BALE MOUNTAINS ECO-REGION REDD+ PROJECT MONITORING PLAN

PREPARED BY

PROJECT PROPONENT

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ACRONYM

BMERP	Bale Mountains Eco-Region Bale REDD+ Project
CBOs	Community Based Organizations
FA	Farm Africa
FGD	Focus group discussion
GPS	Geographical Position System
HVC	High Value Conservation
MA&D	Market Analysis and Development
NGOs	Non-Government Organizations
NTFPS	Non-Timber Forest Products
OCAT	Organizational Capacity Assessment Tool
PDD	Project Design Document
PFRA	Participatory Forest Resources Assessment
PRA	Participatory Rural Appraisal
QC	Quality check
QC	Quality Control
REDD+	Reducing Emission from Deforestation and forest Degradation
SOS	SOS Sahel Ethiopia
VSLA	Village Saving and Lending Association

1 INTRODUCTION TO THE BALE REDD PROJECT

The Bale Mountains Eco-region REDD+ project is a reducing emission from unplanned deforestation and forest degradation (REDD) in the Bale massif, Ethiopia. The eco-region lies between 50º22'–80º08'N and 38º41'–40º44'E in Oromia Regional State in south-eastern Ethiopia.

The project boundary constitutes the Project Area (PA) of about 261,053 ha of moist and dry forests (238,200 ha of moist and 22,853 ha of dry forests), and 72,924 ha of non-forested land that constitutes the Project's Leakage Management Area. The Leakage Belt covers all forest and non-forest areas within 6 km buffer around the PA, which are suitable for non-forest use and that could be deforested by the surrounding community. This has a total area of 398,532 hectares, consisting of 220,010 ha of non-forest, 30,418 ha of dry forest and 148,102 ha of moist forest.

The central area of the eco-region is occupied by a high plateau which is above 3000m asl. Several peaks rise from this plateau including Tullu Dimtu (4377m), the second highest peak in Ethiopia. South of the plateau the land falls steeply into the moist tropical Harenna Forest, that distinctly shows several altitudinal vegetation stratification within short distances starting with mountain grasslands at approximately 3700m followed by Erica forest, and extending to moist tropical forests of variable species composition such as highland bamboo (*Arundinaria alpina*), *Coffea arabica* and others at the middle altitude, and dryland woodlands in the lowlands below 1500m asl. On the northern aspect the eco-region is characterized by high ridges and broad valleys covered mainly with dry Afromontane vegetation of mainly Juniper (*Juniperus procera*) and Hagenia (*Hagenia abyssinica*) species interspaced with other ecosystems such as grasslands and wetlands. The eco-region encompasses the largest Afro-alpine habitat on the African continent. The forests together with the Afro-alpine plateau are host to a globally unique and diverse fauna and flora, including a significant number of rare and endemic species such as Nyla, Absiniayan wolves and many others. It harbours about 67% of mammals known from the Afromontane eco-region in Ethiopia. It is known as hotspot of medicinal plants of Ethiopia so far identified. It is one of the birth places and center of diversity of Arabic coffee (*Coffea arabica*) where the species still exists in a wild state. In general, the eco-region has

critical biodiversity and ecological significances because it belongs to the Afromontane biodiversity hotspot which is one of the 34 global biodiversity hotspots.

The eco-region is inhabited by 1.6 million population (urban and rural combined). Moreover around 12 million population both in the eco-region and beyond within Ethiopia, Somalia and Kenya are estimated to directly and indirectly depend on several ecosystem services generated from the eco-region. Particularly, those rural people in the eco-region are directly dependent on the forest and other natural resources of the area.

However, the Bale Mountains eco-region has been facing pressure that grown over time that challenges the long term sustainable conservation of this globally unique ecosystem and its biodiversity resources. The primary agents of deforestation have identified as smallholder farmers, while the major drivers of deforestation comprised of expansion of agricultural activities, market driven crops and unmanaged fuel wood and construction wood collection from forest and intermittent incidence of forest fires that exacerbated by several underlying factors principally legal and institutional weakness, demography, market system and poverty. Deforestation analysis carried out for 11 years between 2000 and 2011 revealed that an average annual deforestation rate was calculated as 3.7% for the entire eco-region.

In relation to this, projection of the deforestation to the Bale REDD+ crediting period (2012-2031) under the scenario of business as usual the likely deforestation of about 84,150 ha of forest was estimated and these deforestation will expect to result in emission of 38321332.28 tCO_2e. Therefore, the objective of the BMERP is to prevent this high rate of deforestation and to achieve the net ex-ante anthropogenic GHG emission reduction of 21,909,958.19 tCO2e under the project scenario. Hence, the BMERP is designed to support the improved management of the forests in the eco-region and its biodiversity for multiple benefits that includes climate, community and biodiversity outcomes. It contributes to sustainable conservation of the Bale Mountains area as a global hotspot of endemism and high conservation values while improving the livelihoods of the local communities.

2 DESCRIPTION OF THE MONITORING PLAN

The monitoring plan outlines the methods to be used for assessing the net climate, community, and biodiversity benefits achieved by the project through the implementation of project activities. This includes the assessment of potential climate, community and biodiversity impacts, both positive and negative. The monitoring of climate benefits will follow the requirements of the VCS VM0015, V1.1 Methodology. Climate impact monitoring plan will identify the types of measurements required such as above and below ground carbon, while community and biodiversity impacts will be monitored following the monitoring plan and guidance from the CCBA Social and Biodiversity Impact Assessment Manual for REDD+ Projects (Richards & Panfil, 2011). This manual recommends the *theory of change* approach as an appropriate and cost-effective impact assessment approach for biodiversity monitoring of REDD+ projects. Theory of Changes that looks at the logical relationship between activities, outputs, outcomes and impacts to measure the qualitative impacts as shown in the below diagram.

3 OBJECTIVES OF THE MONITORING PLAN

The Bale Mountains Eco-region REDD+ project's monitoring plan has been designed to address the following objectives:

- Measure progress toward the achievement of climate, community, and biodiversity objectives and
- Assess for potential negative and/or unexpected outcomes or impacts that result from the project

4 COMPONENTS OF MONITORING PLAN

4.1 Climate Impact Monitoring

This climate impact monitoring plan has developed in relation to VMM0015 of REDD Methodological Module which is a method for monitoring of greenhouse gas emissions

and removals. The module focuses on establishing the procedures for monitoring deforestation, illegal degradation, natural disturbance, and project emissions in the project area and leakage belt and updating the forest carbon stocks and revising the baseline are described below.

4.1.1 Land-use land-cover change Monitoring within the project area

Land-use land-cover change both in the Bale REDD+ Project area and Leakage Belt will be monitored using freely available Landsat images. The analysis will generate classes of non-forest and forested areas. The deforestation analysis will be compared to the baseline data that obtained from historical deforestation analysis which indicated in the PDD. This deforestation, analysis will be carried out every three years in both project and leakage belt areas using the methodological procedure of Methodology VM0015 v 1.1. OFWE will be responsible to the collection of monitoring data and information management with close support of Farm Africa and SOS Sahel Ethiopia particularly during the first 4-5 years of the project implementation. The data sources like image processing, image classification, produced maps and GPS coordinates will be documented in electronic archive.

4.1.2 Monitoring changes in carbon stocks and GHG emissions

According to the methodology of VM0015 v 1.1, deforestation and forest carbon data analysed. The size of occurred deforestation will be deducted from the predicted deforestation to determine net avoided deforestation. Then net avoided deforestation multiplied by the emission factor to quantify the amount of carbon emission avoided. This monitoring data will be carried out every five years.

4.1.3 Monitoring leakage

This project is not expected to cause any kind of leakage as it is carefully planned to be managed through established Leakage Management Areas. Towards this, following procedure of VM0015 v 1.1methodology, the project proponent will monitor leakage throughout Leakage Belt using remote sensing techniques in all verification events. If some deforestation occurs in the leakage belt during project period, the loss of carbon

stocks will be accounted for using the current values of carbon stock per hectare of the forest class in question and will be deducted from the non-permanence buffer.

4.1.4 Revisiting the projected baseline at fixed periods

4.1.4.1 Updating information on the causes of deforestation

The variables used to project future deforestation from the reference region will be reviewed at 10-year fixed periods. Information regarding the biophysical variables, agents, vectors, and the underlying causes of deforestation will be updated using step 3 indicated in Methodology of VM0015 V 1.1.

4.1.4.2. Adjusting the baseline data of land-use/ land cover change

Following procedure of VM0015 v 1.1 methodology, the land-cover land-use data will be repeated every 10-years of project credit period (2012-2021). Updating the baseline scenario will include spatial component that defines the distribution of deforestation such as key variables that will be used to recalculate the baseline. The OFWE will be responsible to carrying out the monitoring of revisiting baseline of land use land cover change.

4.1.4.3. Adjusting the carbon component of the baseline.

The carbon component of the baseline will be monitored every 10 years according the methodology of VM0015 v 1.1.

4.1.5. Monitoring of impacts of natural disturbances and catastrophic

If significant catastrophic events like forest fire happened during the project lifetime, those event will be monitored following the occurrence of the event and results will be documented.

Table 1: Climate impact Monitoring data and frequency

Parameters to monitor	Monitoring frequency	Responsible body	QC and QA procedures
Monitoring actual changes in carbon stocks in the	Every five years 50% of permanent sample plots will be re-inventoried	OFWE (silviculture unit) and Forest	10% of the sample plots will be assessed by a separate team of

Project Area and leakage belt		managing community CBOs jointly	experts and results will be cross-checked
Area of deforestation in PA	Every 3 years using satellite imagery of the same season as used in the baseline case	OFWE Bale and Arsi branch	OFWE GIS unit
Area of deforestation in the leakage belt	Every 3 years using satellite imagery of the same season as used in the baseline case	OFWE Bale and Arsi branch	OFWE GIS unit
Area within the Project Area affected by catastrophic events in class *icl* at year *t*	Each five year and during each event will be surveyed	OFWE Bale and Arsi branch	OFWE REDD+ unit
Areas affected by forest fires in class *icl* in project area and leakage belt at year *t*	Will be measured after each fire event using remote sensing and ground survey	OFWE Bale and Arsi branch	Checking other team of experts
Ex-post calculation of net GHG emission reduction	Calculation of cumulative carbon stock changes in PA and LB under the project scenario verse baseline projection every five years	OFWE Bale and Arsi branch	OFWE REDD+ unit
Revisiting the projected baseline at fixed	Re-check a baseline case after 10 years since project start date and adjusting the carbon component every 10 years	OFWE Bale and Arsi branch	OFWE REDD+ unit

4.1.5 Data and Parameters Available at monitoring

Data Unit / Parameter:	**Area of dry ever green and moist forest deforested in 20 years within the leakage belt in the baseline case**
Data unit:	Hectares/year
Description:	The annual area of leakage belt forest converted to non-forest land-use
Source of data:	Landsat image of specified years
Description of measurement methods and procedures to be applied:	Deforestation will be measured using the same steps of Methodological steps used and presented in the LUC Methodological in PDD
Frequency of monitoring/recording:	10 years
Value applied:	Deforested area in leakage belt
Monitoring equipment:	ARCGIS, Medium resolution Landsat image
QA/QC procedures to be applied:	See QA / QC protocols document in PDD will be followed
Calculation method:	Average deforestation analysis of different periods will be calculated
Any comment:	

Data Unit / Parameter:	**Area dry evergreen and moist forest deforested in 20 years within the project area in the baseline case**
Data unit:	Hectares/year
Description:	The annual area leakage belt forest converted to non- forest land use
Source of data:	Landsat image of specified years
Description of measurement methods and procedures to be applied:	Deforestation will be measured using the same steps of the Methodological steps used and presented in the PDD. Will be followed
Frequency of monitoring/recording:	10 years
Value applied:	Deforestation area
Monitoring equipment:	ARCGIS, Medium resolution Landsat image
QA/QC procedures to be applied:	See QA / QC protocols document used in PDD will be followed
Calculation method:	Average deforestation analysis of different periods of project area will be calculated
Any comment:	

Data Unit / Parameter:	**Area of dry evergreen and moist forest deforested in 20 years within the reference region in the baseline case**
Data unit:	Hectares/year
Description:	The annual area leakage belt forest converted to non- forest land use
Source of data:	Landsat image of specified years
Description of measurement methods and procedures to be applied:	Deforestation will be measured using the same steps of the Methodological steps used and presented in the PDD will be followed
Frequency of monitoring/recording:	10 years
Value applied:	Deforestation area
Monitoring equipment:	ARCGIS, Medium resolution Landsat image
QA/QC procedures to be applied:	See QA / QC protocols document of PDD will be followed
Calculation method:	Average deforestation analysis of different periods of reference area will be calculated
Any comment:	

Data Unit / Parameter:	**Plot area**
Data unit:	Meter square (m^2)
Description:	This is a sample of forest from which forest biomass data will be collected. A size of 10,000 m2 or equivalent to 1 ha size will be applied.
Source of data:	The size and shape applied will be based on Pearson et al, (2005) as recommended also by VM0015 v1.1.
Description of measurement methods and procedures to be applied:	The plot area has major influence on the sampling intensity, time and resources spent in the field measurements. The area of a plot depends on the stand density, accordingly 17 sample plots from dry evergreen and 62 sample plots from moist forest will be taken.
Frequency of monitoring/recording:	5 years
Value applied:	1ha (10,000m2)
Monitoring equipment:	Measuring tape, GPS,
QA/QC procedures to be applied:	See QA / QC protocols used in PDD will be followed
Calculation method:	Same procedure used in PDD
Any comment:	

Data Unit / Parameter:	**Total forest area in dry evergreen forest within the reference region at the project start date**
Data unit:	Hectares
Description:	
Source of data:	
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	It is done the start of the project

Data Unit / Parameter:	**Total forest area in moist forest within the reference region at the project start date**
Data unit:	
Description:	
Source of data:	
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	It is done the start of the project

Data Unit / Parameter:	**Total area of projected baseline deforestation during the fixed baseline period of Bale REDD+ project**
Data unit:	Hectares
Description:	The annual area of forest area expected to be converted into other non-forest land uses starting from the period of baseline data collection in project area (PA), Leakage Belt (LK) and Reference Region (RR)
Source of data:	Landsat images
Description of measurement methods and procedures to be applied:	Historic deforestation of fixed periods will be assessed using the steps described in the the PDD to obtain the average deforestation rate.so as to establish deforestation baseline
Frequency of monitoring/recording:	10years
Value applied	Area of forest expected to disappear
Monitoring equipment:	ARCGIS, Medium resolution Landsat image
QA/QC procedures to be applied:	QA / QC protocols follow PDD procedure

Calculation method:	Following Methodological VM0015
Any comment:	

Data Unit / Parameter:	**Average carbon stock per hectare in the above-ground biomass carbon pool of initial forest class icl (Moist forest stratum)**
Data unit:	tons C/ha
Description:	tone of carbon stock per hectare in above ground biomass
Source of data:	forest inventory
Description of measurement methods and procedures to be applied:	Stratified sampling technique will be applied, in which moist forest formed one of the strata. Nested 1 ha size plot will be used and a total of 62 sample plots will be inventoried. Dendrometric parameter, principally DBH (cm), of trees falling in the sample plots are measured. Biomass per tree is estimated using Chaves et al., 2005 Allometric equation (for moist tropical forest in this case), summed to per plot and hectare basis. Then, plot biomass will be averaged to a per hectare biomass by strata. For estimating carbon stock, the carbon fraction of 50% based on IPCC good practice guide will be applied.
Frequency of monitoring/recording:	Every five years
Value applied:	Value of average above ground biomass
Monitoring equipment:	Forestry equipment
QA/QC procedures to be applied:	See QA QC protocol document used in PDD will be followed
Calculation method:	Individual tree biomass will be calculated using Chave et al., 2005 allometric equation, for moist tropical forest. For wood density average value for species in the eco-region will be applied. Individual tree biomass is summed up to plot biomass. Then, plot biomass measurements will be averaged to stand biomass per hectare.
Any comment:	

Data Unit / Parameter:	**Average carbon stock per hectare in the above-ground biomass carbon pool of initial forest class icl (Dry forest stratum)**
Data unit:	tons C/ha
Description:	tone of carbon stock per hectare in above ground biomass
Source of data:	Forest inventory
Description of measurement methods and procedures to be applied:	Stratified sampling technique will be applied. A nested 1 ha plot size uses for the inventory. A total of 17 plots will be inventoried. Dendrometric parameter, principally DBH(cm), of all trees falling within the plots will be measured. Biomass per tree is estimated using Chaves et al., 2005 allometric equation (for dry tropical forest), summed to per plot and hectare basis. Then, plot biomass will be averaged to a per hectare biomass. For estimating carbon stock, the carbon fraction of 50% based on IPCC good practice guide will be applied.
Frequency of monitoring/recording:	Every five years
Value applied:	Value of average above ground biomass
Monitoring equipment:	Forestry equipment
QA/QC procedures to be applied:	QA QC protocols of PDD will be followed

Calculation method:	Individual tree biomass was calculated using Chave et al., 2005 allometric equation for dry tropical forest. For wood density average value for species in the eco-region will be applied. Individual tree biomass is summed up to plot biomass. Then, plot biomass measurements will be averaged to stand biomass per hectare.
Any comment:	

Data Unit / Parameter:	**Average carbon stock per hectare in the below -ground biomass carbon pool of initial forest class icl (Dry and moist strata)**
Data unit:	Tons C/ha
Description:	Ton of carbon stock per hectare in above ground biomass
Source of data:	Forest inventory
Description of measurement methods and procedures to be applied:	Below ground biomass and carbon stock is derived from Above ground biomass and carbon stock, will be calculated as described above. The Below ground biomass and carbon will be calculated applying the IPCC good practice guide: which indicates root: shoot of 24% for moist forest and 27% for dry forest.
Frequency of monitoring/recording:	Every five years
Value applied:	24% of moist forest carbon and 27% of dry ever green forest
Monitoring equipment:	Forestry equipment
QA/QC procedures to be applied:	QA QC protocols followed in PDD
Calculation method:	After calculating the above ground biomass, it is assumed that below ground biomass of a tree consisted 27% and 24% of the total above ground biomass for the dry and moist forests, respectively.
Any comment:	

Data Unit / Parameter:	Total baseline carbon stock changes for the above-ground biomass pool in the project area
Data unit:	
Description:	.
Source of data:	
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	Only the living trees are considered

Data Unit / Parameter:	**Cumulative actual carbon stock change due to un avoided unplanned deforestation at year *t* in the project area**
Data unit:	tCO_2-e
Description:	Total amount of CO_2 e GHG emitted from the project during the project monitoring time
Source of data:	Actual deforestation (activity data) and emission factor that obtained from forest inventory

Description of measurement methods and procedures to be applied:	Average carbon stock per hectare by forest stratum (emission factor in CO_2e) and actual deforestation of each strata
Frequency of monitoring/recording:	Every 3 years
Value applied:	Calculated carbon change in tCO_2-e
Monitoring equipment:	Forestry equipment and remote sensing GIS and Landsat
QA/QC procedures to be applied:	QA QC protocols of PDD will be followed
Calculation method:	Emission factor per forest strata multiplied by actual deforestation of each forest strata
Any comment:	

Data Unit / Parameter:	**Total actual carbon stock change due to un avoided unplanned deforestation at year *t* in the project area**
Data unit:	tCO_2-e
Description:	Total CO_2-e emitted during the project implementation after multiplying by performance factors
Source of data:	Emission factor (obtained from forest inventory) & Landsat Image of fixed period , performance factors
Description of measurement methods and procedures to be applied:	The emission factor established for each forest stratum based on forest inventory, projected deforestation and performance factors
Frequency of monitoring/recording:	Annually
Value applied:	Predicted emission after subtracting performance factors
Monitoring equipment:	Conduct forest inventory, remote sensing image analysis
QA/QC procedures to be applied:	QA QC protocols of PDD will be followed
Calculation method:	Projected cumulative carbon change minus net emission reduction that obtained multiplying with performance factors
Any comment:	

Data Unit / Parameter:	**Cumulative net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity**
Data unit:	tCO_2-e
Description:	The total amount of anthropogenic gas emission reduced due to project intervention for the given period of time.
Source of data:	Forest inventory for emission factor, avoided deforestation
Description of measurement methods and procedures to be applied:	The emission factor will be multiplied by activity data.
Frequency of monitoring/recording:	Annually
Value applied:	Data to be calculated
Monitoring equipment:	Forestry equipment, Landsat image, GPS
QA/QC procedures to be applied:	QA QC protocols in followed in PDD
Calculation method:	The avoided deforestation during monitor period will be multiplied by the Emission factor that can be obtained from forest inventory
Any comment:	

Data Unit / Parameter:	Net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t
Data unit:	tCO_2-e
Description:	Mean anthropogenic gas emission reduced due to project intervention per year
Source of data:	Emission factor from forest inventory, projected activity data from historic deforestation and performance factor by the project

Description of measurement methods and procedures to be applied:	Emission factor will be updated for the different forest stratum based on forest inventory, this will be multiplied by activity data projected based on historic deforestation and finally the product of the two multiplied by the project claimed performance factor.
Frequency of monitoring/recording:	Annually
Value applied:	Value of calculation
Monitoring equipment:	Forest inventory, and remote sensing image analysis
QA/QC procedures to be applied:	QA QC protocols
Calculation method:	Emission factor multiplied by activity data and the performance factor per year.
Any comment:	

Data Unit / Parameter:	**Mean Wood density of species**
Data unit:	Gram/cubic centimetre (g/cm^3)
Description:	Average basic wood density for major species in Bale eco-region
Source of data:	Data on basic wood density of tree species in Bale eco-region will be obtained from secondary sources, mainly national research report as described in PDD.
Description of measurement methods and procedures to be applied:	Data on basic wood density of major tree species in Bale eco-region will be obtained, and averaged to develop average basic wood density to be used in the allometric equation.
Frequency of monitoring/recording:	
Value applied:	Value to be derived
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Density of tree specious found in the Bale forest will be identified from literature and their average is computed to use it for tree carbon calculation.
Any comment:	

Data Unit / Parameter:	Ex ante estimated effectiveness index
Data unit:	%
Description:	The effectiveness of project activities in addressing deforestation.
Source of data:	Project self-assessment
Description of measurement methods and procedures to be applied:	Project proponent assessed its project implementation potential based on performance history
Frequency of monitoring/recording:	Annually
Value applied:	The project assumes an effectiveness index of certain % during the initial years of implementation and will increase gradually
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Not applicable
Any comment:	This will be updated at a time when another baseline is calculated

Data Unit / Parameter:	Sum of ex-ante estimated leakage emission at year t
Data unit:	tCO_2-e
Description:	Ex-ant estimation of CO2e emission from deforestation in the leakage belt

Source of data:	Deforestation analysis of monitoring period and emission factors calculated from forest inventory
Description of measurement methods and procedures to be applied:	Occurred deforestation in leakage belt multiplied by emission factor and divided by monitoring period to obtain annual emission in the project area
Frequency of monitoring/recording:	Annually
Value applied:	Output of the calculation
Monitoring equipment:	Forestry equipment and remote sensing
QA/QC procedures to be applied:	QA QC protocols of PDD will be followed
Calculation method:	Emission factor will be multiplied with projected area of deforestation (activity data) in the leakage belt and divided by year t to get annual value
Any comment:	

Data Unit / Parameter:	An Allometric equation for species, or forest type j, linking above ground biomass (in kg $tree^{-1}$) to diameter at breast height (DBH) and possible tree height (H)
Data unit:	None
Description:	Global allometric equation developed by Chave et al., 2005 for dry and moist tropical forest (forest type) will be used to calculate AGB (kg/tree) using wood density and DBH parameters
Source of data:	Chave et al., 2005 (scientific artic
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Only once at project start
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Select appropriate allometric equation for the forest, measure the dendrometric parameters of all of the trees in the sample plot and estimate the CO_2
Any comment:	

Data Unit / Parameter:	Total number of sample units to be measured (in all LU/LC classes)
Data unit:	No
Description:	Total number of sample plots will be used for forest inventory in all forest stratum (dry and moist)
Source of data:	Field inventory
Description of measurement methods and procedures to be applied:	The decision on the number of plots depends on vegetation type, logistics, accuracy level, manpower and cost. The number of samples for each stratum is selected proportional to its size
Frequency of monitoring/recording:	
Value applied:	78 plots
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	The total number of plots to be measured is determined using a tool developed by Winrock International for generating number of plots (http://www.winrock.org/Ecosystems/tools.asp).
Any comment:	

Data Unit / Parameter:	Number of sample unit to be measured in LU/LC class cl that is allocated proportional to the size of the class. If estimated ncl<3,set ncl=3
Data unit:	No
Description:	The total number of sampling units taken from the forest to estimate CO_2 per hectare of the forest. The decision on the number of plots depends on vegetation type, logistics, accuracy level, manpower and cost. The number of samples for each stratum is selected proportional to its size.
Source of data:	
Description of measurement methods and procedures to be applied:	The total number of plots to be measured will be determined using a tool developed by Winrock International for generating number of plots (http://www.winrock.org/Ecosystems/tools.asp).
Frequency of monitoring/recording:	
Value applied:	17 sample plot from dry forest 62 plots from moist forest
Monitoring equipment:	Conduct forest inventory, GPS,GIS
QA/QC procedures to be applied:	QA QC protocols used in PDD will be followed
Calculation method:	Protocols used in PDD
Any comment:	

Data Unit / Parameter:	**Risk factor used to calculate VCS buffer credits**
Data unit:	%
Description:	This refers to risk elements that may affect forest carbon stock and is used to estimate buffer credits based on VCS non-permanence risk tool
Source of data:	Project social, political, economic and environmental situation assessment or analysis (elements required in the VCS non-permanence risk tool)
Description of measurement methods and procedures to be applied:	Risk factors derived based on the guideline in the VCS-approved AFOLU Non-Permanence Tool
Frequency of monitoring/recording:	10 years
Value applied:	15%
Monitoring equipment:	VCS-approved AFOLU Non-Permanence Tool
QA/QC procedures to be applied:	
Calculation method:	Select the likely risks that assumed to appear in the eco-region from the list of VCS-approved Non-Permanence tool and give the score then add the total.
Any comment:	

Data Unit / Parameter:	Root-shoot ratio appropriate for species, group of species or forest type
Data unit:	%
Description:	The ratio of the amount of belowground biomass (root) divided by above ground tree biomass.
Source of data:	IPCC good practice guide
Description of measurement methods and procedures to be applied:	The root-shoot ratio for calculating below ground biomass of the forest strata was obtained from IPCC good practice guide. Different value was used for the different stratum available in the project forest
Frequency of monitoring/recording:	Only once at project start

Value applied:	24% for moist forest and 27% for dry forest
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	**Start date of the historical reference period**
Data unit:	Year
Description:	The year 2000 is the start year of historical reference period which is 2000-2011
Source of data:	Years before project start date was used as a reference to determine the historic reference period, based on IPCC guide
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Once at the project start
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	Duration of the historical reference period
Data unit:	Yrs
Description:	
Source of data:	Image data and forest inventory
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	10 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	t-student value for 95% confidence level
Data unit:	Unit less
Description:	Student t- value is obtained from t-table to calculate CI
Source of data:	t-table
Description of measurement methods and procedures to be applied:	Student t-table value is obtained by taking the degree of freedom (n-1) for the sample number used in each forest stratum
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	**Variable included in the deforestation model**
Data unit:	
Description:	Variables will be identified to drive and/or hinder deforestation through field assessment and expert consultation, and will be applied for modelling future location of deforestation
Source of data:	
Description of measurement methods and procedures to be applied:	Variables will be employed for modelling of deforestation that uses as input for Dinamica software to run modelling.
Frequency of monitoring/recording:	10 years
Value applied:	Varaibles to be identified
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Using Dynamica software
Any comment:	

Data Unit / Parameter:	**Number of Buffer credits deposited in the VCS Buffer at time t**
Data unit:	tCO_2e
Description:	The amount of tCO_2e GHG set aside as buffer to make up the risk identified for the project
Source of data:	Risk assessment for the project
Description of measurement methods and procedures to be applied:	The net emission reduction calculated for the project monitoring period will be multiplied by the buffer risk (15%) to obtain buffer credit by each year. The annual value is cumulated to total project life time buffer credit.
Frequency of monitoring/recording:	Annually
Value applied:	Value to be calculated
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	The Buffer for risk carbon unit is calculated by multiplying net emission reduction per year by the risk factor estimated for the project , which is 15%
Any comment:	

Data Unit / Parameter:	**Number of Verified Carbon Units(VCUs) to be made available for trade at time t**
Data unit:	tCO2e
Description:	The net tCO_2e GHG available after reduction of buffer for risk
Source of data:	Carbon assessment
Description of measurement methods and procedures to be applied:	The net VCU available for trade is obtained after reducing the buffer for risk value from the ex-anet emission reduction by the project
Frequency of monitoring/recording:	Annually
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	The verified Carbon Units (VCTs) are calculated by subtracting the number of Buffer Credits (BCt) is deposited in the VCS Buffer at time t; from the *Ex ant* estimated net anthropogenic greenhouse gas emission reduction by the project
Any comment:	

Data Unit / Parameter:	**Average carbon stock per hectare in the dead wood biomass carbon pool of final post-deforestation class fcl**
Data unit:	
Description:	.
Source of data:	
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	**Average carbon stock per hectare in the dead wood biomass carbon pool of LU/LC class cl**
Data unit:	
Description:	.
Source of data:	
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	**Average carbon stock per hectare in the dead wood biomass carbon pool initial forest class icl**
Data unit:	
Description:	.
Source of data:	
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	**Average carbon stock per hectare in the dead wood biomass carbon pool per zone z**
Data unit:	
Description:	.
Source of data:	
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	**Average combustion efficiency of the carbon pool p in the forest class**
Data unit:	
Description:	.
Source of data:	
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	**Carbon fraction for tree of species, group of species or forest type j**
Data unit:	%
Description:	IPCC good practice guide for carbon fraction, which is 50% of oven dry weight of a tree will be used
Source of data:	IPCC good practice guide
Description of measurement methods and procedures to be applied:	IPCC good practice guide will be applied
Frequency of monitoring/recording:	Once in the project lifetime
Value applied:	0.5, i.e. 50% of oven dry weight
Monitoring equipment:	None
QA/QC procedures to be applied:	None
Calculation method:	Total above ground biomass per hectare of all sample plots will be estimated and their average dry weight is computed using allometric equation. This value will be multiplied by 0.5 to obtain carbon stock
Any comment:	

Data Unit / Parameter:	**DBH**
Data unit:	Centimetre
Description:	Diameter at breast height of individual trees within sample plots
Source of data:	Field direct measurement

Description of measurement methods and procedures to be applied:	Measure the diameter of trees at breast height (DBH) or 1.3 meters of all trees with DBH ≥2 cm using calliper and diameter tape.
Frequency of monitoring/recording:	At project start and every five years
Value applied:	
Monitoring equipment:	Diameter tap and calliper
QA/QC procedures to be applied:	See QA QC protocols of PDD will be followed
Calculation method:	Diameter measured in two opposite direction per tree is averaged and taken as DBH per tree
Any comment:	

Data Unit / Parameter:	**Height of the tree**
Data unit:	
Description:	.
Source of data:	
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	Community forest income change
Data unit:	US$/hh/yr
Description:	Household economic data collection using randomly selected sample households and compare with baseline income level
Source of data:	Field data collection
Description of measurement methods and procedures to be applied:	Household based socio economic survey
Frequency of monitoring/recording:	Every 5 year
Value applied:	Output of the household survey
Monitoring equipment:	Survey, PRA techniques
QA/QC procedures to be applied:	Sufficient number of sample households will be used in the assessment
Calculation method:	Household income disaggregated by source: agriculture, forestry and others
Any comment:	

Data Unit / Parameter:	Community forest management institution capacity assessment
Data unit:	%
Description:	Capacity is assessed regularly using a method developed by the project called Organizational Capacity Assessment Tool (OCAT). The assessment comprises the following parameters: forest protection, forest development, forest utilization, cooperative financial management and leadership. The tool applies scale based assessment and overall average indicates status of the CBO. Based on the result, capacity gap will be known and needed capacity will be built.
Source of data:	Assessment of capacity of Forest management cooperatives

Description of measurement methods and procedures to be applied:	Using established survey questions included in the OCAT tool, all necessary data were assessed from each forest managing institution and analysed using the developed Organizational Capacity Assessment Tool (OCAT) software
Frequency of monitoring/recording:	2 years
Value applied:	Value of assessment
Monitoring equipment:	Annual re-assessment
QA/QC procedures to be applied:	
Calculation method:	A total of 50 questions, each question has a value of 0,1, 2 value as per their capacity, these values added to give the overall result from 100. The average result was
Any comment:	

Data Unit / Parameter:	Biodiversity condition of the area
Data unit:	Basal area, Species richness; stem/ha, ecological indicators
Description:	Biodiversity potential of the forest assessed
Source of data:	Participatory Forest Resources Assessment data
Description of measurement methods and procedures to be applied:	Species abundance or richness of indictor plants and animals (those identified as threatened species such as *Coffea Arabica)* will be assessed
Frequency of monitoring/recording:	Every five years
Value applied:	
Monitoring equipment:	GPS, diameter tape, Chain-relascope, meters
QA/QC procedures to be applied:	
Calculation method:	Calculation of basal area, number of stems per ha
Any comment:	

Data Unit / Parameter:	Monitor community attitude and perception on the project
Data unit:	
Description:	Using established survey questions and participatory rural appraisal (PRA) techniques Communities' attitude toward the project assessed
Source of data:	Community living in and around the forest
Description of measurement methods and procedures to be applied:	Different PRA tools deployed to assess communities' perception and attitude and cross checked with the result of semi structured interview
Frequency of monitoring/recording:	Every five years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

4.2. Community Impact monitoring

Community's impacts monitoring is centred on the monitoring of indicators that reflect socio-economic impacts of the community. These data will be collected through the Participatory Rural Assessment (PRA) and Theory of Changes that looks at the logical relationship between activities, outputs, outcomes and community impacts to measure the qualitative impacts against the baseline. The community impacts monitoring parameters comprise of the socio-economic and institutional indicators. The social indicators monitoring will address community's knowledge and attitudes related to the project implementation like community's awareness about climate change and REDD+ Project, Communities' engagement in forest protection, women's participation in PFM and REDD+ activities and CBOs' capacity of conflict management. Moreover, people's perception about the supply of materials used to improve coffee quality, awareness creation about climate change and REDD+ project, distribution of Fuel efficient stoves, trainings, finance and materials support provided to REDD+ CBOs', business development service, established rural saving and created institutions and forest use property rights will be investigated through PRA and FGD.

The economic parameters include households' income from the forest based natural products such as coffee and honey. These monitoring data indicators will be collected through conducting household survey to quantify socio-economic changes in project area. Therefore, the survey will cover a range of issues like income, education, social capital and resource availability. To avoid attributes of others intervention, the project proponents will make same assessment to outside stakeholders adjacent to the project area. Then the project proponent will conduct a statistical analysis to determine whether the outside stakeholders' socio-economic variables are significantly worse off than the residents throughout the Bale Mountains Eco-region REDD+ Project area.

Apart from the household survey data collection, people's perception about the socio economic parameters will be monitored through PRA techniques and focus group discussions. These parameters comprise of people's perception about trend of coffee quality improvement, trend of honey quality improvement, trend of income increase from coffee and honey, community's improved housing condition, children access to

school, adoption of fuel efficient stoves, woodlot development and income generating aspects.

Institutional impact monitoring covers indicators such as organizational capacity of the forest managing CBOs inline to sustainable forest manage to meet the goal of REDD+ project. Towards this, the Bale Mountains REDD+ Project has developed spread sheet based Organizational Capacity Assessment Tool (OCAT) that uses to assess the capacity status of each forest CBOs in terms of five key pillars of the organizational capacity indicators such as the leadership, finance and assets management, forest protection, forest development and sustainable forest utilization in which altogether scored out of the 100. This assessment will be carried out every year by OFWE and Oromia Cooperative Promotion Agency who are working at grassroots level.

Generally, based on theory of change, the community impacts of the project's activities implementation will be monitored at the outputs, outcomes and in terms of impacts as indicated in (Tables 2, 3 &4).

Table 2: Output level Indicators for social- economic parameters

Output indicators	**Methods of data collection**	**Frequency of monitoring**	**Responsible**
People's participation level	Reports	Every Quarter	CBOs
Established saving & credit associations	Report	Every year	OFWE, FA-SOS
CBOs' provided coffee materials	Report	Every year	OFWE, FA-SOS
Households received fuel efficient stoves	Report	Every 4 years	OFWE, FA-SOS
Trained households on livelihoods	Reports	Every year	OFWE, FA-SOS
CBOs received financial supports	Reports	Every year	OFWE, FA-SOS
CBOs received office and forestry materials	Reports	Every year	OFWE, FA-SOS

Table 3: Outcomes level Indicators for social- economic parameters

Outcomes Indicators	**Methods of data collection**	**Frequency of monitoring**	**Responsible**
Quality of NTFPs	PRA, FGD,	Every 4 years	OFWE, FA-SOS
Constructed CBOs' offices	PRA, FGD	Every 4 years	OFWE, FA-SOS
Gender equity	PRA, FGD	Every 4 years	OFWE, FA-SOS
Assets accumulation by CBOs	PRA, FGD	Every 4 years	OFWE, FA-SOS

Communities' business skills	PRA, FGD	Every 4 years	OFWE, FA-SOS
Households' incomes	Households survey and PRA	Every 5 years	OFWE, FA-SOS

Table 4: Impacts level Indicators for social- economic parameters

Impacts indicators	**Methods of data collection**	**Frequency of monitoring**	**Responsible**
CBOs' Institutional capacity	OCAT data collection	Every year	OFWE, CBOs
Women's empowerment	PRA, reports	Every 4 years	OFWE, CBOs
Forest uses property rights	PRA, reports	Every 4 years	OFWE, CBOs
Housing conditions	PFRA, FGD	Every 4 years	OFWE, CBOs
Children access to school	PFRA , FGD	Every 4 years	OFWE, CBOs
Fuelwoods consumptions	Household survey	Every 4 year	OFWE, CBOs
Forest biodiversity	Forest inventory	Every 5 years	OFWE

4.3. Biodiversity Impact Monitoring

The biodiversity goal of the project focuses around maintaining and improving forest cover and conditions throughout the project areas by implementing project's activities to maintain biodiversity and ecosystem conservation. For this reasons, this biodiversity monitoring plan is devised to monitor the progresses of the project in maintaining and improving the conservation value of the project areas.

The selection of indicators for monitoring the outputs-outcomes and impacts of the project will follow the theory of change approach that uses to explain a causal model to predict changes attributable to the project by measuring the most relevant indicators of the progress. This implies that the theory of change approach allows identification of causal chains from project activities to short-term outputs, from outputs to outcomes and from outcomes to impacts through anticipating the cause-and-effect sequences.

The biodiversity impacts will be measured at landscape level using Landsat images and transect walks to monitor the deforestation and threats to biodiversity as a result of project activities implementation throughout the project areas. The ecosystem and species monitoring will be conducted using the PFRA methodology that is adopted for participatory forest management. In such assessment the project will monitor changes in the forest conditions indicators like basal area, regeneration and other ecological indicators.

Moreover, in Bale Mountains REDD+ project special attention will be given to monitor the High Conservation Value (HCV) areas such as forest *Coffee in the area where coffee arabica* is naturally growing and contributes a lot to the households' economy. The project supports the local community owning the wild coffee in the BMERP area to sustainably use the coffee for their livelihood improvement. Therefore, the project monitoring will be carried out in those area through conducting Participatory Forest Resources Assessment. The conservation aspects of wild animals will be monitored through conducting wild animals counting and photo trap. Moreover, the overall trends of biodiversity conservation of the forest and wild animals will be monitored through PRA technique by measuring people's perception about biodiversity impacts after the implementation of project's activities. This biodiversity impact will be carried out based

on the theory of changes while the indicators will be identified at the outputs, outcomes and Impacts levels that are indicated in Tables1, 2 &3.

Table 5: Output level Indicators for biodiversity parameters

Output indicators	**Methods of data collection**	**Frequency of monitoring**	**Responsible**
People's awareness on climate change and REDD+ project	PRA, FGD,	Every 4 years	OFWE, FA-SOS
Fuel efficient stoves adoption	PRA, FGD	Every 4 years	OFWE, FA-SOS
Supports to forest CBOs	Reports, FGD	Every year	OFWE, FA-SOS
Trainings provided	Reports , FGD	Every year	OFWE, FA-SOS
Materials supports	Reports, FGD	Every year	OFWE, FA-SOS

Table 6*:* Outcomes level Indicators for biodiversity parameters

Outcome indicators	**Methods of data collection**	**Frequency of monitoring**	**Responsible**
Reduced deforestation in the project area	PRA, FGD,	Every 4 years	OFWE, FA-SOS
Reduced deforestation in the leakage belt area	PRA, FGD	Every 4 years	OFWE, FA-SOS
Natural forest regeneration	PRA, FGD	Every 4 years	OFWE, FA-SOS
Illegal forest tree feeling	PRA, FGD	Every 4 years	OFWE, FA-SOS
Incidence of forest Fire	PRA, FGD	Every 4 years	OFWE, FA-SOS
Incidence of killing wild animals	PRA, FGD	Every 4 years	OFWE, FA-SOS
Frequency of wild animals Appearance	PRA, FGD	Every 4 years	OFWE, FA-SOS

Table 7: Impacts level Indicators for biodiversity parameters

Impacts indicators	**Methods of data collection**	**Frequency of monitoring**	**Responsible**
Deforestation area	Land sate image analysis	Every 5 years	OFWE, CBOs
Forest Carbon stock	Carbon stock assessment	Every 5 years	OFWE, CBOs
Forest Basal area	PFRA	Every 3 years	OFWE, CBOs
Forest regeneration	PFRA	Every 3 years	OFWE, CBOs
Forest tree felling	PFRA	Every 3 years	OFWE, CBOs
Forest canopy cover	PFRA	Every 3 years	OFWE, CBOs
Wild animals visibility	PFRA & count	Every 5 years	OFWE, CBOs

5. ORGANIZATIONS, RESPONSIBILITIES AND MONITORING FREQUENCY

- **Oromia Forest and Wildlife Enterprise (OFWE)**

The Oromia Forest and Wildlife Enterprise is primarily responsible to carry out the monitoring of climate, community and biodiversity impacts. The OFWE is responsible to collect monitoring data (1) biomass inventory measurements, (2) community and biodiversity impacts assessments, (3) recording activity implementation and (4) any other data required to be monitored. OFWE will carry out monitoring in collaboration with other government and NGOs. In all cases OFWE will execute the first-pass of quality assurance and quality control (QA/QC) checks on all of the data collected by them or any other partner. OFWE will keep records of all field inventory and social appraisal data sheets and other evidences demonstrating the correct execution of project implementation.

- **Community Based Forest managing Organizations**

In the project area about 64 forest managing REDD+ CBOs have been organized and signed an agreement of joint forest management with government to share roles and responsibilities of forest conservation including benefit sharing from the forest. Under each forest CBO there area compartment committee that will be responsible for day to day monitoring of their compartment for illegal cutting of trees, forest fire and report to CBOs' executive committee and the executive committee of each CBO will expect to report to OFWE office that found at closer place.

- **Farm Africa-SOS Sahel Ethiopia**

During the first 4 to 5 years of the project period, Farm Africa & SOS Sahel Ethiopia will involve in the project implementation monitoring to support the project proponent and local communities in delivering of capacity building supports for both OFWE and CBOs.

- **Other stakeholders**

The other potential partners who will involve in the implementation of project activities and monitoring of the achievements will include Oromia Bureau of Agriculture through its grass-root level development agents, the Oromia Cooperative Promotion Agency (OCPA) which is working with JFM CBOs and the Oromia Land Administration and Environmental Protection office.