and compare the growth rates of each period. If the growth rate of GHG emissions computed for the second period is at least 10% lower than the

growth rate of emissions computed for the first period, and if the decrease cannot be directly related to an external factor (e.g. policy change, economic shock, natural disaster, disease outbreak), then the growth rate of emissions of the second period shall be used to set the cap.

Project compliance: when the baseline period is divided into two equal halves, and regressions run for each part of the time series, the slope of the regression (i.e. growth in emissions per year) for the second half is higher than for the first half (see **Error! Reference source not found.** below). T herefore, the condition in requirement 3 (that would require the growth rate of the second half if the second half has a lower growth rate than the first half) does not apply in this case.

Therefore, the cap on emissions in the 2025-2029 ERPA should be set using the projected emissions using a linear regression based on the 2012-2021 baseline period. The projected emissions using linear regression calculated for each year in 2025-2029 is shown in Table 10 above. However, in accordance with 4.5.8 of the ISFL ER Program Requirements, the cap as referred to in 4.5.7, is equal to the average annual emissions of the projected trend in the ERPA phase. Therefore, the actual cap would be 35,200,286 tCO_2e (*Table 10*)

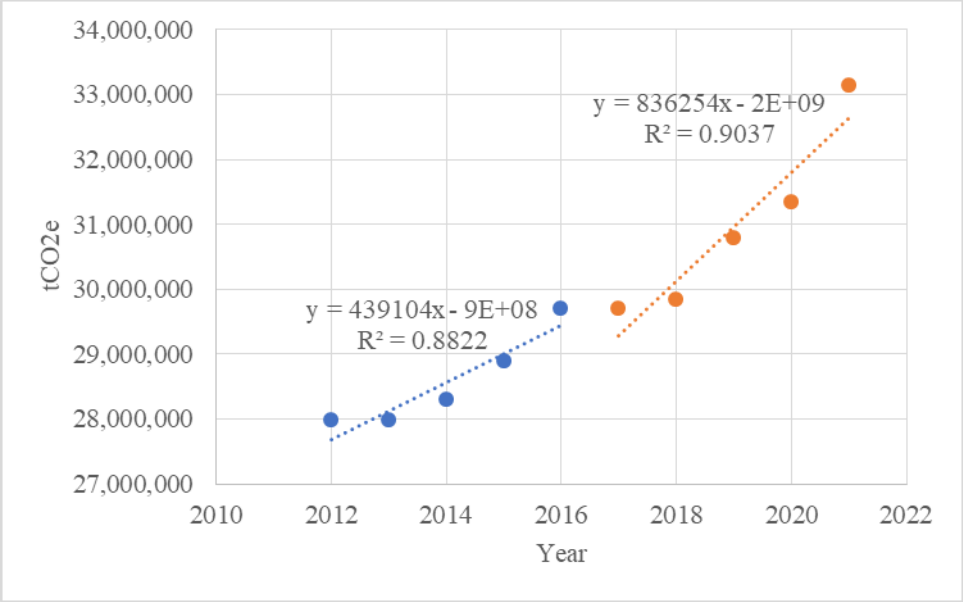


Figure 5. Linear equations for two halves of the baseline period in the project area.

Requirement 4: Notwithstanding requirement 3 above, the growth rate used to calculate the cap for each ERPA Phase shall not exceed the growth rate calculated under requirement 3 above or the growth rate observed in any of the prior ERPA phases. If this occurs the lowest previous growth rate will always be used to calculate the cap.

If the actual emissions exceed the cap in a particular year, the emission reductions from the eligible

livestock subcategories for that year will be considered as zero. In addition, the difference between the actual emissions and the cap shall be considered as an increase in emissions from livestock and will be subtracted from the net emission reductions from the other subcategories.

4.5.2. Organizational Structure for Monitoring and Reporting

The ISFL ER Program is implemented at a regional scale, Oromia National Regional State, which has a REDD+ Coordination Unit (ORCU). The monitoring approach that will be followed for the estimation of emission reductions for ISFL accounting will be aligned with the national monitoring plan. In May 2018, EFCCC, the then EFD, published the "REDD+ MRV implementation in Ethiopia review of the context, framework and progress" (https://agritrop.cirad.fr/591680/1/OP-192%20low%20res.pdf). This document is exhaustive in the consideration of the activities and institutions that are needed to monitor, verify and report REDD+ programs. The ISFL ER Program is similar to a REDD+ program, but it considers other activities such as agriculture. Thus, the MRV presented here uses the same structure as the existing MRV system in the Ethiopia´s Framework for the MRV under the REDD+ Program. The ISFL Program is not creating new structures of activities to the current activities in MEFCC, the then EFD, and other institutions; the monitoring of the program is done with the actual proven capacities.

The Ministry of Agriculture serves as the primary national institution tasked with coordinating emission reduction efforts across both the livestock and forest sectors. The Ethiopian Forest Development (EFD) and the Ministry of Agriculture's Livestock Resource Development subsectors are working in producing accurate data on forest resource and livestock-related enteric fermentation. The national Monitoring, Reporting and Verification (MRV) units within the EFD and MoA are responsible for producing maps, collecting GHG inventory data, and collaborating with federal and regional institutions to carry out MRV activities in collaboration with regional level MRV units on forest and Livestock sectors. The National REDD+ Secretariat plays a supportive role for both national and state-level government frameworks in these initiatives.

At the sub-national level, OEPA and BOA will adopt a similar monitoring strategy to ensure continuity and consistency in tracking progress on emission reductions in collaboration. The ORCU coordinated approach facilitates the effective measurement and verification of the

program's impact on emissions and the attainment of REDD+ goals.

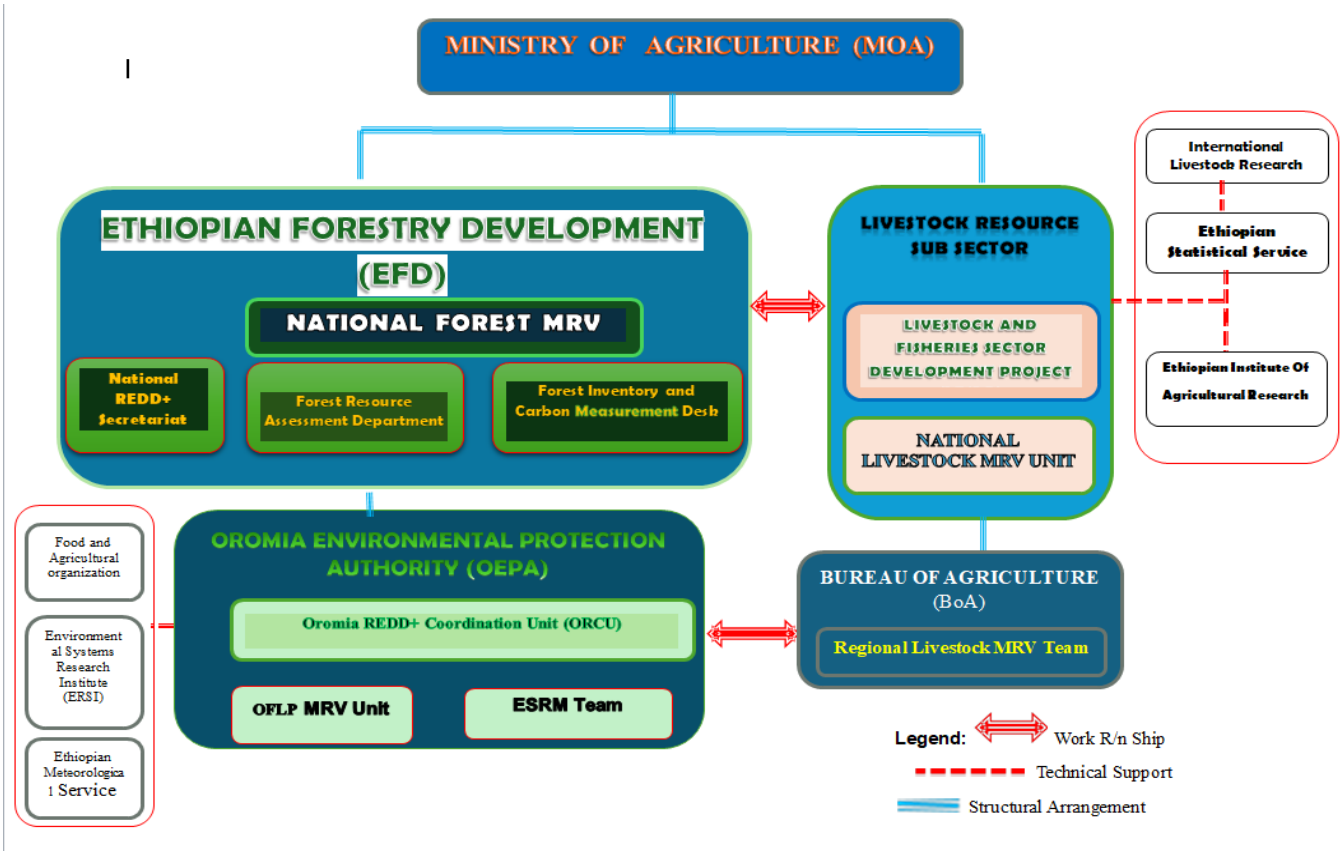


Figure 6 : Organizational structures for monitoring and reporting

The Ethiopian Statistic Service (ESS) is also a key stakeholder in the monitoring. The agency/Service has been reporting information that is used as activity data. Since its establishment in 1960 ESS (then established as the CSA), has been and is involved in socio-economic and demographic data collection, processing, evaluation and dissemination that are used for the country's socio-economic development and planning, monitoring and policy formulation.

4.5.3 Uncertainty

Annex 9 contains information on the uncertainties associated with the different parameters used in the setting of the baseline and the future monitoring. In general, uncertainties arise due to both random and systematic errors. Uncertainties can be addressed in several 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.

The OFLP ER Program will follow a 3-step process to ensure accuracy:

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

For the seven subcategories associated with LULUCF, the uncertainty in activity data in LULUCF is the result of the statistical analysis applied to the sampling method to detect land-use and land-use change with CEO. This uncertainty will be managed through the number of sample plots analyzed for each monitoring event. The interpretation of the sample pots themselves will be subject to QA/QC procedures that involve training of interpreters to ensure consistency in applying the response design and by re-interpretation of a percentage of the sample plots.

The Emission factors for LULUCF are mainly provided by the National Forest Inventory and the uncertainty is from the field work and process of data collected on the field. Systematic errors (bias) are avoided by good measurement practices. The National Forest Inventory has a "Field manual" prepared in July 2013. The document is prepared as a Standard Operational Procedure to summarize the work done and establish guidance for future inventories. It has a description of the sampling design, land use/cover classification and organizational structure and responsibilities. Another section is dedicated to fieldwork procedures with the overview of data collection process, preparation for the fieldwork, introduction of the project to local people, field data collection and end of work in the sampling unit.

In the agriculture sector, the minimization of uncertainty will not be cost-effective. The survey will have to increase the number of samples to a level that will not be efficient, given the low level of uncertainty.

4.5.3.1 Uncertainty analysis for enteric fermentation

Uncertainty analysis for enteric fermentation was accomplished using Monte Carlo (MC) simulation implemented in Palisade @Risk software. The key inputs to the uncertainty analysis were:

(1) Mean values: The values of all activity data, coefficients and emission factors were exactly as implemented in the inventory;
(2) Margins of error: Margins of error around the mean values were estimated for each input parameter.
(3) Probability Density Functions (PDFs): For each parameter, PDFs were chosen either by reference to IPCC guidelines or other literature.

Because animal sub-category populations were estimated using the same data sources, correlations between the time series for populations of each animal sub-category were included in the model. For activity data inputs into emission factors, it was assumed that there are no correlations. Uncertainty was estimated as the margin of error (e.g. ±18%) with a confidence interval of 90% (calculated using a z-score of 1.645, referred to as $MOE_{90\%CI}$ in this report). Note that this differs from the national inventory, which uses a 95% confidence interval. Uncertainty analysis was conducted for the first year in the baseline time series (2012) and the last year (2021) and for the uncertainty in the trend 2012-2021.

Uncertainty in livestock population activity data

For livestock population activity data, CSA annual livestock survey reports were the main data source for cattle in the smallholder dairy, mixed crop-livestock and pastoral/agro-pastoral production systems. Where CSA reported sub-categories were combined in this baseline inventory (e.g. male and female calves < 6 months reported separately by CSA combined into one 'calves < 6 month' category), the standard errors (s.e.) reported by CSA were transformed to margins of error and the $MOE_{90\%CI}$ for these combined sub-categories was calculated as the square root of the sum of MOEs squared:

$$MOE_{comb} = \pm \sqrt{\sum_{m} MOE_{m}^{2}}$$

where *m* is an index of each sub-category combined.

The $MOE_{90\%CI}$ for cattle sub-category populations in each production system were estimated as follows.

Commercial dairy production system: Cattle populations were estimated using data in Minten et al. (2018), which enabled an estimate of the total dairy population, but did not describe standard errors of the estimate. The herd structure was derived from the OFLP survey. The OFLP survey was re-analysed to estimate the margin of error of herd structure estimates for each animal sub-category, and the results ranged between ±11% and ±37% for different sub-categories. Considering uncertainty associated with the total population estimate, the uncertainty analysis here assumes that each sub-category population estimate has an $MoE_{90\%CI}$ of ±42% (i.e. equivalent to an MOE of ±50% with a 95% confidence interval), which was applied to both 2012 and 2021

population estimates. This remains unchanged from the 2021 draft Oromia GHG inventory uncertainty estimate.

Smallholder dairy production system: The herd structure was taken from the OFLP survey. Data were re-analysed to estimate the margin of error achieved with the sample size for households with crossbred cattle (i.e. 132 households) given the variability in populations on each farm in the dataset. The resulting uncertainty estimates were applied in both 2012 and 2021 and are shown in Table 11. The resulting $MOE_{90\%CI}$ estimates are mostly slightly lower than in the 2021 draft Oromia inventory, except for adult males which has a higher uncertainty due to the large variability in the OFLP dataset.

Pastoral/agro-pastoral and mixed crop-livestock systems: Population estimates for both production systems derived from CSA survey reports, but the method for estimating uncertainty differed for 2012 and 2021:

For 2012, the CSA livestock survey report states that Borena zone sample size was 1107 households but did not give separate s.e. values for population estimates in each zone. The 2020 and 2021 CSA livestock survey reports did indicate that the sample sizes were 540 and 511, respectively, with margins of error of 22% and 55%, respectively. CSA reports for other years did not present sufficiently detailed information to assess the relationship between sample size and s.e. in Borena zone. At regional level, a 10% increase in sample size decreases the margin of error of the cattle population estimate by about 4.3%. Noting that the 2012 sample size was double that of 2020 and 2021, we assume that the margin of error would be a similar order of magnitude as in the mixed crop livestock system. Therefore, we applied the 2012 CSA survey report regional level margins of error to each pastoral/agro-pastoral cattle sub-category and then adjusted the regional level margins of error for each mixed crop-livestock system sub-category such that the sum of standard errors of each sub-category in both systems equalled the total s.e. of the cattle population estimate at Oromia region level. The values used are shown in Table 11.

For 2021, the CSA livestock survey report only gives the standard errors of total populations in each zone of Oromia Region and the standard error of total cattle population estimates at region level, with no s.e. for sub-category populations. For the pastoral/agro-pastoral populations, the standard error of the total population estimate was taken as the standard error reported for Borena zone (i.e. 33.72% of the population estimate), which equates to a $MOE_{90\%CI}$ of ±55.48%. It was

assumed that each cattle sub-category in the pastoral/agro-pastoral system had the same margin of error, which by error propagation implies a $MOE_{90\%CI}$ of ±20.97% for each sub-category in that system. For the mixed crop-livestock system, the standard error at regional level (excluding Borena zone) was 2.93% of the total population estimate, which equates to a $MOE_{90\%CI}$ of 4.82%. Error propagation implies a $MOE_{90\%CI}$ of 1.70% for each cattle sub-category in that production system. The values used are shown in Table 11**.** A normal distribution was used to characterize all sub-category populations.

Due to a change in data source and method for estimating feedlot cattle populations in the mixed crop-livestock system, the feedlot sub-category uncertainty range is now similar to that of other mixed crop-livestock system sub-categories and substantially reduced compared to the 2021 Oromia inventory.

Compared to the 2021 draft Oromia inventory uncertainty estimates, the uncertainty levels assumed in this inventory for 2021 are lower for the mixed crop-livestock system and higher for the pastoral-agropastoral system due to the sample sizes of CSA livestock sample surveys in different zones of the region.

Table 11 Margins of error (90% CI) for cattle sub-category population estimates used in uncertainty analysis (%)

System	Sub-category	**$MOE_{90\%CI}$ 2012**	**$MOE_{90\%CI}$ 2021**
	Adult multipurpose cows >3 years	4.54	1.70

Mixed crop livestock system	Adult males used for draught (3-10 years)	3.09	1.70
	Adult males used for breeding & other purpose (>3-10 years)	3.09	1.70
	Growing males 1-<3 years	4.00	1.70
	Growing females 1-<3 years	4.29	1.70
	Calves 6 m-<1 year (male & female)	3.44	1.70
	Calves < 6 months (male & female)	3.71	1.70
	Feedlot cattle (male 3-10 years)	4.54	1.70
Pastoral & agropastoral system	Adult multipurpose cows >3 years	4.82	20.97
	Adult males used for draught (3-10 years)	3.37	20.97
	Adult males used for breeding & other purpose (>3-10 years)	3.37	20.97
	Growing males 1-<3 years	3.99	20.97
	Growing females 1-<3 years	3.72	20.97
	Calves 6 m-<1 year (male & female)	4.28	20.97
	Calves < 6 months (male & female)	4.57	20.97
Commercial dairy system	Adult crossbred & pure exotic dairy cows (3-10 years)	42.00	42.00
	Adult crossbred & pure exotic males 3 years & above	42.00	42.00
	Crossbred & pure exotic growing males (1 - < 3 years)	42.00	42.00
	Crossbred & pure exotic growing females (1 -< 3 years)	42.00	42.00
	Crossbred & pure exotic calves (6 m - < 1 yr) male & female	42.00	42.00
	Crossbred & pure exotic calves (<6 months) male & female	42.00	42.00
Smallholder dairy system	Adult crossbred & pure exotic dairy cows (3-10 years)	7.01	7.01
	Adult crossbred & pure exotic males 3 years & above	30.28	30.28
	Crossbred & pure exotic growing males (1 - < 3 years)	7.28	7.28
	Crossbred & pure exotic growing females (1 -< 3 years)	7.38	7.38
	Crossbred & pure exotic calves (6 m - < 1 yr) male & female	9.66	9.66
	Crossbred & pure exotic calves (<6 months) male & female	8.01	8.01

Uncertainty in animal performance data

The Tier 2 emission factors used in the inventory are calculated following the IPCC guidelines using activity data on animal performance and management. The margins of error (with a 90% CI) and PDFs and their justifications are as follows.

Live weight and weight gain: LW and WG of smallholder dairy, feedlot cattle and mixed crop-livestock system cattle were derived from the OFLP survey, and variability in those datasets were used to estimate uncertainty. For commercial dairy and pastoral/agro-pastoral systems, the $MOE_{90\%CI}$ for LW of different cattle sub-categories was calculated from the variability in the datasets shown in the tables in the data appendixes. The OFLP survey and most of literature reports used for the pastoral/agro-pastoral system used heart-girth measurements and allometric equations

to estimate LW. Goopy et al. (2018) reported a root mean square error of prediction when using allometric equations to estimate LW of about ±14.5% of the mean with a 95% confidence interval (equivalent to ±12.17% with a 90% confidence interval). The $MOE_{90\%CI}$ for LW was calculated as the combined MOE from the variability in the dataset and from the measurement methods used, except in the commercial dairy system where most studies used weighing scales, so uncertainty associated with conversion of linear measurements was not included. WG was estimated as the difference between LW at the median age in two adjacent age classes, so the $MOE_{90\%CI}$ was calculated as the combined margin of error of LW estimates in those age classes. The $MOE_{90\%CI}$ values used in uncertainty analysis are shown in Table 12**.** A normal distribution was used in all production systems, except the smallholder dairy system, where data were not normally distributed, and a PERT distribution was used as the best fit to the distribution of the survey data.

Compared to the 2021 draft Oromia inventory, LW uncertainty estimates in the mixed crop-livestock and smallholder dairy systems are increased because of the higher variability in the OFLP survey data. WG uncertainty estimates are also increased in all systems because this baseline estimated WG uncertainty as the combined uncertainty of LW uncertainties in adjacent age classes, whereas the draft inventory had assumed that WG and LW uncertainty were the same.

Table 12 ***Margins of error (90%CI) for cattle sub-category LW and WG estimates for 2012 and 2021 used in uncertainty analysis*** *(%)*

System	Sub-category	$MOE_{90\%CI}$ LW	$MOE_{90\%CI}$ WG
Mixed crop livestock system	Adult multipurpose cows >3 years	22.0	0
	Adult males used for draught (3-10 years)	38.5	0
	Adult males used for breeding & other purpose (>3-10 years)	46.1	0
	Growing males 1-<3 years	4.8	25.8
	Growing females 1-<3 years	26.9	19.7
	Calves 6 m-<1 year (male & female)	19.1	27.3
	Calves < 6 months (male & female)	25.4	27.0
	Feedlot cattle	5.9	8.3
Pastoral & agropastoral system	Adult multipurpose cows >3 years	15.32	0
	Adult males used for draught (3-10 years)	15.79	0
	Adult males used for breeding & other purpose (>3-10 years)	15.79	0
	Growing males 1-<3 years	16.33	22.6
	Growing females 1-<3 years	15.69	15.8
	Calves 6 m-<1 year (male & female)	14.90	22.1
	Calves < 6 months (male & female)	16.03	22.9
	Adult crossbred & pure exotic dairy cows (3-10 years)	5.10	0

Commercial dairy system	Adult crossbred & pure exotic males 3 years & above	12.37	0
	Crossbred & pure exotic growing males (1 - < 3 years)	11.22	12.9
	Crossbred & pure exotic growing females (1 -< 3 years)	6.34	6.7
	Crossbred & pure exotic calves (6 m - < 1 yr) male & female	7.68	13.6
	Crossbred & pure exotic calves (<6 months) male & female	4.88	12.2
Smallholder dairy system	Adult crossbred & pure exotic dairy cows (3-10 years)	+45.6,-31.6	110.7
	Adult crossbred & pure exotic males 3 years & above	3.00	89.6
	Crossbred & pure exotic growing males (1 - < 3 years)	+67.5,-44.6	110.7
	Crossbred & pure exotic growing females (1 -< 3 years)	+88.8,-47.3	89.6
	Crossbred & pure exotic calves (6 m - < 1 yr) male & female	+88.3, -41.3	68.0
	Crossbred & pure exotic calves (<6 months) male & female	+128.9, -62.3	88.1

Proportion of cows giving birth: In the commercial and smallholder dairy systems, the $MOE_{90\%CI}$ was calculated from the datasets used to estimate average calving interval. In the pastoral/agro-pastoral and mixed crop-livestock systems, due to the method used to calculate proportion of cows giving birth, the MoE was calculated as the combined MOE of the population estimates for cows, calves <6m and calves 6-12 m. These $MOE_{90\%CI}$ values differed in 2012 and 2021 (Table 13). A beta distribution was used, because the proportion can only take positive values. These uncertainty estimates differ from those used in the 2021 draft Oromia inventory due to changes in data sources and methods used to calculate proportions of cows giving birth in each production system. For the commercial dairy system, the uncertainty estimate is less than half its previous estimated value.

Table 13 ***Margins of error (90% CI) for proportion of cows giving birth in each production system used in uncertainty analysis (%)***

System	2012	2021
Mixed crop-livestock	6.8	3.0
Pastoral/agro-pastoral	4.82	20.97
Commercial dairy	11.9	11.9
Smallholder dairy	11.9	11.9

Milk yield: Both CSA data and OFLP surveys used farmer-reported values of milk off-take and lactation lengths. Migose et al. (2020) estimated mean absolute error of 27.5% for farmer recall data at the 95% confidence level (or 23.1% with 90% confidence). Calf milk suckling was estimated using methods described in NRC (2001) which do not give an estimate of error. We assume ±8.39% uncertainty (equivalent to ±10% with 95% confidence) for predicted calf milk suckling. For the pastoral/agro-pastoral and mixed crop-livestock systems, milk yield data came

from CSA survey reports which do not indicate the variability in milk yield estimates, so the combined MOE from the previous two sources of uncertainty was estimated at ±24.58% with 90% confidence and was applied in both 2012 and 2021 using a normal distribution. For the commercial and smallholder dairy systems, milk yield data came from the OFLP survey, and the above sources of uncertainty were combined with the uncertainty due to variability in the datasets used. Commercial dairy milk yield data showed a $MOE_{90\%CI}$ of 22.1% (normal distribution) and smallholder dairy data uncertainty was (+133%,-72%), modelled using a PERT distribution.

Milk fat content: The IPCC default value of 4% was used and uncertainty analysis assumed an MOE of ±8.4% at the 90% confidence level (i.e. equivalent to ±10% at 95% confidence). A normal distribution was used.

Work hours: Work hours were estimated on the basis of two single studies (1994 and 2018). Neither study reported standard errors. The uncertainty assessment assumes an MOE of ±25.1% at 90% confidence in all years (i.e., equivalent to ±30% at 95% confidence). A normal distribution was used.

Feed digestibility: Data on diet composition in the commercial and smallholder dairy systems derived from the OFLP survey, from which it was not possible to directly calculate a margin of error for feed digestibility. Therefore, the following methods were used to estimate uncertainty. Commercial dairy milk yield was estimated at 8.6 kg/day, with a lower confidence bound of 6.7 kg/day. Milk yields are strongly responsive to feed quality, and in an international database of Tier 2 emission factors[5], the minimum DE% associated with milk yield of 6 kg or more was 60% (i.e., close to the inventory value), whereas the maximum associated with a MY less than 10 kg (i.e. the upper CI in the inventory), was 68%. Therefore, we took 60 and 68 as minimum and maximum of a triangular distribution, with the inventory value as the most likely value. For other sub-categories in this production system, we assumed an $MOE_{90\%CI}$ of ±7.5% with a normal distribution, such that the lower CI would be between 50-53% for different sub-categories and the upper CI about 65-66%. By comparison, IPCC (2019) default values for dairy and "other" (i.e., multipurpose) cattle in Africa vary between 50% and 61%, but assume lower milk yields than estimated here. For smallholder dairy, an $MOE_{90\%CI}$ of ±7.5% was assumed, such that the lower CI would be about

[5] https://www.agmrv.org/bovine/

56-57% for different sub-categories and the upper CI about 59-62%. Compared to the 2021 draft Oromia inventory, these uncertainty estimates are lower due to their derivation from representative sample surveys.

For the multipurpose cattle production systems, data combined the CSA survey reported feed category types with the detailed diet composition data from the OFLP survey (i.e. replacing expert judgement estimates in the 2021 draft Oromia inventory). The resulting DE% estimates were within the range expected given the animal performance in those production systems. So, an $MOE_{90\%CI}$ of ±7.5% was assumed for the pastoral/agro-pastoral system (resulting DE% range between 51% and 61%) and the mixed crop-livestock system (resulting DE% range between 52% and 61%).

Other coefficients: Table 14 shows the MOEs used for other coefficients in the IPCC enteric fermentation model.

Table 14 ***Margins of error and PDFs used for Y_m and other coefficients used in uncertainty analysis (%)***

Parameter	$MOE_{90\%CI}$ 1994, 2009 & 2018	PDF	Explanation
Y_m (%) (all sub-categories)	±16.8%	Normal	Normal, s.e. small. Margin of error from IPCC (2019).
Cf_i (all sub-categories)	±13.4%	Beta	Beta, proportion, cannot have negative values. Corresponds to ±15% at 95% confidence from Monni et al. (2007).
C_a (all sub-categories)	±13.4%	Beta	Beta, proportion, cannot have negative values. Corresponds to ±15% at 95% confidence from Monni et al. (2007).
C_p (all sub-categories)	±13.4%	Beta	Beta, proportion, cannot have negative values. Corresponds to ±15% at 95% confidence from Monni et al. (2007).
C (all sub-categories)	±13.4%	Beta	Beta, proportion, cannot have negative values. Corresponds to ±15% at 95% confidence from Monni et al. (2007).

Uncertainty in protein production

Milk protein content: The IPCC default value was used. Uncertainty was estimated at ±5% based on variability in a study in Ethiopia.[6] A normal distribution was used.

Cattle off-take: The $MOE_{90\%CI}$ was the combined MOE of populations for the animal categories assumed to be sold from each production system.

[6] https://www.ajol.info/index.php/ejas/article/view/176739

Dressing percentage: A triangular distribution was assumed with the default value as the most likely value and the minimum and maximum values derived from the range reported in a study in Ethiopia.[7]

Meat protein content: A $MOE_{90\%CI}$ of ±2% was assumed based on the range reported in a study in Ethiopia.[8]

Bone free meat: A $MOE_{90\%CI}$ of ±2% was assumed based on the variability in meat yield (%) reported a study in Ethiopia.[9]

Results of uncertainty analysis

Uncertainty in activity data

The uncertainty of the total cattle population is ±3.3% in 2012 and ±1.8% in 2021. This is lower than in the 2021 draft Oromia inventory, mainly due to the reduced uncertainty estimated for the mixed crop-livestock system based on the s.e. reported in the CSA survey report for 2021 and the change in method used to estimate population uncertainties in 2012. In both years, uncertainty of the total cattle population is mainly due to uncertainty in the sub-category populations in the mixed crop-livestock system, especially cows and oxen. In 2021, sub-categories in the commercial and smallholder dairy systems make greater contributions to total uncertainty.

Table 15 ***Regression coefficients indicating cattle sub-category population contributions to uncertainty of total cattle population (2012, 2021)***

	2012	**2021**
MCLcow	0.46	0.31
MCLoxen	0.23	0.23
MCLcalf <6m	0.11	0.06
MCLGrF	0.09	0.09
MCLGrM	0.08	0.07
MCLcalf1-12m	0.09	0.07
PAPcow	0.03	0.10
MCL bull	0.03	0.02
PAPcalf0-6	-	0.01
PAPcalf6-12	0.01	0.03
C_Dcow	0.06	0.13
C-DGrF	0.01	0.03
C_Dcalf6-12m	0.02	0.04

[7] doi:10.5539/jas.v11n18p45

[8] https://www.scielo.br/j/asas/a/B6PsHMR8PQBLysQccJqzhGH/#

[9] doi:10.5539/jas.v11n18p45

S_Doxen	-	0.04
S_Dcalf6-12m	-	0.04
PAPGrF	-	0.03
PAPbulls	-	0.04
PAPGrM	-	-
PAPoxen	-	-
S_Dcow	0.01	0.06
S_DGrF		0.01
Feedlot	0.01	-

Note: A regression coefficient of 0 indicates no relationship between the input variable and total cattle population, while a value of 1 indicates that a 1 standard deviation change in the input variable will lead to a 1 standard deviation change in the total cattle population.

Uncertainty in enteric methane emissions

Table 16 shows the uncertainty for total cattle enteric methane emissions for 2012 and 2021, which are within the range of ±18.8% in both years. These results are similar to the total uncertainty estimated for the 2021 draft Oromia inventory (±18.6%-±18.8% in 2009 and 2018, respectively). Error propagation therefore suggests that the average uncertainty of emission factors was about ±18.4% in 2012 and ±18.7% in 2021. These EF uncertainties are slightly higher than estimated by the 2021 draft Oromia inventory but are considered more reliable due to improvements in the data sources and methods for estimating uncertainty. These EF uncertainty estimates also compare well with the IPCC (2006) default uncertainty range for Tier 2 emission factors (i.e. ±20% with a 95% confidence interval, which roughly corresponds to ±16.8% with a 90% confidence interval).

The main factors associated with uncertainty in total enteric fermentation emissions are shown in Table 16. There is significant overlap between the input variables with high correlation to total emissions in 2012 and 2021, but the rank order of input variables is slightly different. Also, commercial dairy sub-category populations have more influence on 2012 uncertainty than 2021 uncertainty. Most influential variables are in the mixed crop-livestock system because that production system accounts for the largest share of total cattle population in the inventory.

Table 16 ***Uncertainty of total enteric fermentation emissions 2012 and 2021***

	2012	**2021**
Uncertainty (%)	+18.7, -17.0%	+18.8, -17.0%

Table 17 ***Contribution of each variable to enteric fermentation emissions and rank order***

	2012		2021	
	Correlation coefficient	Rank order	Correlation coefficient	Rank order
LW_MCLoxen	0.51	1	0.52	1
Ym_MCLcow	0.39	2	0.39	2
LW_MCLcow	0.36	3	0.37	3
CD_oxen (pop.)	0.36	3	-	-
Cfi_MCLcow	0.30	5	0.30	4
Ym_MCLoxen	0.29	6	0.30	4
DE%_MCLcow	-0.29	6	-0.28	5
Cfi_MCLoxen	0.24	8	0.25	6
DE%_MCLoxen	-0.21	9	-0.22	7
CD_cow (pop.)	-0.16	10	-	-
CD_calf0-6m (pop.)	-0.15	11	-	-
MCLcow (pop)	0.11	12	-	-
LW_MCLGrF	0.08	13	0.10	8
Ym_MCLGrF	0.07	14	0.08	9
LW_MCLbull	0.06	15	0.07	10
MCLoxen (pop)	0.06	15	-	-
CD_GrF (pop)	-	-	-	-
DE%_MCLGrF	-	-	-0.07	10
Ym_MCLGrM	-	-	0.06	11
Cfi_MCLGrF	-	-	0.05	12
DE%_MCLGrM	-	-	-0.05	12

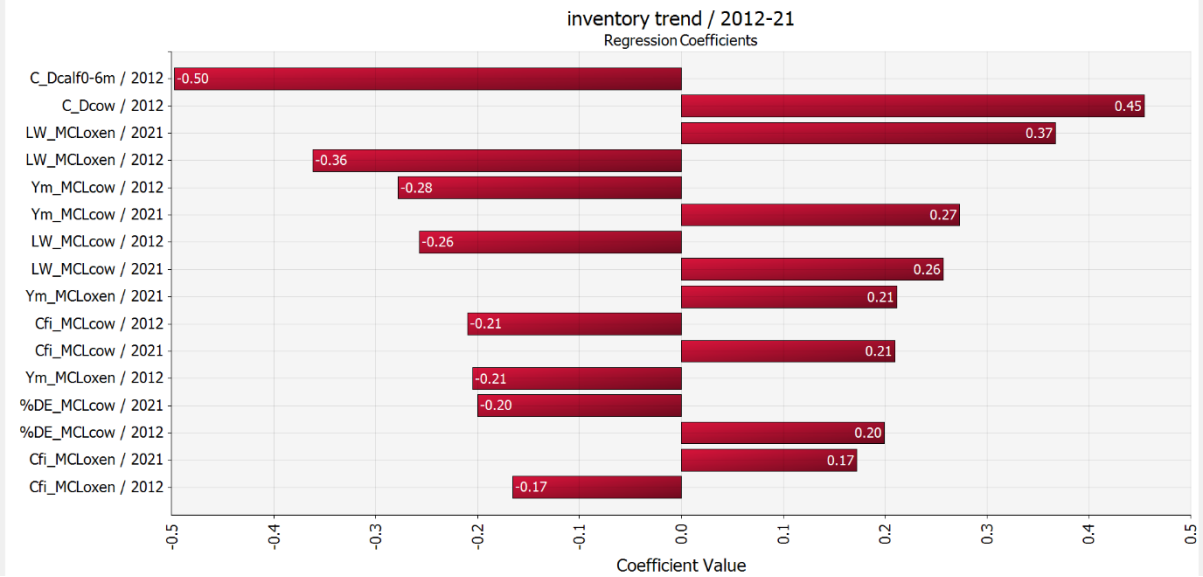
Uncertainty of the trend was calculated as:

Trend = $(TotalCH4_{2021} – TotalCH4_{2012})/TotalCH4_{2012}$

Uncertainty of the trend for 2012-2021 was (+191.1%, -64.6%).

The main variables contributing to uncertainty of the 2012-2021 trend are shown in Figure 7. The key parameters influencing the trend are similar to those influencing the level of emissions, including some sub-category populations in the commercial dairy system, and liveweight, methane conversion factor, coefficient for maintenance and feed digestibility for cows and oxen in the mixed crop-livestock system.

Figure 7 Contribution of each variable to uncertainty of the trend in enteric fermentation emissions, 2012-2021



Uncertainty in protein production

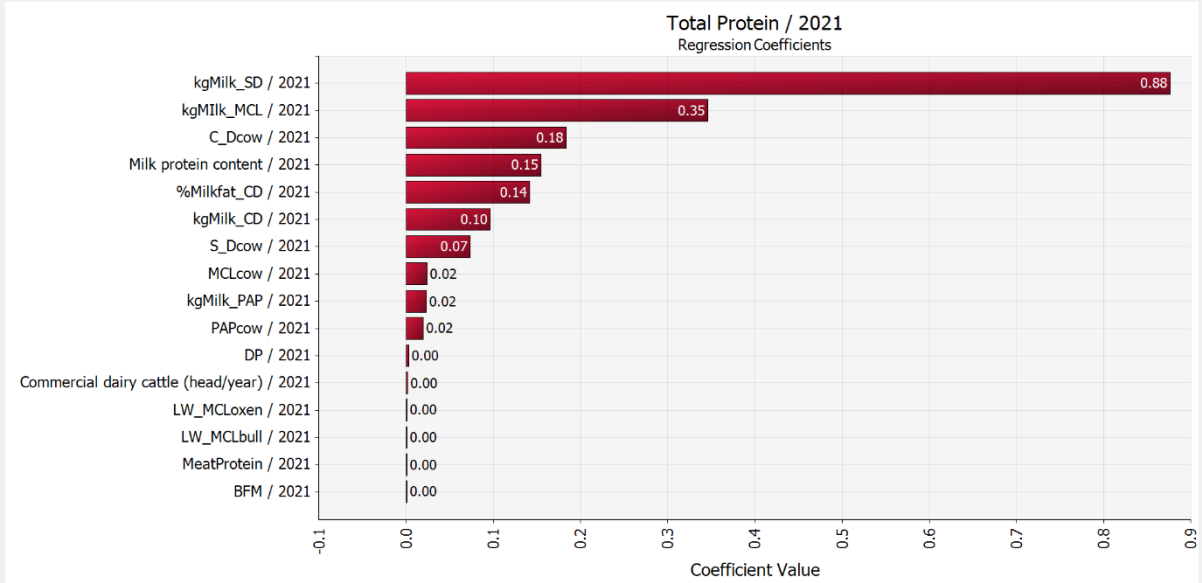
Uncertainties of total protein production (i.e. milk and meat protein combined) are shown in . *Table 18*.

Table 18 Uncertainty of total protein production 2012 and 2021

	2012	**2021**
Uncertainty (%)	+24.0, -22.6%	+35.3, -30.4%

The main factors influencing total protein production in 2021 are shown in Figure 8. Milk yields in the smallholder dairy, mixed crop livestock and commercial dairy systems are among the top factors. Commercial and smallholder dairy cow populations are also influential, as is milk protein content for which a single value was applied to all production systems.

*Figure 8 **Contribution of each variable to the uncertainty of total protein production, 2021***



Uncertainty in emission intensity

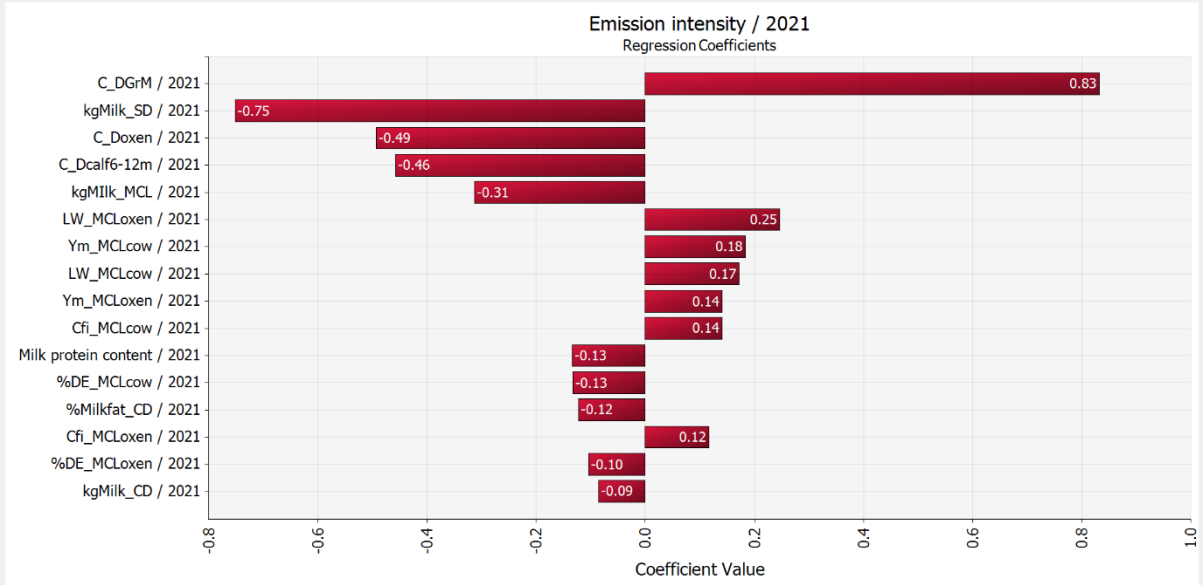
Uncertainties of emission intensity are shown in Table 19.

Table 19 ***Uncertainty of emission intensity in 2012 and 2021***

	2012	**2021**
Uncertainty (%)	+31.2, -71.2%	+42.0, -32.0%

The main variables influencing 2021 emission intensity are shown in Figure 9. Among population variables, sub-category populations in the commercial dairy system are the most influential. Milk yields in smallholder and mixed crop-livestock systems are influential, primarily because of their impact on total protein production. Animal performance variables are primarily those that impact on the uncertainty of enteric methane emissions from the mixed crop livestock system.

Figure 9 ***Contribution of each variable to the uncertainty of emission intensity, 2021***



4.6 Estimation of Emission Reductions

For the seven subcategories related to LULUCF, the emission reductions are estimated in the

Table *20* below. The baseline is consistent with the baseline numbers in section 4.4.2.

For the LULUCF related categories, the interventions that have been implemented in the forest phase will be continued in the second phase of the ERPA. In the first phase, these activities had a significant impact. The (unverified) first monitoring report of the first phase[10] in table 15 summarizes that in the period 2022-2023, the activities implemented were able to reduce emissions by almost 71% compared to the baseline. The baseline was 10,821,183.85 tCO2-e per year (or 21,642,367.70 tCO2-e over the period 2022-2023) while the actual emissions for 2022-2023 are estimated as 6,333,180.34 tCO2-e.

To estimate the expected enteric methane emissions under the ISFL ER Program, a conservative assumption was made of a 20% reduction in emission intensity compared to the baseline GHG-Emission intensity of 291.1 tCO2e / t protein (see Table 8). This means that for the ex-ante

[10] https://www.biocarbonfund-isfl.org/system/files/2025-01/ISFL%20ER%20Monitoring%20Report%20final%20for%20verification%20V4%20Clean.pdf

calculation of the emission reductions, an emission intensity of 232.8 t CO2e/t protein was assumed. The conservative assumption of a 20% reduction in emission intensity is based on the analysis conducted for the World Bank–funded LFSDP project in the Oromia region (unpublished report), which only considered enteric methane emissions within the scope of the OFLP program. The assessment estimated that LFSDP interventions in dairy cattle during 2019/2020 and 2020/2021 resulted in a 44.2% reduction in GHG emission intensity. These interventions primarily focused on improved feeding practices, enhanced breeding programs, and overall better herd and farm management practices.

To perform an ex-ante estimate of the emissions and the emission reductions from enteric fermentation, assumptions also needed to be made on the protein production in the period 2025-2029. Protein production projections for 2025-2029 were therefore estimated using a linear trend based on historical data on protein production from 2012 to 2021 ($Y=3,734.10x - 7,426,886.84$, $R^2 = 0.91$)

The estimated emissions and emissions reductions from enteric fermentation over the five-year crediting period (2025–2029) were calculated (using ISFL ER program Eq 2) by combining/multiplying the projected protein production in the period 2025-2029 with the baseline intensity of 291.1 t CO2e/t protein (to calculate a projected ex-ante baseline) and the assumed project intensity of 232.8 t CO2e/t protein (to estimate the projected ex-ante project emissions). The estimated cumulative emission reductions from enteric fermentation baseline amount to 41,369,788.7 tCO_2e. This figure reflects the product of improved production efficiency and reduced methane intensity in the livestock sector. Using the assusumptions above, the yearly estimated program emission from enteric fermentation remain below the established cap.

The expected set aside is also based on the same monitoring report. For reversals, the same set-aside of 10% is assumed. For uncertainty, the first monitoring report estimated the uncertainty for LULUCF as 53.8%. The estimated error for the emission intensity approach for enteric fermentation according to table 18 above is 42%. Combining these numbers using simple error propagation results in an ex-ante estimation of the future uncertainty of 68% and a set-aside of 12%.

Table 20: Estimation of the Emission Reduction

Year of reporting period t	Estimation of ex-ante baseline emissions under the ISFL ER Program (tCO2e/yr)		Estimation of expected emissions under the ISFL ER Program (tCO2e/yr)		Estimation of ex-ante emission reductions without considering buffers	Estimation of expected reversal set-aside under the ISFL ER Program (tCO2e) (10%)	Estimation of expected set-aside emissions to reflect the level of uncertainty associated with the estimation of ERs during the term of the ERPA (tCO2e)	Estimated Emission Reductions (tCO2e)
	LULUCF	Enteric fermentation	LULUCF	Enteric fermentation				
2025	11,144,464	39,196,078	2,311,310	31,356,863	16,672,370	1,667,237	2,000,684	13,004,449
2026	10,967,936	40,282,933	2,274,698	32,226,347	16,749,824	1,674,982	2,009,979	13,064,862
2027	10,791,405	41,369,789	2,238,087	33,095,831	16,827,277	1,682,728	2,019,273	13,125,276
2028	10,614,877	42,456,644	2,201,476	33,965,315	16,904,730	1,690,473	2,028,568	13,185,689
2029	10,438,347	43,543,499	2,164,865	34,834,799	16,982,183	1,698,218	2,037,862	13,246,103
Total	**53,957,029**	**206,848,943**	**11,190,436**	**165,479,155**	**84,136,384**	**8,413,638**	**10,096,366**	**65,626,380**

4.7 Reversals

4.7.1 Assessment of the Anthropogenic and Natural Risk of Reversals

Permanence in REDD+ projects refers to the principle that carbon stored in forests must be maintained over a very long period of time to "offset" the release of fossil carbon. Under OFLP-ERP the period of reversal risks determined under ERP framework agreement, however the storage should be guaranteed for at least a duration equivalent to the lifetime of CO2 in the atmosphere. Reversal risk, the risk that carbon is re-released into the atmosphere, is a significant concern in REDD+ projects. Under the context of OFLP-ERP risk factors are classified into three categories are internal risk, which refers to risks that originate within the project (such as project finances and management of benefit distribution); external risk, which refers to human-induced risks (such as certainty in land and resource ownership, community engagement and political risks); and natural risk, which refers to risks that arise from natural factors (including fires, extreme weather events and pests).

The intentional or unintentional release of stored carbon back to the atmosphere, particular management strategies are either minimizing risk of reversal or increase stand susceptibility to loss. Under the umbrella of OFLP-ERP an individual landowner is seeking to maximize carbon storage on their lands. Lands under different ownerships and landowners pursuing different project types have different goals and motivations currently mandated with emission reduction activities as carbon registries and trading programs in use or under development today.

In case of natural disturbance, the program area does not experience significant risks due to pests, extreme weather events and other natural risks, except possible medium risk of forest fire in the dry lowland forests like Acacia Commiphora and Combretum-Terminalia woodlands. Some studies in the lowland woodlands have shown an increasing incidence of fire with human activities, e.g., settlement and roads (Jadouli and El Amrani, 2022[11]). It is evident that there is a growing population in those areas and increasing road density. Fire severity is associated with grass biomass, when the biomass increases the fire incident also increases. In many lowland areas, fire has led to declines in the extent of dry forests. Fire has accelerated (along with population pressure and agricultural investment) the process of changes from dry forest and dense woodland to open woodland and wooded grassland, and, eventually to agriculture. However, the program design has involved many stakeholders at different levels through a series of consultation and awareness raising events. The program was quite across the Oromia region, especially in forested landscape area. Communities at grassroots level have been aware of the direct and indirect benefits of the program and are familiar with the intended program interventions and outcomes from experiences of implementation of other programs with similar activities on sustainable forest, land management and climate smart agriculture (e.g. PFM, SLMP, AGP).

With the establishment of OEPA and clarification of institutional arrangement among relevant sector offices at all levels, there is a strong and resilient public sector capacity to implement the program. Traditionally, there is a problem of coordination among public sector institutions. For effective coordination both vertically and horizontal among key sectors, the OFLP has a coordination unit, ORCU, hosted by OEPA. In addition to the main coordination at OEPA, ORCU has coordinators at different levels, down to woreda coordinators during grant

[11] Jadouli, A., El Amrani, C. (2022). Detection of Human Activities in Wildlands to Prevent the Occurrence of Wildfires Using Deep Learning and Remote Sensing. In: Ben Ahmed, M., Teodorescu, HN.L., Mazri, T., Subashini, P., Boudhir, A.A. (eds) Networking, Intelligent Systems and Security. Smart Innovation, Systems and Technologies, vol 237. Springer, Singapore. https://doi.org/10.1007/978-981-16-3637-0_1

implementation phase. There are also different sector policies and laws like forest and land related proclamations and regulations that have created a conducive environment for the program. Hence, there is a conducive policy and institutional environment that enables success of the program.

4.7.2 Assessment of the Level of Risk of Reversals during 1st Monitoring Report

The primary area of apprehension regarding reversal risks identified in the first monitoring report encompasses risks stemming from both natural disturbances and anthropogenic activities. These risks can be influenced by a variety of factors that are either intrinsic or extrinsic to an ISFL ER Program. The evaluation of the risk level associated with reversals has been conducted utilizing the latest iteration of the Reversals Risk Assessment outlined in the "ISFL Buffer requirements." This assessment is comprehensive, treating all categories uniformly without differentiating between subcategories, and includes both forest-related and non-forest-related aspects. The results of this assessment are summarized in the following Table 21

Table 21 : ISFL risk of reversals assessment

Risk factors	Risk indicators	Level of risk	Reversal set-aside percentage
Lack of long-term effectiveness in addressing the key drivers of AFOLU emissions and removals	**Effective Structural arrangement and minimum Stakeholder support** ✓ The OFLP-ERP initiative is essential in promoting sustainable forest management through the establishment and coordination of programs that involve a wide array of sectors and partners. This collaborative framework facilitates the convergence of different stakeholders, allowing them to pool their resources, share valuable knowledge, and exchange best practices. Such synergy is crucial for the effective management and preservation of forest ecosystems, ensuring that they are maintained in a responsible and sustainable manner. ✓ To manage the Key drivers of AFOLU emissions and removals related to forestland remaining forestland, conversion from forestland to grassland and cropland (Deforestation) conversion from grassland and cropland to forestland (afforestation), conversion from grassland to cropland. The Oromia regional state is highly working on tenure certification that helps to ban illegal encroachment and expansion of Agricultural activity to forest land. ✓ During the OFLP grant period different platforms, Workshops and consultation were held with law enforcement agencies, forest sectors, Program/project coordinator, private forest investors and heads of government institutions smoothen integration on legal enforcement and even the penalty on illegal encroachment/clearing of forest unforgivable in contrast to other illegal civil acts.	Low	5%

	✓ 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, it 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, the program 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 ✓ Result Based payment distribution for forest based communities following Benefit Sharing Plan (BSP) and BSOM, which increases community trust and community commitment in decouple deforestation and degradation from increases in agricultural production and other economic activities ✓ Insignificant occurrences of conflicts over land and resources in the program area (applicable to all eligible sub-categories). ✓ There has not been detected any conflict over land, land tenure insecurity in particularly important in forested areas, since individual land certificates were issued. ✓ Forest Land tenure security resolved and PFM is additional addressing this perceived lack of security on Natural forest by transferring forest management rights to communities through contracts, this could be strengthened through communal land certification in forest areas, and this also applies to communal grazing lands.		

Exposure and vulnerability to natural disturbances	✓ *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 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 play 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*	low	5% Reversal Risk is considered low for all eligible subcategories

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,) Programs /project interventions for Watershed management (AGP,SLMP,CALM) ✓ *Land tenure certification:- Securing land tenures for private farmers that restrict framers illegal intervention and expansion of agricultural land in to forest designation that may worse the natural disturbances and to cover the remaining part of the region Bureau of Land continues providing Second Level Certificate for all landowners.* ✓ *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.* ✓ *Drought leads to reduced water availability for livestock, affecting hydration and overall health. Insufficient water can lead to stress, lower productivity, and increased mortality rates in livestock.* ✓ *Extended dry periods result in reduced forage quality and quantity, forcing farmers to rely on supplemental feeding, which can increase costs.* ✓ *Drought conditions can diminish grain and forage crop yields, may leads to higher feed prices and affecting the profitability of livestock operations.* ✓ *Stress from drought can weaken livestock immunity, making them more susceptible to diseases. Additionally, drought can lead to concentrated pest populations in smaller water sources.* ✓ *Flooding can lead to exposure of livestock to contaminated water, increasing the risk of waterborne diseases, and in some cases leading to acute health issues or death.*		
Actual reversal risk set-aside percentage			10%

Annex 2: Financing Plan for ISFL ER Program

Annex 2 is attached separately as an Excel document to this document

Annex 4. Current version of comprehensive Benefit Sharing Plan for the ISFL ER Program

Introduction

BSP design and structure

The comprehensive BSP (cBSP) elaborates an equitable benefit sharing mechanism that is intended to effectively distribute carbon and non-carbon benefits generated by the Oromia Forested Landscape Program (OFLP) under the Emission Reductions Purchase Agreement (ERPA) phase two. The cBSP builds on the benefit sharing arrangements described in the Emission Reduction Program Document (ERPD) and the BSP established for ERPA first phase[12], which focuses on deforestation and Afforestation/Reforestation (A/R). The cBSP aims to distribute benefits among OFLP stakeholders involved in ER generation from avoided deforestation and forest degradation, afforestation and reforestation, and enteric fermentation from cattle in the second phase.

The approach of cBSP is to reward OFLP stakeholders across the Oromia landscape for their effective participation in ER generation. OFLP will measure, monitor, and report ERs at landscape level, applying ISFL carbon accounting methodologies in the forestry and livestock sectors. Following verification by a Third-Party auditor, ISFL will calculate the corresponding results-based payments considering relevant guidelines and agreements. The ERPA results-based payments that Ethiopia will receive will not be attributable to specific stakeholders; therefore, this cBSP include the agreements reached among relevant stakeholders to distribute the funds in an equitable, transparent, and cost-effective manner.

The cBSP will apply two different modalities of benefit distribution: direct allocations and performance-based payments.

[12] https://documents.worldbank.org/en/publication/documents-reports/documentdetail/722771624985229961/benefit-sharing-plan-for-disbursing-result-based-payments-from-biocf-isfl-program

- Direct allocation of ERPA benefits: the cBSP directly allocates a share of net ERPA results-based payments to relevant federal and regional government entities to support cross-sectoral coordination and adequate technical assistance for Emission Reductions (ER) generation.
- Performance based distribution: the cBSP will distribute ERPA benefits to the forestry and livestock sector stakeholders at the community level, based on their performance on ER generation measured by applying criteria and indicators explained in this cBSP. For benefit-sharing purposes, the forestry sector, the performance at kebele level, the smallest unit at which forestry management is organized, will be calculated using several indicators as explained in Section 5.3.1. On the other hand, for benefit sharing purposes the ER performance in the livestock (cattle) sector will be measured at the cooperative level. The cBSP also provide ERPA performance-based payments to private sector stakeholders to reward their contribution in adopting sustainable and low-carbon forest and livestock production practices.

The payment under this cBSP will not contribute to directly finance stakeholders/land manager's costs associated with ER generation. The investment finances to cover the costs of activities leading to ER generation is provided by the underlying government and donor partners financing through projects coordinated by OFLP. However, as explained in Section 7 of this cBSP, the ERPA results-based payments incentivize communities to reinvest half of their ERPA benefits in productive activities aligned with ER generation, while the other half will be used to cover the cost of social development and livelihoods improvement activities to be done using community action plans.

The cBSP is organized in nine sections. Section 1 is a brief **introduction** to the cBSP. Section 2 discusses **beneficiaries**, including their eligibility and conditions for participation. Section 3 introduces ERPA **benefits**. Section 4 presents **gross and net ERPA benefits**, MRV timeframe, ER targets, performance scenarios. Section 5 presents the **distribution of net ERPA revenues**, including broad apportionment of benefits between the forestry and livestock sectors, vertical and horizontal sharing. Section 6 presents the **benefit disbursement mechanism**, particularly flow of funds and governance. Section 7 presents a list of **potential use of benefits**. Section 8 describes

the processes to ensure **Environmental and Social (E&S) compliance** on BSP application, including the Feedback, Grievance and Redress Mechanism (FGRM); and Section 9 presents the **monitoring procedures of the cBSP**. The Annexes include (1) an overview of the OFLP, (2) stakeholder analysis, (3) roles and responsibilities in benefit sharing; and (4) key results of grass-root consultations.

This cBSP should be accompanied by an operations manual to be prepared by the Oromia REDD+ Coordination Unit (ORCU) and approved by the World Bank. The operations manual which will include the specific administrative and financial processes and procedures for benefit distribution, as indicated throughout this document; call for proposals and Terms of References; monitoring and reporting formats; indicators to monitor environmental and social compliance of projects financed with ERPA results-based payment; detail budget for operational costs; specific roles and responsibilities of the ORCU team responsible for cBSP implementation; rules of procedures for ad hoc committees that will select proposals; as well as any other information that need to be included considering lessons from applying BSP for ERPA first phase.

Principles of the cBSP

The cBSP will apply the following principles:

- **Joint responsibility of the forestry and livestock sectors**. The cBSP explicitly recognizes that attaining results-based payments will depend on the joint responsibility of all involved stakeholders from the forestry and livestock sectors. The cBSP contains measures to ensure that proper performance of each sector is accounted for, and to provide compensating incentives to beneficiaries whose performance has been negatively affected by catastrophic events, to be drawn from the Performance Reserve (See Sections 4.1.1) and according to the performance scenarios (Section 4.3).
- **Justice and equity.** The cBSP addresses the outcomes of resource management (allocation of benefits and costs) between the forestry and livestock sector by allocating more benefits to the forestry sector, recognizing its higher needs of investment (See Section 5.1 Broad apportionment of benefits between the forestry and livestock sector). The cBSP also ensures a participatory decision making on the use of benefits at local level according to customary rules and governance systems. The cBSP facilitates the participation of stakeholders with pre-existing unfavorable socio-economic conditions (e.g., underserved

communities, women, youth, and other vulnerable individuals) in benefit distribution (See Section 7 Potential Use of Benefits).

- **Performance Reserve**: The cBSP sets aside a small percentage (3percent) of the gross ERPA benefits to provide solidarity incentives to zones/woredas negatively affected by catastrophic events during each reporting period of the second ERPA phase. This principle recognizes that when acting together, the performance of all beneficiaries can affect the level of the benefits that they can all receive; therefore, the cBSP includes a Performance Reserve and rules to apply it under different performance scenarios (See Section 4.3) and.
- **Transparency.** The cBSP contains measures to ensure that its operation is transparent as well as accountable, making it mandatory to publish all information on how decisions have been made for the distribution and transfer of resources to beneficiaries and all the benefits generated by OFLP. (See Section 9). The Benefit sharing arrangements have been designed in a participatory manner involving multiple stakeholders from all Oromia State administrative levels (See Annex 4) 10).
- **Cost-effectiveness**. The cBSP uses existing institutions and capacity to minimize transaction costs and maximize benefits that will reach the beneficiaries (See Section 6). The institutional arrangements defined for the BSP for the ERPA first phase are the starting point for this cBSP, in agreement with livestock sector stakeholders and in consultation with grass root stakeholders.
- **Continuous improvement:** the cBSP will be reviewed periodically as required to improve benefit sharing, considering improvements to the MRV system and the institutional capability to collect and process data, while taking advantage of lessons learned from implementation of the BSP first phase

Beneficiaries

Beneficiaries refer to a subset of OFLP stakeholders identified using the below criteria to receive monetary and non-monetary benefits as a reward for their participation in ER generation activities under OFLP. Beneficiaries are priority individuals, group of individuals organized in Community-Based Organizations (CBO), or private entities that need incentives from ERPA revenues to engage or continue engaging in the implementation of sustainable low carbon activities in the forestry and livestock sectors of Oromia. OFLP stakeholders should provide evidence of eligibility

requirements compliance to become cBSP beneficiaries, as explained below.

Eligible beneficiaries

The cBSP beneficiaries are those beneficiaries from the forestry and livestock sectors who are eligible to receive carbon and non-carbon benefits. Carbon benefits are those derived from ERPA revenues and can be delivered to beneficiaries in the form of monetary and non-monetary benefits. During consultations, stakeholders identified eligible beneficiaries by applying the four criteria listed below. Table 1 presents the eligible beneficiaries of the cBSP. The legal basis supporting beneficiaries' eligibility is presented in Annex 1; however, this should be revised considering new legal developments in terms of forest regulation and carbon rights.

- Direct contribution to GHG emissions reduction from deforestation, forest degradation, enteric fermentation, and other unsustainable land uses.
- Willingness to use ERPA benefits to maintain interventions and contribute to the successful ER Program implementation.
- Historical contribution to forest conservation or the promotion of other sustainable land uses.
- Current engagement in projects and activities that undertake concrete actions to reduce GHG emissions from deforestation, forest degradation, enteric fermentation, and other unsustainable land uses.

Table 1 Categories of eligible beneficiaries and rationale for participation in the cBSP

Category of eligible beneficiaries	Rationale for participation in the cBSP[13]
Federal-level Government Entities	
• Ministry of Finance (MoF)	• Policy formulation and implementation, coordination, and facilitation • Promote OFLP at the high-level of decision-making platforms such as council of ministers, the federal parliament, and CRGE committee. • Provide political support in mobilizing additional resources from the GRCE fund, bilateral and multilateral partners, and the private sector to upscale on-the-ground investments in forest development, forest protection, and sustainable low carbon livestock production systems. • Structure innovative blended financial schemes to scale up GHG mitigation by integrating private and public finance with carbon finance (i.e., ERPA revenues from this cBSP) • Oversee OFLP-ERP implementation and ensure it gets adequate technical, fiduciary, and administrative support from the EFD' respective directorates, the National REDD+ Steering Committee, and MoA 's respective directorates and units
• Ethiopian Forestry Development (EFD) • Ministry of Agriculture (MoA)	• Monitor and follow-up proper implementation of national and international requirements (Safeguard, MRV, Leakage management) and ER benefit distribution. • Assist in coordination of federal and regional level cross sectoral policy and programmatic actions relevant to forest and livestock management and forest development activities of the OFLP, such as: coordination among forests and land use, forests and energy use, and forest in livestock development. • Oversee Environmental and Social compliance through the National REDD+ Steering Committee. • Be legally responsible government institutions for ER generation in their respective sectors • Lead at national level MRV processes coordinating with relevant regional MRV units, • Compile ER report and communicate to concerned national and international body (ISFL)
Oromia National Regional State sector institutions	

[13] See specific roles for each institution in Annex 3.

• Vice President Office for Agriculture and Rural Development Cluster	• Coordinate the OFLP through the Oromia REDD+ Coordinating Unit (ORCU) • Integrate the regional state's multi-sector REDD+ Steering Committee and Technical Working Group, which is responsible for providing strategic guidance and technical inputs, respectively, to guide OFLP implementation.
• Bureau of Finance (BoF)	• Coordinate benefit disbursement/distribution processes at the regional level ensuring allocated benefits reach to intended recipients in full and on-time
• OEPA/ORCU • Oromia Forest and Wildlife Enterprise (OFWE) • Bureau of Agriculture (BoA) • Bureau of Water and Energy Resources Development (BoWERD) • Bureau of Land (BoL) • Oromia Women and Children Affairs (OWCAB) • Bureau of Cooperative Promotion and Development Bureau (BoCPD)	• The OEPA and sector bureaus including the BoA, OWEB, BoL, OWCAB, OCPA and OFWE will be supporting cBSP implementation and coordinate activities on the ground through their decentralized staff, particularly those activities potentially conducive to promote ER generation. • Strengthen stakeholder's capacity on ER generating activities and safeguards managements. • Lead the MRV and ES safeguards management tasks of the ER Program at regional level through ORCU's dedicated MRV unit and safeguards management specialists, including the collection and analysis of regional- level ER performance data including assurance for its compliance to the agreed safeguards instruments, as well as reporting to the EFD and MoA as appropriate (OEPA/ORCU and BoA).
Private sector entities	
Forest sector: • Private entities involved in Afforestation and Reforestation • Entrepreneurs involved in assisted natural regeneration and forest conservation. • Forest coffee growers (outside forests)	Direct participation in ER generation under OFLP through the implementation of forestry plantations (A/R), Participatory Forest Management (PFM), forest conservation projects, forestry coffee, dissemination of energy efficiency technologies to reduce unsustainable fuel wood use, among others. As such, these forestry private sector entities are eligible to receive ERPA benefits, using the modalities explained in this cBSP.
Livestock sector • Feedlots/fattening firms • Commercial milk/meat producers and processors	Direct participation in ER generation activities under OFLP through the implementation of GHG mitigation

	measures[14] to reduce Emission Intensity, such as: o Silvopastoral systems o Sustainable rangeland management o Improved quality and availability of feed resources o Improved health extension services o Improved cattle reproductive performance o Improved breeds As such, these livestock private sector entities are eligible to receive ERPA benefits, through the modalities explained in this cBSP.
Community entities	
Forestry sector • Community-based Organizations (CBO) directly engaged in PFM, Afforestation/Reforestation, assisted natural regeneration. • Communities legally registered member of specific Kebele under consideration who have been historically contributing to forest conservation and currently functional to forest conservation	Communities have cultural and social responsibility of managing, protecting, and developing the forest. Eligible CBO can contribute to ER generation through their participation in forestry plantations (A/R), PFM, forest conservation projects, forest coffee within agricultural landscapes, as well as through the adoption of energy efficiency technologies to reduce unsustainable fuel wood use.
Livestock sector • Smallholder Primary dairy cooperatives • Range land management cooperatives • Smallholder feedlots/fattening cooperatives	Contribute to ER generation under OFLP through their participation in best practices in the livestock sector[15], such as: o Silvopastoral systems o Sustainable rangeland management o Improved quality and availability of feed resources o Improved health extension services o Improved cattle reproductive performance o Improved breeds

Conditions for participation

[14] election of ER generating activities please see Section 7.

[15] This cBSP does not prescribe the specific type of ER generating activity they should implement; this would rather depend on their preference and the type of support they get from underlying projects. However, Section 7 presents stakeholders' preferences to reinvest ERPA revenues to contribute to ER generation, as collected during the grassroot consultations.

The general conditions for participation applicable to all types of beneficiaries are listed below and specific conditions are presented in Table 2:.

- Participate in ER generating activities organized by OFLP/OEPA and MoA.
- Be willing to collaborate with ORCU and relevant local government entities in complying with and report on Program Environmental and Social Standards.
- Be willing to comply with Program financial management policies.
- Be willing to use the OFLP's Grievance Redress Mechanism.

Regional government entities and private sector stakeholders should apply to call for proposals to be launched by OEPA to access the ERPA benefits directly allocated to them in the cBSP. The call for proposals for regional government entities will focus on technical assistance, research, and development. Private sector's proposals will focus on sustainable low-carbon forest and livestock sector development.

Community beneficiaries will access their benefits through projects implemented by them and facilitated by regional and local government entities, based on community action plans. Beneficiaries would receive benefits conditioned to the positive ER performance of the Oromia region, compared with an established baseline (See Section 4.2).

Table 2: Specific conditions for participation applicable to different types of cBSP beneficiaries

Conditions for participation	
Private forest stakeholders (individual or groups):	• Recognized as a "Private Forest" or "Association Forest" developer by Proclamation No. 1065/2018. • Have a license as individual investors, private corporations, business associations. • Have developed new and existing forests and forest management operations that demonstrate contribution to achieving OFLP ER goals.

	• Be willing to contribute significant (at least 20 percent) matching fund, as described in the call for proposals.
Private livestock developers	• Same as requirements for private forest developers, but instead of developing new forests they should have implemented best livestock-sector practices indicated in Table 2.
CBO	• Forest and livestock cooperatives • Have forests on their own land or land with land holding/user certificate. • PFM CBOs signed legal agreement with pertinent government organization. • Demonstrable financial management capacity
Communities	• Reside nearby and inside the forests. • Should hold a land tenure certification and legally registered on communal land and patches of forests. • To be considered as members of a community, individuals must be legally registered member of specific Kebele, as per law/constitution of Ethiopia and the Oromia Land Use and Administration Proclamation No. 130/2007.

Existing ER initiatives in the Oromia landscape: Programs and projects such as the two legacy REDD+ Projects (Bale Mountains Eco-region REDD+ Project; and REDD+ Joint Forest Management in five districts of Ili Abba Bora Zone, Oromia Regional State, Southwest Ethiopia – Phase II Project), the REDD+ Investment Project (RIP), and the Green Legacy Initiative[16] (GLI), will be integrated into OFLP during the ERPA second phase. This reflects stakeholders' decisions made during the BSP first phase, confirmed during stakeholder consultations for this cBSP. The

[16] Implemented by FDRE and the Oromia Regional State and with a focus on afforestation and reforestation.

integration implies that the said REDD+ initiatives will not claim ERs generated by applying carbon accounting rules different to those of the BioCarbon Fund (BioCF) Initiative for Sustainable Forest Landscapes (ISFL). Thus, cBSP will continue applying the benefit-sharing agreements achieved between OFLP and these projects while developing the BSP for first phase ERPA (forest). Because these initiatives will be integrated into the OFLP, the beneficiaries of these and other underlying projects in place during the timeframe of the ERPA second phase could benefit from ERPA revenue only through this cBSP.

Benefits

Types of Benefits

The implementation of OFLP second phase will generate two types of benefits (i) GHG mitigation benefits (also known as "climate change mitigation", "benefits associated with carbon", or "carbon benefits"); and (ii) benefits other than GHG mitigation (also known as "non-carbon benefits" or "co-benefits").[17]

Carbon benefits

These correspond to the ERPA revenues to be made by the ISFL contributors, through the World Bank, in exchange for ER credits transferred to the Fund. The cBSP covered in this document is responsible for providing the general guidelines for the distribution of benefits associated with carbon. In general terms, ERPA revenues from the sale of emissions reductions to the ISFL will be distributed to the beneficiaries in the form of monetary or non-monetary (in kind) benefits.

- Monetary benefits: refers to the delivery of cash to beneficiaries, financed through the ERPA revenues from ISFL.
- Non-monetary benefits refer to the benefits received by the beneficiaries by way of goods, services or other benefits funded by the payments to be received from the ISFL/World Bank. Non-monetary benefits can include, but are not limited to, technical assistance for capacity building and the provision of inputs such as seeds, seedlings, equipment, and infrastructure, among others.

This cBSP will distribute monetary benefits to government institutions, communities, and private

[17] World Bank, 2022. Oromia Forested Landscape Program – Emission Reduction Project. Project Appraisal Document.

sector stakeholders. During stakeholder consultations communities expressed interest in receiving monetary benefits, to be used to cover the costs of activities in the community action plans, facilitated by woreda-level government entities. The resources will be used to finance community projects. Kebeles or cooperatives with low financial management capacity will also receive benefits in non-monetary terms where funds allocated to them to finance community projects that generate more ERs and social projects useful to the whole community.

Non-carbon benefits

Non-carbon benefits are any benefits produced by or in relation to the implementation and operation of OFLP second phase other than monetary and non-monetary benefits associated with carbon. The ERPA will not pay Ethiopia/Oromia for the delivery of non-carbon benefits; however, OFLP should report on the priority non-carbon benefits generated or enhanced by the program. Non-carbon benefits are crucial for OFLP sustainability as they have the potential to support the Program, even if ER performance is low, and are meant to secure stakeholder's engagement and ownership, as well as success over the long term (beyond the ERPA term) by ensuring that significant non-carbon benefits are accrued to the main stakeholders across the landscape and across the livestock sector supply chain. ISFL requires demonstrating that reported non-carbon benefits are culturally appropriate and inclusive from a gender and intergenerational perspective.

OFLP shall report on the following non-carbon benefits:

- Number of people engaged in income-generating activities because of ERPA benefit distribution (number) (% women).
- Volume of for-profit private sector finance leveraged to contribute to OFLP objectives.
- Volume of not-for profit finance (public or private) leveraged to contribute to ISFL objectives.
- Number of smallholder farmers in private sector schemes adopting improved agricultural practices (% women) (Number People).

Gross and net ERPA benefits
Gross carbon benefits

Implementing the cBSP requires covering a series of operational, monitoring, verification[18] and reporting costs. The following Table indicates that the total operational costs, which covers the needs for the forestry and livestock sectors. This represents US$ 3,044,548.40 for the total ERPA second phase.

[18] External and internal verification. Internal verification includes ground inventory of permanent sample plots and determine emission factors.

Table 3:. Annual operational costs for cBSP

S/N	Activity	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
I	**Implementation costs**						
1	Maintenance of Regional OFLP_ERP staffs						
1.1	OFLP coordinator	18,000.00	18,000.00	18,000.00	18,000.00	18,000.00	90,000.00
1.2	Financial Management Specialists (2)	31,200.00	31,200.00	31,200.00	31,200.00	31,200.00	156,000.00
1.3	ORCU MRV Specialists (5) and Livestock MRV Specialists (2)	109,200.00	109,200.00	109,200.00	109,200.00	109,200.00	546,000.00
1.4	2 ERM Specialists and 2 SRM Specialists	62,400.00	62,400.00	62,400.00	62,400.00	62,400.00	312,000.00
1.5	1 Information and Technology Specialist	15,600.00	15,600.00	15,600.00	15,600.00	15,600.00	78,000.00
1.6	1 Communication Specialist	15,600.00	15,600.00	15,600.00	15,600.00	15,600.00	78,000.00
1.7	1 M and E specialist	15,600.00	15,600.00	15,600.00	15,600.00	15,600.00	78,000.00
1.8	1 procurement Specialist	15,600.00	15,600.00	15,600.00	15,600.00	15,600.00	78,000.00
1.9	1 Benefit Sharing Plan Implementation and Livelihood specialist	15,600.00	15,600.00	15,600.00	15,600.00	15,600.00	78,000.00
1.1	1 Gender Mainstreaming Specialist	15,600.00	15,600.00	15,600.00	15,600.00	15,600.00	78,000.00
1.11	1 Secretary Casher	6,000.00	6,000.00	6,000.00	6,000.00	6,000.00	30,000.00
1.12	Drivers (3)	18,000.00	18,000.00	18,000.00	18,000.00	18,000.00	90,000.00
	Sub Total	**338,400.00**	**338,400.00**	**338,400.00**	**338,400.00**	**338,400.00**	**1,692,000.00**
II	**Institutional costs**						
1	Program mgt & admin costs	87,000.00	87,000.00	87,000.00	87,000.00	87,000.00	435,000.00
2	Policy, legal & enforcement (ESA)	0	0	0	0	0	0
3	Training & capacity building(Workshop and consultation)	7,488.00	7,488.00	7,488.00	7,488.00	0	29,952.00

4	*Stakeholder consultation & grievance resolution*	*137,598.00*	*0*	*137,598.00*	*137,598.00*	*0*	*412,794.00*
5	*SESA, ESMF, Benefit sharing(BSI Audit)*	*0*	*0*	*0*	*0*	*0*	*0*
6	*Other institutional costs (MRV &ESRM Supervision)*	*7,159.20*	*7,159.20*	*7,159.20*	*7,159.20*	*3579.6*	*32,216.40*
	Sub-total – Institutional costs	***239,245.20***	***101,647.20***	***239,245.20***	***239,245.20***	***90,579.60***	***909,962.40***
III	***Transaction costs***						
1	*Costs to design REL/ RL*	*0*	*0*	*0*	*0*	*0*	*0*
2	*Capacity building on GIS and remote sensing (Project staff, Regional and Zonal level experts on Forest resources monitoring using CEO,SEPAL and QGIS) including eSBAE method*	*21,780.00*	*63,960.00*	*21,780.00*	*63,960.00*	*30,360.00*	*201,840.00*
3	*AD Collection for MR preparation and Ground verification*	*0*	*11,862.00*	*0*	*11,862.00*	*11,862.00*	*35,586.00*
4	*Monitoring report preparation and Validation*	*17,316.00*	*32,748.00*	*0*	*32,748.00*	*32,748.00*	*115,560.00*
5	*Experience sharing abroad twice in Five years*	*0*	*44,800.00*	*0*	*44,800.00*	*0*	*89,600.00*
6	*Legal and contractual costs*	*0*	*0*	*0*	*0*	*0*	*0*
7	*Costs related to registry*	*0*	*0*	*0*	*0*	*0*	*0*
8	*Other transaction costs*	*0*	*0*	*0*	*0*	*0*	*0*
	Sub-total: MRV costs	***39,096.00***	***153,370.00***	***21,780.00***	***153,370.00***	***74,970.00***	***442,586.00***
	GrandTotal costs: I+ II + III	***616,741.20***	***593,417.20***	***599,425.20***	***731,015.20***	***503,949.60***	***3,044,548.40***

ER payment would be made approximately one year after ERPA Reporting Period (RP) end date (See Section 4.2). The number of RP during the ERPA timeframe would be determined at ERPA negotiations stage. For illustration purposes, Table 4 presents a hypothetical example considering the following RPs: (1) from January 1, 2025, to December 31, 2026; and (2) from January 1, 2027, to December 31, 2029. In this scenario there would be two payments during the second ERPA phase delivered approximately by the second half of 2027 and 2030, considering typical duration of the verification of the monitoring report by an independent Third Party and payment processing required by the World Bank. Table 4 presents the sources of funding for operational costs in this hypothetical scenario.

Table 4: Sources of funding to cover cBSP operational costs.

Year	Annual estimated operational costs	Source of funding
ERPA second phase		
2025	616,741.20	100% from payments to be received during the first ERPA phase
2026	593,417.20	
2027	599,425.20	100% from the first payment to be received during the second ERPA phase
2028	731,015.20	
2029	503,949.60	

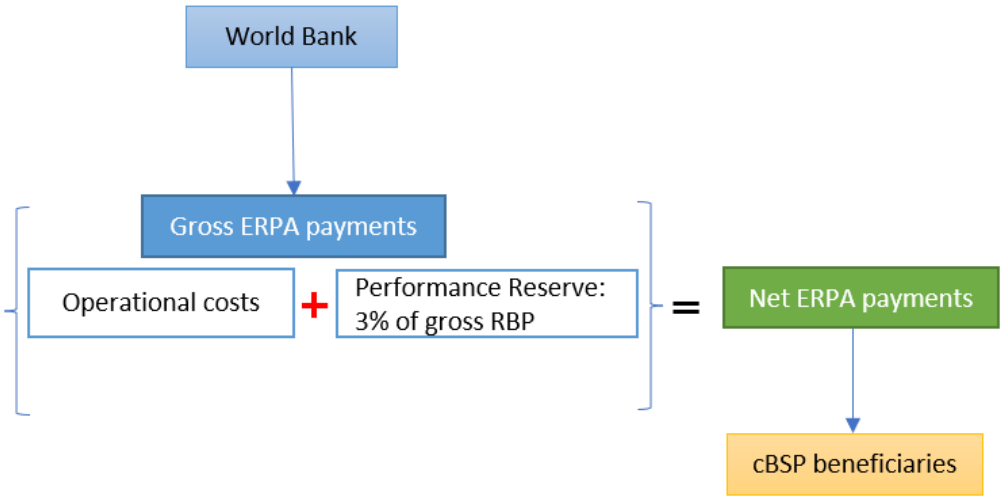
Performance Reserve

In line with the principles that govern this cBSP, the creation of a Performance Reserve has been considered, which will seek to separate three percent (3%) of the ERPA gross payments received to guarantee the payment of benefits in periods in which ERs are less than expected due to events beyond control, such as the effects of natural catastrophe (See Section 4.3).

Considering the above, it is important to differentiate between gross benefits and net benefits. Gross benefits correspond to the ERPA payments that the GoE will receive in exchange for the total ER reduced because of OFLP implementation during the ERPA period. Net benefits, on the other hand, correspond to the amount of ERPA benefits that the GoE will distribute among the different types of beneficiaries. Therefore, net benefits are calculated by deducting the operational costs and the three percent (3%) performance buffer, as illustrated in Figure 1. The governance procedures to reduce operational costs and mechanism to channel funds flow to the corresponding

unit are explained in Section 6.

Figure 1. Gross and net ERPA payments



MRV timeframe and ERs targets

The GoE will prepare a Monitoring Report (MR) corresponding to each RP. ISFL will review the MR for completeness and minimum quality, which can imply some iteration with GoE. Then, an independent third party hired by ISFL will verify the MR. Using the results of the verification report, ISFL will calculate the ER payments corresponding to the RP. The process from MR submission to ER payment delivery could take one year. The number of RP, the corresponding ER targets, and the type of payments (e.g., interim vs periodic) will be defined at ERPA negotiations. This information will be added summarized in a table in this section once available.

The GoE will present, in the MR, integrated results in terms of ER from the forestry and livestock sectors. ERs generated will be measured as tCO2e against a previously determined baseline[19], through an MRV system and involving independent verification by a Third Party of the Monitoring Report corresponding to each RP. Result calculation, in simple terms, involves determining the GHG emissions due to land-use change and Emission Intensity (EI) in the livestock sector during the ERPA period against the respective values in the reference period.

[19] The forest reference period applicable to the ERPA first phase (2008-2017) could be reviewed for the second phase. Also, the baseline for land-use and enteric fermentation from cattle are yet to be included and determined.

Performance scenarios

Benefit sharing can occur in practice under three scenarios.

- **Scenario 1**: OFLP achieves the ER committed target during RP, since forest zones and livestock sector stakeholders performed as expected. In this scenario, the Performance Reserve would be proportional to performance level among the best performers' forestry zones or livestock production systems, i.e., those that exceeded (more than 50%) their targeted ERs.

- **Scenario 2:** OFLP manages to produce less ERs than the committed target and some zones (for the forestry sector) and livestock sector stakeholders report a performance below expected during the RP. In this scenario, if the zone has a significantly (less than 50%) lower performance than expected **due to force majeure events**, less performing zone or livestock cooperatives could receive a "solidarity contribution" from the Performance Reserve to ensure their continued participation and contribution to achieving OFLP committed targets under the ERPA. Force majeure events include natural events such as droughts, floods, earthquakes, as well as anthropogenic events such as civil unrest. The resources in the Performance Reserve will be distributed according to criteria established by ORCU and approved by the OFLP Steering Committee. The criteria should be publicly available, in line with the transparency principle that governs this cBSP.

  If significantly low performance occurs due to causes demonstrably attributable to poor performance, mismanagement, and persistent failures in complying with agreed commitments of CBO, private sector stakeholders, individuals, or project proponents, OFLP Steering Committee may agree to carry out measures (i.e., capacity building, and technical support) to prevent this situation from recurring. This may include, in extreme cases, agreements to cancellation and exclusion of those poorly performing due to negligence from the cBSP during a given RP. Establishing such a measure will make the participating entities more responsible in their management and more careful in applying the rules and procedures of OFLP. Zones or livestock sector stakeholders with negative performance will not be rewarded, in line with the BSP for the first phase.

- **Scenario 3:** OFLP does not manage to reduce emissions with respect to its committed target and thus there will not be benefits to share, although one or more zones (for the

forestry sector) or production systems (for the livestock sector) may have achieved a performance equal to or better than expected during the RP. In this Scenario, the good performers may receive a compensatory payment in the future from the Performance Reserve, the amount of compensation to be determined by the OFLP Steering Committee. The beneficiary entities with markedly poor performance should carry out remedy actions reflected in an action plan.

Distribution of net ERPA revenues

Broad apportionment of benefits between the forestry and the livestock sectors

A high-level consultation meeting conducted in December 2021 decided to apportion the ERPA benefits generated from OFLP second phase in a 70:30 proportion (in %) to the forestry and the livestock sector respectively. This decision considered equity, effectiveness, and efficiency aspects that may affect the OFLP capacity to deliver ERPA commitments. In summary, the decision reflects the sectors' relative contribution as sources of GHG emissions in the Oromia region (see Figure 2) and prioritizes equity considerations by ensuring higher financial support is provided to the sector in most need of investments to generate ERs. Therefore, the cBSP will help alleviate the forestry sector's historical imbalance in investments and high levels of underserved populations, vulnerable people (including women and youth), and remote communities whose livelihoods depend on forest resources.

Vertical sharing

The grassroots consultations confirmed that the cBSP should apply the same approach defined for the existing BSP for the forest sector. Therefore, the vertical sharing refers to the distribution of benefits among government entities, private sector, and communities. The grassroots stakeholder consultations also defined the proportion of benefits to be distributed to each category of beneficiaries in both sectors, as presented in Table 5.

Table 5: Vertical sharing of benefits applicable to the forestry and livestock sectors

Category of beneficiary	Forestry sector (% out of its 70% allocation)	Livestock sector (% out of its 30% allocation)
Federal government entities	5	5
Regional and local	15	15

government entities		
Private sector	5	5
Communities	75	75

Federal government entities

Each sector (forestry and livestock) will use its allocated share of benefit received from the 5% net ER proceeds for federal government entities to undertake the roles and responsibilities as specified in Table 1 and Annex 3. MoA and EFD will prepare annual work plans, which will be approved by the National REDD+ Steering Committee, in coordination with the OFLP Steering Committee and OEPA.

Regional and local government (relevant) sector bureaus

Each sector (forestry and livestock) will use its allocated share of benefit received from the 15% net ER proceeds for regional and local government entities to undertake the roles and responsibilities as specified in Table 1 and Annex 3.

OEPA and BoA will launch call for proposals to select relevant sector bureaus, to provide (i) technical assistance in project development[20], (ii) capacity strengthening to ensure stakeholders implement projects according to the plan, (iii) coordination, supervision, monitoring, and evaluation, and (iv) reporting.

Resources distribution among sector bureaus should follow the steps below.

- Step 1: BoF split resources between sectors. Seventy percent (70%) of resources should be distributed proportionally to the zone's ER performance from forestry (See Section 5.3.1) and should be used to support projects in kebeles and FMCs; the remaining 30 percent should be distributed to support projects in livestock (cattle) sector cooperatives and communities, reflecting their performance in GHG emission reduction intensity.

- Step 2: OEPA and BoA will design the call for proposals, focusing on zones/woredas, kebeles/cooperatives that generated ERs in the preceding ERPA reporting period. OFLP Steering Committee should approve the call for proposals. The operations

[20] ER generating projects in line with OEPA and BoA guidelines; and social development and livelihoods diversification projects in line with Community Actions Plans.

manual should include the call for proposals, as well as processes for selecting relevant sectoral bureaus.

- Step 3: OFLP Technical Committee will evaluate the quality of the proposals submitted by the sector bureaus and prepare and present a report on the selection for OFLP Steering Committee approval. [21]
- Step 4: BoF grant the resources to winning sector bureaus as per OEPA request.

Private sector

OEPA will launch a call for proposals for private sector entities. Each eligible private sector benefit recipient (forest and livestock) will use its allocated share of benefit received from the 5% net ER proceeds for private sector entities complimented with their own matching fund (not less than 20% of the amount received) to undertake the roles and responsibilities specified in Table 1 and Annex 3. Private sector entities will participate in a call for proposals launched by OEPA and BoA. Suggested criteria, parameters, and weights to select the winning proposals are presented in Annex 5 Table 2.

The payments to the winning private sector entities are provided in two phases. The first phase are payments against a percentage decided by OEPA and BoA to private sector entities that presented a winning proposal. The second phase is payments against performance. The baseline for performance evaluation will be collected after the implementation of the first phase payment. OEPA MRV team will develop baseline data collection procedures.

Communities

Eligible communities will use their respective resource allocations to comply with their roles in ER generation as indicated in Table 1 and Annex 3. The criteria and indicators to distribute benefits among communities are presented in Section 5.3. Five percent (5%) of the resources for communities will be allocated to support undeserved communities, women, and youth, facilitated by Oromia Women and Children Affairs Office. The criteria, parameters, and weights to select beneficiaries from underserved communities, women, and youth will be included in the operations manual. Figure 2 below illustrates the vertical sharing of ERPA results-based payments.

[21] Annex 5 Table 1 presents suggested criteria, parameters, and weights to evaluate the proposals from sector bureaus.

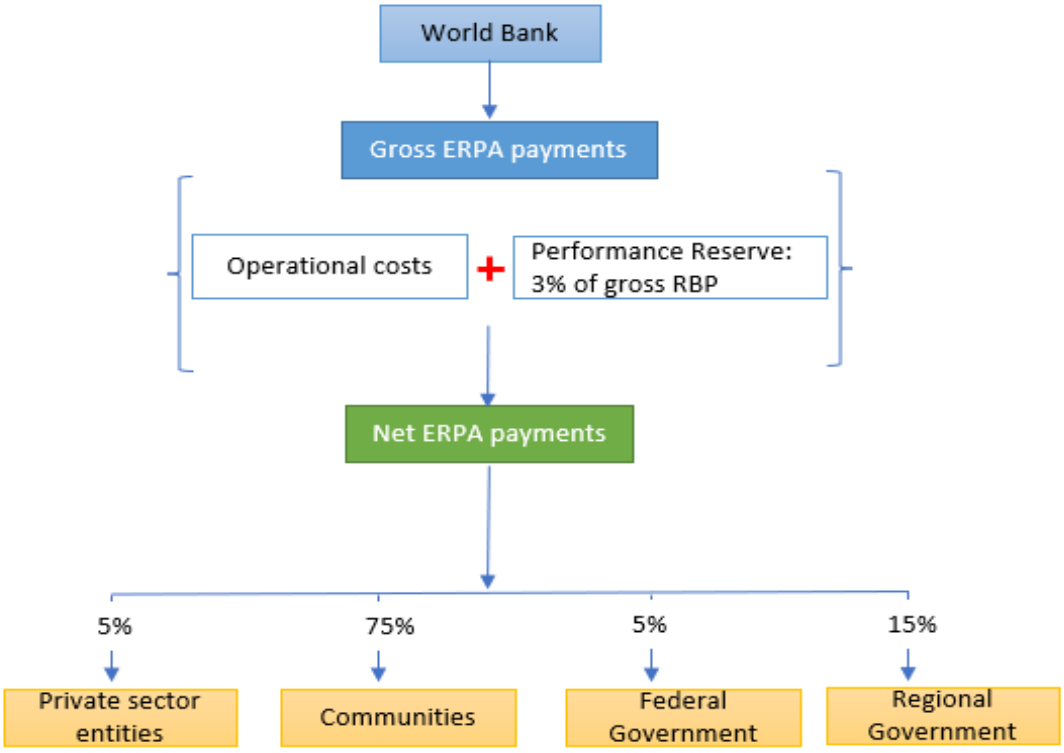


Figure 2. Vertical sharing of ERPA results-based payments

Horizontal sharing

The horizontal sharing refers to net benefits distribution within communities. Net benefits for communities correspond to 75 percent of total net benefits (see Table 5). Communities would be able to receive benefits through the forestry (See Section 5.3.1) and livestock (See Section 5.3.2) funds. The following illustrates benefit distribution between the forestry and livestock sectors.

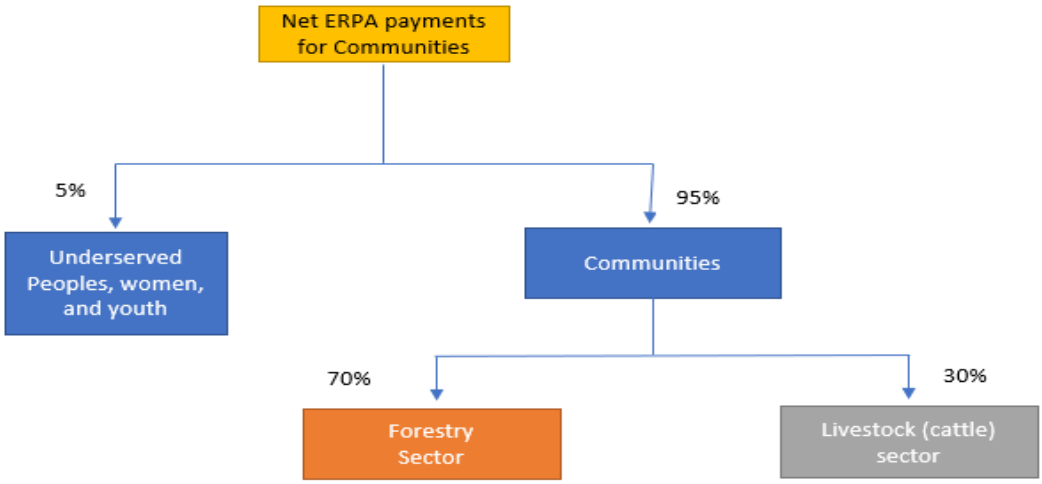


Figure 3 Benefit distribution at community level between the Forestry and Livestock Sectors.

Criteria for selecting undeserved population include

- Age and gender: Women, children, and the elderly who are often vulnerable and may have limited access to basic services and resources due to cultural or social norms.
- Disability: People with disabilities may face significant barriers in accessing basic services and resources, such as physical access to buildings or lack of accommodation.
- Health status: Populations with high rates of illness, such as those living with HIV/AIDS or other chronic diseases, who may require specialized care and attention.

Forestry sector

The ERPA results-based payments for forestry communities are the lump sum amount available for all Oromia zones, and it will be distributed among the ER performing zones. The grassroots consultations confirmed that cBSP should apply an approach like the one defined for the existing BSP for forestry sector but adding reduction in rate of forest degradation as a criterion for benefit distribution. Therefore, the benefits will be distributed among kebeles applying the following fourth-steps calculation process:

- **Step 1. Calculate the performance of zones (within Oromia region).**

Oromia zones are expected to differ in their performance in terms of ER generation reflecting their internal strengths, experience, and the support services they get from governmental and non-

governmental organizations. The stakeholder consultations agreed to use the criteria and indicators presented in **Error! Reference source not found.** to assess the zones' efforts to contribute to a chieving OFLP ER goals from forestry. [22]

Table:6. Criteria and indicators to assess the performance of zones.

Criteria	Weight (%)	Indicators
Area of existing forest[23], ha	40	This indicator is measured in hectares and excludes newly developed or rehabilitated forest to avoid double counting with forest development.
Avoided deforestation, ha	40	This indicator is measured in hectares of forest area standing that would otherwise have been lost under the reference scenario.
Forest development, ha	20	This indicator is measured in hectares of forest gain due to A/R, and Area of natural regeneration, ha.[24]

The following equation would be applied to calculate the share of benefits corresponding to the zones:

$$SBZ = TCS * \left(\left(0.4 * \frac{FA\ Zone}{FA\ Oromia}\right) + 0.4 * \left(\frac{AD\ Zone}{AD\ Oromia}\right) + 0.2 * \left(\frac{FD\ Zone}{FD\ Oromia}\right)\right) \quad (1)$$

Where:

SBZ: Share of Benefits per Zone

TCS: Total Community Share

FA: Forest Area

AD: Avoided Deforestation

[22] While forest degradation is expected to be applied in determining ER performance at regional level, stakeholders recommended not using this indicator to allocate benefits among zones because of high uncertainty to conclude/finalize the methodology and security issues in some part of Oromia to collect data for establishing baseline.

[23] This cBSP applies the following national forest definition comunicated by the Government of Ethiopia to the United Framework Convention on Climate Change: "Land spanning at least 0.5 ha covered by trees (including bamboo) attaining a height of at least 2 meters and a canopy cover of at least 20% or trees with the potential to reach these thresholds in situ in due curse.

[24] Distinction between the different forest change/development indicator (A/R and ANR) will be made through high resolution satellite image to detect the biomass change where forest develop activities are performed and developing shape files of each forest development area.

FD: Forest Development

- **Step 2: Calculate the performance of woredas (within zones)**

The calculation of resources per Woreda will be done applying the following criteria and indicators.

Table 7. Criteria and indicators to assess the performance of Woredas.

Criteria	Weight (%)	Indicators
Area of existing forest	50	This indicator is measured in hectares and excludes newly developed or rehabilitated forests to avoid double counting with forest development.
Forest Development	30	The following proxy indicators will be measured, depending on data availability[25] • Area of forest gain due to A/R, ha • Area of enrichment planting, ha
FMC	20	Area covered by FMCs, ha

The following equation would be applied to calculate the share of benefits corresponding to woredas within a specific zone:

$$SBW = TZS * \left(\left(0.5 * \frac{FA\ Woreda}{FA\ Zone}\right) + \left(0.3 * \frac{FD\ Woreda}{FD\ Zone}\right) + \left(0.2 * \frac{FMC\ Woreda}{FMC\ Zone}\right)\right) (2)$$

Where:

SBW: Share of Benefits per Woreda

TZS: Total Zone Share

FA: Forest Area

FD: Forest Development

FMC: Forest Management Cooperatives

- **Step 3: Calculate the performance of kebeles (within Woredas)**

The calculation of net ERPA benefits per Kebele within a Woreda will be done by applying the

[25] ORCU MRV team will (i) define parameters to distinguish between afforestation/reforestation and enrichment planting; and (ii) determine the data that should be collected for baseline and monitoring. This will be included in the Operations Manual.

following criteria and indicators

Table 8. Criteria and indicators to calculate benefits corresponding to Kebeles

Criteria	Weight (%)	Indicators
Area of existing forest	60	This indicator is measured in hectares and excludes newly developed or rehabilitated forest to avoid double counting with forest development.
Forest Development	40	The following proxy indicators could be applied, depending on data availability[25] • Area of forest gain due to A/R, ha • Area of enrichment planting, ha

The following equation would be applied to calculate the share of benefits corresponding to the kebeles within a woreda:

$$SBK = TWS * \left(\left(0.6 * \frac{FA\ Kebele}{FA\ Woreda}\right) + \left(0.4 * \frac{FD\ Kebele}{FD\ Woreda}\right)\right) \quad (3)$$

Where:

SBK: Share of Benefits per Kebele

TWS: Total Woreda Share

FA: Forest Area

FD: Forest Development

- **Step 4: Distribution of ERPA benefits among communities within kebeles**

The distribution of benefits among communities within a specific kebele should be done in a participatory manner, following the existing decision-making processes and local governance systems. Most benefit may likely go to the FMCs or kebeles with larger area of forest. The share of FMCs will be determined by their performances, which will be assessed through Organizational Capacity Assessment Tool (OCAT). OCAT focuses on governance, administration, forest management practices and utilization, business development and women's empowerment aspects. Detailed approaches to conducting Organizational Capacity Assessment will be provided by OEPA and to be approved by OFLP Steering Committee. See Section 7 on the use of ERPA

benefits by communities.

Livestock sector

The cBSP will focus on rewarding livestock sector stakeholders participating in reducing emission from enteric fermentation from dairy cattle and dual-purpose production systems. According to the Oromia GHG Inventory, the mix crop-livestock system contributed almost (91.46%) of the GHG emissions during the 1994-2018 period, followed by the pastoral and agro-pastoral system (6.5%), smallholder commercial dairy (1.29%) and commercial intensive dairy cattle (0.73%). This is in line with the increase in cattle population of 76% in Oromia from 1994-2018.[26] OFLP aims to support cattle owners to produce more or the same amount of product without increasing the number of herds. Such an increase in efficiency would also lead to reduced GHG emission intensity per unit of product also through the implementation of best practices such as improved herd management, feed availability, animal health services, cattle reproduction, and breeds. OFLP will coordinate with livestock sector development projects to ensure Oromia achieves committed targets of ERs under the ERPA second phase.

The cBSP will follow an approach of distributing ERPA benefits among livestock (cattle) sector cooperatives based on (i) performance in key determinants of GHG emission intensity, and (ii) establishment of silvopastoral systems. The performance of the different livestock production systems in terms of GHG emission reduction from enteric fermentation depends on herd population, management systems, and animals' performance. For this cBSP two indicators (see

) are used as proxy to measure GHG emission intensity in each productive system. Other indicators such as feed digestibility and number of crossbred cows were explored but were finally not considered due to high monitoring cost, difficulties for measurement, or were deemed biased against traditional cattle management systems.

Within each productive system, communities engaged in livestock production are organized into cooperatives. Stakeholders not organized into livestock cooperatives are not eligible to receive ERPA benefits under this cBSP. This eligibility criteria reflects that, unlike forestry, livestock is not a common pool resource, but often individual holding. It is also consistent with the livestock sector stakeholders' willingness to be organized into cooperatives to be able to use the ERPA

[26] Unique and Silva Carbon, 2021.Inventory of GHG emissions from cattle in Oromia Region (1994-2018) calculated using the IPCC Tier 2 approach.

benefits for common ER generating projects and social development and livelihood improvements, as expressed during grassroot consultations. Furthermore, including livestock sector stakeholders not organized into cooperatives would increase the costs of baseline establishment and performance monitoring.

Table 9: Criteria and indicators to distribute ERPA benefits among cooperatives and communities.

Criteria	**Parameters and allocation rules**	**Weights (%)**
Performance	1. Determine eligibility of cooperatives: The weight of this criteria will be distributed only to those cooperatives that (i) reduced their herd population, and (ii) increased their productivity of dairy milk and/or meat output (m3), with respect to the productive system established baseline.[27] 2. Distribute the weight of the criteria among eligible cooperatives, based on their performance in terms of herd population size reduction and increased productivity, measured against the baseline and applying the following rules: • Eligible cooperatives will de divided into two groups: average and high performing. • *Average performing cooperatives* are those who achieved up to 25% of herd population size reduction and increased productivity above the baseline. These cooperatives will receive equal parts of 40 % of available resources under this criterion. • *High performing cooperative*s are those who achieved more than 25% in herd population size	70

[27] See Section 9.1 Table 11

	decrease and increased productivity above the baseline. These cooperatives will receive equal parts of 60% of the available resources under this criterion.	
Silvopastoral systems, ha or number of trees/ha	1. Determine eligibility of cooperatives. The weight of this criteria will be distributed only to those eligible livestock (cattle) sector cooperatives that (i) are eligible under Criterion 1, and (ii) increased area of sylvopastoral systems, with respect to the average for their productive system in established baseline. 2. Distribute the weight of the criteria among cooperatives, based on their performance in terms of increment of area of silvopastoral systems, measured against the baseline and applying the following rules: • Eligible cooperatives will de divided into two groups: average and high performing. • *Average performing cooperatives* are those who achieved up to 25% of area of silvopastoral systems increment above the baseline. These cooperatives will receive equal parts of 40 % of available resources under this criterion. • *High performing cooperatives* are those who achieved more than 25% of area of silvopastoral systems increment above the baseline. These cooperatives will receive equal parts of 60% of the available resources under this criterion.	30

The calculation of the amount of ERPA benefits to be shared among livestock (cattle) cooperatives) that manage to reduce and maintain their population will be done applying the following steps:

- **Step 1: Calculate the share of benefits for ER performing livestock (cattle) cooperatives**

$$SBLC = 0.7C1 + 0.3C2 \ (4)$$

Where:

SBLC: Share of Benefits for ER performing livestock (cattle) cooperatives

C1: Improved performance in GHG emission intensity, based on decreased herd population size; increased productivity in term of milk (m3) and/or meat (kg);. The weight of this criterion is 70%.

C2: Increased area of silvopastoral systems within cooperatives' land. The weight of this Criterion is 30%.

- **Step 2: Calculate the share of benefits for livestock cooperatives that increased their performance in terms of GHG emission reduction intensity (Criterion 1)**

$$SBLC\_GHG\ EI = SBLC * 0.7 * (\frac{Number\ of\ cooperatives\ that\ improved GHG\ emission\ intensity}{Total\ number\ of\ eligible\ cooperatives}) \ (4)$$

Where:

SBLC: Share of Benefits for Livestock Communities

SBLC_GHG EI: Share of Benefits for livestock (cattle) cooperatives that iimproved their GHG emission reduction intensity, compared with established baseline. GHG emission reduction intensity

*0.*7: weight of Criterion 1.

- **Step 2: Calculate the share of benefits for livestock cooperatives increasing their area of silvopastoral systems (Criterion 2)**

$$SBLC\_SP = SBLC * 0.3 * (\frac{Number\ of\ cooperatives\ that\ increased\ their\ area\ of\ silvopastoral\ systems}{Total\ number\ of\ eligible\ cooperatives}) \ (5)$$

Where:

SBLC: Share of Benefits for Livestock Communities

SBLC_SP: Share of Benefits for Livestock Cooperatives that increased their area of silvopastoral systems against established baseline and are eligible under Criterion 1.

*0.*3: weight of Criterion 2

Disbursement mechanism and governance procedures

The disbursement mechanism of the cBSP follows an approach defined for the BSP first phase. **Error! Reference source not found.** presents the funds flow of gross (left side) and net ERPA r esults-based payments (right side). The World Bank will deposit the gross ERPA revenues into a MoF dedicated account. MoF will set aside and administer the three percent (3%) of the gross ERPA results-based payments received each reporting period corresponding to the Performance Reserve until receiving a funding request by BoF; OEPA will prepare and send the funding request, in coordination with BoA, and prior OFLP Steering Committee approval. MoF will also set aside and administer an amount (see Figure 4) to cover the operational costs associated with a financial management specialist at MoF. MoF will transfer the remaining fund to BoF, upon OEPA request, developed in collaboration with BoA, and previously approved by OFLP Steering Committee.

The net ERPA benefits (see the right side of **Error! Reference source not found.**), will be d istributed in the form of direct allocations and performance-based allocation. MoF will distribute direct allocations corresponding to five percent (5%) of the net ERPA results-based payments received to EFD and MoA, applying the 70:30 apportionment for the forestry and livestock sectors respectively. MoF will distribute the remaining resources (95%) of net payment to Oromia BoF, per OEPA funding request. Oromia BoF will distribute 15% of the total net ERPA results-based payment directly allocated to sectors administering the selected proposals; until the selection is completed, the funding will be kept at BoF. These funds intend to cover the relevant sector bureaus' costs associated with the technical support to be provided for OFLP and cBSP implementation, monitoring, evaluation, and reporting. OEPA, in collaboration with BoA, will develop the call for proposals, which will be included in the operations manual. The proposals will be evaluated by OFLP Technical Committee and approved by OFLP Steering Committee.

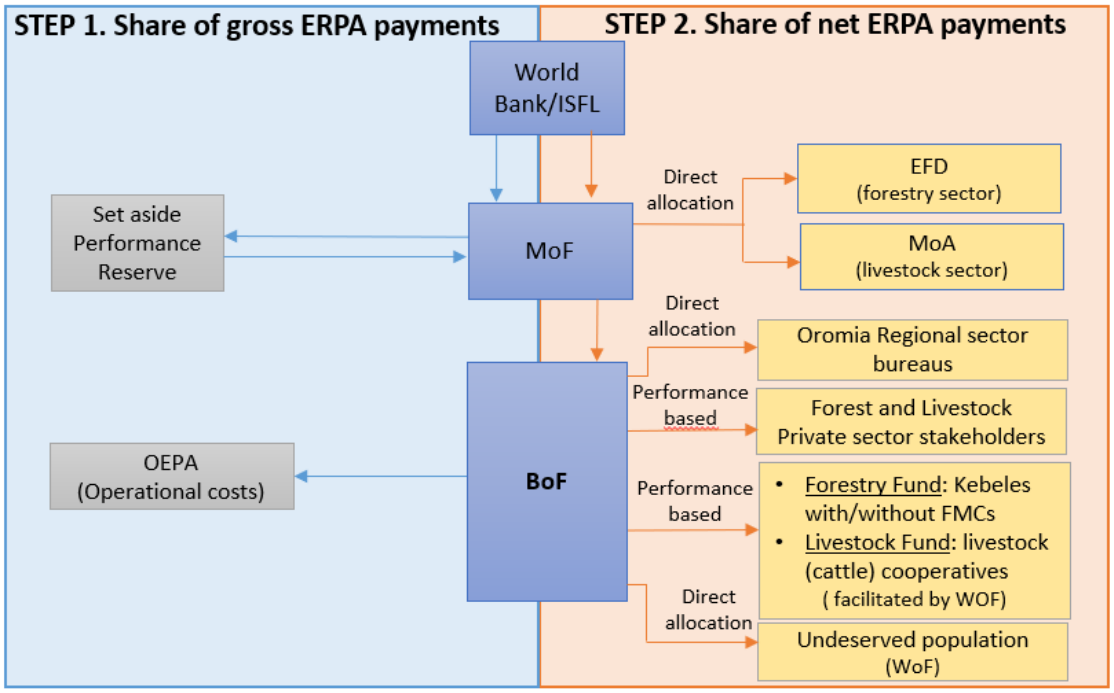


Figure 4. Disbursement mechanism and governance of the cBSP

BoF will also distribute performance-based ERPA payments to selected stakeholders, as requested by OEPA. The decision-making on the distribution of these resources will be made by OEPA and BoA, following Section 4.3 of this cBSP. OFLP Steering Committee will review and approve the OEPA-BoA resource distribution proposal. The resources from the performance reserve will be distributed through the same channels used for distributing community benefits.

Regarding the resources for communities, BoF will distribute 75% of the net ERPA results-based payments directly to the Woreda Finance Office (WoF) to be invested in selected social and development projects at well performing kebeles. BoF will channel the resources to FMCs and livestock (cattle) sector cooperatives with good financial management capacity. BoF may distribute to WoF the funds allocated to FMCs and livestock (cattle) cooperatives without adequate management capacity. The Woreda-level Cooperative Office will support funds utilization at kebele, FMCs, and dairy livestock (cattle) sector cooperatives without adequate financial management capacity. WoF and BoCPA will provide technical support to improve the kebeles and cooperatives' financial management capacity.

The operations manual will indicate the specific processes and procedures applicable to the flow of funds presented in **Error! Reference source not found.**.

Potential use of benefits

Stakeholders' participants of grassroot consultations manifested their preference for applying similar decisions made for the BSP first phase related to distribution of net ERPA benefits allocated to communities. The resources will be invested as follows:

- 50% on ER-generating activities. The projects will be developed with the help of woreda sector offices, including OEPA. The same applies for FMCs, if they exist at kebele level. Kebeles without FMCs will work towards establishing its FMC. Livestock cooperatives will re-invest their resources in activities that reduce GHG emission intensity in cattle. The livestock (cattle) cooperative stakeholders manifested their priorities to invest in ER generating activities (See Annex 4).

- 45% in community development and livelihoods improvement activities, as per a Community Action Plan. Stakeholders' preference for use of the funds for social development and livelihoods improvements are also presented in Annex 4, including a negative list to avoid undesirable negative impacts. The rest 5% will be used as a revolving fund for underserved peoples within that kebele.

Decision making on the use of ERPA benefits will be made through existing community decision-making rules and structures at kebeles, FMCs and livestock cooperatives levels. Relevant sector offices will assist the decision-making at local level, ensuring transparency and inclusiveness. The sector bureaus will guide the preparation of and implementation framework and plans.

Environmental and Social compliance

Institutional provisions to apply the Environmental and Social (E&S) Risk Management

Under OEPA leadership, OFLP ERP stakeholders developed Environmental and Social Risk Management (ESRM) instruments which comprise proportionate mitigation measures to address the potential E&S risks and impacts during OFLP implementation. Such instruments apply to this cBSP as there is a need to ensure the ER generating activities and social development/livelihoods development activities to be financed through ERPA revenues are safeguarded. The instruments, which are publicly disclosed[28] , include the Strategic Environmental and Social Assessment

[28] https://projects.worldbank.org/en/projects-operations/document-detail/P151294?type=projects

(SESA), the Social Development Plan (SDP), the Environmental and Social Management Framework (ESMF), the Resettlement Framework (RF), the Process Framework (PF), the Stakeholder Engagement Plan (SEP), Labor management procedures (LMP), Security Management Plan (SMP), the Environmental and Social Due Diligence Guideline for Retroactive Carbon Accounting for OFLP-ERP[29]and the Environmental and Social Commitment Plan (ESCP).[30]

Overall, the underlying activities that contribute to generate ERs during ERPA second phase should apply the ESRM instruments elaborated for OFLP-ERP ESMF. If additional activities that generate ERs are identified, they will be required to comply with the umbrella OFLP ERP E&S risk management requirement. The institutional and implementation arrangement for E&S risk management established during the OFLP grant financing will be maintained and strengthened during the ERPA period which relies on existing government institutions both at the federal and the Oromia Regional State levels with discrete accountabilities and decision-making roles based on existing mandates.

Any of the ER generating and social development/livelihood improvement activities to be financed with ERPA revenues will have to be screened for eligibility and for adverse E&S risks and impacts. For the adverse impacts, an appropriate E&S management plan must be prepared to prevent, minimize, mitigate, or compensate for and maximize beneficial impact on a sustainable basis. The ESMF[31] includes activities screening principles that should be followed in planning and implementing E&S management. Below is a subset of principles that apply to this cBSP:

- The ER generating activities should prioritize the need of community level beneficiaries, as per this cBSP; participation in the community activities will be entirely voluntary.

- The design of ER generating should be guided by technical support and technical materials to avoid or minimize adverse impacts and encourage positive environmental effects

[29] Annex 11 of the ESMF for Oromia Forested Landscape Program-Emission Reduction Project (updated)
[30] These instruments will be updated to address environmental and social risks of livestock sector activities.

[31] ESMF for OFLP-ERP ESMF annexed E&S Due Diligence Guideline for Retroactive Financing

https://documents1.worldbank.org/curated/en/099240008262283882/pdf/P1512940707cc809c0b42003fb650b4bd62.pdf

- The ER generating activities planning and implementation should integrate appropriate E&S management and enhancement measures.

- Identified ER-generating activities by the communities will be screened vetted and adopted in the Kebele landscape management plan based on selection criteria and screening designed to eliminate ER activities with major or irreversible E&S impacts. The ER generating activities with special E&S concern will be directed to the attention of the Oromia REDD+ Technical Working Group and OEPA at the regional level.

- Approval at regional level will involve OEPA, which will have the right to decline an ER activity on E&S grounds, or to assess likely impacts prior to approval.

- Special attention should be given to the impacts of small-scale construction/maintenance of schools, clinics, and community access roads involving land/asset acquisition and activities that may negatively affect Physical and Cultural Resources, forest, and natural habitat as well. Such types of activities should be notified by OEPA, which may recommend modifying the activity, recommend a management plan, or disapprove ER activities.

- ER activities implementation will be supervised and monitored at Kebele and Woreda levels. OEPA will rely on Development Agents (DAs), which, with assistance as deemed necessary from the Woreda sector office experts, Woreda EPA, and the Woreda OFLP coordinators, and OFLP E&S Risk Management coordinators.

ESS2: Environmental and Social Standard 2 on Labor Management

The LMP should be designed to manage worker-management relationships during cBSP implementation. These procedures will set out the way in which project workers will be managed, in accordance with the provisions of national laws and this ESS2. During cBSP implementation the OFLP will employ and deploy project workers and engage project consultants, contractors, temporary workers, and community workers from different segments of society. Therefore, the LMP will be used to manage labor related risks and to promote sound worker management relationships during cBSP implementation.

Private contractors will comply with the national labor proclamation (proc.No.1156/2019) and this

ESS2 requirements, which clearly spells out the (i) terms and conditions of employment; (ii) measures to ensure non-discrimination and equal opportunity; (iii) provisions to form workers' organizations; and (iv) prevention of child and forced labor.

The LMP in general will have to incorporate key aspects of conditions that will effectively address labor-related risks. These include the following:

- Conditions of services.
- Code of conduct.
- Occupational, health and safety (OHS) measures.
- Covid-19 prevention measures.
- Prevention of children and forced labor.
- Emergency preparedness and response.
- Grievance redress mechanism for project workers.
- Training of project workers on key issues including OHS and GBV prevention; and
- Management of labor influx.

Requirements applicable to contractors and subcontractors shall be specified in each Sub- project specific contract document as part of the ESMP to be developed for each Sub- Project in accordance with the ESMF to address labor risks, including (but not limited to) requiring signature of and training on Code of Conduct, OHS measures, prevention of child and forced labor; emergency preparedness and response, grievance redress mechanism (GRM) for Project workers, training of Project workers on key issues including OHS and GBV prevention, and management of labor influx, and Covid-19 prevention and control. The ORCU shall adopt and implement appropriate measures of protection and assistance to address the vulnerabilities of Project workers, including specific groups of workers, such as women, people with disabilities, and any other disadvantaged groups in accordance with ESS2.

ESS4: Community Health and Safety

The ESS4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from

climate change may also experience acceleration or intensification of impacts due to project activities. ESS4 addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to people who, because of their circumstances, may be vulnerable. Generally, ESS4 has the following objectives:

- To anticipate and avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from both routine and non-routine circumstances.
- To promote quality and safety, and considerations relating to climate change, in the design and construction of infrastructure, including dams.
- To avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials.
- To have in place effective measures to address emergency events; and
- To ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.

The activities to be financed with ERPA results-based payments can cause community and health risks. Forest dependent communities, project affected people, and people in the surroundings of forest project areas may increase the use of agrochemicals such as herbicides and insecticides, in agroforestry and agricultural intensification activities. The ESS requires safe, effective, and environmentally sound pest management. Thus, appropriate pest management measures such as IPM approaches, including biological control of pests, cultural practices, and use of crop varieties that are resistant or tolerant to pests should be used. In line with the standards outlined in the ESS3, the overall IPM process involves; (a) managing pests (keeping them below economically damaging levels) rather than seeking to eradicate them; (b) integrating multiple methods (relying, to the extent possible, on nonchemical measures) to keep pest populations low; and (c) selecting and applying pesticides, when they have to be used in a way that minimizes adverse effects on beneficial organisms, humans, and the environment.

Community health risks may also be considered due to traffic and movement of vehicles, influx of causal workers, contract workers in search of jobs construction and rehabilitation projects activities areas. Project affected people and local communities, project workers could be exposed

to increased gender-based violence, sexual exploitation and abuse, sexual harassment, spread of COVID-19 and other STDs.

ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

ESS5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and people. Project-related land acquisition or restrictions on land use may cause physical displacement (relocation, loss of residential land or loss of shelter), economic displacement (loss of land, assets, or access to assets, leading to loss of income sources or other means of livelihood), or both. The impacts caused by such risks are referred to as involuntary resettlement. Resettlement is considered involuntary when affected people or communities do not have the right to refuse land acquisition or restrictions on land use that result in displacement. Activities financed by ERPA results-based payments under this cBSP may induce minor level of land acquisition and /or restriction of access to legally designated parks, protected areas, or forest management/reforestation areas. When possible, project activities must avoid land acquisition and severe restrictions that jeopardize people's livelihoods. If it is not possible to avoid, appropriate mitigation measures must be laid out in a separate resettlement framework (RF) and process framework (PF) to minimize, reduce, and mitigate risks, or provide compensatory measures according to relevant national laws and consistent with this ESS5.

ESS10: Stakeholder Engagement and Information Disclosure

According to the ESS 10 Guidance Note, "stakeholders" are defined as "individuals or groups who (a) Are affected or likely to be affected by the project (project-affected parties); and (b) May have an interest in the project (other interested parties)." may be because of the project location, its characteristics, its impacts, or matters related to public interest. The ESS10 is relevant to the cBSP, and stakeholder engagement and information disclosure is a priority for planning, implementing, and ensuring sustainability of the proposed program. The cBSP has several stakeholders from the federal to the local communities, who are affected by the sub-project activities, i.e., local communities and/or government organizations, the private sector, civil society organizations, local administration, religious groups, academic and research institutes, traditional associations, etc. Thus, stakeholder engagement process is a requirement from the project preparation to implementation, monitoring and evaluation cycle. The ESS10 requires to prepare a stakeholder engagement plan, information disclosure and grievance redress mechanism for project affected people.

Consultation prior to engagement during cBSP implementation.

Consultation prior to engagement during the cBSP should be in line with OFLP Stakeholder Engagement Plan.[32] . The overall purpose of the stakeholder consultation plan is to provide a framework for achieving effective stakeholder involvement and promoting greater awareness and understanding of issues so that the project will be carried out effectively within project period to the satisfaction of all concerned parties. Stakeholder consultations are specifically aimed to:

- Get necessary information that enables OEPA/ORCU to refine the cBSP and address environmental and social concerns considering the opinion/ suggestions of the stakeholders in the course of project implementation
- To get possible recommendations and implement them accordingly
- To create a forum for interaction and discussion for OEPA/ORCU and participating institutions at different levels
- To ensure that proposed projects to be supported with ERPA results-based payments have broad community support, and that affected people endorse the proposed mitigation and management measures.

The consultation process should follow five principles. These principles are: (i) open to the input from stakeholders and consider their contribution; (ii) stakeholders should have access to all relevant information in advance, to ensure a meaningful stakeholder's participation in the consultation process and to have informed opinion on the relevant matters; (iii) the impact and feedback from each stakeholder is collated and assessed, shared back with stakeholders, and brought to the attention of decision makers; (iv) information sharing should be transparent, ensuring that information is available to stakeholders about relevant aspects of the process, stakeholder engagement, stakeholder input, consultation outcomes, and how stakeholder input is used; and (v) the consultation process should be visible to reach all impacted groups, experts, and other relevant and interested stakeholders.

Consultation can be conducted in several forms. Iterative consultation involves consulting using basic principles of good practice, incorporate feedback, documenting the process, and results of

[32] https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099300110222225407/p15129401390de03e0a2bd06e072e65b15f

consultation; letting stakeholders consult to know what has happened and what the next steps in the process will be (reporting back) are among the major iterative consultation process. Informed participation is a more intensive and active form of consultation. It involves a more in-depth exchange of views and information, leading to joint analysis and decision making. This increased level of involvement tends to generate a shared sense of ownership in a process and its outcomes.

Consultation with Underserved Peoples. Underserved Peoples are often among the most marginalized and vulnerable segments of the population. They can be subject to different types of risks and severity of impacts including loss of identity, culture, traditional lands, and natural resource-based livelihoods. Essential parts of preparation for the consultation process with underserved people include reconsult, identify priority issues for consultation, give special care to cultural appropriateness, and share responsibilities with government for disclosure and consultation. In line with the Stakeholder Engagement Plan of OFLP, the proposed strategy to incorporate the view of vulnerable groups include women focused groups, focal groups with pastoral and agropastoral communities, household visits, consultations in local language, and consultation in appropriate manner.

The ORCU team will be responsible for implementing the consultation plan during cBSP implementation, according to OFLP Stakeholder Engagement Plan. The cBPS allocated budget for broader environmental and social issues (See Section 4.1 Table 1). The budget will be used for producing communications materials.

Stakeholder engagement in the cBSP implementation will be assessed using criteria, indicators and weights included in the Operations Manual. Annex 1 Table 6 presents indicative performance indicators

Environmental & Social Management Process

The screening for adverse E&S will involve the following steps:

- **Step (i): Eligibility check (Guidance for relevant sector bureaus)**

The cBSP subprojects that are not eligible under the OFLP ERP can be reviewed and checked by the DAs at the Kebele level against any of the features mentioned in the check list in Table 16 of the ESMF. The assessment will help identify not eligible activities and have to be excluded unless the features can be avoided by a change of design or location.

- **Step (ii): Screening of ERP activities that require special attention and environmental and social concerns (Guidance for OEPA)**

Eligible ERP activities financed with ERPA results-based payments are further screened for potential impacts and E&S concerns by OEPA, with technical inputs of the relevant sector bureaus staff.[33]. Activities used to generate incomes (such as seedling production, coffee outside forest, tree planting, fruit tree planting, fuel saving stoves) and small-scale construction/refurbishment and social development/livelihood improvement, including small scale construction/refurbishment of clinics/schools/roads fattening, beekeeping, and agro-forestry which may require land acquisition, use of agro-chemicals including pesticides, and/or relocation of underserved groups. Further, access road construction/maintenance activities may involve voluntary land acquisition and loss of assets or minor displacement of people. Therefore, if the project activities have any of the above features, the OEPA focal person/expert, with the relevant sector bureaus staff, notifies the Woreda Administrators (Council) to make sure that the necessary procedures and guidelines are followed in the site-specific E&S instruments.[34]

Then, the ERP activities must be screened for any potential E&S concern.[35] This screening will help identify ERP activities with undesirable features, try to avoid the impacts by modifying the design. Otherwise, the activity must be tagged as a 'program activity of E&S concern.' In such a case, a checklist of potential impacts and level of adversity shown in Table 19 of the ESMF can be used to judge if the activities should be modified to avoid/mitigate the impacts or should be referred for further environmental and social analysis because of complex or unknown impacts. The table can be used by checking/ticking (☑) the approximate degree of adversity. The format indicated in Annex 3 of the ESMF can be used for reporting purposes.

Those ERP activities with no potential adverse impacts can be directly approved. For those activities, they are likely to have low to moderate risks and impacts may be modified if suitable mitigation measures are incorporated into the design by relevant sector bureaus.[36] Those ERP activities which are likely to have substantial and high risks and impacts should be tagged as 'ERP

[33] Checklist in Table 17 of the ESMF can be used for screening and the format indicated in Annex 3 of the ESMF can be used for reporting.
[34] See Annex 4 of the ESMF.
[35] The checklist in Table 18 of the ESMF can be used for screening.
[36] Mitigation measures can be referred from chapter four of the ESMF (See Section 4.2 and table 6)

activities of E&S concern' before referring the plan for approval.

- **Step (iii): Notification of ERP activities of E&S Concern: Guidance for the Woreda Administrators (Council) and OEPA**

The Woreda Administrators (Council) consolidates plans and forwards the same to OEPA together with the list of ERP activities that are tagged as of 'environmental concerns. ORCU then notifies the OEPA of the ERP activities of E&S concern and requests for review of the same to determine if an E&S Impact Assessment (ESIA) is required.

- **Step (iv): Review of notified ERP activities: Guidance for OEPA**

The OEPA, with inputs of OFLP Steering Committee, conducts review of the ERP activities considering that most activities may not necessarily need a full scale ESIA since OFLP-ERP is not a high-risk project, and those ERP activities tagged as 'ERP activities needing special attention' are already identified following the special procedures and guidelines referred in Annex 4 of the ESMF.

The Review report to ORCU should include i) the decision on each ERP activity whether an ESIA is required or not, ii) if an ESIA is required, the recommended scope of the ESIA clearly indicating the aspects to be seriously addressed, the skills required and duration of the ESIA, iii) A detailed Terms of Reference for the ESIA expert (consultant), iv) if an ESIA is not required, include guidance on special needs such as technical guidelines and an environmental and social management plan on any of the ERP activities.

- **Step (v): Environmental and Social Management Plan (ESMP)**

The ESMP should include both E&S management measures and it should be based on the result of screening and technical information about the proposed subproject/activity (i.e., the type, scale, and extent of the subproject). The ESMP consists of the set of E&S negative impacts, mitigation, monitoring, time of implementation, and institutional measures to be taken during implementation and operation phases. This is just either to eliminate the adverse impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures.

Similarly, identified social adverse impacts with their mitigation measures, responsible implementing body and required budget (social assessment report) should be followed to avoid minimizing and/or mitigate adverse social impacts with special focus on underserved people and

vulnerable groups. The impacts and the measures identified in the ESMP should be consistent with the findings of the screening results. It serves as a pertinent instrument to guide the subproject proponents and other implementers to implement effective mitigation measures, design, and conduct sound environmental and social monitoring programs.

- **Step (vi): Conducting an ESIA: Guidance for the Woreda level OEPA**

In liaison with ORCU and with the support from the OEPA, the Woreda-level OEPA office together with relevant sector bureaus is responsible for ensuring that the required ESIA is conducted as per the WB ESF requirements and the national and regional ESIA requirements. The ESIA can be conducted by a team of experts drawn from the Woreda sector offices or by a consultant as deemed necessary. If a team of woreda experts is accepted, they should be given the necessary training on ESIA procedures, ESRM policies, relevant policies and ESIA guidelines before conducting the environmental and social impact study.[37] It is vital to underline terms of reference (ToR)[38] for the ESIA should be provided by the OEPA. The ESIA report should consist of i) description of the ERP activity (with location), the environmental baseline, the impacts, mitigating measures, and recommendations for implementation and monitoring of the mitigating measures, among others.[39]. Reference for mitigation measures can be made in FEPA ESIA guidelines.

- **Step (vii): Reviewing the ESIA Report: Guidance for the OEPA**

The ESIA report will be submitted to OEPA through ORCU. The OEPA, with technical inputs of the OFLP Steering Committee, will review the ESIA report and makes decision by (a) approving the ERP activity (with conditions relating to implementation); (b) recommending re- design (with required and/or recommended amendments); or (c) rejecting the ERP activity (with comments as to what is required to submit as an acceptable screening report). ESIA report reviews should be done in the given time frame (shortest possible time) to avoid delays in ERP activity

[37] The outline for ESMP is indicated in Annex 4 of the ESMF.
[38] A suggested ToR can be found in Annex 6 of the ESMF
[39] Annex 6 of the ESMF includes detail information on the contents of the ESIA report.

implementation. The result of the review must be communicated to ORCU as soon as completed.

As stated above, the E&S Management Process in steps (i) and (ii) must be conducted for all activities in OFLP- ERP while the steps from (iii) to (vi) should be conducted only for ERP activities needing special attention and those of environmental concerns.

Based on the ESIA implementation, the environmental and social risk management monitoring reports should be submitted internally to OEPA ORCU and to NSC and then to the World Bank for review. The purpose of these reports is to provide:

- Status on compliance with ESHS requirements established for the Project including those in sub-projects.
- A record of ERP Components 1 and 2 subproject activities, experience and issues running from year-to-year throughout the ERP Components 1and 2 that can be used for identifying difficulties and improving performance: and
- Practical information for undertaking an annual review.

Error! Reference source not found. below summarizes the E&S management process.

Figure 5. E&S Management Process, as per the ESMF. Source: ESMF of OFLP ERP

Schedule for consultations

The operations manual will include a consultations plan for the cBSP, considering the following indicative list of activities prior, during, and after benefit sharing.

- Prior to benefit sharing
    i. Information sharing about available resources for the forestry and livestock (cattle) sector communities, including for Kebeles and livestock sector cooperative.
    ii. Launch of call for proposals for private sector and regional sector bureaus
    iii. Participatory design and consultation on ER generating projects; social development and livelihood diversification projects; and projects for Underserved Peoples, women, and youth
- During and after benefit sharing
    i. Information sharing on progress reports on implementation of projects financed with ERPA results-based finance, including achievements, risks, and opportunities for improvement.
    ii. Information sharing on final reports on benefit distribution

Grievance Redress Mechanism (GRM)

EFD and OEPA are responsible for timely responding to OFLP ERP affected parties' concerns and grievances related to the E&S performance. For this purpose, ORCU will strengthen the existing GRM, developed under the context of the OFLP grant project, to address citizen's complaints or grievances in a formal, transparent, cost-effective, and time-bound manner. OEPA, in collaboration with sector bureaus will ensure OFLP ERP- affected people/community are adequately informed about the process to register grievances, complaints, and concerns about OFLP-ERP activities. Grievances may arise from members of communities who are dissatisfied with (i) the eligibility criteria, (ii) community planning and resettlement measures, and/or (iii) actual implementation, among others. Grievances will be actively managed and tracked to ensure

that appropriate resolutions and actions are timely taken, corrective actions are implemented (as applicable), and the outcome is informed to the compliant. The resolution of different types of grievances can be addressed at different levels.

There are several types of GRMs in Oromia. The institution of the Gadaa system, for example, is considered a traditional mechanism; there are also religious systems such as the Shari'a Court; and the formal GRM, which follows the court system, including the local Shengo and modern courts.

The Oromo Gadaa System includes various traditional institutions such as Gadaa, Aadaa, Safuu, Seera, and Sinquee. It focuses on grievances arising from natural resources management and use. Traditionally, in the Oromo culture, the redress grievances responsibilities are assigned based on age classes. The Luba elders (with ages between 40-48 years), are responsible for redressing grievances within the community or among groups and individuals and apply the laws dealing with the distribution of resources, criminal fines and punishment, protection of property, theft, etc.

Shari'a Court, a system run by local communities, is an integral part of the formal legal system. It sometimes starts at the Kebele level and attend cases for which traditional ways of redressing grievances have not achieved the desired outcome; in the Shari'a Court the disputants face a statement of verdict given by the religious judges (Qadis). This structure has some links to the government court at the Woreda level. While the sharia 'courts work independently of the modern courts; it does not investigate cases being handled by the formal courts. Its decisions are approved and implemented by the other formal legal and administrative bodies at a higher level.

The formal GRM comprises several instances. These are: social courts, court, the office of the ombudsman, the Ethiopian Ethics and Anticorruption Commission (EACC), and the Ethiopian Human Rights Commission (EHRC).

- Social courts aim to ensure peace and stability among Kebele community. It allows for quick and affordable dispute settlement at the Kebele level as stipulated in the revised Constitution of the Oromia Regional State. Shengo is a judicial committee to oversee conflicts with the power to impose decisions through fines and imprisonment. Grievances related to natural resources management are reported to the relevant government office after the decision is made by Shengo. Social courts have jurisdiction over minor cases. For instance, the Determination of Powers of Social Courts of Oromia Proclamation No. 66/2003 limits the jurisdiction of social courts on cases up to 1000 ETB.

- Court is a formal state judiciary system that may be viewed as external to the parties involved in the grievance. The formal court established at Woreda level accomplishes the issues of grievances that arise in the community. This court handles both civil and criminal cases. The decision made at Woreda court abides to the parties involved in grieves with their rights reserved to take to the case into the next higher-level court by appeal. The Woreda court mostly settles grievance cases related to natural resource management and use.
- The office of the ombudsman aims to bring about high-quality, efficiency, and transparent governance, that is based on the rule of law, by ensuring that citizens' rights and benefits provided by law are respected by the organs of the executive. The Institution has jurisdiction over executive organs of the federal as well as regional governments. It is an organ that protects citizens from maladministration. To accomplish its activities, it has powers to: supervise administrative directives issued, and decisions given, by executive organs and the practices thereof so that they do not contravene the constitutional rights of citizens; receive and investigate complaints in respect of maladministration; conduct supervision, with a view to ensuring that the executive carries out its functions in accordance with the law and to preventing maladministration; seek remedies in case where it believes that maladministration has occurred; and make recommendations for the revision of existing laws, practices or directives and for the enactment of new laws and formulation of policies, with a view to bringing about better governance.
- EACC jurisdiction is limited to prosecuting or causing the prosecution of serious ethical breaches and corruption that constitute violations of the penal code. The EACC has no jurisdiction to entertain citizen complaints involving maladministration.
- EHRC offers advisory services and has decision-making power. It only investigates issues relating to violations of fundamental human rights which will exclude the great majority of complaints of administrative maladministration.

The following table suggests OFLP ERP GRM applicable at different levels

Table 10: Suggested GRM at different levels as per the ESMF

Level	Responsible Institution	How
Federal	EPA- REDD+ Secretariat	The National REDD+ Steering Committee and EPA

	(REDD+ Steering Committee)	gives response within a maximum of one month time on cross cutting conflict issue not responded by a region.
	Federal Ombudsman's Office	The Federal Ombudsman gives advice for unresolved issues before the case submitted to the court
	Federal Court	Grievances settled at different level may be pursued at the court if complainants not satisfied with the grievance redressed at that level.
Regional	Oromia Environment Protection Authority (OEPA) & Oromia REDD+ Coordination Unit (ORCU)	If stakeholders or community may not satisfy with the grievance settlement proposal or may be referred to OEPA or ORCU, then the OEPA/ORCU will give response within 15 days. Regional stakeholders can submit their appeal to the OEPA/ORCU
	Regional Ombudsman's Office	Regional stakeholders can also get advice from the office
	Regional Court	Regional stakeholders affected by the implementation OFLP can appeal to the court if it is not resolved by OEPA/ORCU
Woreda	Woreda Office of Rural Land and Environmental Protection (WoEPA)	For grievance not addressed at Kebele level and other grievance raised at Woreda level, appeal can be submitted to WoEPA and provide response after clarifying the issue within 10 days. If the applicant may not satisfy by the response, then he/she can take the issue to the ORCU or Woreda formal court
	Woreda Ombudsman's Office	The affected stakeholder can also submit its apple to get advice to Ombudsman's Office
	Woreda Court	The applicant can submit the appeal to the formal court and continue with the formal process

Kebele	Kebele Shengo/Social Court or Traditional Leaders (Aba Gada), Religious Leaders	Community/person can apply for traditional leaders and/ or Kebele Shengo for grievance caused by REDD+ implementation. Response is to be discharge within 10 days of receiving the complaint.

Grievances Resolution Approach

The ESMF explains the scope, scale, and type of the GRM. It shall be proportionate to the nature and scale of the potential risks and impacts of the project. It also provides the following elements of the approach:

- A grievance mechanism will be designed based on an understanding of the issues that are likely to be the subject of concerns and grievances in the project. The appropriate design and scale of the grievance mechanism will be subproject specific.
- Grievance mechanism will be readily accessible to all project-affected parties and inclusive system, process, or procedure that receives and acts upon complaints and suggestions for improvement in a timely fashion and facilitates resolution of concerns and grievances arising in connection with the project. The grievance mechanism of the project will provide project-affected parties with redress and help address issues at an early stage.
- Handling of grievances will be done in a culturally appropriate manner and be discreet, objective, sensitive, and responsive to the needs and concerns of the project-affected parties. The mechanism will also allow for anonymous complaints to be raised and addressed.
- The grievance mechanism is expected to address concerns objectively and in a transparent manner. The process or procedure involved will not prevent the right of the project-affected parties to access formal judicial or administrative remedies concerning the subject of grievance being raised. Also, the grievance mechanism will allow for anonymous complaints to be raised and addressed.
- The grievance mechanism will provide specific places and ways whereby grievances would be received and how they can be submitted (for example, mail, text message, e-mail, website, telephone, suggestion/complaint boxes, grievance form); specifies a person, an office, or an institution responsible for processing grievances; and establishes timelines for processing a

complaint and a process for registering and monitoring grievances. Grievance mechanisms for larger or more complex subprojects may have multiple locations, means, and methods to receive, process, and monitor grievances, an adequately staffed team, and an appeals process.

- Actions taken on the grievance or suggestions should be informed and balanced. The time frame for grievance resolution depends on factors such as the urgency of the complaint; need for research, investigation, consultation, and funding; and institutional capacity.

Procedures and Timeframe

The OFLP ERP GRM will involve the following procedures and timeframe:

- Step 1: Submission of grievances either orally or in writing.
- Step 2: Recording grievance and providing the initial response within 24 hours.
- Step 3: Investigating the grievance and communication of the response within 7 days.
- Step 4: Complainant response: either grievance closure or taking further steps if the grievance remains open. Once possible redress has been proposed and if the complainant is still not satisfied then the project-affected parties with the complaint will be advised of their right to formal legal recourse.

Grievance Log

The OFLP ERP grievance mechanism should have a log where grievances are properly registered in writing and maintained as a database. Different ways in which users can submit their grievances, which may include submissions in person, by phone, text message, mail, e-mail or via a web site. But that needs to be properly recorded and documented.

The log will contain records of the people responsible for an individual complaint, and records of dates for the following events:

- Date the complaint was reported.
- Date the Grievance Log was added onto the project database.
- Date information on proposed corrective action sent to complainant (if appropriate).
- The date the complaint was closed out.

- Date response was sent to complainant.

Project-level GRM structures

The ESMF provides project-level grievance mechanisms, processes, or procedures to receive and facilitate resolution of concerns and grievances of project-affected parties arising in connection with the project. Project's Environmental and Social Safeguards personnel in the project area are the lower level of the GRM structure. The next structure refers to the implementing organization in order of hierarchies (local, regional, and government). If the project-affected parties with the complaints not satisfied by the complaint responses of these GRM structure, they can submit their complaints to the World Bank's Independent Inspection Panel to request an inspection to determine whether harm has occurred as a direct result of project performance's noncompliance with ESSs and procedures. Once possible redress has been proposed and if the complainant is still not satisfied then the project-affected parties with the complaint will be advised of their right to formal legal recourse.

World Bank Grievance Redress Services

Communities and individuals who believe that they are adversely affected by the World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed to address project-related concerns. Project affected communities and individuals may submit their complaint to WB's independent Inspection Panel which determines whether harm occurred, or could occur, because of WB non- compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/ GRS. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

Monitoring and reporting on cBSP implementation

Monitoring of ER performance

OEPA/ORCU is working to establish the baseline to monitor the indicators presented in Sections 5.3.1 and 5.3.2. The table below includes institutional arrangements for data collection, registration and reporting for each indicator. These arrangements may change to incorporate lessons learned during implementation of BSP first phase for the forestry sector.

Table 11. Baseline and monitoring approach

Number	Indicators	Responsibilities	
		Baseline establishment	Monitoring
Forestry			
1	Area of existing forest	ORCU MRV team	ORCU MRV team
2	Forest area standing that would otherwise have been lost under the reference scenario, at zone level	ORCU MRV team is currently developing the baseline; it is responsible for data collection, registration, and reporting.	ORCU MRV team [40]is responsible for data collection, registration, and reporting.
3	Area of forest gain due to A/R at zone level	ORCU MRV team: baseline development, data registration, and reporting.	ORCU MRV team[40]: data collection, registration, and reporting.
4	Area of natural or assisted regeneration at zone level	ORCU MRV team: baseline development, data registration, and reporting	ORCU MRV team[40]: data collection, registration, and reporting.
5	Area of existing forest at Woreda Level	ORCU MRV team: baseline development, data registration, and reporting	ORCU MRV team[40]: data collection, registration, and reporting.
6	Area of forest gain due to A/R at Woreda level	ORCU MRV team: baseline development, data registration, and reporting	ORCU MRV team[40]: data collection, registration, and reporting.
7	Area of enrichment planting at Woreda level	ORCU MRV team: baseline development, data registration, and reporting	ORCU MRV team[40]: data collection, registration, and

[40] Supervised by EDF MRV Unit

			reporting.
8	Area covered by FMCs at Woreda level	ORCU MRV team: baseline development, data registration, and reporting	ORCU MRV team[40]: data collection, registration, and reporting.
9	Area of existing forest at kebele level	ORCU MRV team: baseline development, data registration, and reporting	ORCU MRV team[40]: data collection, registration, and reporting.
10	Area of forest gain due to A/R at kebele level	ORCU MRV team: baseline development, data registration, and reporting	ORCU MRV team[40]: data collection, registration, and reporting.
11	Area of enrichment planting at kebele level	ORCU MRV team: baseline development, data registration, and reporting	ORCU MRV team[40]: data collection, registration, and reporting.
Livestock sector			
1	Population heard, average number of animals at level of cooperatives and communities for the productive system, for the reporting period. This should be measured also in cooperatives that practice traditional cattle management.	Baseline information will be outsourced to specialized entities	MoA MRV team
2	Productivity in terms of average daily milk and meat production at cooperative level, in each productive system	Baseline information will be outsourced to specialized entities	MoA MRV team
3	Area of silvopastoral systems in cattle cooperatives, ha	Baseline information will be outsourced to specialized entities	ORCU and MoA MRV team

Monitoring of BSP implementation

Implementation of the cBSP will be monitored by different stakeholders through the following

performance indicators.

Table 12. Monitoring Plan for implementation of cBSP

Criteria	**Indicator**	**Frequency of measurement**	**Monitoring responsibility**
cBSP preparation	cBSP and its operations manual are completed and endorsed by relevant stakeholders and institutions	Once a year after the first ERPA payment of OFLP second phase	OEPA and BoA with support of relevant sector bureaus
Effective institutional arrangements	Institutional arrangements agreed have been established and are working properly	Once a year	EDF and MoA with support from OEPA and BoA
	Relevant entities have adequate resources to carry out their responsibilities		EDF and MoA with support from OEPA and BoA
	A system is in place to document benefit distribution as well as the		EDF and MoA with support from OEPA and BoA
Compliance with benefit distribution criteria	The criteria, indicators parameters, rules, and weights for benefit distribution were applied correctly	Two months after receiving the ERPA payments	EDF and MoA, with support from OFLP Steering Committee and National REDD+
	Percentage of benefits distributed to Underserved Population, women, and youth		Relevant sector bureaus
Transparency of the benefit distribution	The percentage of documents that were		EDF and MoA, with support from

process	published and disseminated		OFLP Steering Committee and National REDD+
Agility in benefit distribution	Number of days that elapsed from the receipt of the resources to actual distribution to communities and cooperatives	Once a year after the first ERPA payment of OFLP second phase	BoF, with support from WoF, supported by ORCU and relevant sector bureaus.
Utilization of the FGRM	Number of complaints and claims related to the benefit distribution received through the FGRM received and addressed	continuous	ORCU with support from relevant sector bureaus
Implementation of ER generating projects carried out by FMCs and livestock (cattle) cooperatives[41]	Projects implemented as per the work plan	continuous	Relevant sector bureaus with support from Woreda-level Cooperative Office.
Implementation of Community Action Plans[41]	Projects implemented as per the work plan	continuous	Relevant sector bureaus with support from Woreda-level Cooperative Office.
Implementation of projects for Underserved Peoples,	Projects implemented as per the work plan	continuous	Relevant sector bureaus with support from

[41] Financed with ERPA results-based payments

woman, and youth[41]			Woreda-level Cooperative Office.
Implementation of projects carried out by private sector entities[41]	Projects implemented as per the work plan	continuous	Relevant sector bureaus with support from Woreda-level Cooperative Office.
Benefits distribution	Number and type of beneficiaries that received benefits during the reporting period	annual	Relevant sector bureaus with support from WoF
Promotion of local organization	Number of capacity building events to strengthen organization		

OEPA will be responsible for overseeing cBSP implementation at regional level. As such, it will responsible for identifying (i) specific recommendations to modify the procedures in the operations manual or substantive changes in the cBSP[42], (ii) present the mental or administrative obstacles for timely benefit distribution, (iii) evidences of other emerging risks that can affect this sustainability or effectiveness of cBSP implementation, and (iv) recommended changes in benefit distribution timeline, and administrative arrangements schemes.

Monitoring of E&S Compliance

OEPA is responsible for monitoring ESRM activities against the ESRM instruments mentioned in Section 8 of this cBSP. These entities will jointly monitor the effective implementation of the

[42] Substantive changes could include modification of beneficiary eligibility, benefit distribution rationale and justification, modality of benefit distribution, beneficiaries obligations.

mitigation measures in avoiding or minimizing adverse impacts, and the nature and extent of any such impacts. This approach is useful to determine whether the mitigation measures incorporated in the technical designs and ESRM instruments including ESMP's have been successful in such a way that the pre-program activity E&S condition has been restored, improved upon or is worse than before and to determine what further mitigation measures may be required.

The level of detail and complexity of the monitoring methods will be proportionate to the risks and impacts of activities financed with ERPA benefits, and the measures and actions identified to address such risks and impacts. All or a mix of the following methods are expected in the monitoring of the OFLP ERP ESRMESRM.

- **Stakeholders' consultation**: Stakeholder engagement is an inclusive process that needs to be conducted for monitoring throughout the project lifecycle. The monitoring method will require engaging with stakeholders including communities, groups, or individuals affected by the subproject under implementation, and with other interested parties, through information disclosure, consultation, and informed participation in a manner proportionate to the risks to and impacts on affected communities. Likewise, the Bank will have the right to participate in consultation activities to understand the concerns of the affected people, and how such concerns will be addressed by the ORCU for the enhancement of the environmental and social performance of the subproject's implementation.
- **Field visit**: The OEPA will facilitate site visits by Bank staff or consultants acting on the Bank's behalf if that is deemed necessary to monitor the environmental and social performance of the project.
- **Review checklist**: the E&S checklist monitoring will be used to conduct a survey assessment with different stakeholders at the end of the project year and the inputs will used to prepare an annual review report
- **Use of third parties**: Where appropriate and as set out in the ESCP, the ORCU will engage third parties or independent experts to complement or verify its own monitoring activities. Where third parties or independent experts are responsible, the ORCU will collaborate with such parties to establish and monitor the implementation of the environmental and social mitigation measures of the subprojects. The scope of third-party monitoring (TPM) will also

include system-level monitoring of fiduciary mechanisms, including funds flowing through the benefit sharing plan (cBSP) and relevant financial and audit controls.

- **Review and feedback**: as appropriate, the Bank will review and provide feedback on the implementing organization's monitoring reports concerning the compliance of the implementation of the ESMPs/ESIAs/RAPs with the requirements of the legal agreement, including the ESCP and ESSs. Based on the feedback, the Bank will propose the necessary corrective measures that will be incorporated.

In case there are environmental and social issues that need special follow up, the Bank and ORCU may agree on the frequency of the reports and the ESRM instruments[43], will specify the reporting time frame accordingly. Otherwise, the following reporting timeframe applies:

- Relevant sector bureaus staff should produce a monthly monitoring report on cBSP ESRM implementation and submit it to ORCU for prompt decision in case corrective measures are needed.

- A copy of monthly monitoring reports will be shared with ORCU, involving third parties, project affected communities and other interested parties.

- The Bank may require a quarterly monitoring report that provides detailed information on the environmental and social performance of the subprojects under this cBSP, under special circumstances (See Section 8.2)

- OEPA will submit to the World Bank (and other entities concerned) annual reports on cBSP ESRM implementation during the preceding year; it should also undertake annual reviews after the annual report has been prepared and submitted to the World Bank.

OEPA will develop a results monitoring plan for environmental and social compliance during cBSP implementation, focused on monitoring the compliance and effectiveness of cBSP ESRM and application of recommended standards to confirm that the necessary mitigation measures are considered and implemented. The purpose of result monitoring is (i) to support compliance with ESRM standards, to identify the emergence of any unforeseen ESRM issues, (ii) to determine lessons learned during cBSP implementation, and (iii) to provide an early warning about potential

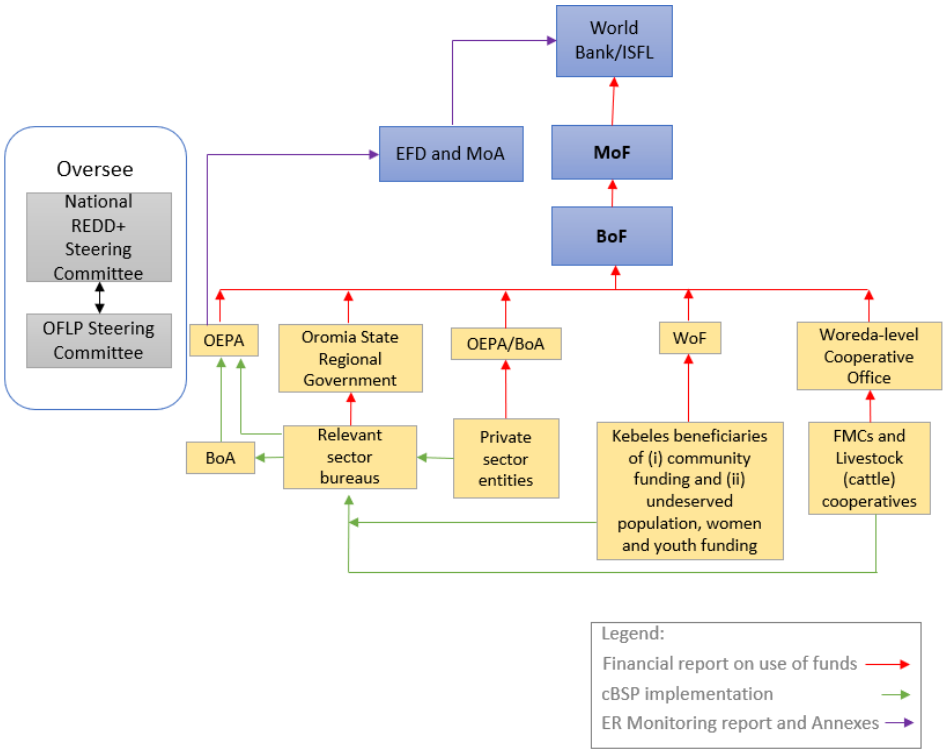
[43] ESMP, ESIA, and Resettlement Action Plan developed at the subproject level as screening.

cumulative impacts. The World Bank, as necessary, will periodically conduct reviews of cBSP ESRM implementation. Monitoring indicators are presented on the **Error! Reference source not found.**. The environmental and social monitoring plan, which will be elaborated by the environmental and social specialist will be included in the operations manual. The monitoring plan will provide the required information for results monitoring

Reporting

The **Error! Reference source not found.** presents the flow of reports on cBSP implementation. Sector bureaus will support kebeles and private sector entities in generating reports; BoCPA will support FMCs and livestock-sector cooperatives in developing reports. The reports from WoF, Woreda-level Cooperative Office, and Oromia State Regional Government should be approved by OEPA, in coordination with BoA, and the OFLP Steering Committee prior submission to BoF. Similarly, the OEPA's report on the use of operating costs and OEPA/BoA reports on the use of funds by private sector entities should be previously approved by OFLP Steering Committee prior submission to BoF. BoF should prepare and submit a consolidated financial report to MoF, and this to the World Bank. OEPA will prepare and submit the ER monitoring report, including Annex 2 Information on cBSP implementation to EFD and MoA. EFD will submit the ER monitoring report to the World Bank. The National REDD+ Steering Committee, with support from OFLP Steering Committee, will review the reports from EFD, MoA, and MoF prior to submission to the World Bank. Green lines in **Error! Reference source not found.** presents the flow of reporting on implementation of ER generating activities as well as social development and livelihood diversification activities. The format reports will be included in the Operations Manual.

Figure 6. Flow of reports on cBSP implementation



Annex 9: Estimation of the Emissions Baseline

The construction of the Emissions Baseline in the current ERPA phase follows the ISFL requirements. The first step was the preparation of the GHG Inventory for the Agriculture, Forestry, and Other Land Use (AFOLU) sector, applying the methodology, categories, and subcategories from the 2006 IPCC Guidelines (described in detail in section 3.1.1 and Annex 6 of the original ISFL PD for the first phase). Based on this inventory, eligible subcategories for accounting were identified following section 4.3.4 of the ISFL ER Program Requirements.

In the ERPD for the first phase of the ERPA, it was found that not all the identified subcategories were meeting the quality requirements. For the second phase of the ISFL ERPA, the OFLP-ERP has implemented the improvement plan contained in the original ISFL PD for the first phase. Therefore, for this second phase, the following subcategories are now included in accounting scope and the Emissions Baseline described in this annex:

- Forest to cropland
- Forest to grassland
- Forest to shrubland
- Cropland to forest
- Grassland to forest
- Shrubland to forest
- Forest remaining forest
- Enteric fermentation - cattle

In line with section 4.2.6 of the ISFL ER Program Requirements, the Emission Baseline is constructed based on the average annual historical GHG Emissions and Removals over a historical period (Baseline Period) of approximately 10 years where the end date for the Baseline Period for each ISFL ERPA Phase is a recent date prior to two calendar years before the ISFL Fund

Management Team shares the complete advanced draft ER-PD with an independent third-party firm for Validation. Since it was originally anticipated that the advanced draft ER-PD would be finalized in 2025, the Baseline Period used for the construction of the Emission Baseline for the second phase of the ERPA period January 2012- December 2021. The following sections describe the step-by-step calculation of the emission baseline considering these subcategories.

Emissions Baseline for LULUCF related subcategories

Land use definitions

For the determination of the Emissions Baseline, the following land use definitions were used which are consistent with the ones used in Ethiopia's Forest Reference Emission Level (FREL) submission to the UNFCCC:

- 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. 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.

Activity Data Collection

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)[44], Olofsson (2014)[45], Stehman (2013)[46]).

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 a "stacked generalization" approach that uses a parametric model for the fusion of algorithm outputs (Healey et al, 2018)[47].

The method used is based on the use of multi-sensor stacks. All data has been created on FAO's SEPAL platform (sepal.io) and exported at 20-meter resolution to Google's Earth Engine. The stacks have been classified into forest and non-forest, using the Random Forest algorithm (Breiman 2001)[48]. The result of the classification process are maps of forest probability, ranging from 0 to 100. Subtracting the maps 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 are useful when approaching stratification and defining 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

[44] Cochran W.G. Sampling Techniques. New York: Wiley (1977)
[45] Pontius 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)
[46] Stehman S.V. Estimating area from an accuracy assessment error matrix. Remote Sensing of Environment 132, 202-211 (2013)
[47] 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,
[48] Breiman, L. (2001). Random Forests. Machine Learning. 45. 5-32. 10.1023/A:1010950718922.

systematic grid.

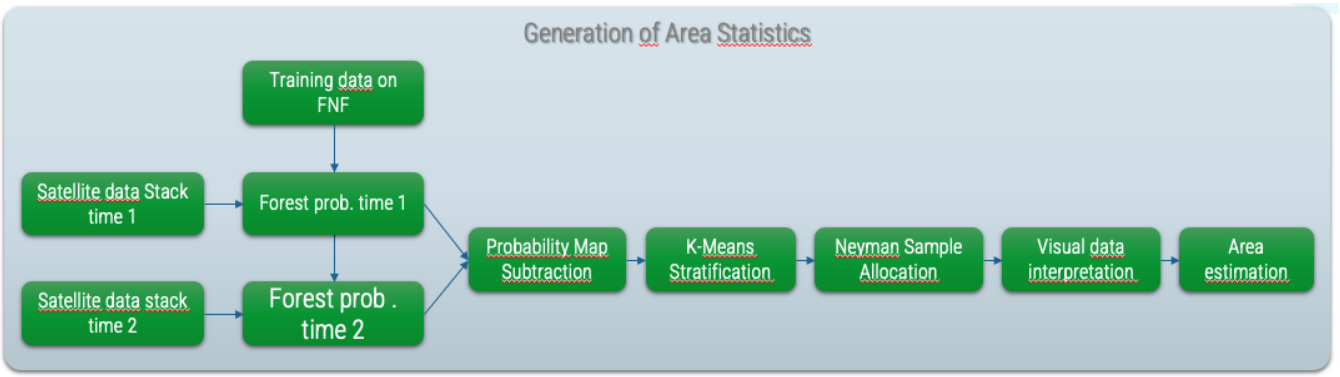


Figure 1: Workflow of the activity data generation, including the PROMS process for a statically optimized stratification of the land area

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. The mask has been derived by removing areas that in none of the forest probability layers exhibit a value of more than 5% probability of being a forest. This results in a further reduced area looking 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 stratum from low to high forest change likelihood. K-Means uses the underlying statistics to derive optimal strata boundaries (Kozak 2011)[49].

Next, an optimal sample allocation scheme has been employed using Neyman allocation with a total of 5,003 samples. 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.

Response design

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

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

Key aspects include:

- **Majority Land Use Land Cover (LULC) Type in 2012:** Each sample point was categorized based on the predominant land use observed in 2012. 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 2021**: Similarly, each sample point was reassessed for 2021 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, 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.
- **Forest degradation:** to include the forest-remaining-forest subcategory in the emissions baseline, sample plots showing consistent forest cover were included in the sampling approach and as part of the response design any disturbances and signs of forest degradation were noted. If forest degradation was found, the driver of degradation was also noted (see Figure 2 below).

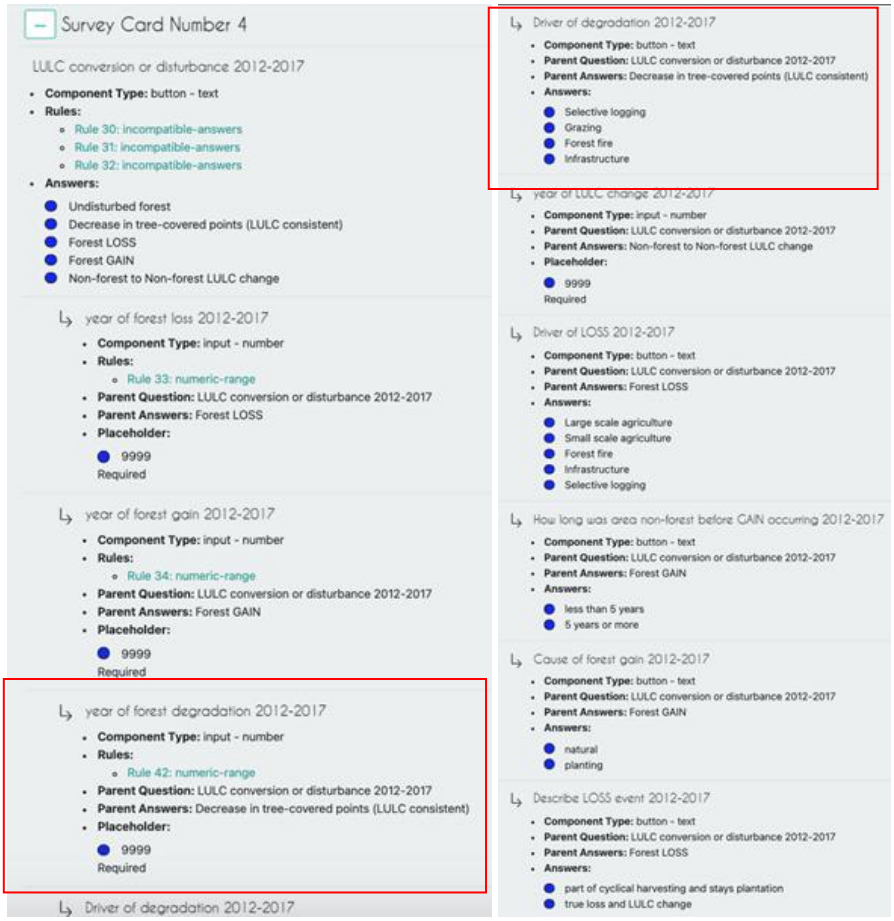


Figure 2: Elements of the response design related to forest-remaining-forest subcategory

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, 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, Planet data (where available), 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 3 sample of activity data on CEO

Data collection

A total of 5,003 sample points were distributed among the 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 **Error! Reference source not found.** below for general e

xample from CEO documentation).

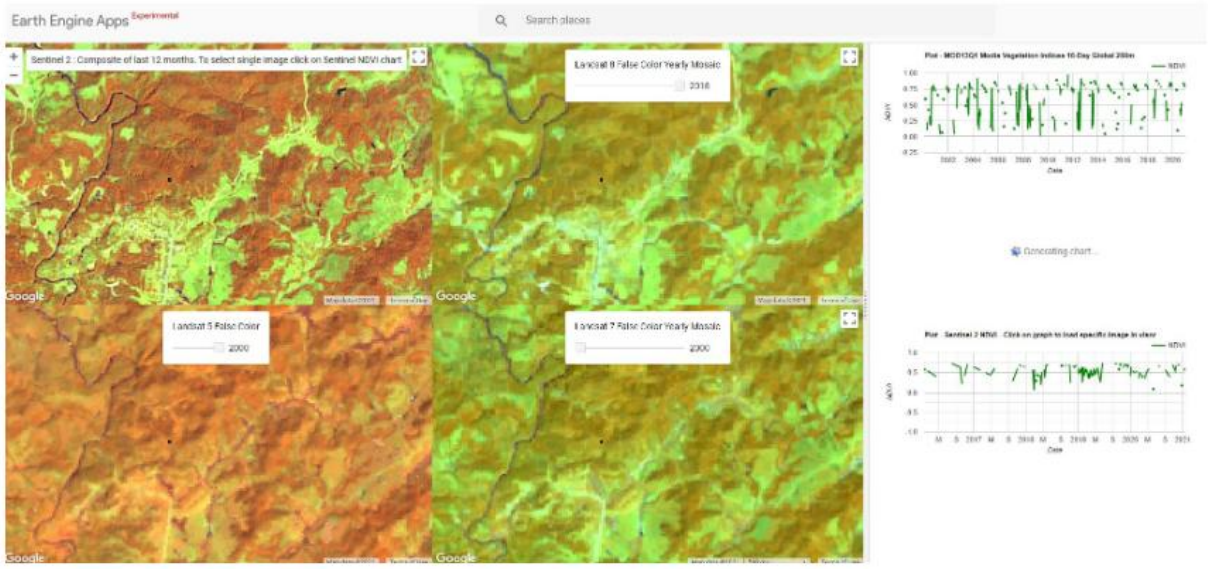


Figure 4: CEO interface showing GEE script results

Furthermore, historical trends in land use/cover from 2012 to 2021 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. A quality control team conducted cross-checking activities using multiple data sources and local knowledge.

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 made for all relevant land use categories and change classes, including the unbiased sample estimate as well as the surrounding uncertainty.

Table 1: Transition matrix of AD analysis result

	Count of plot	2012 LULC							
2021 LULC	Row Labels	Cropland	Forest land	Grassland	Other land	Settlement	Shrub land	Wetland	**Grand Total**
	Cropland	11,144,408	287,080	187,341	_	2,736	243,600	2,736	**11,867,901.77**
	Forest land	111,135	9,508,006	18,587	_	_	62,743	_	**9,700,471.41**
	Grassland	6,227	11,039	3,962,742	_	_	78,516	_	**4,058,523.07**
	Other land	19,426	2,736	_	379,663	_	_	_	**401,825.49**
	Settlement	31,126	6,888	2,076	_	456,947	2,736	_	**499,773.10**
	Shrub land	22,078	4,151	78,018	_	_	4,888,970	_	**4,993,217.23**
	Wetland	_	_	_	_	_	19,426	760,881	**780,307.62**
	Grand Total	**11,334,400**	**9,819,900**	**4,248,763**	**379,663**	**459,684**	**5,295,992**	**763,618**	**32,302,019.70**

Within the forest-remaining-forest subcategory, it was found that 116,218.41ha was considered as having degraded in the period 2012-2021, while at the same time 2,736.40 ha was considered as forest enhancement (i.e., gaining carbon stocks). The different findings on the forest are summarized in **Error! Reference source not found.** below.

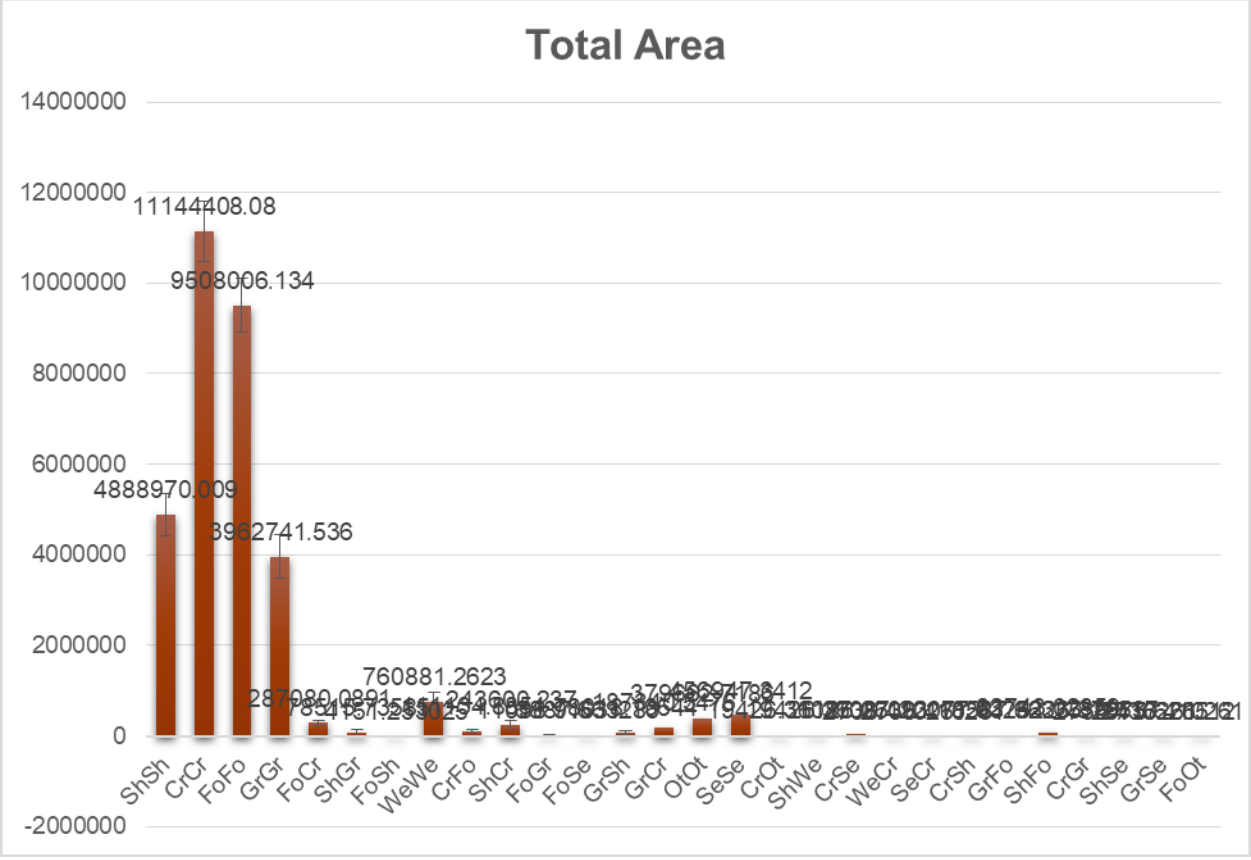


Figure 5: Summary of forest area changes and changes within forest-remaining-forest

Emission and Removal Factors

The values of the emission factors used in this Emissions Baseline have been updated compared to the Emissions Baseline for the first phase. The updated values are calculated using the final report (MEFCC, 2018)[50] of the National Forest Inventory (NFI) that was conducted between 2014 and 2016. Furthermore, to generate the emission and removal factors, the default carbon fraction from the IPCC 2006 Guidelines was applied across the different vegetation types. However, for the purpose of this ERPD, belowground biomass has been recalculated using aboveground biomass values, based on the default values provided in the IPCC 2006 Guidelines for different forest types. In the Emissions Baseline of the first phase, four carbon pools were considered: aboveground and belowground biomass, deadwood and soil organic carbon. It was shown that litter could be excluded from accounting since the contribution of the litter carbon pool is insignificant and the same assumption is made for this Emissions Baseline. The NFI report covers three of the four carbon pools: aboveground biomass, belowground biomass and deadwood. For soil organic carbon, the values are obtained from the "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 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 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,

[50] 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

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 1.3 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 (***Error! Reference source not found.*** *2*).

Table 2: 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 subjected 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)[51]. 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[52]. 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 whose 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 following 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];

[51] Sarndal, C-E., Swensson, B. and Wretman, J. (1992). "Model assisted survey sampling".
[52] 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/

WD = Dry wood density [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.

- 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. 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)53. 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. The same values have been used in Ethiopia's FREL as can be seen in Annex II of the Ethiopia FREL document

- For the fallen deadwood volume, De Vries formula (De Vries, 1986)[54] 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.

The National Forest Inventory Report 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.

For this ERPD, the below-ground biomass (BGB) was estimated using the above-ground biomass values from the National Forest Inventory Report and root-shoot ratios from the Intergovernmental Panel on Climate Change (IPCC) (2006) by the ecological zones. The following root-shoot rations have been applied.

[53] Zanne, A.E. et al. (2009). "Global wood density database". DRYAD. URL: http://hdl.handle.net/10255/dryad 235.
[54] de Vries P. Sampling Theory for Forest Inventory: a Teach-Yourself Course1986. Springer
[54] https://redd.unfccc.int/files/ethiopia_frel_3.2_final_modified_submission.pdf

Tbable 3: Root-shoot rations applied for calculating below ground biomass

IPCC ecological zone	Value	Source	Application to Ethiopia biomes
Tropical Moist Afromontane Forest	0.24	2006 IPCCC guidelines, vol4, chapter 4, table 4.4, default value for tropical moist deciduous	Applicable to Moist Afromontane forest
Tropical Dry forest	0.28	2006 IPCCC guidelines, vol4, chapter 4, table 4.4, default value for tropical dry	Applicable to Dry Afromontane forest, Combretum-Terminalia, Acacia-Commiphora
Tropical shrubland	0.4	2006 IPCCC guidelines, vol4, chapter 4, table 4.4, default value for tropical shrubland	Applicable to other wooded land

To estimate the carbon from the biomass, the following carbon fraction values have been applied from the Intergovernmental Panel on Climate Change (IPCC) (2006).

Table 4: Carbon fractions applied for calculating carbon from biomass

Vegetation type	Carbon fraction	Source
Forest	0.47	2006 IPCCC guidelines, vol4, chapter 4, table 4.3
Woody biomass	0.5	2006 IPCC guidelines, Vol 4, chapter 6, suggested default value in step 5 on page 6.29
Herbaceous biomass	0.47	2006 IPCC guidelines, Vol 4, chapter 6, suggested default value in step 5 on page 6.29

Calculation of Emissions and Removals

Emissions and removals are calculated as

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

Where

$E_{Baseline}$ = Baseline net emissions from the ISFL ER Program (tCO2-e)

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

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

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

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

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

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

$E_{B\text{-}FF}$ = Baseline net emissions for forest remaining forest (tCO2-e)

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

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

Where

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

$$(\Delta C_{i,ABG} + \Delta C_{i,BGB} = EF_{i\_ABBG} \cdot \Delta A_i$$

Where:

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

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

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 above ground biomass values used in the calculation of the emission and removal factors. The National Forest Inventory Report (MEFCC, 2018) provides a summary of the information from the NFI per biome, major land use/land cover type and regions.

For the calculation of the biomass and carbon values for the forest and shrubland categories, the values for 'forest' and 'Other wooded land' respectively were used from the NFI report. Since table A2.3 of the NFI report provides area estimates by regions, biomes and FRA classes, it was possible to calculate an Oromia specific, weighted biomass/carbon value for forest and shrubland using these areas.

Table 5: 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

For this table A9.7 of the NFI report provides value for above ground biomass per Region, Biome and FRA class. Using the IPCC root-shoot ratios from table 3 above, 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

Table 6 below provides an overview of the different Oromia specific values and provides reference to the source tables in the NFI report.

Table 6: Forest and shrubland 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)	root-shoot	bg_biomass (t /ha)	Total biomass (t /ha)
Acacia-Commiphora	Forest	431,237	80.3	0.28	22.48	102.78
	Shrubland /Other wooded land	11,149,959	9.3	0.40	3.72	13.02
Combretum-Terminalia	Forest	205,087	46.8	0.28	13.10	59.90
	Shrubland/ Other wooded land	645,693	25.0	0.40	10.00	35.00
Dry Afromontane	Forest	488,946	69.4	0.28	19.43	88.83
	Shrubland / Other wooded land	7,029,220	9.0	0.40	3.60	12.60
Moist Afromontane	Forest	1,643,917	217.4	0.24	52.176	269.576
	Shrubland Other wooded land	2,747,305	17.8	0.40	7.12	24.92
Sources		***NFI report table A.2.3***	***NFI report table A9.7***			

From the values above and using the carbon fractions from **Error! Reference source not found.**, a weighted region specific value region for tree biomass and carbon was calculated as shown in the table below.[55]

Table 7: Tree biomass and carbon for forest and shrubland in Oromia

FRA Class	Biomes	Area (ha)	biomass (t /ha)	Carbon fraction	carbon (t /ha)	total carbon (Total)	Weighted carbon t/ha
Forest	Acacia-Commiphora	431,237	102.78	0.47	48.31	20,832,404	
	Combretum-Terminalia	205,087	59.90	0.47	28.15	5,774,200	
	Dry Afromontane	488,946	88.83	0.47	41.75	20,414,004	
	Moist Afromontane	1,643,917	269.58	0.47	126.70	208,285,468	
Weighted value forest		2,769,187				255,306,075	92.2
Other Wooded Land	Acacia-Commiphora	11,149,959	13.02	0.47	6.12	68,231,059	
	Combretum-Terminalia	645,693	35.00	0.47	16.45	10,621,650	
	Dry Afromontane	694,253	12.60	0.47	5.92	4,111,366	
	Moist Afromontane	867,005	24.92	0.47	11.71	10,154,709	
Weighted value Other Wooded Land		13,356,910				93,118,785	7.0

[55] The results of a similar calculation are provided in table A8.4 of the National Forest Inventory Report (MEFCC, 2018). However, since this calculation uses different values for the root-shoot rations and carbon fractions, the outcomes this calculation in the NFI report is different from the numbers presented here

The National Forest Inventory Report (MEFCC, 2018) does not provide specific values for cropland and grassland. Table A1.1 of this report provides a description of the land use/land cover categories used. In this table, different vegetation types related to cropland and grassland are all included under the FRA class 'Other land'. Since the National Forest Inventory Report still provides the most comprehensive data set available, biomass and carbon values for cropland and grassland have been estimated using the data provided in this report.

Under the definitions of cropland and grassland used in Ethiopia, the following land uses from table A1.1 of the National Forest Inventory Report (MEFCC, 2018) would be included under the IPCC categories of Cropland and Grassland respectively:

Cropland	Annual crops
	Perennial crops
	Mixed annual and perennial crops
	Coffee plantations
	Fallow land
Grassland	Natural grassland

Table A2.2 of the National Forest Inventory Report provides Ethiopia wide area estimates for each of these land use classes. Table A8.1 of the same report provides (tree) biomass for the same. Using these data, an Ethiopia level weighted biomass and carbon value was calculated for Cropland and Grassland respectively using the root-shoot ratios and carbon fraction from **Error! R eference source not found.** and **Error! Reference source not found.** above. Since there are no Oromia specific area and biomass values available in the report, it was not possible to calculate an Oromia specific value. The result of these calculations is shown in the table below.

Table 8: Biomass and carbon for cropland and grassland in Ethiopia

IPCC Class	NFI LUCC	Area (ha) (from NFI report, table A.2.2)	Biomass (t ha-1) (from NFI report, table A8.1)	Total biomass	Carbon fraction	Total carbon	Total carbon /ha	Weighted carbon (t C/ ha)
Cropland	Coffee plantation	1,073,035	214.9	230,595,222	0.47	108,379,754	101.0	
	Annual crop	28,283,110	11.3	319,599,143	0.47	150,211,597	5.3	
	Perennial crop	1,149,832	102.7	118,087,746	0.50	59,043,873	51.4	
	Mixed annual and perennial crops	393,913	37.7	14,850,520	0.47	6,979,744	17.7	
	Fallow	2,075,917	8.5	17,645,295	0.50	8,822,647	4.3	
Weighted value cropland		**32,975,807**		**700,777,926**		**333,437,616**		**10.1**
Grassland	Natural grassland	7,464,741	7.5	55,985,558	0.47	26,313,212	3.5	
Weighted value grassland		**7,464,741**		**55,985,558**		**26,313,212**		**3.5**

For the calculation of the emission factors used for conversions of forest to cropland and grassland, the difference between the carbon stocks of forest in Oromia from table 7 and that of the Ethiopia wide value for cropland and grassland from table 8 was used. For the conversion of forest to shrubland, the difference between the carbon stock of forest and that of 'other wooded land' in table 7 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.

For the subcategory forest-remaining-forest, the National Forest Inventory Report does not directly provide values that can be used to determine emission factors for above ground and below ground

biomass. Although Ethiopia has planned to revise the carbon stock by conducting national forest inventory every five year, the country did not undertake the national forest inventory as planned due to some challenging factors. A new NFI is currently being conducted and it is expected that the results of this new NFI will provide a basis for determining carbon stock changes for forest-remaining forests. For the purpose of this Emissions Baseline, interim emissions factors for forest-remaining-forest have been developed. These interim emissions factors will be updated when the current NFI process has been completed, and the updated Emissions Baseline will be attached to the first monitoring report of the second ERPA phase.

To determine the interim emission factors for forest-remaining-forest, the data of the 2014-2016 were re-analyzed. When the field work for the NFI was done, information was collected for the plots on the impact of human disturbances. The plots were classified into four categories of disturbance as shown in **Error! Reference source not found.** below.

Figure 6:: Classification of level of disturbance used in the NFI

Human disturbances (94): impact level of human activity in the forest or other wooded land. To be indicated according to option list:

Options	Description/definition	Code
Not disturbed	Protected areas, all resources conserved	**0**
Slightly disturbed	Exploitation of goods and services is carried out according to management plans	**1**
Moderately disturbed	Many products collected without conforming to management plans, notion of sustainability not respected	**2**
Heavily disturbed	Removal of products at rates higher than Mean Annual Increment (MAI), biodiversity degradation due to high pressure on selected species, encroachment of agriculture leading to high rate of deforestation	**3**

Based on these categories, the original plots were divided into 2 classes: (1) disturbed and (2) stable. Plots were considered to be part of the class ‘disturbed’ if in the NFI they were classified as ‘moderately disturbed’ or ‘heavily disturbed’ as defined in the figure above. The above ground biomass was then calculated using the information from all the plots across Ethiopia where information on the level of disturbances had been collected. The result is shown in Table 9 below.

Table 9 Analysis of differences in above ground biomass for disturbed and stable forest in the different biomes of Ethiopia

Biome		n Sus	n plots	n subplots	AGB (tons/ha)		St.dev	Confidence interval (95%)	Rel. CI
Acacia-Commiphora	DISTURBED	12	29	29	**26.8**	102%	**28.8**	10.50	39%
	Stable	14	49	49	**26.3**		**54.6**	15.29	58%
Combretum-Terminalia	DISTURBED	36	86	87	**39.2**	73%	**55.67**	11.70	30%
	Stable	33	97	102	**53.7**		**50.94**	9.89	18%
Dry Afromontane	DISTURBED	18	35	36	**120.9**	71%	**123.15**	40.23	33%
	Stable	22	39	42	**170.7**		**438.60**	132.65	78%
Moist Afromontane	DISTURBED	26	56	58	**163.5**	70%	**311.09**	80.06	49%
	Stable	50	143	146	**233.8**		**196.28**	31.84	14%

During the analysis of the data it was found that the data available on the Acacia-Commiphora biome do not allow for clearly analyzing the difference between stable and disturbed forest in the biome. In this context, the difference between stable and disturbed will be considered as zero for the Acacia-Commiphora biome.

The same root-shoot ratios as used for the emission factors for the conversion categories (see Table 10 below) were applied to estimate the below-ground biomass from the above ground biomass. The difference in carbon stocks between stable and disturbed was then estimated for each biome based on the difference in above ground and below ground biomass between the two classes and by applying the carbon fraction of 0.47 t C/ t d.m as shown in **Error! Reference source not found.** b elow.

Table 10: Estimation of carbon stock changes between disturbed and stable forest for the different biomes in Ethiopia

Biomes	FRA class	ag_biomass (t /ha)	root-shoot	bg_biomass (t /ha)	total_biomass (t /ha)	Carbon fraction	total_carbon (t /ha)	EF (t C /ha)
Acacia-Commiphora	Disturbed	26.78	0.28	7.50	34.28	0.47	16.11	
	Stable	26.29	0.28	7.36	33.65	0.47	15.82	-0.30
Combretum-Terminalia	Disturbed	39.22	0.28	10.98	50.20	0.47	23.60	
	Stable	53.67	0.28	15.03	68.70	0.47	32.29	8.69
Dry Afromontane	Disturbed	120.88	0.28	33.85	154.73	0.47	72.72	
	Stable	170.75	0.28	47.81	218.56	0.47	102.72	30.00
Moist Afromontane	Disturbed	163.48	0.24	39.24	202.72	0.47	95.28	
	Stable	233.85	0.24	56.12	289.97	0.47	136.29	41.01

These values were then used to estimate one Oromia specific weighted emission factor for forest-remaining-forest. The same weighing was applied as described below for the emission and removals factors used in the conversion categories and the result is shown in
11.

Table 11: Weighted emission factor for forest-remaining-forest

Weighted emission factor stable-disturbed						
Regions	**FRA Class**	**Biomes**	**Area (ha)**	**EF**		**Weighted EF**
Oromia	Forest	Acacia-Commiphora	431,237	-0.30	-128,012	
Oromia	Forest	Combretum-Terminalia	205,087	8.69	1,783,181	
Oromia	Forest	Dry Afromontane	488,946	30.00	14,667,762	
Oromia	Forest	Moist Afromontane	1,643,917	41.01	67,414,664	
	Forest		**2,769,187**	**79**	**83,737,595**	**30.2**

The weighted value of 30.2 t C/ha (or 110.73 t CO2/ha) was applied as an emission factor for forest-remaining forest classified as degraded (i.e., going from stable to disturbed) and as removal factor for forest-remaining-forest classified as enhancement (going from disturbed back to stable). The emission and removal factor were multiplied with the activity data show in **Error! Reference s**

ource not found.. The combination of the emission factors and the activity data shown in table 7 and Figure 6 above gives the following baseline emissions and removals from above ground and below ground biomass for the different subcategories.

Table 12: baseline emissions and removals from above ground and below ground biomass for the different subcategories

Subcategory	2025	2026	2027	2028	2029
Forest to cropland	8,640,355.47	8,640,355.47	8,640,355.47	8,640,355.47	8,640,355.47
Forest to grassland	358,902.21	358,902.21	358,902.21	358,902.21	358,902.21
Forest to shrubland	129,721.27	129,721.27	129,721.27	129,721.27	129,721.27
Forest remaining forest	1,258,249.06	1,258,249.06	1,258,249.06	1,258,249.06	1,258,249.06
Cropland to forest	(167,243.38)	(334,486.77)	(501,730.15)	(668,973.54)	(836,216.92)
Grassland to forest	(30,216.04)	(60,432.07)	(90,648.11)	(120,864.14)	(151,080.18)
Shrubland to forest	(98,031.91)	(196,063.83)	(294,095.74)	(392,127.66)	(490,159.57)

Dead wood

Emissions 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 in **Error! Reference source not found.**.

Table 13 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 outlines in the table below.

Table 14: Dead wood change factors applied

Baseline subcategory	**Corresponding change from LUCC classes 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	0.66
Grassland to forest	Other land-natural to plantation	0.745
Shrubland to forest	Other wooded land to plantation	0.695

The NFI does not have data on the difference in dead wood between stable and disturbed forest. For the forest-remaining forest subcategory it has therefore been assumed that there are no changes in the amount of dead wood and hence the change factor is zero. This appears to be conservative since the dead wood can be expected to be lower in disturbed forest due to more (fire)wood collection.

The combination of the change factors and the activity data shown in Table 7 and figure 6 above gives the following baseline emissions and removals from dead wood for the different subcategories.

Table 15 Baseline emissions and removals from dead wood for the different subcategories.

Subcategory	**2025**	**2026**	**2027**	**2028**	**2029**
Forest to cropland	69,473.38	138,946.76	208,420.14	277,893.53	347,366.91

Forest to grassland	3,015.46	6,030.93	9,046.39	12,061.86	15,077.32
Forest to shrubland	1,057.88	2,115.76	3,173.63	4,231.51	5,289.39
Forest remaining forest	0	0	0	0	0
Cropland to forest	(26,894.64)	(53,789.28)	(80,683.93)	(107,578.57)	(134,473.21)
Grassland to forest	(5,077.45)	(10,154.90)	(15,232.34)	(20,309.79)	(25,387.24)
Shrubland to forest	(15,989.02)	(31,978.03)	(47,967.05)	(63,956.06)	(79,945.08)

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)

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

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"[56] 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 **Error! Reference source not found.** below.

Table 16: 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 -

[56] 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

				February 2018. Beneficiaries: FAO, MEFCC, EEFRI
Combretum Terminalia	**41.561**	37	28.25306	Idem above
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 Table 17 below.

Table 17: 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

The report does not have data on the difference in SOC between stable and disturbed forest. For the forest-remaining forest subcategory it has therefore been assumed that there are no changes in the amount of SOC and hence the change factor is zero. This appears to be conservative since in disturbed forest the SOC can be expected to be lower than in stable forest. The resulting baseline SOC changes estimates are detailed in **Error! Reference source not found.** below.

Table 18 Baseline SOC change

	2025	2026	2027	2028	2029
forest to other categories	1,683,273.53	1,836,298.39	1,989,323.26	2,142,348.13	2,295,372.99
other categories to forest	-656,131.21	-715,779.51	775,427.80	835,076.08	894,724.38

Error! Reference source not found. 19 below provides a consolidated summary of the Emissions B aseline for the LULUCF related subcategories combining all the considered carbon pools (above and below ground biomass, dead wood, soil organic carbon).

Table 19: Summary of the Emissions Baseline for LULUCF subcategories

Year of reporting period t	Baseline Emissions								Total emissions baseline LULUCF (tCO2e)
	Forest to cropland	Forest to grassland	Forest to shrubland	Cropland to forest	Grassland to forest	Shrubland to forest	Forest remaining forest	SOC	
2025	8,709,828	361,917	130,779	(194,138)	(35,293)	(114,020)	1,258,249	1,027,142	11,144,464
2026	8,779,302	364,933	131,837	(388,276)	(70,586)	(228,041)	1,258,249	1,120,518	10,967,936
2027	8,848,775	367,948	132,894	(582,414)	(105,880)	(342,062)	1,258,249	1,213,895	10,791,405
2028	8,918,248	370,964	133,952	(776,552)	(141,173)	(456,083)	1,258,249	1,307,272	10,614,877
2029	8,987,722	373,979	135,010	(970,690)	(176,467)	(570,104)	1,258,249	1,400,648	10,438,347

Estimation of the Emissions Baseline in Enteric Fermentation

Approach

The approach focuses on identifying the key GHG emission source categories within Oromia

region that requires Tier 2 emission factor (T2EF) estimation. In Oromia, cattle are an important source of methane (CH4) emissions due to their large population size and high CH4 emission rates from their ruminant digestive system.

The IPCC Tier 2 methodology calculates emission factors using country-specific data, including livestock population, production systems, productivity, and feed characteristics. This method provides a more accurate representation of regional management practices, diets, and animal productivity across different production systems and livestock subcategories.

Adopting a Tier 2 approach is crucial for assessing the impact of livestock development and climate change mitigation policies on emissions. It enables tracking changes in GHG emissions resulting from climate-smart livestock interventions and supports the implementation of a carbon credit system for farmers. The Tier 2 EF from enteric fermentation were calculated based on the feed intakes for each subcategory. Feed intake, measured in terms of gross energy (e.g., mega Joules (MJ) per day) or dry matter (e.g., kilograms (kg)) consumed per day for each subcategory, were estimated using IPCC coefficients. These coefficients account for maintenance, growth, work, activity, pregnancy, and feeding situation, while performance data such as (average live weight, growth rate, milk yield, etc.) will be sources from literature and survey findings for each sub-category.

Parameters required: In the Tier 2 approach, the emission factor was estimated using data on animal population and performance. Based on IPCC guideline the following activity data will be collected for Tier 2 EF on enteric fermentation;

- Average Live weight (BW), kg/head,
- Average mature weight (MW), kg **(**the body weight at which skeletal development is complete),
- Average weight gain, kg per day,
- Average milk production per day (kg/day),
- Fat content and protein content (%): average fat and protein content of milk is required for lactating cows
- Average amount of work performed per day (hours day-1); For draft animals,
- Percentage of females that give birth in a year,

- Types/proportion/sources of feed used for different age classes of animals (feed basket) and feed digestibility value (%DE).
- Feeding situation, to select activity coefficient corresponding to animal movement,
- Methane conversion factor (percentage of feed energy converted to methane)

According to IFSL ER PR 4.2.7, when using the emission intensity approach, the emission intensity (EI) is calculated as follows:

1. Combine the emissions from eligible subcategories and livestock species. For the Oromia case, this includes cattle.
2. Determine the total amount of protein produced from milk and meat from all included livestock species, expressed in tonnes.
3. Emission intensity is defined as the emissions per unit of protein produced, measured in CO2e per tonne of protein.

Once the total emissions and total protein output are established, the emission intensity can be calculated using the following equation

$$EI = GHGI = \frac{GHG\ emissions\ from\ cattle}{Protein_{cattle\ milk} + Protein_{cattle\ meat}}$$

Emissions model and inventory structure

Enteric fermentation emissions have been estimated using the IPCC Tier 2 model (IPCC 2006, Vol 4, Ch 10, Equations 10.3-10.16). These equations were used to estimate emissions from 15 categories of other cattle.

Cattle Population

Cattle sub-categories were defined based on IPCC (2006) guidance on livestock characterization, the availability of IPCC default coefficients, and the sub-categories presented in annual livestock sample surveys reported by the Central Statistical Agency of Ethiopia (CSA).

IPCC (2006) recommends that cattle populations "should be classified into at least three main subcategories: mature dairy, other mature, and growing cattle. Depending on the level of detail in the emissions estimation method, subcategories can be further classified based on animal or feed characteristics." The classification used in this report reflects cattle type (i.e., dairy, other), feed characteristics (i.e., production systems and feeding systems), and animal characteristics (i.e., age,

sex, utilization).

In terms of cattle type, IPCC (2006) distinguishes between “dairy cattle” and “other cattle”. The IPCC Guidelines gives a clear definition of “dairy cow” (i.e., “mature cows (first lactation and beyond) that are producing milk in commercial quantities for consumption” (IPCC 2019, p. 10.24) and requires that the dairy cow population is estimated separately from other cattle. In this report, dairy cattle are defined as exotic breed or cross-bred cattle, including dairy cows as well as other sub-categories defined based on age and sex, as described in detail below. “Other cattle” in Oromia Region are raised for multiple purposes (e.g., meat, milk, draft power, manure, savings, social functions), are cattle of indigenous breeds, and are referred to throughout this report as multipurpose cattle.

For dairy cattle, two production systems have been identified: (i) a smallholder dairy production system and (ii) a commercial dairy production system. The commercial dairy production system is defined as consisting of dairy cattle in urban and peri-urban areas and on farms owned by companies. For multipurpose cattle, two production systems were also identified based on differences in agro-ecology and management: (i) the mixed crop-livestock system located in the highland areas, where rain-fed agriculture dominates and cattle feed on communal grazing land and crop residues, and (ii) a pastoral / agro-pastoral system found in lowland grazing areas, where extensive grazing of natural pastures is the main source of feed. For Oromia Region, multipurpose cattle in Borena Zone (a lowland area) were allocated to the pastoral/agro-pastoral system. All other zones in Oromia Region are considered to be highland areas and therefore multipurpose cattle in these zones were allocated to the mixed crop-livestock system. In zones other than Borena Zone, there are a small number of kebeles with pastoral or agro-pastoral production systems, but data below the zonal level is not available to allocate cattle in specific kebeles to each production system. Within the mixed crop-livestock production system, one fattening feeding system was identified. These feedlot systems are run by private commercial farmers or meat and live animal exporters in the highland areas. They purchase male cattle aged between 1-3 years and > 3 years old from various parts of Oromia Region and use concentrate and agro-industrial by products as the main feeds.

The primary data source for cattle populations in the smallholder dairy, mixed crop-livestock and

pastoral/agro-pastoral production systems is CSA annual live-stock sample survey reports, using the results reported for Oromia Region. This time series of cattle population data is available by age, sex, purpose and breed at national, region and zone levels for every year from 2012-2021. The CSA livestock surveys enumerate cattle by breed type (i.e., indigenous, hybrid, and pure exotic). Pure exotic breeds and hybrids are almost exclusively used for dairy production. The CSA annual livestock surveys only sample rural households. Therefore, this report identifies all hybrid and exotic cattle enumerated in the CSA annual livestock surveys as representing the smallholder dairy production system, while the indigenous breed cattle represent the mixed crop-livestock and pastoral/agro-pastoral systems.

Gross energy calculations: Animal management, animal performance, and diet data were used to estimate feed intake, which is the amount of energy (MJ/day) an animal needs for maintenance and for metabolic functions such as growth, lactation, and pregnancy as per Table 10.3 of the IPCC 2006 guidelines. This section provides the methods used to estimate gross energy intake for the cattle sub-categories.

***Net energy for maintenance*:** (NE_m) is the net energy required for maintenance, which is the amount of energy needed to keep the animal in equilibrium where body energy is neither gained nor lost (Jurgen, 1988). NE_m for cattle was calculated following IPCC (2006) Equation 10.3:

EQUATION 10.3

NET ENERGY FOR MAINTENANCE

$$NE_m = Cf_i \bullet (Weight)^{0.75}$$

Where:

NE_m = net energy required by the animal for maintenance, MJ day^{-1}

Cf_i = a coefficient which varies for each animal category as shown in Table 10.4 (Coefficients for calculating NE_m), MJ day^{-1} kg^{-1}

Weight = live-weight of animal, kg

IPCC 2006 Table 10.4 gives default values for Cfj for lactating cows (0.386), non-lactating cows (0.322) bulls (0.370) and other age/sex classes (0.322). The default value of Cfi for lactating cows

refers to net energy for maintenance during lactation. Lactation duration in Oromia Region is lower than 365 days. Region-specific values for Cfi were calculated for dairy cows and multipurpose cows by taking into account the proportion of cows giving birth and days in milk and the proportion of cows not giving birth and days not in milk (for more details, refer to section 4.3.1 of baseline cattle GHG emission intensity report for Oromia region). The values for the coefficient for maintenance for cattle in different production systems are shown in **Error! R eference source not found.**. The same coefficient value was used for each dairy and multipurpose cattle sub-category for each year from 2012-2021.

Table 20: Coefficient for maintenance values for cattle sub-categories, 2012-2021

System	Sub-category	C_{fi}
Commercial intensive system	Adult cows (>3 years)	0.383
	Adult males 3-10 years	0.370
	Growing males (1 - < 3 year)	0.322
	Growing females (1 -< 3 years)	0.322
	Calves (6 m - < 1 year) male & female	0.322
	Calves (<6 months) male & female	0.322
Smallholder intensive system	Adult cows (>3 years)	0.383
	Adult males 3-10 years	0.370
	Growing males (1 - < 3 year)	0.322
	Growing females (1 -< 3 years)	0.322
	Calves (6 m - < 1 year) male & female	0.322
	Calves (<6 months) male & female	0.322
Mixed crop livestock system	Adult multipurpose cows (⩾ 3 years)	0.370
	Adult males used for draught (3-10 yrs)	0.322
	Adult males for breeding & other purposes (⩾3 yrs)	0.370
	Growing males 1-<3 years	0.322
	Growing females (1-<3 years)	0.322
	Calves 6 m-<1 year (male & female)	0.322
	Calves < 6 months (male & female)	0.322
	Feedlot-fed cattle	0.322
Pastoral/agro-pastoral system	Adult multipurpose cows (≥ 3 years)	0.381
	Adult males used for draught (3-10 yrs)	0.322
	Adult males for breeding & other purposes (≥3 yrs)	0.370
	Growing males 1-<3 years	0.322
	Growing females (1-<3 years)	0.322
	Calves 6 m-<1 year (male & female)	0.322
	Calves < 6 months (male & female)	0.322

The live weights of each sub-category of dairy and multipurpose cattle used in Equation 10.3 were

the values given in **Error! Reference source not found.**. The methods and assumptions used to e stimate the live weight of each cattle subcategory are detailed in the Baseline Cattle GHG Emission Intensity Report – Oromia Region. Specifically, they can be found in sections 4.2.1.1 for commercial dairy, 4.2.1.2 for smallholder dairy, 4.2.1.3 for mixed-crop livestock, and 4.2.1.4 for pastoral and agro-pastoral production systems. The same value for live weight was used for each dairy and multipurpose cattle sub-category for each year from 2012-2021. The calculated net energy for maintenance for each cattle sub-category is shown in **Error! Reference source not f ound.** and **Error! Reference source not found.**.

Table 21: Live weights of dairy and multipurpose cattle sub-categories, 2012-2021

System	Sub-category	Live weight
Commercial intensive system	Adult cows (>3 years)	362.5
	Adult males 3-10 years	552.8
	Growing males (1 - < 3 year)	338.0
	Growing females (1 -< 3 years)	267.4
	Calves (6 m - < 1 year) male & female	121.9
	Calves (<6 months) male & female	59.9
Smallholder intensive system	Adult cows (>3 years)	340.5
	Adult males 3-10 years	375.9
	Growing males (1 - < 3 year)	161.8
	Growing females (1 -< 3 years)	165.6
	Calves (6 m - < 1 year) male & female	107.9
	Calves (<6 months) male & female	49.7
Mixed crop livestock system	Adult multipurpose cows (⩾ 3 years)	239.7
	Adult males used for draught (3-10 yrs)	307.4
	Adult males for breeding & other purposes (⩾3 yrs)	261.3
	Growing males 1-<3 years	143.7
	Growing females (1-<3 years)	150.5
	Calves 6 m-<1 year (male & female)	76.7
	Calves < 6 months (male & female)	50.2
	Feedlot-fed cattle	302.9
Pastoral/agro-pastoral system	Adult multipurpose cows (≥ 3 years)	289.3
	Adult males used for draught (3-10 yrs)	321.8
	Adult males for breeding & other purposes (≥3 yrs)	321.8
	Growing males 1-<3 years	217.2
	Growing females (1-<3 years)	191.0
	Calves 6 m-<1 year (male & female)	109.3
	Calves < 6 months (male & female)	54.0

Table 22: Net Energy required for Maintenance (MJ head/day) for dairy cattle sub-categories (2012-2021)

	Commercial intensive dairy system						Smallholder intensive dairy system					
Year	Adult exotic dairy cows (> 3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female	Adult exotic dairy cows (>3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female
2012	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2013	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2014	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2015	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2016	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2017	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2018	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2019	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2020	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0
2021	31.9	42.2	25.4	21.3	11.8	6.9	30.4	31.6	14.6	14.9	10.8	6.0

Tabel 23: Net Energy required for maintenance (MJ head/day) for multipurpose cattle sub-categories (2012-2021)

	Mixed crop-livestock system								Pastoral/agro-pastoral system						
Year	Adult multipurpose cows (⩾ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (≥3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)	Feedlot-fed Cattle	Adult multipurpose cows (⩾ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (>3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)
2012	22.5	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.7	24.5	28.1	18.2	16.5	10.9	7.1
2013	22.5	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.0	24.5	28.1	18.2	16.5	10.9	7.1
2014	22.4	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.3	24.5	28.1	18.2	16.5	10.9	7.1
2015	22.3	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.2	24.5	28.1	18.2	16.5	10.9	7.1
2016	22.5	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.6	24.5	28.1	18.2	16.5	10.9	7.1
2017	22.2	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.3	24.5	28.1	18.2	16.5	10.9	7.1
2018	22.4	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.1	24.5	28.1	18.2	16.5	10.9	7.1
2019	22.3	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.1	24.5	28.1	18.2	16.5	10.9	7.1
2020	22.2	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.1	24.5	28.1	18.2	16.5	10.9	7.1
2021	22.1	23.6	24.0	13.4	13.8	8.3	6.1	23.4	26.1	24.5	28.1	18.2	16.5	10.9	7.1

Net energy for activity: **(**NE_a) is the net energy for activity, or the energy needed for animals to obtain their food, water and shelter. It is based on its feeding situation rather than characteristics of the feed itself. .

EQUATION 10.4

NET ENERGY FOR ACTIVITY (FOR CATTLE AND BUFFALO)

$$NE_a = C_a \bullet NE_m$$

Where:

NE_a = net energy for animal activity, MJ day^{-1}

C_a = coefficient corresponding to animal's feeding situation (Table 10.5, Activity coefficients)

NE_m = net energy required by the animal for maintenance (Equation 10.3), MJ day^{-1}

The feeding situation that most accurately represents the animal subcategory must be determined in order to select the appropriate coefficient for estimating net energy for activity. IPCC (2006) Table 10.5 gives default values for Ca for cattle in different feeding situations (i.e., stall-fed (0.00), grazing pasture (0.17) and grazing large areas or hilly terrain (0.36)). For all smallholder and commercial dairy cattle sub-categories, data from the Oromia cattle GHG inventory improvement survey (JaRco Consulting, 2023) reported that natural pasture grazing contributed 6-30 % to the diet for sub-categories in both the commercial and smallholder dairy production systems. Therefore, the value of 0.17 was used for Ca in both dairy production systems. For all pastoral/agro-pastoral and mixed crop-livestock system cattle sub-categories, the baseline GHG emission estimate uses the IPCC default values of 0.36 and 0.17, respectively. For feedlot cattle, the value of 0.11 was used for Ca, which is the weighted average considering time in the feedlot (137 days, Ca=0) and time in the mixed crop-livestock system (228, Ca=0.17). The calculated net energy for activity for each cattle sub-category is shown in **Error! Reference source not found.** a nd **Error! Reference source not found.**.

Table 24: Net Energy required for activity (MJ head/day) for dairy cattle sub-categories (2012-2021)

	Commercial intensive dairy system						Smallholder intensive dairy system					
Year	Adult exotic dairy cows (> 3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female	Adult exotic dairy cows (>3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female
2012	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2013	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2014	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2015	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2016	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2017	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2018	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2019	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2020	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0
2021	5.4	7.2	4.3	3.6	2.0	1.2	5.2	5.4	2.5	2.5	1.8	1.0

Table 25: Net Energy required for activity (MJ head/day) for multipurpose cattle sub-categories (2012-2021)

	Mixed crop-livestock system								Pastoral/agro-pastoral system						
Year	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (≥3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)	Feedlot-fed Cattle	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (>3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)
2012	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.6	8.8	10.1	6.6	6.0	3.9	2.6
2013	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.4	8.8	10.1	6.6	6.0	3.9	2.6
2014	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.5	8.8	10.1	6.6	6.0	3.9	2.6
2015	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.4	8.8	10.1	6.6	6.0	3.9	2.6
2016	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.6	8.8	10.1	6.6	6.0	3.9	2.6
2017	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.5	8.8	10.1	6.6	6.0	3.9	2.6
2018	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.4	8.8	10.1	6.6	6.0	3.9	2.6
2019	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.4	8.8	10.1	6.6	6.0	3.9	2.6
2020	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.4	8.8	10.1	6.6	6.0	3.9	2.6
2021	3.8	4.0	4.1	2.3	2.4	1.4	1.0	2.5	9.4	8.8	10.1	6.6	6.0	3.9	2.6

Net energy for growth (NEg): NEg was calculated using IPCC (2006) Equation 10.6:

$$NE_g = 22.02 \times \left(\frac{BW}{C \times MW}\right)^{0.75} \times WG^{1.097}$$

Where:

BW is average live weight (kg head-1);

MW is the mature live body weight of an adult animal in moderate body condition, kg;

WG is the average daily weight gain of cattle in each sub-category, kg /day

C is a coefficient with a value of 0.8 for females, 1.0 for castrates and 1.2 for bulls (IPCC 2006, page 10.17). For calves < 6 months and calves 6 months – 1 year that include both male and female cattle in the commercial and smallholder dairy systems, the proportions of male and female calves (Table 6 and Table 8 of the Baseline cattle GHG emission intensity report) were used to estimate the weighted average of growth coefficients. For the mixed crop-livestock and pastoral/agro-pastoral systems, the populations of male and female calves in each age class were taken from CSA annual livestock sample surveys reports for Oromia Region and used to estimate the population-weighted averages of females (C=0.8) and intact males (C=1.2).

The live weights of each sub-category of dairy and multipurpose cattle used in Equation 10.6 were the values given in **Error! Reference source not found.**26. In addition, the mature weight and d aily live weight gain of each sub-category of dairy and multipurpose cattle used in Equation 10.6 were the values given in **Error! Reference source not found.**. The calculated net energy for g rowth for each cattle sub-category is shown in and **Error! Reference source not found.**.

Table 26: Mature weight (kg) and daily weight gain (kg) of dairy and multipurpose cattle sub-categories, 2012-2021

System	Sub-category	Mature weight	Weight gain
Commercial intensive system	Adult cows (>3 years)	362.5	
	Adult males 3-10 years	552.8	
	Growing males (1 - < 3 year)	552.8	0.480
	Growing females (1 -< 3 years)	362.5	0.323
	Calves (6 m - < 1 year) male & female	405.3	0.344
	Calves (<6 months) male & female	405.5	0.350
Smallholder intensive system	Adult cows (>3 years)	340.5	
	Adult males 3-10 years	375.9	
	Growing males (1 - < 3 year)	375.9	0.120
	Growing females (1 -< 3 years)	340.5	0.128

	Calves (6 m - < 1 year) male & female	352.9	0.323
	Calves (<6 months) male & female	352.0	0.238
Mixed crop livestock system	Adult multipurpose cows (≥ 3 years)	248.9	
	Adult males used for draught (3-10 yrs)	337.8	
	Adult males for breeding & other purposes (≥3 yrs)	264.9	
	Growing males 1-<3 years	264.9	0.149
	Growing females (1-<3 years)	248.9	0.164
	Calves 6 m-<1 year (male & female)	291.0	0.147
	Calves < 6 months (male & female)	292.8	0.198
	Feedlot-fed cattle	337.8	0.559
Pastoral/agro-pastoral system	Adult multipurpose cows (≥ 3 years)	289.3	
	Adult males used for draught (3-10 yrs)	321.8	
	Adult males for breeding & other purposes (≥3 yrs)	321.8	
	Growing males 1-<3 years	321.8	0.164
	Growing females (1-<3 years)	289.3	0.155
	Calves 6 m-<1 year (male & female)	304.2	0.267
	Calves < 6 months (male & female)	303.9	0.348

The specific methodologies and data sources used for estimating mature weight and daily live weight gain for each cattle sub-category across different production systems are described in Section 4.2.1.1 to Section 4.2.1.4 of the Baseline cattle GHG emission intensity report. Weight gain was assumed to be zero for adult cattle, which is consistent with the recommendation in IPCC (2006).

Table 27: Net Energy required for growth (MJ head/day) for dairy cattle sub-categories (2012-2021)

	Commercial intensive dairy system						Smallholder intensive dairy system					
Year	Adult exotic dairy cows (> 3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female	Adult exotic dairy cows (>3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female
2012	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2013	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2014	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2015	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2016	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2017	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2018	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2019	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2020	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1
2021	0.0	0.0	5.9	6.0	3.0	1.8	0.0	0.0	1.0	1.6	2.7	1.1

Table 28: Net Energy required for growth (MJ head/day) for multipurpose cattle sub-categories (2012-2021)

	Mixed crop-livestock system								Pastoral/agro-pastoral system						
Year	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (≥3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)	Feedlot-fed Cattle	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (>3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)
2012	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.1	1.3
2013	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.1	1.3
2014	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.1	1.3
2015	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.1	1.3
2016	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.2	1.3
2017	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.2	1.3
2018	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.2	1.3
2019	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.2	1.3
2020	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.3	1.3
2021	0.0	0.0	0.0	1.5	2.5	1.0	1.0	10.7	0.0	0.0	0.0	4.0	2.9	5.2	1.3

***Net energy for lactation*: (**NE_l) is the net energy for lactation. For cattle and buffalo the net energy for lactation is expressed as a function of the amount of milk produced and its fat content expressed as a percentage (e.g., 4%) (NRC, 1989):

EQUATION 10.8
NET ENERGY FOR LACTATION (FOR BEEF CATTLE, DAIRY CATTLE AND BUFFALO) $NE_l = Milk \bullet (1.47 + 0.40 \bullet Fat)$

Where:

NE_l = net energy for lactation, MJ day^{-1}

Milk = amount of milk produced, kg of milk day^{-1} Fat = fat content of milk, % by weight.

The IPCC equations express milk yield in kg $head^{-1}$ day^{-1} over 365 days. For the commercial and smallholder-intensive dairy production systems, milk yield was estimated using methods and data sources described in section 4.2.2.1 of the Baseline cattle GHG emission intensity report. The milk yield estimates consider reported milk off-take, length of lactation, and proportion of cows lactating, as well as estimated calf suckling (smallholder intensive dairy system). Accordingly, milk yield estimates of 8.6 and 6.7 kg/head were used for commercial and smallholder-intensive dairy production systems, respectively. Consistent values were used throughout the time series. For multipurpose cattle in the mixed crop-livestock and pastoral/agro-pastoral systems, milk yield was estimated using methods and data sources described in section 4.2.2.2 of the Baseline cattle GHG emission intensity report. The average milk yields for multipurpose cows in the mixed crop-livestock and pastoral/agro-pastoral production systems are shown in **Error! Reference source not found.**. F or milk fat content, a default value of 4% was used (IPCC 2006). The calculated net energy required for lactation is shown in **Error! Reference source not found.**.

Table 29: Average daily milk yields for multipurpose cows, 2012-2021 (kg head^{-1} day^{-1})

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Mixed crop-livestock	0.56	0.55	0.52	0.55	0.54	0.52	0.57	0.54	0.55	0.48
Pastoral/agro pastoral	0.84	0.57	0.67	0.71	0.78	0.71	0.65	1.08	1.50	1.23

Table 30: Net Energy required for lactation (MJ head/day) for adult cows of different pro production systems, 2012-2021

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Commercial intensive system	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4
Smallholder intensive system	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7
Mixed crop-livestock system	1.7	1.7	1.6	1.7	1.7	1.6	1.7	1.7	1.7	1.7
Pastoral/agro-pastoral system	2.6	1.7	2.1	2.2	2.4	2.2	2.0	3.3	4.6	2.6

***Net energy for pregnancy*:** (NEp) is the energy required for pregnancy.

EQUATION 10.13
NET ENERGY FOR PREGNANCY (FOR CATTLE/BUFFALO AND SHEEP) $NEp = Cpregnancy \bullet NEm$

Where:

NE_p = net energy required for pregnancy, MJ day^{-1}

$C_{pregnancy}$ = is a coefficient with a value of 0.1

NE_m = net energy required by the animal for maintenance (Equation 10.3), MJ day^{-1}

$C_{pregnancy}$ was applied to the proportion of cows giving birth in the year. The proportions of cows giving birth in the commercial and smallholder dairy systems were estimated using methods and data sources described in section 4.2.2.1 of the Baseline cattle GHG emission intensity report and a constant value of 0.746 was used. For cows in the mixed crop-livestock and pastoral/agro-pastoral systems, the proportions of cows giving birth in the year were estimated using methods described in section 4.2.2.2, which used the ratio of calves to cows in milk reported in CSA reports for Oromia Region together with an estimate of calf mortality to estimate the proportion of cows giving birth in the year. The estimated proportions of cows giving birth are shown in **Error! Reference source not found.**.

Table 31: The proportion of multipurpose cows giving birth in the mixed crop-livestock and pastoral/agro-pastoral production system, 2012-2021 (%)

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Mixed crop-livestock	57.9	56.5	53.7	52.2	56.6	49.5	55.6	49.7	46.9	45.7
Pastoral/agro pastoral	83.8	59.3	67.7	66.7	79.1	68.2	63.1	63.1	63.1	63.1

The calculated net energy required for lactation is shown in **Error! Reference source not found.**32.

Table 32: Net Energy required for pregnancy (MJ head/day) for adult cows of different pro production systems, 2012-2021

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Commercial intensive system	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Smallholder intensive system	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Mixed crop-livestock system	1.3	1.3	1.2	1.2	1.3	1.1	1.2	1.1	1.0	1.0
Pastoral/agro-pastoral system	2.2	1.5	1.8	1.7	2.1	1.8	1.6	1.6	1.6	1.6

***Net energy for work*:** (NE_{work}) is the net energy for work. It is used to estimate the energy required for draft power for cattle and buffalo.

EQUATION 10.11

NET ENERGY FOR WORK (FOR CATTLE AND BUFFALO)

$$NE_{work} = 0.10 \bullet NE_m \bullet Hours$$

Where:

NE_{work} = net energy for work, MJ day^{-1}

NE_m = net energy required by the animal for maintenance (Equation 10.3), MJ day^{-1}

Hours = is the average number of hours of work per calendar day

The average hours of work for cattle sub-categories across different production systems were estimated using methods and data sources described in section 4.2.4 of the Baseline cattle GHG emission intensity report. The resulting time series hours of the work are shown in Table 3. The estimated net energy required for work for cattle sub-categories is shown in **Error! Reference source not found.**.

Table 33 Estimated work hours for cattle sub-categories, 2012-2021

System	Sub-category	Annual work hours (hour/head/day)									
		2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Smallholder intensive system	Adult cows (3-10 years)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Adult males 3-10 years	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Growing males (1 - < 3 year)	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Growing females (1 -< 3 years)	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Calves (6 m - < 1 year) male & female	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Calves (<6 months) male & female	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Adult multipurpose cows (≥ 3 years)	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41

Mixed crop livestock system	Adult males used for draught (3-10 yrs)	1.38	1.36	1.35	1.33	1.31	1.30	1.28	1.27	1.25	1.23
	Adult males for breeding & other (⩾3 yrs)	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Growing males 1-<3 years	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Growing females (1-<3 years)	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Calves 6 m-<1 year (male & female)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Calves < 6 months (male & female)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Feedlot-fed cattle	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
Pastoral/agro-pastoral system	Adult multipurpose cows (≥ 3 years)	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Adult males used for draught (3-10 yrs)	1.38	1.36	1.35	1.33	1.31	1.30	1.28	1.27	1.25	1.23
	Adult males for breeding & other (≥3 yrs)	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Growing males 1-<3 years	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Growing females (1-<3 years)	0.46	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41
	Calves 6 m-<1 year (male & female)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Calves < 6 months (male & female)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 34: Net Energy required for work cattle sub-categories, 2012-2021

System	Sub-category	Annual work hours (hour/head/day)									
		2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Smallholder intensive system	Adult cows (3-10 years)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Adult males 3-10 years	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3
	Growing males (1 - < 3 year)	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Growing females (1 -< 3 years)	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6
	Calves (6 m - < 1 year) male & female	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Calves (<6 months) male & female	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mixed crop livestock system	Adult multipurpose cows (⩾ 3 years)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9
	Adult males used for draught (3-10 yrs)	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9
	Adult males for breeding & other (⩾3 yrs)	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0
	Growing males 1-<3 years	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5
	Growing females (1-<3 years)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Calves 6 m-<1 year (male & female)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Calves < 6 months (male & female)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Feedlot-fed cattle	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Pastoral/agro-pastoral system	Adult multipurpose cows (≥ 3 years)	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1
	Adult males used for draught (3-10 yrs)	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0
	Adult males for breeding & other (≥3 yrs)	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Growing males 1-<3 years	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7
	Growing females (1-<3 years)	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Calves 6 m-<1 year (male & female)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Calves < 6 months (male & female)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Ratio of net energy available in diet for maintenance to digestible energy consumed (REM)
For cattle, the ratio of net energy available in a diet for maintenance to digestible energy consumed (REM) is estimated using IPCC (2006) Equation 10.14:

EQUATION 10.14
RATIO OF NET ENERGY AVAILABLE IN A DIET FOR MAINTENANCE TO DIGESTIBLE ENERGY CONSUMED

$$REM = \left[1.123 - \left(4.092 \bullet 10^{-3} \bullet DE\%\right) + \left[1.126 \bullet 10^{-5} \bullet (DE\%)^2\right] - \left(\frac{25.4}{DE\%}\right)\right]$$

Where:

REM = ratio of net energy available in a diet for maintenance to digestible energy consumed

DE% = digestible energy expressed as a percentage of gross energy

The values for DE % for the four production systems used in Equation 10.14 were the values given in **Error! Reference source not found.**, and **Error! Reference source not found.**. The me thodology and data sources sued to estimate feed digestibility in the four production systems described in section 4.2.6 of the Baseline cattle GHG emission intensity report.

Table 35: Feed digestibility (DE %) for dairy cattle sub-categories, 2012-2021.

	Commercial intensive dairy system						Smallholder intensive dairy system					
Year	Adult exotic dairy cows (> 3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female	Adult exotic dairy cows (>3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female
2012	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2013	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2014	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2015	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2016	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2017	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2018	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2019	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2020	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9
2021	61.8	60.6	60.7	60.8	61.6	61.6	58.0	55.5	55.0	56.6	54.9	54.9

Table 36: Feed digestibility (%) for multipurpose cattle sub-categories, 2012-2021

	Mixed crop-livestock system								Pastoral/agro-pastoral system						
Year	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (≥3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)	Feedlot-fed Cattle	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (>3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)
2012	56.3	56.3	56.3	56.3	56.3	56.3	56.3	58.2	56.0	56.0	56.0	56.0	56.0	56.0	56.0
2013	56.3	56.3	56.3	56.3	56.3	56.3	56.3	58.2	55.8	55.8	55.8	55.8	55.8	55.8	55.8
2014	56.3	56.3	56.3	56.3	56.3	56.3	56.3	58.2	56.0	56.0	56.0	56.0	56.0	56.0	56.0
2015	56.4	56.4	56.4	56.4	56.4	56.4	56.4	58.2	56.2	56.2	56.2	56.2	56.2	56.2	56.2
2016	56.4	56.4	56.4	56.4	56.4	56.4	56.4	58.2	56.2	56.2	56.2	56.2	56.2	56.2	56.2
2017	56.5	56.5	56.5	56.5	56.5	56.5	56.5	58.2	56.2	56.2	56.2	56.2	56.2	56.2	56.2
2018	56.5	56.5	56.5	56.5	56.5	56.5	56.5	58.3	56.2	56.2	56.2	56.2	56.2	56.2	56.2
2019	56.4	56.4	56.4	56.4	56.4	56.4	56.4	58.2	56.3	56.3	56.3	56.3	56.3	56.3	56.3
2020	56.5	56.5	56.5	56.5	56.5	56.5	56.5	58.2	55.9	55.9	55.9	55.9	55.9	55.9	55.9
2021	56.4	56.4	56.4	56.4	56.4	56.4	56.4	58.2	56.6	56.6	56.6	56.6	56.6	56.6	56.6

Ratio of net energy available for growth in a diet to digestible energy consumed (REG)

For cattle, the ratio of net energy available for growth in a diet to digestible energy consumed (REG) is estimated using IPCC (2006) Equation 10.15:

EQUATION 10.15
RATIO OF NET ENERGY AVAILABLE FOR GROWTH IN A DIET TO DIGESTIBLE ENERGY CONSUMED

$$REG = \left[1.164 - \left(5.160 \bullet 10^{-3} \bullet DE\%\right) + \left[1.308 \bullet 10^{-5} \bullet (DE\%)^2\right] - \left(\frac{37.4}{DE\%}\right)\right]$$

Where:

REG = ratio of net energy available for growth in a diet to digestible energy consumed

DE% = digestible energy expressed as a percentage of gross energy

The values for DE % for the four production systems used in Equation 10.14 were the values given in **Error! Reference source not found.** and **Error! Reference source not found.**. The me thodology and data sources sued to estimate feed digestibility in the four production systems described in section 4.2.6 of the Baseline cattle GHG emission intensity report. The calculated REM (Equation 10.14) and REG (Equation 10.15) values for the four production systems are shown in Error! Reference source not found., **Error! Reference source not found.**, **Error! Ref erence source not found.** and **Error! Reference source not found.** respectively.

Table 37: Ratio of net energy available in diet for maintenance to digestible energy consumed for dairy cattle sub-categories, 2012-2021.

	Commercial intensive dairy system						Smallholder intensive dairy system					
Year	Adult exotic dairy cows (> 3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female	Adult exotic dairy cows (>3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female
2012	0.502	0.497	0.498	0.498	0.498	0.501	0.486	0.486	0.486	0.486	0.486	0.486
2013	0.502	0.497	0.498	0.498	0.498	0.501	0.473	0.473	0.473	0.473	0.473	0.473
2014	0.502	0.497	0.498	0.498	0.498	0.501	0.470	0.470	0.470	0.470	0.470	0.470
2015	0.502	0.497	0.498	0.498	0.498	0.501	0.470	0.470	0.470	0.470	0.470	0.470
2016	0.502	0.497	0.498	0.498	0.498	0.501	0.479	0.479	0.479	0.479	0.479	0.479
2017	0.502	0.497	0.498	0.498	0.498	0.501	0.470	0.470	0.470	0.470	0.470	0.470
2018	0.502	0.497	0.498	0.498	0.498	0.501	0.486	0.486	0.486	0.486	0.486	0.486
2019	0.502	0.497	0.498	0.498	0.498	0.501	0.473	0.473	0.473	0.473	0.473	0.473
2020	0.502	0.497	0.498	0.498	0.498	0.501	0.470	0.470	0.470	0.470	0.470	0.470
2021	0.502	0.497	0.498	0.498	0.498	0.501	0.470	0.470	0.470	0.470	0.470	0.470

Table 38: Ratio of net energy available in diet for maintenance to digestible energy consumed for multipurpose cattle sub-categories, 2012-2021

	Mixed crop-livestock system								Pastoral/agro-pastoral system						
Year	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (≥3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)	Feedlot-fed Cattle	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (>3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)
2012	0.477	0.477	0.477	0.477	0.477	0.477	0.477	0.486	0.475	0.475	0.475	0.475	0.475	0.475	0.475
2013	0.477	0.477	0.477	0.477	0.477	0.477	0.477	0.486	0.475	0.475	0.475	0.475	0.475	0.475	0.475
2014	0.477	0.477	0.477	0.477	0.477	0.477	0.477	0.486	0.476	0.476	0.476	0.476	0.476	0.476	0.476
2015	0.477	0.478	0.478	0.478	0.478	0.478	0.478	0.486	0.477	0.477	0.477	0.477	0.477	0.477	0.477
2016	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.487	0.476	0.476	0.476	0.476	0.476	0.476	0.476
2017	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.487	0.477	0.477	0.477	0.477	0.477	0.477	0.477
2018	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.487	0.477	0.477	0.477	0.477	0.477	0.477	0.477
2019	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.487	0.477	0.477	0.477	0.477	0.477	0.477	0.477
2020	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.487	0.475	0.475	0.475	0.475	0.475	0.475	0.475
2021	0.477	0.478	0.478	0.478	0.478	0.478	0.478	0.486	0.479	0.479	0.479	0.479	0.479	0.479	0.479

Table 39: Ratio of net energy available in diet for growth to digestible energy consumed for dairy cattle sub-categories, 2012-2021.

	Commercial intensive dairy system						Smallholder intensive dairy system					
Year	Adult exotic dairy cows (> 3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female	Adult exotic dairy cows (>3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female
2012	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2013	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2014	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2015	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2016	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2017	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2018	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2019	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2020	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239
2021	0.290	0.282	0.283	0.283	0.283	0.289	0.264	0.244	0.240	0.240	0.253	0.239

Table 40: Ratio of net energy available in diet for growth to digestible energy consumed for multipurpose cattle sub-categories, 2012-2021

	Mixed crop-livestock system								Pastoral/agro-pastoral system						
Year	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (≥3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)	Feedlot-fed Cattle	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (>3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)
2012	0.251	0.251	0.251	0.251	0.251	0.251	0.251	0.265	0.248	0.248	0.248	0.248	0.248	0.248	0.248
2013	0.251	0.251	0.251	0.251	0.251	0.251	0.251	0.265	0.247	0.247	0.247	0.247	0.247	0.247	0.247
2014	0.251	0.251	0.251	0.251	0.251	0.251	0.251	0.265	0.248	0.248	0.248	0.248	0.248	0.248	0.248
2015	0.251	0.251	0.251	0.251	0.251	0.251	0.251	0.265	0.250	0.250	0.250	0.250	0.250	0.250	0.250
2016	0.252	0.251	0.251	0.251	0.251	0.251	0.251	0.265	0.249	0.249	0.249	0.249	0.249	0.249	0.249
2017	0.252	0.252	0.252	0.252	0.252	0.252	0.252	0.266	0.250	0.250	0.250	0.250	0.250	0.250	0.250
2018	0.253	0.252	0.252	0.252	0.252	0.252	0.252	0.266	0.250	0.250	0.250	0.250	0.250	0.250	0.250
2019	0.252	0.251	0.251	0.251	0.251	0.251	0.251	0.266	0.250	0.250	0.250	0.250	0.250	0.250	0.250
2020	0.252	0.252	0.252	0.252	0.252	0.252	0.252	0.266	0.247	0.247	0.247	0.247	0.247	0.247	0.247
2021	0.251	0.251	0.251	0.251	0.251	0.251	0.251	0.265	0.253	0.253	0.253	0.253	0.253	0.253	0.253

Calculation of gross energy

Gross energy was calculated using IPCC (2006) Equation 10.16. The gross energy requirement is derived based on the summed net energy requirements and the energy availability characteristics of the feed(s) calculated using the results of the equations presented above. Gross energy for each sub-category is shown in **Error! Reference source not found.** and **Error! Reference source not fo und.**. The estimated DMI to body weight ratio was 2.07%-3.90% of body weight for all animal types, which is consistent with the suggested "in the order of 2% to 3% of the bodyweight" in IPCC (2019). The higher values were for growing animal types.

EQUATION 10.16
GROSS ENERGY FOR CATTLE/BUFFALO AND SHEEP

$$GE = \left[\frac{\left(\frac{NE_m + NE_a + NE_l + NE_{work} + NE_p}{REM} \right) + \left(\frac{NE_g + NE_{wool}}{REG} \right)}{\frac{DE\%}{100}} \right]$$

Where:

GE = gross energy, MJ day^{-1}

NE_m = net energy required by the animal for maintenance (Equation 10.3), MJ day^{-1}

NE_a = net energy for animal activity (Equations 10.4 and 10.5), MJ day^{-1}

NE_l = net energy for lactation (Equations 10.8, 10.9, and 10.10), MJ day^{-1}

NE_{work} = net energy for work (Equation 10.11), MJ day^{-1}

NE_p = net energy required for pregnancy (Equation 10.13), MJ day^{-1}

REM = ratio of net energy available in a diet for maintenance to digestible energy consumed (Equation 10.14)

NE_g = net energy needed for growth (Equations 10.6 and 10.7), MJ day^{-1}

NE_{wool} = net energy required to produce a year of wool (Equation 10.12), MJ day^{-1}

REG = ratio of net energy available for growth in a diet to digestible energy consumed (Equation 10.15)

DE%= digestible energy expressed as a percentage of gross energy

Table 41: Gross energy (MJ head/day) for dairy cattle sub-categories (2012-2021)

	Commercial intensive dairy system						Smallholder intensive dairy system					
Year	Adult exotic dairy cows (> 3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female	Adult exotic dairy cows (>3 years)	Adult males 3-10 years)	Growing males (1 - < 3 year	Growing females (1 - < 3 year	Exotic calves (6 m - < 1 year) male & female	Exotic calves (6 m - < 1 year) male & female
2012	212.9	163.8	132.9	117.2	62.4	36.5	207.8	146.3	76.2	79.7	67.8	35.8
2013	212.9	163.8	132.9	117.2	62.4	36.5	207.8	146.3	76.2	79.6	67.8	35.8
2014	212.9	163.8	132.9	117.2	62.4	36.5	207.8	146.2	76.2	79.6	67.8	35.8
2015	212.9	163.8	132.9	117.2	62.4	36.5	207.8	146.2	76.1	79.6	67.8	35.8
2016	212.9	163.8	132.9	117.2	62.4	36.5	207.8	146.1	76.1	79.5	67.8	35.8
2017	212.9	163.8	132.9	117.2	62.4	36.5	207.8	146.0	76.1	79.5	67.8	35.8
2018	212.9	163.8	132.9	117.2	62.4	36.5	207.8	146.0	76.1	79.5	67.8	35.8
2019	212.9	163.8	132.9	117.2	62.4	36.5	207.8	145.9	76.0	79.5	67.8	35.8
2020	212.9	163.8	132.9	117.2	62.4	36.5	207.8	145.8	76.0	79.4	67.8	35.8
2021	212.9	163.8	132.9	117.2	62.4	36.5	207.8	145.8	76.0	79.4	67.8	35.8

Table 42: Gross energy (MJ head/day) for multipurpose cattle sub-categories (2012-2021)

	Mixed crop-livestock system								Pastoral/agro-pastoral system						
Year	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (≥3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)	Feedlot-fed Cattle	Adult multipurpose cows (≥ 3 years)	Adult males used for draught (3-10 yrs)	Adult males for breeding & other (>3 yrs)	Growing males 1-<3 years	Growing females (1-<3 years)	Calves 6 m-<1 year (male & female)	Calves < 6 months (male & female)
2012	113.2	115.1	108.9	115.1	80.0	43.4	33.5	164.8	159.1	137.6	148.4	125.1	108.4	92.3	45.7
2013	112.6	114.9	108.8	114.9	80.0	43.3	33.5	164.7	150.1	138.2	149.2	125.9	109.1	92.8	45.9
2014	111.6	114.8	108.8	114.8	80.0	43.4	33.5	164.7	152.9	137.3	148.3	125.0	108.3	92.2	45.7
2015	111.4	114.3	108.4	114.3	79.7	43.2	33.4	164.5	152.0	136.4	147.4	124.1	107.6	91.6	45.2
2016	112.1	114.2	108.4	114.2	79.7	43.3	33.5	164.3	156.3	136.6	147.8	124.5	107.9	92.4	45.7
2017	110.1	113.7	108.0	113.7	79.4	43.1	33.4	164.2	152.5	136.1	147.3	124.0	107.5	92.4	45.6
2018	111.8	113.6	108.0	113.6	79.3	43.1	33.3	163.9	150.2	135.9	147.2	124.0	107.5	92.5	45.6
2019	110.3	113.8	108.2	113.8	79.6	43.3	33.4	164.1	154.8	135.4	146.8	123.5	107.1	92.3	45.4
2020	109.6	113.3	107.9	113.3	79.3	43.2	33.3	164.0	161.4	136.8	148.4	125.2	108.5	93.9	45.9
2021	108.8	113.5	108.1	113.5	79.5	43.3	33.4	164.3	155.0	134.0	145.4	122.2	106.0	90.6	45.0

Calculation of methane emission factors

Enteric fermentation emissions factors were calculated for 15 sub-categories of Multipurpose cattle using IPCC (2006) Equation 10.21:

EQUATION 10.21

CH_4 EMISSION FACTORS FOR ENTERIC FERMENTATION FROM A LIVESTOCK CATEGORY

$$EF = \left[\frac{GE \bullet \left(\frac{Y_m}{100} \right) \bullet 365}{55.65} \right]$$

Where:

EF = emission factor, kg CH_4 $head^{-1}$ yr^{-1}

GE = gross energy intake, MJ $head^{-1}$ day^{-1}

Y_m = methane conversion factor, per cent of gross energy in feed converted to methane

The factor 55.65 (MJ/kg CH_4) is the energy content of methane

The value for the methane conversion factor (Ym) used was the IPCC default value of 6.5% with Diets DE (≤ 62%) for dairy cows in the commercial and smallholder dairy intensive systems, while 7.0% was used for other dairy sub-categories and for multipurpose cattle in the mixed and pastoral/agro-pastoral systems, including for feedlot cattle. For calves <6 months a methane conversion factor of 1.625% was used, representing emissions after weaning at the age of 90 days and assuming no emissions during the 90-day suckling period. For calves 6 months – 1 year, a methane conversion factor of 3.25% was used, representing the fact that animals are not in each of this age class for more than 6 months of the year. The resulting emission factors for each year are shown in **Error! Reference source not found.** and **Error! Reference source not found.**.

Table 43: Emission factors for dairy cattle sub-categories, 2012-2021 (kg CH_4/head/year)

	Commercial intensive dairy system						Smallholder intensive dairy system					
Year	Adult cows ≥3 years	Adult males (3-10 years)	Growing males 1-3 years	Growing females 1-3 years	Calves 6 m-1 year (male & female)	Calves < 6 months (male & female)	Adult cows ≥3 years	Adult males used for breeding (3-10 years)	Growing males 1-3 years	Growing females 1-3 years	Calves 6 m-1 year (male & female)	Calves < 6 months (male & female)
2012	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.2	35.0	36.6	14.4	3.8
2013	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.2	35.0	36.6	14.4	3.8
2014	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.1	35.0	36.5	14.4	3.8
2015	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.1	35.0	36.5	14.4	3.8
2016	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.1	34.9	36.5	14.4	3.8
2017	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.0	34.9	36.5	14.4	3.8
2018	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.0	34.9	36.5	14.4	3.8
2019	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.0	34.9	36.5	14.4	3.8
2020	90.8	75.2	61.0	53.8	13.3	3.9	88.6	67.0	34.9	36.5	14.4	3.8
2021	90.8	75.2	61.0	53.8	13.3	3.9	88.6	66.9	34.9	36.5	14.4	3.8

Table 44: Emission factors for multipurpose cattle sub-categories, 2012-2021 (kg CH_4/head/year)

	Mixed crop-livestock system								Pastoral and agro-pastoral system						
Year	**Adult multipurpose cows ≥3 years**	**Adult males used for draught (3-10 years)**	**Adult males used for breeding & other purpose (>3-10 years)**	**Growing males (1-3 years)**	**Growing females 1-3 years**	**Calves 6 m-1 year (male & female)**	**Calves < 6 months (male & female**	**Feedlot**	**Adult multipurpose cows ≥3 years**	**Adult males used for draught (3-10 years)**	**Adult males used for breeding & other purpose (>3-10 years)**	**Growing males 1-3 years**	**Growing females 1-3 years**	**Calves 6 m-1 year (male & female)**	**Calves < 6 months (male & female)**
2012	52.0	52.9	50.0	52.9	36.7	9.3	3.6	75.7	73.1	63.2	68.2	57.4	49.8	19.7	4.9
2013	51.7	52.8	49.9	52.8	36.7	9.2	3.6	75.6	68.9	63.4	68.4	57.7	50.0	19.8	4.9
2014	51.3	52.7	49.9	52.7	36.7	9.2	3.6	75.6	70.2	63.0	68.1	57.4	49.7	19.6	4.9
2015	51.1	52.5	49.8	52.5	36.6	9.2	3.6	75.5	69.8	62.6	67.6	56.9	49.3	19.5	4.8
2016	51.5	52.4	49.8	52.4	36.6	9.2	3.6	75.5	71.8	62.6	67.8	57.1	49.5	19.7	4.9
2017	50.5	52.2	49.6	52.2	36.4	9.2	3.6	75.4	70.0	62.5	67.6	57.0	49.4	19.7	4.9
2018	51.3	52.1	49.6	52.1	36.4	9.2	3.6	75.3	68.9	62.3	67.5	56.9	49.3	19.7	4.9
2019	50.6	52.3	49.7	52.3	36.5	9.2	3.6	75.3	71.1	62.2	67.4	56.8	49.2	19.7	4.8
2020	50.3	52.0	49.5	52.0	36.4	9.2	3.6	75.3	74.1	62.8	68.2	57.5	49.8	20.0	4.9
2021	49.9	52.1	49.6	52.1	36.5	9.2	3.6	75.4	71.1	61.5	66.7	56.1	48.6	19.3	4.8

Total enteric fermentation Baseline emissions

Total enteric fermentation GHG emissions (tCO_2e/year) were estimated for each year as the sum of enteric fermentation methane emission from all sub-categories in each production system (see equation below). The resulting total emission for each year is presented in the **Error! Reference s ource not found.** below.

$$EntF = N_{S,X} \times EF_{EFS,Xj} \times \frac{GWP_{CH4}}{1000}$$

Were

EntF = enteric fermentation emissions, t CO_2e per head per year;

$N_{S,X}$ = number of cattle of different sub-category in production *S* for year *X*;

$EF_{EF,S,X}$ = enteric fermentation emission factor for cattle of different sub-category in production system *S* for year *X*, kg CH_4 per head per year;

GWP_{CH4} = Global warming potential of methane (28 according to the IPCC Fifth Assessment Report); 1000 is the conversion from kg to tonnes.

Table 45: Enteric fermentation emissions from dairy cattle and multipurpose cattle in different production systems, 2012-2021 (tCO_2e/year)

Year	Commercial dairy cattle	Smallholder dairy cattle	Multipurpose cattle, mixed-crop livestock	Multipurpose cattle, pastoral/agro-pastoral	Total
2012	342,539	425,032	25,605,215	1,596,944	27,969,730
2013	360,490	525,655	25,602,164	1,486,736	27,975,044
2014	378,435	521,752	25,869,750	1,528,494	28,298,431
2015	396,386	520,327	26,371,753	1,600,074	28,888,540
2016	414,332	663,762	27,034,214	1,596,195	29,708,504
2017	432,280	557,443	27,397,908	1,320,430	29,708,061
2018	450,228	773,844	27,476,382	1,143,086	29,843,541
2019	468,177	1,049,328	28,187,955	1,077,353	30,782,813
2020	486,128	1,100,474	28,944,410	814,814	31,345,826
2021	504,076	1,341,990	30,434,323	857,799	33,138,187

Emission Intensity Approach

Under the ISFL ER Program requirements, ISFL ER Programs can choose to use an emission intensity approach for estimating emission reductions if the ER Program complies with the criteria identified in requirement 4.2.2.

The emission intensity (EI) is calculated as

$$EI = \frac{Emissions}{Production} \qquad \text{Equation 1}$$

Where:

Production = Amount of protein from milk and meat produced from all included livestock species, expressed in kg;

Emission intensity =: Emission per unit of protein produced, expressed in CO2e / kg protein.

This section contains the calculations for applying the emission intensity approach for Oromia.

Total protein output

The total protein output of animal source was estimated using Equation 2:

$$\text{Total Protein}_{output,\ S,\ X} = PO_{meat,\ S,\ X} + PO_{milk,S,\ X} \qquad \text{Equation 2}$$

Where $PO_{meat,X}$, and $PO_{milk,X}$, are the total protein output (t protein) from meat and milk, respectively, from the four production systems *S*in year *X*.

Cattle meat protein:

The total protein output from meat in year X was estimated for all production system following (FAO, 2018) as (Equation 3):

$$PO_{meat,\ X} = \frac{\sum_s (n\_off_{S,X} \times LW_{S,X} \times \frac{DP}{100}) \times (\frac{BFM_S \times meat\_prot}{100})}{1000} \qquad \text{Equation 3}$$

where $PO_{meat,\ S,\ X}$ is total protein output from meat in production system S for year X, $n\_off_{S,X}$ is the total number of cattle slaughtered (n) in production system S for year X, $LW_{S,X}$ the average

live weight (kg) of cattle slaughtered in production system S in year X, DP_S the dressing percentage for cattle (assumed to be 47% following FAO GLEAM), BFM_J the bone-free-meat percentage (ratio of bone free meat to cold carcass weight) for cattle (0.75, following FAO GLEAM), meat_prot is the mean protein content (g/100g) in cattle meat (21.13%, following FAO GLEAM), and 1,000 is the conversion factor from kg to tonnes.

Cattle offtake data (i.e., male and female animals slaughtered) were extracted from the annual livestock sample survey reports for the period from 2012 to 2021 and presented in **Error! R eference source not found.**. Furthermore, the annual livestock sample surveys do not cover households in urban and peri-urban areas, or farms owned by companies. Therefore, two assumptions were made to fill data gaps in the animal offtake data: i) the annual offtake rate on commercial dairy farms was assumed to be 15 % of the total population; iii) all cattle kept on feedlots in the urban and peri-urban areas were sold annually. The resulting total output of meat protein is presented in table 47.

Table 46: Cattle offtake (slaughter) from commercial dairy production system in Oromia, 2012-2021 (head/year)

Year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Commercial dairy	28,899	30,413	31,927	33,442	34,956	36,470	37,984	39,498	41,013	42,527

Table 47: Total output of meat protein of dairy and multipurpose cattle in the different production systems, 2012-2021 (t protein/year)

Year	**Mixed crop-livestock**		**Pastoral/agro-pastoral**		**Feedlot cattle**	**Commercial dairy**	**Total protein**
	Male	Female	Male	Female			
2012	1,399	1,113	50.4	40.4	4,950	780	8,333
2013	1,031	878	54.7	12.1	4,923	821	7,720
2014	1,339	1,263	74.4	58.3	4,616	862	8,213
2015	1,843	1,337	40.1	30.3	5,378	903	9,532
2016	1,392	1,095	49.2	37.7	5,926	944	9,443

2017	1,105	1,064	58.3	45.2	5,367	985	8,625
2018	1,291	864	67.4	52.7	6,498	1,026	9,798
2019	1,764	1,025	76.6	60.2	6,832	1,066	10,825
2020	992	833	85.7	67.6	6,852	1,107	9,938
2021	1,022	460	94.8	75.1	6,868	1,148	9,668

Cattle milk Protein:

The total protein output from milk in year x was estimated using Equation 4:

$$PO_{milk,\ S,\ X} = \frac{\sum_s ((lact\_animals_{s,x} \times FPCM_{s,x}) \times (\frac{prot_{milk}}{100}))}{1000} \qquad \text{Equation 4}$$

where $PO_{milk,\ S,\ X}$ is total protein output from milk in production system S for year X, $lact\_animals_{s,x}$ is the total number of lactating cows (n) in production systems S for year X, $FPCM_{s,x}$ the mean annual milk yield (kg) corrected for fat and protein per lactating cow in production system S for year X, $prot_{milk}$ is the mean protein content of milk (g/100g, 3.5%), and 1,000 is the conversion factor from kg to tonnes. The mean annual milk yields of cows were corrected for fat and protein following Equation 5 (FAO and ILRI, 2016).

$$PCM_{S,X} = MY_{S,X} \times (0.337 + (0.116 \times MF) + (0.06 \times MP)) \qquad \text{Equation 5}$$

where $FPCM_{S,\ X}$ is the mean annual milk yield corrected for fat and protein per lactating cow in production S for year X, MY is the mean annual milk yield (kg) per cow in the production S for year X, MF the milk fat content (g/100g, 4% following IPCC 2006), and MP is the milk protein content (g/100g, 3.5% following IPCC 2006).

The annual milk yields per cow were 8.6 and 6.7 kg/head year for commercial and smallholder intensive dairy production systems, respectively (section 4.2.2.1, & 4.2.2. 2). The annual milk yields per cow for mixed crop-livestock and pastoral/agro-pastoral production systems were taken from **Error! Reference source not found.** below. These average daily milk yield values have a

lready been adjusted for the number of days in milk (lactation length) and proportion cows giving birth so the total output of milk per cow per year was estimated using data on the number of adult cows in the commercial, smallholder dairy and mixed crop-livestock and pastoral/agro-pastoral systems multiplied by 365 days. The annual milk yield corrected for fat and protein per lactating cows in the four production systems was calculated using Equation 5.

Table 48: Total output from milk protein from dairy and multipurpose cattle, 2012-2021 (t protein/year)

Year	Commercial dairy	Smallholder dairy	Mixed crop-livestock	Pastoral/agro-pastoral	Total protein (t protein)
2012	11,616	10,886	54,881	5,398	82,781
2013	12,225	13,464	53,660	3,581	82,930
2014	12,834	13,366	51,752	3,990	81,941
2015	13,442	13,330	55,441	4,385	86,599
2016	14,051	17,006	56,200	4,818	92,075
2017	14,659	14,284	55,681	3,523	88,147
2018	15,268	19,830	62,065	2,699	99,863
2019	15,877	26,892	56,884	4,049	103,702
2020	16,486	28,205	59,474	3,826	107,990
2021	17,094	34,398	55,991	3,682	111,166

Emission intensity

According to IFSL ER PR 4.2.7, if the emission intensity approach is used, the emission intensity (EI) will be calculated using equation 6 and by combining the emissions of the eligible subcategories and livestock species:

$$EI = GHGI = \frac{GHG\ emissions\ from\ cattle}{Protein_{cattle\ milk} + Protein_{cattle\ meat}} \qquad \text{Equation 6}$$

Where:

Amount of protein from milk and meat produced from all included livestock species (i.e., cattle in

the Oromia case), expressed in tonnes, and emission intensity is the emission per unit of protein produced, expressed in CO_2e / t protein.

When total emissions and total protein output have been calculated, emission intensity can be calculated using Equation 6. The resulting emission intensity (tCO_2/t Protein) is presented in 49 below.

Table 49: Emission intensity of cattle production in Oromia region, 2012-2021 (tCO_2/t protein)

Year	Total meat protein (t protein)	Total milk protein (t protein)	Total protein (t protein)	Total enteric fermentation GHG emission (tCO2e)	GHG-Emission intensity (tCO2e / t protein)
2012	8,333	82,781	91,113	27,969,730	307.0
2013	7,720	82,930	90,649	27,975,044	308.6
2014	8,213	81,941	90,153	28,298,431	313.9
2015	9,532	86,599	96,130	28,888,540	300.5
2016	9,443	92,075	101,517	29,708,504	292.6
2017	8,625	88,147	96,771	29,708,061	307.0
2018	9,798	99,863	109,660	29,843,541	272.1
2019	10,825	103,702	114,526	30,782,813	268.8
2020	9,938	107,990	117,927	31,345,826	265.8

2021	9,668	111,166	120,833	33,138,187	274.2
				Historic average	**291.1**

This means the baseline GHG emission intensity for enteric fermentation – cattle is 291.1 t CO2e/t protein as calculated in the table above.

Annex 10: Data and parameters to be monitored

Using the table provided, clearly describe all the data and parameters to be monitored (copy table foreach parameter).

Parameter:	EF_{C_ABBG}
Description:	*Emission Factor for loss of above ground and below ground biomass in the conversion from forest to cropland*
Data unit:	tCO_2/ha
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	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

z

The EF is obtained by subtracting from the tree carbon stock of forest the carbon stock of the level 1 FRA class 'other land'

92.2tC/ha – 10.1tC/ha = 82.1 t C/ha * 44/12 = 300.97.06tCO2eq

Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed but might be updated if new data from the ongoing NFI are available.
Quality Assurance/Quality Control procedures to be applied:	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.

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.

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 esti***
Tropical shrubland	0.4	
Tropical desert	0.5	
Tropical Moist Deciduous Forest	0.24	0.22 - 0.33
Tropical dry forest	0.28	0.27 - 0.28

Process for managing and reducing uncertainty associated with this parameter	Parameter is calculated from NFI data and therefore the data collection (and with that the possibility to manage and reduce uncertainty) is not under control of the ER Program.

Parameter:	EF_{G_ABBG}
Description:	*Emission Factor for loss of above ground and below ground biomass in the conversion from forest to grassland*
Data unit:	tCO_2/ha
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	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)). . The EF is obtained by subtracting from the tree carbon stock of forest the carbon stock of the level 1 FRA class 'other land' 92.2 tC/ha – 3.5tC/ha = 88.7 t C/ha * 44/12 = 325.12
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed but might be updated if new data from the ongoing NFI are available.
Quality Assurance/Quality Control procedures to be applied:	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

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

	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.

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.

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 uncertainty esti***
Tropical shrubland	0.4	
Tropical desert	0.5	
Tropical Moist Deciduous Forest	0.24	0.22 - 0.33
Tropical dry forest	0.28	0.27 - 0.28

Process for managing and reducing uncertainty associated with this parameter	Parameter is calculated from NFI data and therefore the data collection (and with that the possibility to manage and reduce uncertainty) is not under control of the ER Program.

Parameter:	*EF shrub_AGBG*
Description:	*Emission Factor for loss of above ground and below ground biomass in the conversion from forest to shrubland*
Data unit:	tCO_2/ha
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	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

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'

*92.2 tC/ha – 7 tC/ha = 85.2 t C/ha * 44/12= 312.49 tCO2eq*

Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed but might be updated if new data from the ongoing NFI are available.
Quality Assurance/Quality Control procedures to be applied:	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.

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.

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 uncertainty esti***
Tropical shrubland	0.4	
Tropical desert	0.5	
Tropical Moist Deciduous Forest	0.24	0.22 - 0.33
Tropical dry forest	0.28	0.27 - 0.28

Process for managing and reducing uncertainty associated with this parameter	Parameter is calculated from NFI data and therefore the data collection (and with that the possibility to manage and reduce uncertainty) is not under control of the ER Program.

Parameter:	RF_{C_AGBB}
Description:	*Above ground and below ground biomass removal Factor for the conversion of cropland to forest land*
Data unit:	tCO_2/ha/year
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	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)). . 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 *10.1tC/ha and 92.2 tC/ha= 82.1 t C/ha* *82.1 / 20 = 4.10 t C/ha/year* *4.10 * (44/12) = 15.05 CO2eq/ha/yr*
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed but might be updated if new data from the ongoing NFI are available.

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

Quality Assurance/Quality Control procedures to be applied:	*See EF_{C_AGBG}*
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	*See EF_{C_AGBG}*
Process for managing and reducing uncertainty associated with this parameter	*See EF_{C_AGBG}*

Parameter:	*RF_{G_AGBB}*
Description:	*Above ground and below ground biomass removal factor for the conversion of cropland to forest land*
Data unit:	tCO_2/ha/year
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	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)).

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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 *3.5tC/ha and 100.5 tC/ha= 88.7 t C/ha* *88.7 / 20 = 4.43 t C/ha/year* *4.43 * (44/12) = 16.26 CO2eq/ha/yr*
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed but might be updated if new data from the ongoing NFI are available.
Quality Assurance/Quality Control procedures to be applied:	*See* EF_{G_AGBG}
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	*See* EF_{G_AGBG}
Process for managing and reducing uncertainty associated with this parameter	*See* EF_{G_AGBG}

Parameter:	RF_{shrub_AGBB}
Description:	*Above ground and below ground biomass removal factor for the conversion of shrubland to forest land*
Data unit:	tCO_2/ha/year

Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	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)). . 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 7 tC/ha and 92.2 tC/ha = 85.2 t C/ha *85.2 / 20 = 4.26 t C/ha/year* *4.26 * (44/12) = 15.62 CO2eq/ha/yr*
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed but might be updated if new data from the ongoing NFI are available.
Quality Assurance/Quality Control procedures to be applied:	*See EF_{shrub_AGBG}*
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	*See EF_{shrub_AGBG}*

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

Process for managing and reducing uncertainty associated with this parameter	*See EF_{G_AGBG}*

Parameter:	R
Description:	*Root to shoot ratio to estimate Below Ground Biomass*
Data unit:	Dimensionless
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	National forest inventory which has been using IPCC default values

Biome	FRA class	root-shoot
Acacia-Commiphora	Forest	0.28
	Other wooded land	0.4
	Other land	0.4
Combretum-Terminalia	Forest	0.28
	Other wooded land	0.4
	Other land	0.3
Dry Afromontane	Forest	0.28
	Other wooded land	0.4
	Other land	0.3
Moist Afromontane	Forest	0.24
	Other wooded land	0.4
	Other land	0.3

Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed but might be updated if new data from the ongoing NFI are available.
Quality Assurance/Quality Control procedures to be	IPCC defaults

applied:	
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	IPCC defaults, the values and the uncertainties of the parameters is outside the control of the ER Program
Process for managing and reducing uncertainty associated with this parameter	*See* EF_{G_AGBG}

Parameter:	ΔCF_{DOM}
Description:	*annual change in carbon stocks in dead wood*
Data unit:	tonnes C ha^{-1} yr^{-1}s
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	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.

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.

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

Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed but might be updated if new data from the ongoing NFI are available.
Quality Assurance/Quality Control procedures to be applied:	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
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	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
Process for managing and reducing uncertainty associated with this parameter	Parameter is taken from NFI data and therefore the data collection (and with that the possibility to manage and reduce uncertainty) is not under control of the ER Program.

Parameter:	SOC_{ref}
Description:	*reference soil organic C stocks for mineral soils under native forest (in 0-30 cm depth)*
Data unit:	tonnes C ha^{-1}
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific	"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 values as shown in the table below.

Soil type - Biome	**SOC ref (tC/ha)**	**N**	**Standard deviation (tC/ha)**

literature), including the spatial level of the data (local, regional, national, international)	**Acacia Commiphora**	**34.245**	11	17.01197
	Combretum Terminalia	**41.561**	37	28.25306
	Dry Afromontaine	**53.080**	33	34.46676
	Moist Afromontaine	**83.886**	17	34.65632
	Average	**51.961**	98	33.58339
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed			
Quality Assurance/Quality Control procedures to be applied:	QA/QC applied when the study was performed			
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Standard deviation as provided above.			
Process for managing and reducing uncertainty associated with this parameter	Parameter is taken from national study and therefore the data collection (and with that the possibility to manage and reduce uncertainty) is not under control of the ER Program.			

Parameter:	*SOCi*
Description:	*Equilibrium soil organic C stocks for mineral soils under land use type i*
Data unit:	tonnes C ha^{-1}

<table>
<tr><td>Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)</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>This results int he following values
<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>Fixed value or monitored? If monitored, frequency of monitoring/recording:</td><td>Fixed</td></tr>
<tr><td>Quality Assurance/Quality Control procedures to be applied:</td><td>QA/QC applied when the study was performed</td></tr>
<tr><td>Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.</td><td>Standard deviation as provided above.</td></tr>
<tr><td>Process for managing and reducing uncertainty associated with this parameter</td><td>Parameter is taken from national study and therefore the data collection (and with that the possibility to manage and reduce uncertainty) is not under control of the ER Program.</td></tr>
</table>

Parameter:	$\Delta A_{F\text{-}C}$

Description:	*area converted from forest to cropland category during the monitoring period*
Data unit:	Hectares
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Analysis of remote sensing images using stratified random sampling and the Collect Earth Online and SEPAL platform to integrate the different satellite imagery. Sample points will be analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Monitored every 2 years or more frequent depending on the monitoring periods agreed for ERPA phase 2
Quality Assurance/Quality Control procedures to be applied:	Data interpretation will be done by a centralized data collection team using the same approach and response design to facilitate a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues will be held regularly. A quality control team will conduct cross-checking activities using multiple data sources and local knowledge. Points will be reinterpreted by experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Discrepancies will be resolved

	through discussions with all team members.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	The assessment of sample points is 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.. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling but interpretation errors can still occur.
Process for managing and reducing uncertainty associated with this parameter	Training of team members to ensure consistent interpretation. To ensure the quality of the AD collection, various vegetation indices will be used, such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI). Furthermore, historical trends in land use/cover will be 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.

Parameter:	$\Delta A_{F\text{-}G}$
Description:	*area converted from forest to grassland category during the monitoring period*
Data unit:	Hectares
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and	Analysis of remote sensing images using stratified random sampling and the Collect Earth Online and SEPAL platform to integrate the different satellite imagery. Sample points will be analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat.

scientific literature), including the spatial level of the data (local, regional, national, international)	
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Monitored every 2 years or more frequent depending on the monitoring periods agreed for ERPA phase 2
Quality Assurance/Quality Control procedures to be applied:	Data interpretation will be done by a centralized data collection team using the same approach and response design to facilitate a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues will be held regularly. A quality control team will conduct cross-checking activities using multiple data sources and local knowledge. Points will be reinterpreted by experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Discrepancies will be resolved through discussions with all team members.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	The assessment of sample points is 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.. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling but interpretation errors can still occur.

Process for managing and reducing uncertainty associated with this parameter	Training of team members to ensure consistent interpretation. To ensure the quality of the AD collection, various vegetation indices will be used, such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI). Furthermore, historical trends in land use/cover will be 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.

Parameter:	$\Delta A_{F\text{-}shrub}$
Description:	*area converted from forest to shrubland category during the monitoring period*
Data unit:	Hectares
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Analysis of remote sensing images using stratified random sampling and the Collect Earth Online and SEPAL platform to integrate the different satellite imagery. Sample points will be analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Monitored every 2 years or more frequent depending on the monitoring periods agreed for ERPA phase 2

Quality Assurance/Quality Control procedures to be applied:	Data interpretation will be done by a centralized data collection team using the same approach and response design to facilitate a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues will be held regularly. A quality control team will conduct cross-checking activities using multiple data sources and local knowledge. Points will be reinterpreted by experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Discrepancies will be resolved through discussions with all team members.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	The assessment of sample points is 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.. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling but interpretation errors can still occur.
Process for managing and reducing uncertainty associated with this parameter	Training of team members to ensure consistent interpretation. To ensure the quality of the AD collection, various vegetation indices will be used, such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI). Furthermore, historical trends in land use/cover will be 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.

Parameter:	$\Delta A_{C\text{-}F}$
Description:	*area converted from cropland to forest category during the monitoring period*

Data unit:	Hectares
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Analysis of remote sensing images using stratified random sampling and the Collect Earth Online and SEPAL platform to integrate the different satellite imagery. Sample points will be analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Monitored every 2 years or more frequent depending on the monitoring periods agreed for ERPA phase 2
Quality Assurance/Quality Control procedures to be applied:	Data interpretation will be done by a centralized data collection team using the same approach and response design to facilitate a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues will be held regularly. A quality control team will conduct cross-checking activities using multiple data sources and local knowledge. Points will be reinterpreted by experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Discrepancies will be resolved through discussions with all team members.

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	The assessment of sample points is 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.. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling but interpretation errors can still occur.
Process for managing and reducing uncertainty associated with this parameter	Training of team members to ensure consistent interpretation. To ensure the quality of the AD collection, various vegetation indices will be used, such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI). Furthermore, historical trends in land use/cover will be 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.

Parameter:	$\Delta A_{G\text{-}F}$
Description:	*area converted from grassland to forest category during the monitoring period*
Data unit:	Hectares
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of	Analysis of remote sensing images using stratified random sampling and the Collect Earth Online and SEPAL platform to integrate the different satellite imagery. Sample points will be analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat.

the data (local, regional, national, international)	
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Monitored every 2 years or more frequent depending on the monitoring periods agreed for ERPA phase 2
Quality Assurance/Quality Control procedures to be applied:	Data interpretation will be done by a centralized data collection team using the same approach and response design to facilitate a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues will be held regularly. A quality control team will conduct cross-checking activities using multiple data sources and local knowledge. Points will be reinterpreted by experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Discrepancies will be resolved through discussions with all team members.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	The assessment of sample points is 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.. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling but interpretation errors can still occur.
Process for managing and reducing uncertainty	Training of team members to ensure consistent interpretation. To ensure the quality of the AD collection, various vegetation indices

associated with this parameter	will be used, such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI). Furthermore, historical trends in land use/cover will be 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.

Parameter:	$\Delta A_{shrub\text{-}F}$
Description:	*area converted from shrubland to forest category during the monitoring period*
Data unit:	Hectares
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Analysis of remote sensing images using stratified random sampling and the Collect Earth Online and SEPAL platform to integrate the different satellite imagery. Sample points will be analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Monitored every 2 years or more frequent depending on the monitoring periods agreed for ERPA phase 2
Quality Assurance/Quality Control procedures to be	Data interpretation will be done by a centralized data collection team using the same approach and response design to facilitate a

applied:	common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues will be held regularly. A quality control team will conduct cross-checking activities using multiple data sources and local knowledge. Points will be reinterpreted by experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Discrepancies will be resolved through discussions with all team members.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	The assessment of sample points is 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.. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling but interpretation errors can still occur.
Process for managing and reducing uncertainty associated with this parameter	Training of team members to ensure consistent interpretation. To ensure the quality of the AD collection, various vegetation indices will be used, such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI). Furthermore, historical trends in land use/cover will be 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.

Parameter:	A_{FF}
Description:	*area of forest remaining forest during the monitoring period*
Data unit:	Hectares

Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Analysis of remote sensing images using stratified random sampling and the Collect Earth Online and SEPAL platform to integrate the different satellite imagery. Sample points will be analyzed through visual interpretation of various high-resolution satellite images like NICFI Planet, Google Earth, Sentinel, and Landsat.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Monitored every 2 years or more frequent depending on the monitoring periods agreed for ERPA phase 2
Quality Assurance/Quality Control procedures to be applied:	Data interpretation will be done by a centralized data collection team using the same approach and response design to facilitate a common understanding and accurate interpretation of land use and forest area changes. Peer-to-peer support and group discussions on challenging issues will be held regularly. A quality control team will conduct cross-checking activities using multiple data sources and local knowledge. Points will be reinterpreted by experts with extensive knowledge of LULC changes in Oromia and Ethiopia. Discrepancies will be resolved through discussions with all team members.

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	The assessment of sample points is 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.. QA/QC procedures are applied to ensure correct and consistent interpretation of sampling but interpretation errors can still occur.
Process for managing and reducing uncertainty associated with this parameter	Training of team members to ensure consistent interpretation. To ensure the quality of the AD collection, various vegetation indices will be used, such as the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Fraction Index (NDFI). Furthermore, historical trends in land use/cover will be 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.

Parameter:	EF_{FF}
Description:	*Emission Factor for forest remaining forest*
Data unit:	tCO_2/ha
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional,	An interim value is used for now but it is anticipated that with the ongoing NFI, better data will be available on forest-remaining-forest based on the remeasurement of a number of sample plots that were also measured during the 2024-2026 NFI

national, international)	
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Interim value to be updated if new data from the ongoing NFI are available.
Quality Assurance/Quality Control procedures to be applied:	QA/QC procedures being applied in the ongoing NFI
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	The sampling approach used in the NFI has inherent uncertainties associated with it. At this point it is not yet clear how many sample plots can be remeasured to provide estimates of the carbon stock changes in forest-remaining-forest. The processing and analysis of the NFI also brings uncertainty associated with the use of allometric models, root-to-shoor ratios and carbon fractions.
Process for managing and reducing uncertainty associated with this parameter	Parameter is calculated from ongoing NFI data and therefore the data collection (and with that the possibility to manage and reduce uncertainty) is not under control of the ER Program. NFI is applying QA/QC processes and using SOPs

Parameters to be monitored for methane emission from cattle

Parameter:	Cattle sub-category populations
Description:	Cattle sub-category populations for smallholder dairy, mixed crop-livestock, pastoral/agro-pastoral
Data unit:	Head/year
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Central Statistical Agency (CSA)annual livestock survey has consistent time series data on different cattle sub-categories
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Annual monitoring data
Quality Assurance/Quality Control procedures to be applied:	Make sure the classification of cattle sub-categories in the baseline maps to the categories in CSA annual livestock sample surveys
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Cattle population estimates from the CSA are subject to several uncertainties, including sampling errors due to survey-based methods, underrepresentation of mobile pastoral systems, and enumerator and respondent errors. As a result, while ESS data are useful for national-level planning, their application in emission inventories or productivity assessments requires caution and, where possible, triangulation with ground surveys or administrative records.
Process for managing and reducing uncertainty associated with this parameter	Parameter is taken from CSA and therefore the data collection (and with that the possibility to manage and reduce uncertainty) is not under control of the ER Program

Parameter:	Commercial dairy cattle sub-category population
Description:	Cattle sub-category population for commercial intensive dairy system
Data unit:	Head/year
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Calculated in the Oromia cattle GHG inventory GHG tool
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Census on commercial dairy farms/CSA annual report when available. Until census data is available, linearly extrapolated value, annual
Quality Assurance/Quality Control procedures to be applied:	Temporal and spatial consistency checks, along with triangulation using output data such as milk production and feed use, help detect anomalies. Periodic field surveys and clear documentation of sources and assumptions further strengthen the reliability and transparency of the estimates.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Estimating cattle population in the commercial dairy sector using literature values or outdated surveys introduces uncertainty due to potential changes in herd size, structure, and expansion trends that are not captured in older data. This may lead to significant over- or under-estimation, especially in rapidly growing peri-urban systems.
Process for managing and reducing uncertainty associated with this parameter	To improve uncertainty, estimates should be cross validated with recent administrative records, private sector registries, and expert consultations, and updated through targeted field surveys.

Parameter:	Live weight
Description:	Live-weight data should be collected for each animal subcategory
Data unit:	Kg
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	The Oromia cattle GHG inventory improvement survey report, literature value for commercial feedlot, pastoral/agro-pastoral system
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed values. Representative sample surveys should be done every five years.
Quality Assurance/Quality Control procedures to be applied:	The following QA/QC measures help ensure reliable and defensible live weight data for emissions calculations or productivity assessments. Standardized measurement protocols such as using heart girth with validated regression equations should be strictly followed. Enumerators must receive thorough training on livestock measurement techniques, and their work should be supervised to minimize human error. Regular calibration of measuring tools (e.g., tapes or scales) is essential to maintain data precision. Furthermore, duplicate measurements on a subset of animals can be used to assess consistency, and data entry should be done using digital tools with built-in checks to catch outliers or entry errors. Finally, survey results should be cross-checked with secondary sources such as previous studies, institutional records, or known feedlot data to validate the plausibility of the estimates.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Measurement variability in heart girth data collected during the Oromia survey, which can affect the accuracy of weight estimation equations. Use of generalized regression models, such as the Goopy et al. (2018) equation, which may not fully account for breed, age, and body condition differences across systems. Reliance on literature values for commercial feedlots and pastoral systems, which may not reflect current practices or regional variations.

Process for managing and reducing uncertainty associated with this parameter	The following QA/QC measures help ensure reliable and defensible live weight data for emissions calculations or productivity assessments. Standardized measurement protocols such as using heart girth with validated regression equations should be strictly followed. Enumerators must receive thorough training on livestock measurement techniques, and their work should be supervised to minimize human error. Regular calibration of measuring tools (e.g., tapes or scales) is essential to maintain data precision. Furthermore, duplicate measurements on a subset of animals can be used to assess consistency, and data entry should be done using digital tools with built-in checks to catch outliers or entry errors. Finally, survey results should be cross-checked with secondary sources such as previous studies, institutional records, or known feedlot data to validate the plausibility of the estimates.

Parameter:	Weight gain
Description:	Weight gain per day for growing animal subcategories
Data unit:	Kg per day
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	The Oromia cattle GHG inventory improvement survey report, literature value for commercial feedlot, pastoral/agro-pastoral system
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed values. Representative sample surveys should be done every five years and weight gain values recalculated.

Quality Assurance/Quality Control procedures to be applied:	Calculating weight gain should involve cross-checking age classifications and validating growth trends against published benchmarks or expert knowledge to identify any anomalies.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Since weight gain is derived from the difference in live weight between adjacent age groups, and live weight itself is estimated using heart girth measurements, the accuracy of weight gain estimates is directly dependent on the quality of live weight data. Any measurement error, bias, or inconsistency in recording heart girth can significantly affect the calculated weight gain values. Therefore, reducing uncertainty in live weight data collection through standardized measurement protocols, proper enumerator training, tool calibration, and quality assurance checks will lead to more reliable and accurate weight gain estimates. Improving these underlying data's precision strengthens the validity of emission factor calculations and productivity assessments based on weight gain.
Process for managing and reducing uncertainty associated with this parameter	Weight gain data should be consistent with live weight of animals at different ages.

Parameter:	Mature weight
Description:	Live-weight of mature animals (i.e. skeletally complete) and in moderate body condition
Data unit:	Kg

Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Representative survey and literature values
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed values. Representative sample studies should be done every five years.
Quality Assurance/Quality Control procedures to be applied:	This involves cross-checking age classifications and validating growth trends against published benchmarks or expert knowledge to identify any anomalies.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Since mature weight is derived from the difference in live weight between adjacent age groups, and live weight itself is estimated using heart girth measurements, the accuracy of weight gain estimates directly depends on the quality of live weight data. Any measurement error, bias, or inconsistency in recording heart girth can significantly affect the calculated weight gain values. Therefore, reducing uncertainty in live weight data collection through standardized measurement protocols, proper enumerator training, tool calibration, and quality assurance checks will lead to more reliable and accurate weight gain estimates. Improving these underlying data's precision strengthens the validity of emission factor calculations and productivity assessments based on weight gain.
Process for managing and reducing uncertainty associated with this parameter	Live-weight data can be obtained from representative sample studies or statistical databases.

Parameter:	Percentage of females that give birth in a year
Description:	Calving rate (%) for adult females in each production system
Data unit:	%
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Central Statistical Agency (CSA) annual livestock survey has consistent time series data for mixed crop-livestock and pastoral agro-pastoral systems and going forward will also include commercial and smallholder dairy-intensive systems. Until the survey data is available, the Oromia cattle GHG inventory report will be used for commercial and smallholder dairy-intensive systems.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Annual monitoring data
Quality Assurance/Quality Control procedures to be applied:	QA/QC activities for the percentage of females that give birth annually should include validating survey responses through cross-checks with insemination records where available and triangulating with milk production and calving season data. Enumerator training should emphasize consistent interpretation of reproductive status and timeframes to reduce recall bias.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Uncertainty in the percentage of females that give birth annually arises from several sources. For mixed crop-livestock and pastoral/agro-pastoral systems, while CSA provides consistent time series data, it relies on farmer recall and self-reporting, which can introduce recall bias or misreporting. For commercial and smallholder dairy-intensive systems, reliance on the Oromia cattle GHG inventory report as a proxy until CSA data become available may not fully capture regional or management-specific variations in reproductive performance.
Process for managing and reducing uncertainty associated with this parameter	A representative sample survey should be done for commercial and smallholder dairy production system.

Parameter:	Average daily milk production
Description:	This data is for milking cows and is required for sub-category adult cows for all production system
Data unit:	(kg/day)
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Central Statistical Agency (CSA) annual livestock survey has consistent time series milk yield data for mixed crop-livestock and pastoral agro-pastoral systems. The Oromia cattle GHG inventory improvement survey report for commercial and smallholder dairy-intensive systems.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Annual monitoring data
Quality Assurance/Quality Control procedures to be applied:	QA/QC activities for milk yield should include cross-verifying farmer-reported data with milk sales or collection center records where available, and conducting spot measurements or short-term monitoring on a subset of farms to validate recall-based estimates. Enumerator training is essential to ensure consistent data collection across production systems, especially in interpreting yield over different timeframes (daily, weekly, lactation).
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	For mixed crop-livestock and pastoral/agro-pastoral systems, CSA data are based on farmer recall, which can lead to inaccuracies due to memory lapses, estimation bias, or seasonal variation in production. For commercial and smallholder dairy-intensive systems, the Oromia cattle GHG inventory improvement survey provides more specific data, but its representativeness may be limited by sample size, and short data collection periods.
Process for managing and reducing uncertainty associated with this parameter	A representative sample survey should be done for all production systems.

Parameter:	Fat content (percent)
Description:	Average fat content of milk is required for lactating cow.
Data unit:	%
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	IPCC default value
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed value .
Quality Assurance/Quality Control procedures to be applied:	IPCC default
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Currently, the milk fat is taken from the IPCC 2006 default value.
Process for managing and reducing uncertainty associated with this parameter	A representative sample survey could be done for all production systems but this would not have a major impact on overall inventory uncertainty

Parameter:	Feed digestibility (DE)
Description:	Digestible energy expressed as a percentage of Gross energy
Data unit:	%
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Central Statistical Agency (CSA) annual livestock survey has consistent time series feed basket data for mixed crop-livestock and pastoral agro-pastoral systems, survey for commercial and smallholder dairy-intensive systems.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Annual monitoring
Quality Assurance/Quality Control procedures to be applied:	QA/QC measures for the feed basket should include cross-checking reported feed types and quantities with extension service data to validate farmer responses. Chemical composition values from the literature should be verified or adjusted using periodic laboratory analysis of representative local feed samples. Enumerator training and standardized survey tools during data collection can also help ensure consistency and accuracy across different production systems.
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	For mixed crop-livestock and pastoral/agro-pastoral systems, CSA data rely on farmer recall and self-reporting, which may not accurately capture feed quantity due to seasonal variation. In commercial and smallholder dairy-intensive systems, survey data may be limited by sample size, lack of detailed feed composition information, and variability in feeding practices across farms.

	Furthermore, using literature-based chemical composition values introduces uncertainty, as these may not reflect the actual nutrient content of locally available feed resources due to differences in variety, harvest timing.
Process for managing and reducing uncertainty associated with this parameter	An annual representative sample survey should be done for the two dairy production systems.

Parameter:	Average number of hours worked per day
Description:	For draft animals, the average number of hours worked per day
Data unit:	Hour/head/year
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	Literature (Oromia cattle GHG inventory report)
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed value (can be monitored)
Quality Assurance/Quality Control procedures to be applied:	QA/QC measures for the average number of hours worked per day should include validating literature-based estimates through time-use surveys or field observations in representative production systems. Engaging local experts and extension officers can help assess the relevance and accuracy of assumed values.

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	Reliance on literature-based estimates may not accurately reflect current practices. Variations in production systems, seasonal workload, and farm size can lead to significant deviations from the assumed average. Additionally, the absence of direct measurement or recent time-use surveys increases the risk of misrepresenting actual labor inputs.
Process for managing and reducing uncertainty associated with this parameter	National GHG inventory assumptions could be updated with targeted surveys, but the impact on overall inventory uncertainty would not be large

Parameter:	Cattle off-take
Description:	Number of cattle slaughtered in each production system
Data unit:	head/year
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	CSA annual livestock survey for mixed crop- livestock and pastoral/agro-pastoral systems For commercial dairy, a fixed value was used.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Annual monitoring
Quality Assurance/Quality Control procedures to be applied:	QA/QC measures for cattle offtake estimates should include cross-verifying CSA survey results with local market records, and abattoir data to validate reported sales or exits.

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	For mixed crop-livestock and pastoral/agro-pastoral systems, CSA survey data rely on farmer recall and reporting, which can introduce bias or underreporting especially in informal or non-market transactions. For commercial dairy systems, the use of a constant fixed value does not account for year-to-year variability in sales, culling practices, or herd management changes, potentially leading to over- or underestimation of offtake rates.
Process for managing and reducing uncertainty associated with this parameter	Commercial dairy value can be updated using a targeted sample survey

Parameter:	Milk protein content (percent)
Description:	Average protein content of milk.
Data unit:	%
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	IPCC default value
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed value .
Quality Assurance/Quality Control procedures to	Currently, the milk protein content is taken from the IPCC 2006 default value

be applied:	
Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	FAO default, the values and the uncertainties of this parameter is outside the control of the ER Program.
Process for managing and reducing uncertainty associated with this parameter	A representative sample survey could be done for all production systems

Parameter:	Dressing percentage
Description:	Proportion of final live weight that remains after internal organs have been removed
Data unit:	%
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	FAO default value is used.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed value
Quality Assurance/Quality Control procedures to be applied:	FAO default

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	FAO default, the values and the uncertainties of this parameter is outside the control of the ER Program
Process for managing and reducing uncertainty associated with this parameter	Fixed value from FAO can be updated using a targeted sample survey

Parameter:	Bone free meat
Description:	Percent of the slaughtered carcass that is meat
Data unit:	%
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international)	FAO default value is used.
Fixed value or monitored? If monitored, frequency of monitoring/recording:	Fixed value
Quality Assurance/Quality Control procedures to be applied:	FAO default

Identification of sources of uncertainty for this parameter following approaches from the most recent IPCC guidance and guidelines.	FAO defaults, the values and the uncertainties of this parameter is outside the control of the ER Program
Process for managing and reducing uncertainty associated with this parameter	Fixed value from FAO can be updated using a targeted sample survey