Monitoring report form for CDM project activity
(Version 06.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT	
Title of the project activity	Humbo Ethiopia Assisted Natural Regeneration Project
UNFCCC reference number of the project activity	2712
Version number of the PDD applicable to this monitoring report	03
Version number of this monitoring report	1
Completion date of this monitoring report	14 March 2018
Monitoring period number	2
Duration of this monitoring period	02/12/2011 – 01/12/2017
Monitoring report number for this monitoring report	1
Project participants	Ethiopia: World Vision Ethiopia Spain: Kingdom of Spain - Ministry of Agriculture, Food and Environment and Ministry of Economy and Competitiveness Japan: Japan Petroleum Exploration Co., Ltd. (JAPEX); The Okinawa Electric Power Co., Inc.; Suntory Holdings Limited; Tokyo Electric Power Company Holdings, Inc.; Sumitomo Joint Electric Power Co., Ltd.; Japan Iron and Steel Federation (JISF); Sumitomo Chemical; Idemitsu Kosan Co., Ltd. Italy: Government of Italy - Ministry for the Environment Land and Sea France: Eco-Carbone S.A.S. Luxembourg:

	Ministry of Sustainable Development and Infrastructure	
Host Party	Federal Democratic Republic of Ethiopia (host)	
Sectoral scopes	14: Afforestation and reforestation	
Applied methodologies and standardized baselines	This project activity uses the approved baseline methodology AR-AM0003, Version 4, *Afforestation and reforestation of degraded land through tree planting, assisted natural regeneration and control of animal grazing.* This methodology utilizes *Version 2 of the Tool for the Demonstration and Assessment of Additionally in A/R CDM Project Activities*. The Monitoring Report utilizes *Version 01.0.0 of the Tool for the Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM Project Activities.* The Monitoring Report utilizes *Version 01.0.0 Annex 27 from EB 63. Guidelines on accounting of specified types of changes in A/R CDM project activities from the description in registered project design documents.* The Monitoring Report utilizes *Version 01.0 Annex 26 from EB 63. Guidelines on application of specified versions of A/R CDM methodologies in verification of registered A/R CDM project activities*	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0	109,584
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	268,182.8	

SECTION A. Description of project activity

A.1. General description of project activity

Purpose of the project activity and the measures taken to reduce greenhouse gas emissions

The afforestation and reforestation activity of the Humbo Assisted Regeneration Project, involves the restoration of indigenous tree species in a mountainous region of South Western Ethiopia. The project zone covers approximately 2728 hectares of land and includes 5 strata. The project contributes to climate change mitigation objectives by creating Greenhouse gas (GHG) sinks through assisted natural regeneration of degraded lands. Furthermore, the project compliments the natural resource management goals of the Ethiopian Agricultural Rural Development and Forestry Coordination Office (ARDFCO), and social development goals of the Ethiopian government, and World Vision Ethiopia, the humanitarian organization implementing the project.

The Humbo Assisted regeneration project has established seven community cooperative societies, which have legal ownership to 2,728 hectares of community land. These groups are managing the areas using the Farmer Managed Natural Regeneration techniques for the purposes of carbon removal, environmental benefits (biodiversity, water quality, and habitat) and income producing activities for the local population. Bylaws agreed upon at project inception form the rules for community cooperative societies to manage the project.

In summary, the implemented project activities are contributing to sustainable development in the following ways:

1. Regeneration of native forest, utilizing the farmer managed natural regeneration (FMNR) and traditional forest establishment techniques.
2. Enhancement of GHG removals by sinks in the project area.
3. Promotion of native vegetation and biodiversity in the project area, which can be utilized as a refuge for local and migratory species and to improve the connectivity of fragmented forest resources.
4. Reduction in soil erosion and flooding and help maintain supply of the subterranean streams to support the region's water supply.
5. Provision of an income stream for communities through sustainable harvesting of forest resources.

Brief description of the installed technology and equipment;

The technology employed in this project is Farmer Managed Natural Regeneration (FMNR), and planting of seedlings raised from nursery stock. The FMNR technique has been developed in Niger Republic, West Africa over 20 years where it is now practiced on over 2 million hectares. The technique has also spread to Chad, Burkina Faso and Senegal. FMNR falls within the definition of afforestation / reforestation in the manner articulated in the approved methodology AR-AM0003 version 04.

Farmer Managed Natural Revegetation (FMNR) is a system of reforestation utilised by rural communities to achieve the objective of forest restoration over a short period. They have rights to forests and their products. Professor Chris Reij, of Vrije University in Amsterdam and Dr. Peter Cunningham, SIM International, have documented the technique, and this work is publicly available[1].

[1] Farmer Managed Natural Regeneration. Impressions of a short field trip. June 9-11, 2004. Reij. C. Vrije Universiteit, Amsterdam; Reforesting the Sahel: Farmer Managed Natural Regeneration. Cunningham P.J and Abas. T.

Implementation of FMNR

FMNR can be implemented in areas that have root stock that could resprout under protection and management. It works best where annual rainfall is in excess of 650mm and is not suitable for areas with an annual rainfall of less than 200mm. Root stock from trees cleared as long as 60 years can remain in the soil, resprouting periodically. This root stock will develop new shoots each year, and these can be mistaken for small shrubs or broadleaf groundcover species. On farmland, standard practice for farmers has been to slash this regrowth each year in preparation for planting crops. In non-arable areas, such growth is controlled through regular burning, grazing and fuel wood collection. However, with training, the local communities could identify young shoots tend and manage them to regenerate the root stock. The proposed Humbo community forest area has been assessed and found suitable for application of the FMNR technique.

FMNR involves area closure for a minimum of 2 years, and training thinning and pruning of rootstock identified as possible to grow into mature trees. In the most basic form of FMNR, all stalks except one are cut from the root stock. Side branches are then pruned half way up the stem. Selecting and pruning five to seven stems can offer more benefits, and this has been the practice in West Africa. Unwanted stems are removed, and the managed stems increase in size each year, protecting the immediate soil environment and providing other useful materials and services such as fodder, humus, habitat, and protection from the wind and shade. On occasions that a stem is harvested, a younger stem is selected to replace it.

Different tree species require different pruning techniques, and these are determined through on-site observation. A small handsaw or machete is the only tool used for pruning side branches of young shoots.

Land managers visit the project area every 2-4 months to re-prune as necessary. Heavy equipment is not required as a result there is minimal soil disturbance when this technique is used. Integrated fire management approaches are implemented in cooperation with the local communities. Grazing is prevented during the vulnerable period after pruning. The decision to allow grazing would be depend upon the growth of trees beyond the height that would not be vulnerable to grazing.

Supplemental planting

Supplemental planting was used to augment the FMNR established forests. A nursery was established with capacity to deliver up to 500,000 seedlings per year for the first four years, sufficient to reforest 500 hectares at 1000 stems per hectare. However, during project implementation only 50.7 hectares has been planted in stratum 5 not the estimated 500ha of land that was planned for new plantation for the entire project site. A map of the replanted areas, represented as stratum 5, is included in section A1. The nursery was established in a conventional manner. Seedlings were planted in small pits (0.3m x 0.2m), which were pre-dug through the community participation. Seedlings were planted at the start of the rainy season and follow up weed control was undertaken after each planting.

The Humbo AR project site was stratified into five strata based on the pre-existing vegetation cover and accordingly the project has been registered with the UNFCCC in December 2009 after it had been validated by the DOE JACO in March 2009.Stratum one up to four refers natural regeneration areas with various status of vegetation coverage, while stratum five was open patchy area expected to be replanted with seedlings. These strata are described below.

a) **Stratum 1**: - is relatively dense area of the site with some big trees found in different parts. It is located at the South end of the site in a Kebele known as Abela Gefeta.
b) **Stratum 2**: - is an area with scattered tree/vegetation cover and open land dominated with grass. It is geographically located in the south-east end of

stratum 3 bordered by stratum 1 from south. This stratum has high potential for enrichment planting.

c) **Stratum 3:** -is covered with relatively dense bushes and shrub on hillsides in a Kebele named as Abela Longena, Abala shoya, Bossa, Bolla, Bada and Bongota. Stratum 3 is bound by stratum 2 from east and stratum 4 from North.
d) **Stratum 4**: - is situated extreme north, on opposite hillside of stratum 3. The stratum is characterized by scattered vegetation cover grown on very rocky area that is difficult for planting.
e) **Stratum 5**: this stratum is considered to be open patchy area found scattered in stratum 3 proposed for new plantation.

After four years of intervention, these strata have been revised as significant changes on growth of vegetation have been observed within the same stratum (2, 3, and 4). To address these changes, the project site has been re-stratified using the same strata definitions given above. Some areas within stratum 2 have been moved to stratum 3. Some areas of stratum 3 covered with rocky and scattered vegetation have been removed and included into stratum 4. The fifth stratum (new plantation area) which was estimated to be 500ha at project inception has been reassessed after plantation activities were completed. As a result, the total size of stratum 5 has been reduced to 50.7ha from 500ha estimated for the baseline scenario. The size of each stratum before and after the revision is shown in Table A-1 below.

Table A-1 Reforestation and Forest management practices carried out over the last five years (area closure affects all strata)

S/N	strata	Strata at project inception	Strata after re-stratification
1	stratum 1	234	233.48
2	stratum 2	745	630.71
3	stratum 3	1154	1698.71
4	stratum 4	95	114.41
5	stratum 5	500	50.7
	Total	2728	2728.01

A map of the strata of the project is included below in Figure A-1 Replanted areas are identified as Strata 5.

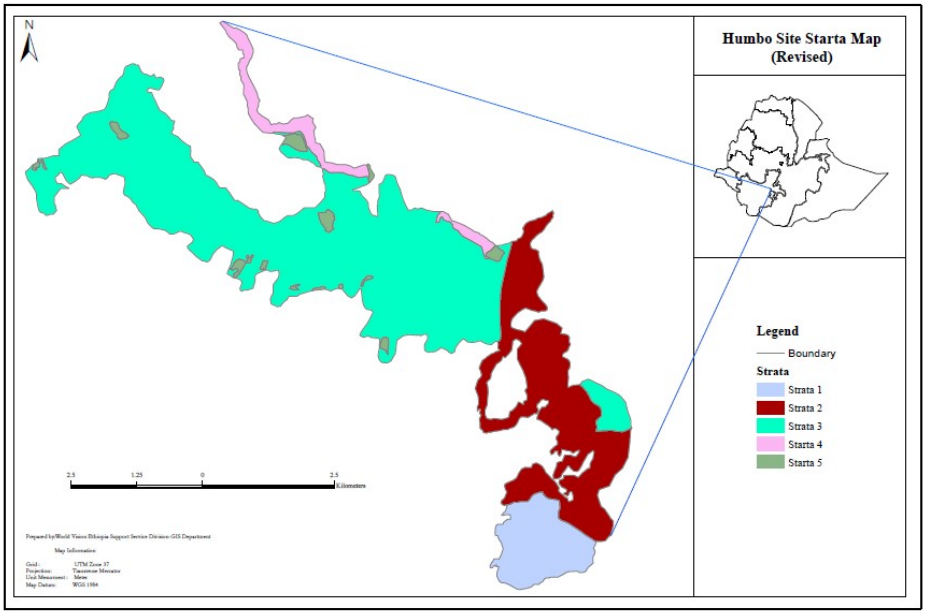

Figure A-1 – Humbo site Strata (revised)

Species endemic to the area are used to restore the forest and sequester carbon from the atmosphere. These include *Acacia* spp., *Aningeria adolfifericii*, *Podocarpus facutus*, *Olea africana*, *Cordia africana*, *Croton macrostachytus*, *Erthrina* spp., *Ficus* spp, among others. The naturalized species such as *Grevillea robusta* and *Eucalyptus globulus* are also utilised for block planting in open spaces where there are no tree stumps and on individual farmers' lands outside of the project boundary to assist in establishment of their own wood lots. Of the 500ha of land expected to be covered by new seedlings from the project site, only 50.7ha has been planted with naturalized species and delineated as stratum 5 and the remaining area (2677.3 ha) is being managed using farmer managed natural regeneration techniques supported by area closure.

Farmer managed natural regeneration (FMNR) was adopted for the endemic species whilst the naturalised species were produced in nurseries over a 5-year period. FMNR involves area closure for a minimum of 2 years, and training on thinning and pruning of rootstock identified as possible to grow into mature trees. A full description of FMNR and nursery operations is provided in Section A.4 of the Monitoring Report.

No genetically modified organisms or invasive alien species have been used in this project.

Relevant dates for the project activity

The start date of the project activity was 01/12/2006. However, active management of the forest started on 5/06/2007. The following table depicts the details of annual reforestation activities carried out at stratum 5. The species planted at stratum 5 are *Grevelia robusta* and with a mixture of *Eucalyptus spp.* The remaining part of the project site (2677.3 hectares) has been reforested through farmer managed natural regeneration. The natural regeneration area is stratified into four strata (1, 2, 3 & 4). Table A-2 shows the project activities that have been undertaken since the implementation of the project.

Table A-2 Reforestation and Forest management practices carried out between 2012 and 2017 (area closure affects all strata)

Pruning/ thinning and planting carried out at d/t strata	2012		2013		2014		2015		2016		2017		total	
	Pruning/ Thinning (ha)	Planting (ha)	Pruning/ Thinning (ha)	Planting (ha)	Pruning/ Thinning (ha)	Planting (ha)	Pruning/ Thinning (ha)	Planting (ha)	Pruning/ Thinning(ha)	Planting (ha)	Pruning/ Thinning (ha)	Planting (ha)	Pruning/ Thinning (ha)	Planting (ha)
Strata-1	3.4	0	4.75	0	5.75	0	2.75	0	2.75	0	0	0	19.4	0
Strata-2	12	0	7	0	11	0	9	0	6	0	0	0	45	0
Strata-3	374	0	269	0	186.5	0	179	0	111.6	0	10	0	1120.1	0
Strata-4	5.75	0	8	0	0	0	4	0	0	0	0	0	17.75	0
strata-5	4	0	3	0	3.25	0	2.5	0	2.75	0	0	0	15.5	0

A.2. Location of project activity

The project activity is located in the Humbo Woreda, Wolayita zone, Southern Nations Nationalities and Peoples Region (SNNPR), South Western Ethiopia. The closest town is Humbo (Te Bela). Humbo Woreda is approximately 420km south of Addis Ababa, and 195km south-west of Awassa, the capital city of SNNPRS.

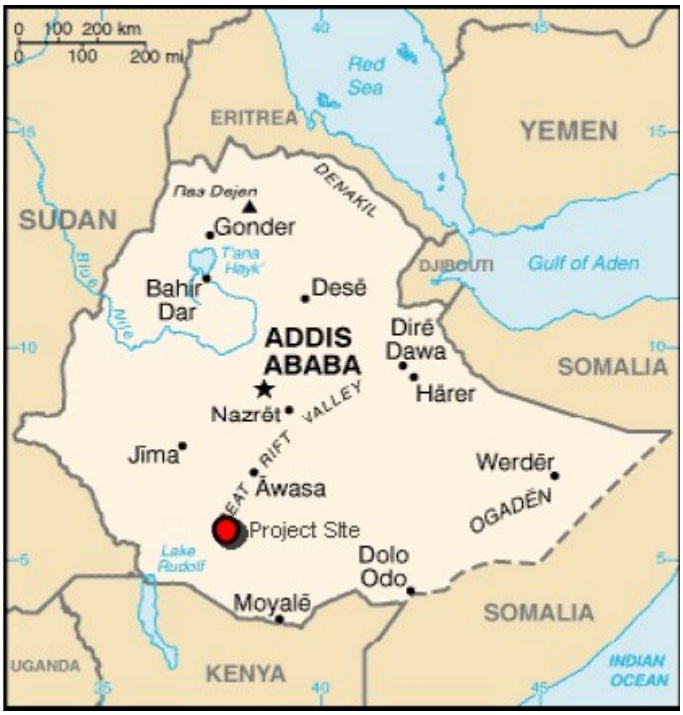

Figure A-2 Location of the project activity within Ethiopia

The GPS Coordinates of the project site is shown below, and a shape file is available of this polygon. The project extends from latitude 6° 46'48.47 to 6° 41'04.28 N and longitude 37° 48'35.44 to 37° 55'14.51 E. A full list of the GPS coordinates taken at each corner points of project boundary is included in strata boundaries annexed to this monitoring report.

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Federal Democratic Republic of Ethiopia (host)	World Vision Ethiopia	No
Spain	Kingdom of Spain- Ministry of Agriculture, Food and Environment and Ministry of Economy and Competitiveness	Yes
Italy	Government of Italy - Ministry for the Environment Land and Sea	Yes

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Japan	Japan Petroleum Exploration Co., Ltd. (JAPEX); The Okinawa Electric Power Co., Inc.; Suntory Holdings Limited; Tokyo Electric Power Company Holdings, Inc.; Sumitomo Joint Electric Power Co., Ltd.; Japan Iron and Steel Federation (JISF); Sumitomo Chemical; Idemitsu Kosan Co., Ltd.	No
France	Eco-Carbone S.A.S.	No
Luxembourg	Ministry of Sustainable Development and Infrastructure	Yes

A.4. Reference to applied methodologies and standardized baselines

This project activity uses the approved baseline methodology AR-AM0003, Version 4, Afforestation and reforestation of degraded land through tree planting, assisted natural regeneration and control of animal grazing.

This methodology utilizes Version 2 of the Tool for the Demonstration and Assessment of Additionally in A/R CDM Project Activities.

The Monitoring Report utilizes Version 01.0.0 of the Tool for the Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM Project Activities.

The Monitoring Report utilizes Version 01.0.0 Annex 27 from EB 63. Guidelines on accounting of specified types of changes in A/R CDM project activities from the description in registered project design documents.

The Monitoring Report utilizes Version 01.0 Annex 26 from EB 63. Guidelines on application of specified versions of A/R CDM methodologies in verification of registered A/R CDM project activities

A.5. Crediting period type and duration

30 years fixed crediting period starting from date 01/12/2006

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

1. The starting date of operation of the project activity

Actual field activity implementation started on 1/12/2006 (coppicing and pruning using the FMNR technique) however plantation activities in stratum 5 started on 05/6/2007 to coincide with World Environment Day. The annual details of the project schedule are delineated in section A1.

2. The information regarding the actual operation of the project activity during this monitoring period, including information on special events, for example overhaul times, downtimes of equipment, exchange of equipment, etc.

1. Plantation activities

The tree species used for supplementary planting have mainly included *Eucalyptus camaldulensis, Eucalyptus Globulus* and *Grevillea robusta*. However, small quantities of native tree species such as *Balanatus egiptica* and *Cordia Africana* including exotic ones like *Acacia saligna* have been planted as well. The list of species planted differs slightly from what is stated in the PDD. The reason for planting mostly *Grevillea robusta* species is because it is widely accepted by the community and has been adapted by the community for more than three decades due to its fast growth and adaptability to the local climate. Furthermore, some of the seeds listed in the PDD were difficult to obtain and some failed to germinate in the nursery such as the *Podocarpus facutus* due to the poor quality of the seed.

Considering the amendments endorsed as being able to be approved by the DOE at verification by the CDM executive board at meeting EB 63, documented in Annex 27, "Guidelines on accounting of specified types of changes in A/R CDM project activities from the description in registered project design documents" paragraph 3, these changes from the PDD are considered minor. Amendments to the species planted, and an updated stratification plan are presented in this document.

The survival rate monitoring has been carried out three months after plantation. According to the survey result, the survival ranged from 79 to 85% depending on rainfall variability from season to season. However, replacement has been done in the following rainy season. Replacement plantings were monitored for survival and further replanting was undertaken in the subsequent year. Final survival counts were undertaken in November 2012 (3 years post planting as described in the PDD), the survival rate rages between 71% to 85% within the samples taken and the average was 80.4%.

Plantation activities were concluded by 31st August 2011.

2. Forest management

Forest management activities mentioned in the PDD such as pruning/thinning/coppice reduction have been carried out for the last ten years through community participation. The practice includes removal of branches, twigs and deformed coppices that suppress the growth of main trees. The materials removed are used as fuel wood by the community living adjacent to the project site. These practices are expected mainly to carry out on natural regeneration areas categorized as stratum 1, 2, 3, and 4, whilst removal of side branches of planted trees ins strata 5 also occurred. For the last 6 years, thinning and pruning have been carried out on 1217.75 hectares of land.

3. Community engagement activities

The other major activities being implemented in the project scenario are capacity building activities to enable communities to manage the project over the crediting period in a sustainable manner. In this regard, trainings on forest management, nursery management, soil and water conservation, farmer managed natural regeneration technique (pruning, thinning, coppice reduction and enrichment plantation), livestock management, project management, financial management, leadership, and conflict resolution have already been conducted. These practices have built the capacity of the communities to undertake the role of project management over the long term and to educate the communities about the benefits of the project ecosystem and to precipitate climate change resilience. A list of training activities and the number of participants involved is included in the Humbo Data Management Template. Moreover, the project is supporting communities to form cooperatives into unions and once the approval of the unions is granted by the concerned Zonal bureau, the role of each party (union, cooperative, World Vision and Government will be agreed) and training on monitoring, reporting and management of the unions will be conducted for the union and cooperative leaders, etc.

Table B.1 Project Activities

Key Event	Date
Project implementation begins with area closure, application of FMNR technology to project site and establishment of forest cooperatives	01/12/2006
Nurseries Established near to project site	01/01/2007
First plantation establishment (118,808 seedlings planted)	05/06/2007
Second plantation establishment (345,158 seedlings planted)	10/07/2008
Third plantation establishment (168, 676 seedlings planted)	30/07/2009
Forth plantation establishment (75,350)	15/07/2010
Fifth plantation establishment (11,365)	20/07/2011
The seven Cooperatives amalgamated under one umbrella institution, Union	22/05/2013

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

There have been no changes to the monitoring plan, applied methodology or standardized baselines.

B.2.2. Corrections

No corrections have been made during Monitoring Period 2

B.2.3. Changes to the start date of the crediting period

No changes to the start date of the crediting period have occurred.

B.2.4. Inclusion of monitoring plan

No changes have been made to the monitoring plan since the first Monitoring Period.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

There have been no permanent changes to the registered monitoring plan or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools.

B.2.6. Changes to project design

In 2015 a road was built through strata 3. A road impact report on carbon sequestration was undertaken and is provided as supplementary documentation to this monitoring report. Overall the road reduced the project area by 4.07 hectares which has been deducted from strata 3 project area.

SECTION C. Description of monitoring system

As per the registered PDD, the project proposes monitoring of:

1. Plantation Establishment and Management
    a. Project boundaries
    b. Forest establishment
    c. Forest management
2. GHG emissions by sinks

The monitoring system as described in the PDD involves the monitoring of parameters which allow the project emissions, boundaries, and GHG reductions to be accurately measured and net GHG reductions to be calculated.

The following diagram C-1 outlines the relevant monitoring points.

Figure C-1 Diagram of monitoring points

Monitoring of Plantation Establishment and Management

Monitoring of the project boundary

As per the monitoring methodology, a sample of boundary points has been monitored for this monitoring period to ensure accuracy of the project boundary. The PDD requires that 1% of boundary points be monitored, however to increase the quality of the data from this parameter, a sample of 8% of boundary points was monitored. The sample coordinates were selected randomly (from the PDD and the monitoring exercise) and are annexed with this report. It was calculated that 24 of the 66 points showed minor difference from those reported in the PDD, however the differences were both positive and negative (not biased), and all were minor, and most likely due to the quality satellite reception during the original mapping. A summary of the QA process is included in the excel spreadsheet.

Monitoring forest establishment

To ensure the planting quality and forest establishment, the following monitoring activities were conducted in accordance with the monitoring methodology and Table C-1 below:

- Confirmed that site and soil preparation are implemented based on practice documented in section A of the PDD, no slash and burn and widespread tillage was used on the site and soil preparation.
- Survival rate checking, the initial survival rate of planted trees was checked three months after the planting, and re-planting was conducted where the survival rate is lower than 90%. Replanted sites were monitored, but survival counts were not recorded.
- Final survival checking is to be carried out three years after planting.
- Weeding checking to check and confirm that the weeding practice where necessary is implemented.
- Surveying and checking the area of planted species and planting year for each substratum within stratum 5.

Table C-1 Data for monitoring forest establishment

Data variable	Data Unit	Measured (m), calculated (c) estimated (e) or default (d)	Recording frequency	Number of data points / Other measure of number of collected data	Comment
Site preparation	*Yes / No*	*Measured*	*At planting*	*Open areas allocated for planting*	*This involves preparation of a small pit manually with a size of (0.2mx0.3m) no other site preparation has been undertaken*
Seedling survival	*%*	*Measured*	*3-months after planting, then annually up to year 3*	*Permanent sample plots*	*Checking carried out by Counting for 100% plants from 12-36 sample plots having a plot size of 100m^2 each. Replanting has been carried out if less than 90% survival rate is recorded*
Weeding efficacy	*Yes / No*	*Measured*	*Weeding is conducted before the commencement of dry season 2 months after of planting*	*Permanent sample plots*	
Area of planted strata	*Ha*	*Measured*	*At end of year 1*	*All boundaries monitored*	*Boundary is delineated using GPS*

Monitoring of forest management

To ensure the forest management is well implemented the following monitoring activities have been conducted since project implementation:

- Site preparation measures: date, location, area and other measures undertaken;
- Planting: date, location, area, tree species (establishment of the stand models);
- Thinning: date, location, area, tree species, volumes or biomass removed;
- Coppicing: date, location, area, tree species, volumes or biomass removed;
- Fuel wood collection: date, location, area, tree species, volumes or biomass removed;
- Monitoring for disturbances: date, location, area (GPS coordinates and remote sensing, as applicable), tree species, type of disturbance, biomass lost, implemented corrective measures, change in the boundary of strata and stands.

The data required for forest management is shown in table C-2 below.

Table C-2 Data required for monitoring forest management

Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)	Recording frequency	Number of sample plots at which the data will be monitored / Other measure of number of collected data	Comment
Site preparation – date	*Date*	*Measured*	*Project start*		Humbo CDM Data Management Template
Site preparation – location	*Parcel ID*	*Measured*	*Project start*	*All planted plots*	Humbo CDM Data Management Template
Site preparation – area	*Ha*	*Measured*	*Project start*	*All planted plots*	Humbo CDM Data Management Template
Site preparation – biomass loss	*tonnes*	*estimated*	*Project start*	*NA*	*NA*
Planting/Replanting – date	*Date*	*Measured*	*At each planting event*	*All replanted plots*	*Humbo CDM Data Management Template*
Planting/Replanting – location	*Parcel ID*	*Measured*	*At project start/rotation*	*ID of plots requiring replanting*	*Humbo CDM Data Management Template*
Planting/Replanting – area	*ha*	*Measured*	*At project start/rotation*	*Area of plots requiring replanting*	*Humbo CDM Data Management Template*
Planting/Replanting – species	*Species*	*Measured*	*At project start/rotation*	*All species planted*	*Humbo CDM Data Management Template*
Management –	*Date*	*Measured*	*At project*	*At each thinning*	*Humbo CDM*

Thinning/coppicing - date			*start/rotation*	*event*	*Data Management Template*
Management – Thinning/coppicing - location	*Parcel ID*	*Measured*	*periodic*	*At each thinning event*	*Humbo CDM Data Management Template*
Management – Thinning/coppicing - area	*ha*	*Measured*	*Periodically after each thinning*	*entire area thinned*	
Management – Thinning/coppicing - species	*species*	*Measured*	*Periodically after each thining*	*Sample of area to determine species thinned*	
Fuel wood collection – date	*Date*	*Estimated*	*Periodically during collection*	*Discussion with 7community cooperatives*	*After one week of pruning/thinning activities*
Fuel wood collection – location	*Parcel ID*	*Measured*	*Periodically during collection*	*Discussion with 7community cooperatives*	*Abala longena, shoya, Bossa, Bolla, Bada and Bongota*
Fuel wood collection – area	*ha*	*Estimated*	*Periodically during collection*	*Discussion with 7community cooperatives*	*Fuel wood has been collected from 1129ha where pruning and thinning has been carried out*
Fuel wood collection – species	*species*	*measured*	*Periodically during collection*	*Discussion with 7community cooperatives*	*Terminalia brownii* *Combretum collinum* *Terminalia laxiflora* *Combretum molle R. Br.ex G.Don*
Fuel wood collection – volume	*Tonnes*	*Measured*	*Periodically after one week of pruning*	*Representative areas from each of 7 Cooperatives*	*Measured by taking sample from 4 plots with a size of 100m2 from each cooperative*.

Monitoring of GHG emissions by sinks

GHG removals by sinks have been monitored through the establishment of permanent sample plots throughout the project site. These sample plots have been established in accordance with the sampling design developed according to the procedure in the Sourcebook for LULUCF projects, approved methodology AM0003 version 4 and monitoring manual developed by World Bank and the data monitored have been recorded in the Humbo CDM Data Management Template developed in collaboration with by the BioCarbon fund.

Training

A number of trainings were offered to community groups, WVE field staff and management. See Table C-3 below for details.

Table C-3 Training undertaken by community groups, WVE field staff and management

S.No.	Description of Training	Total No of Participants
1	Training on Forest Management	62
2	Training CBOs and FBOs on Forest management	60
4	Training on Soil and Water conservation	80
5	Training on Biodiversity	105
6	Training on Biofuel extraction	29
7	Training on saving and credit	133
8	Training on Nursery Management	76
9	Training and assist private nursery	7
10	Training on Cooperative leadership	99
11	Training on carbon stock monitoring	213
12	Training cooperative & union leaders on financial management and book keeping	159
13	Training on empowerment and community mobilization	86
14	Refresher training on bird survey technique	9
15	Refresher training on biodiversity monitoring	33
16	Training on High Conservation Value species conservation	65
17	Training on wild life management	74
18	Awareness creation training on ecotourism and tourist guide	97
	Total	**1,387**

Monitoring Organisation and Responsibilities

The project manager has designated a monitoring team responsible for implementing the monitoring plan. The structure of this team is outlined in Table C-4 and Figure C-2.

Table C-4 Roles and responsibilities of project team

Task and Area of Responsibility	Method Used	Frequency	Responsible Role	Contact details
Staff and Community Training in monitoring	Application of sourcebook and	Annually and as new staff and	Climate Change and Environmental Projects	+251-116-293350 Kebede_Regassa@wvi.org

systems	Standard Operating Procedures for Humbo CDM	community members are recruited	manager	
Operation of Monitoring Equipment	As per equipment instructions	Review annually	Field based project manager	+251-465-510079 tesfahun_eyoel@wvi.org
Quality control (checking) of monitoring equipment	Standard Operating Procedures for Humbo CDM	Annual	Climate Change and Environmental Projects manager	+251-116-293350 Kebede_Regassa@wvi.org
Collection and Coordination of field data	As per sourcebook and Standard Operating Procedures for Humbo CDM	Annual	Field based project manager and/or trained community members	+251-465-510079 tesfahun_eyoel@wvi.org
Calculation of emissions reductions and deviations from projections	Humbo CDM Data Management Template and Standard Operating Procedures for Humbo CDM	Annual	CDM Technical Advisor	+61 (0) 417 1080 49 dean.thomson@worldvision.com.au
Data cross-check of field measurements	As per sourcebook and Standard Operating Procedures for Humbo CDM	Annual	Climate Change and Environmental Projects manager	+251-116-293350 Kebede_Regassa@wvi.org
Data Storage at field level	As per Standard Operating Procedures for Humbo CDM (Backup to external hard disk drive and hard copy on file)	Annual	Field based project manager	+251-465-510079 tesfahun_eyoel@wvi.org
Data Storage at Head office	As per Standard Operating Procedures for Humbo CDM	Annual	Climate Change and Environmental Projects manager	+251-116-293350 Kebede_Regassa@wvi.org

	(Backup to external hard disk drive, and hard copy on file)			
Who undertakes Quality Assurance / control	As per sourcebook and SMART template	Annual	Climate Change and Environmental Projects manager	+251-116-293350 Kebede_Regassa@wvi.org
Sign off of monitoring reports and ER calculations	As per sourcebook and SMART template	Annual	Climate Change and Environmental Projects manager	+251-116-293350 Kebede_Regassa@wvi.org

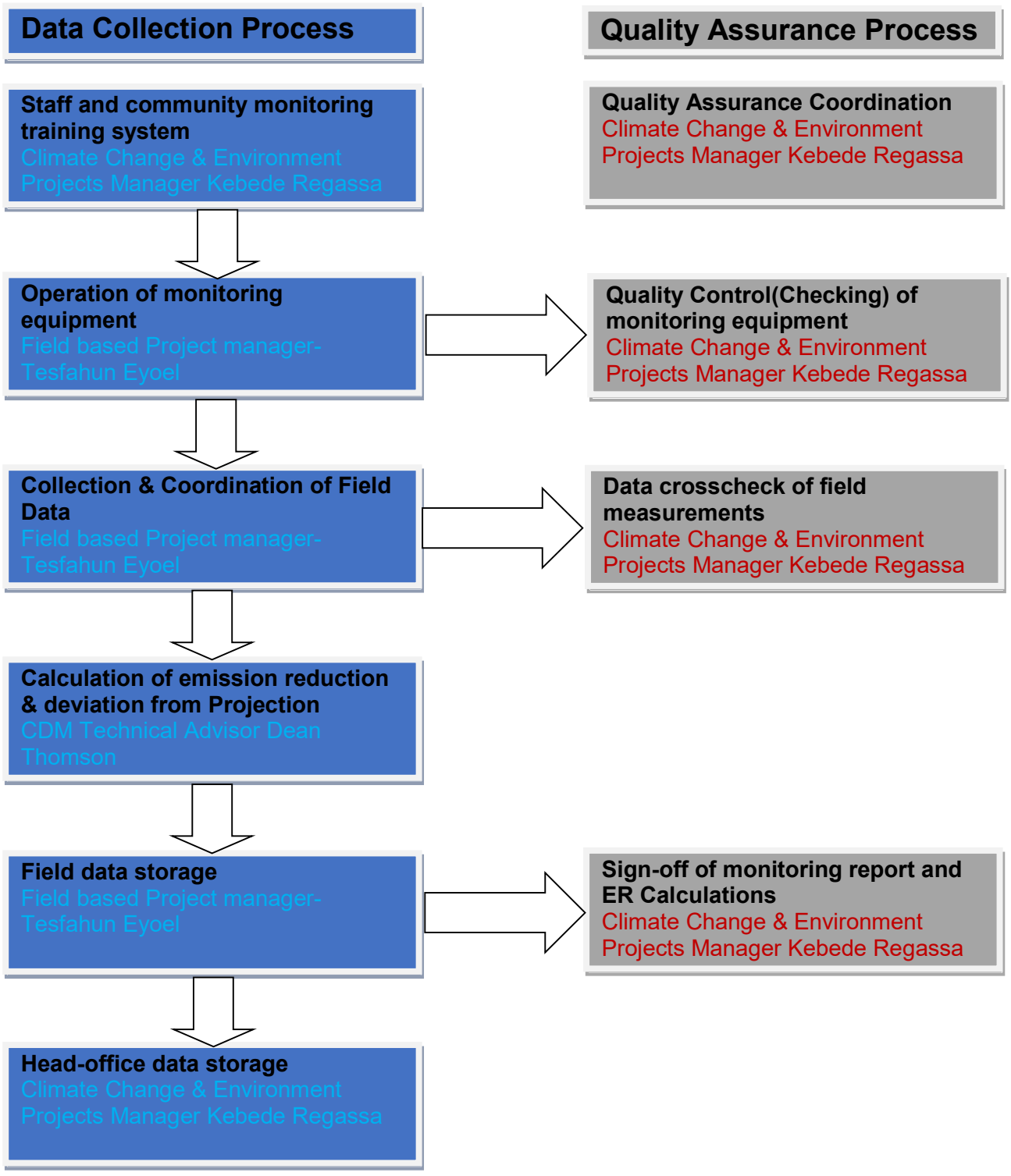

Figure C-2 Structure and responsibilities of the monitoring team

In addition to the above structure developed for quality assessment process, please refer the quality assurance procedure developed and annexed to CDM operational monitoring plan

Emergency procedure for the monitoring system

In the case measuring equipment is damaged and no reliable readings can be recorded, the project owner will purchase replacement equipment and repeat the monitoring procedures.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

Data/Parameter	C_{BSL}
Unit	Numeric
Description	Baseline net GHG removals by sinks
Source of data	Determined in PDD.
Value(s) applied	0
Choice of data or measurement methods and procedures	Not applicable
Purpose of data/parameter	Baseline
Additional comments	The accepted baseline approach assumes the continuation of existing changes in carbon stock resulting further loss of regeneration ability hence, assumed to be zero

Data/Parameter	CF_j
Unit	tonnes C
Description	Carbon fraction of species, j
Source of data	Local, national, GPG for LULUCF IPCC
Value(s) applied	0.5
Choice of data or measurement methods and procedures	IPCC default
Purpose of data/parameter	Emissions calculations
Additional comments	Not applicable

Data/Parameter	*44/12*
Unit	Dimensionless
Description	Ratio of molecular weights of Carbon and CO_2
Source of data	Universal constant
Value(s) applied	44/12
Choice of data or measurement methods and procedures	Not applicable
Purpose of data/parameter	Emissions calculations
Additional comments	Not applicable

Data/Parameter	*Confidence level*
Unit	**%**
Description	*Confidence level*
Source of data	Defined
Value(s) applied	90
Choice of data or measurement methods and procedures	Not applicable

Purpose of data/parameter	Emissions calculations
Additional comments	Not applicable

Data/Parameter	*Fi (DBH, H)*
Unit	Kg tree -1
Description	Allometric equation for species *j* linking above-ground tree biomass (kg tree-1) to diameter at breast height (*DBH*) and possibly tree height (*H*) measured in plots for stratum *i* species *j,* time *t using a published equation applicable to the project.*

Source of data	The chosen Allometric Equations were selected using the A/R Methodological Tool, Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities (Version 01.0.0). In applying this tool to the project ***Section II, Appropriateness of Allometric Equations***, was used to determine the appropriateness of the equations. Section II identifies that: *For ex ante estimation of aboveground tree biomass in project scenario any allometric equation can be used.* *For ex-post estimation an equation is considered eligible for estimation if it meets **one** of the following criteria.* *(a) The equation is used in the national forest inventory, or the national GHG inventory, of the host Party;* *(b) The equation has been used in commercial forestry sector of the host Party for ten years or more;* *(c) The equation was derived from a data set of at least 30 sample trees, and the value of coefficient of determination (R^2) obtained was not less than 0.85.* The equation used in the ex post calculation for natural regeneration (and also in ex ante estimations for biodiversity planting) for this project comes from page 43 of the Sourcebook for Land Use, Land Use Change, and Forestry Projects (Timothy Pearson, Sarah Walker, and Sandra Brown, Winrock 2005). The equation satisfies criteria (c), as it was based on a data set of over 500 trees, and the value of coefficient of determination (R^2) was 0.97. Data for the development of this dry tropical equation was collated by Sandra Brown of Winrock International. The equation is: Aboveground Biomass = 0.2035*(DBH^2.3196) The equation to be used for Eucalyptus was developed for E. Globulus in Ethiopia by Fantu, Nuruddin, Haris and Ab Malik and is: Log10 Aboveground biomass = -1.189 +1.391(logDBH2) The equations chosen for Grevillea was developed by Jangra, Gupta, Kumar and Singh and is: log10 Aboveground biomass bole = -0.2055 + 1.221 log10 X log10 Aboveground biomass branches = -1.9583 + 1.9585 log10 X where X = circumference at breast height (cm), N= 30 (number of trees felled)

Value(s) applied	Natural Regeneration Aboveground Biomass = 0.2035*(DBH^2.3196) Eucalyptus = Log10 Aboveground biomass = -1.189 +1.391(logDBH2) Grevillea = log10 Aboveground biomass bole = -0.2055 + 1.221 log10 X
Choice of data or measurement methods and procedures	Allometric equations to convert dbh to biomass (kg)
Purpose of data/parameter	Project Emissions calculations
Additional comments	Not applicable

Data/Parameter	i_{ID}
Unit	Alpha numeric
Description	Stratum ID
Source of data	Stand Map, GIS
Value(s) applied	Strata A1, A2, A3, A4, A5 See Humbo CDM Data Management Template.
Choice of data or measurement methods and procedures	GIS
Purpose of data/parameter	Emissions calculations
Additional comments	Not applicable

Data/Parameter	*ID ikt*
Unit	Alpha numeric
Description	Stand ID
Source of data	Stand Map, GIS
Value(s) applied	See Humbo CDM Data Management Template to see the GPS coordinates and identify area of each stand for (natural regeneration –stand model-1 and plantation stand model-2)
Choice of data or measurement methods and procedures	GIS
Purpose of data/parameter	Emissions calculations
Additional comments	Not applicable

Data/Parameter	k ID
Unit	Alpha numeric
Description	Stand model ID
Source of data	AR-CDM-PDD and ex-post adjusted strata.
Value(s) applied	
Choice of data or measurement methods and procedures	
Purpose of data/parameter	Project Emissions calculations
Additional comments	Not applicable

Data/Parameter	N
Unit	Numeric
Description	Maximum possible number of sample plots in the project area
Source of data	Calculated
Value(s) applied	43,644
Choice of data or measurement methods and procedures	See sampling design in section c
Purpose of data/parameter	Project Emissions calculations
Additional comments	Not applicable

Data/Parameter	NaBL
Unit	Numeric
Description	Pre-project number of animals from different livestock groups
Source of data	Estimated at project start
Value(s) applied	3,990
Choice of data or measurement methods and procedures	Government Livestock Inventory data
Purpose of data/parameter	Leakage Emissions calculations
Additional comments	Ex-ante estimation – the estimate is fixed for the entire crediting period

Data/Parameter	Ni
Unit	Numeric
Description	Maximum possible number of sample plots in stratum *i*
Source of data	Calculated
Value(s) applied	N1=3737, N2=10079, N3=27090, N4=1819, N5=919
Choice of data or measurement methods and procedures	See sampling design in section c
Purpose of data/parameter	Project Emissions calculations
Additional comments	Ex-ante estimation – the estimate is fixed for the entire crediting period

Data/Parameter	P
Unit	**%**
Description	Desired level of precision
Source of data	Defined
Value(s) applied	10%
Choice of data or measurement methods and procedures	See sampling design in section c
Purpose of data/parameter	Project Emissions calculations
Additional comments	For the purpose of QA/QC and measuring and monitoring precision control. PDD implied both 5% and 10% precision, however the methodology clearly states that 10% precision is required.

Data/Parameter	Bijt
Unit	Tonnes Dry matter per Hectare
Description	Average above ground biomass stock before burning for stratum i, species j, time t
Source of data	Not Monitored
Value(s) applied	Not Monitored
Choice of data or measurement methods and procedures	Not applicable
Purpose of data/parameter	Leakage emissions
Additional comments	Not applicable as there is no burning in the project scenario

Data/Parameter	AN ikt
Unit	-
Description	Area of with N applied in stratum i, stand model k, at time t
Source of data	Not Monitored
Value(s) applied	Not Monitored
Choice of data or measurement methods and procedures	Not applicable
Purpose of data/parameter	Leakage emissions
Additional comments	Not applicable as there is no nitrogen used in the project scenario

Data/Parameter	GWPCH4
Unit	-
Description	Global warming potential for CH4
Source of data	Not Monitored
Value(s) applied	Not Monitored
Choice of data or measurement methods and procedures	Not applicable
Purpose of data/parameter	Leakage emissions
Additional comments	Not applicable as there is no biomass burning in the project scenario

Data/Parameter	*Ri*
Unit	Dimensionless
Description	Root to shoot ratio
Source of data	IPCC 2003, GPG LULUCF – Annex 3.A1, Table 3A.1.8 Average Belowground to Aboveground Biomass ratio in Natural Regeneration by broad category, page 3.168
Value(s) applied	Natural regeneration by broad category 0.27 *Eucalyptus* spp. 0.29 *Grevillea* spp. 0.27 As per validated PDD.
Choice of data or measurement methods and procedures	Default factors from IPCC 2003

Purpose of data/parameter	Project emissions
Additional comments	The Root to Shoot ratio will only be updated where third party peered reviewed studies have been undertaken

Data/Parameter	*XF*
Unit	Dimensionless
Description	Plot expansion factor from per plot values to per hectare values for plots 1m, 4m, 14m and 20m in diameter.
Source of data	Calculations
Value(s) applied	Plot expansion factors are made using formula 10,000 / (π * radius^2) 1m plot = 10000/ (π * 1 * 1) = 10000/ 3.142m^2. = 3183 4m plot = 10000/ (π * 4 * 4) = 10000/ 50.265m^2. = 198.9 14m plot = 10000/ (π * 14 * 14) = 10000/ 615.75m^2. = 16.2 20m plot = 10000/ (π * 20 * 20) = 10000/ 1256.63m^2. = 8.0
Choice of data or measurement methods and procedures	See sampling design in section c
Purpose of data/parameter	Emissions calculations
Additional comments	Not applicable

Data/Parameter	*Za/2*
Unit	Dimensionless
Description	Value of the statistic *z* (normal probability density function) for*α=0.05* (implying a 95% confidence interval)
Source of data	*Sourcebook for LULUCF projects* Timothy Pearson, Sarah Walker and Sandra Brown, 2005)
Value(s) applied	1.96
Choice of data or measurement methods and procedures	See sampling design in section c
Purpose of data/parameter	Emissions calculations
Additional comments	Not applicable

D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

Data/Parameter	Sti
Unit	-
Description	Standard deviation for each stratum, i
Measured/calculated/ default	Calculated
Source of data	Calculated
Value(s) of monitored parameter	SD for each stratum has been calculated based on precision level of 10%. Refer the value from sampling design attached
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Before the start of the project and adjusted there after every 5-years

Calculation method (if applicable)	Not applicable
QA/QC procedures	
Purpose of data/parameter	Project emission calculations
Additional comments	Used for estimating numbers of sample plots of each stratum and stand, as necessary.

Data/Parameter	A
Unit	Hectares
Description	Total size of all strata
Measured/calculated/ default	Measured
Source of data	GIS and / or GPS
Value(s) of monitored parameter	2,728
Monitoring equipment	GIS and GPS
Measuring/reading/recording frequency	Before the start of the project and adjusted there after every 5-years
Calculation method (if applicable)	Not applicable
QA/QC procedures	
Purpose of data/parameter	Project emission calculations
Additional comments	Used for estimating numbers of sample plots of each stratum and stand, as necessary.

Data/Parameter	Area of planted strata
Unit	Ha
Description	
Measured/calculated/ default	Measured
Source of data	GIS calculations
Value(s) of monitored parameter	See Data Management Template Stratum 1 233.48 Ha Stratum 2 630.71 Ha Stratum 3 1694.64 Ha Stratum 4 114.41 Ha Stratum 5 50.7 Ha
Monitoring equipment	GPS
Measuring/reading/recording frequency	At the end of planting activities
Calculation method (if applicable)	Using GIS software
QA/QC procedures	
Purpose of data/parameter	Project emission calculations
Additional comments	Used for estimating numbers of sample plots of each stratum and stand, as necessary.

Data/Parameter	Ai
Unit	Hectares

Description	Area of stratum i
Measured/calculated/ default	Measured
Source of data	GIS and / or GPS
Value(s) of monitored parameter	A1 = 233.48; A2 = 630.71; A3 = 1698.71; A4 = 114.41; A5 = 50.7
Monitoring equipment	GPS and GIS
Measuring/reading/recording frequency	Before the start of the project and adjusted thereafter every 5-years
Calculation method (if applicable)	Using GIS software
QA/QC procedures	
Purpose of data/parameter	Project emission calculations
Additional comments	

Data/Parameter	AB, ijt
Unit	Hectares
Description	Area of slash and burn stratum i, species j, at time t
Measured/calculated/ default	Measured
Source of data	Measurement
Value(s) of monitored parameter	Zero (there has been no slash and burn for site preparation)
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Not applicable
QA/QC procedures	-
Purpose of data/parameter	Project emission calculations
Additional comments	There is no slash and burning in the project site

Data/Parameter	AP
Unit	m^2
Description	Sample Plot area
Measured/calculated/ default	Measured
Source of data	Field measurements using nested plots with radius of 1m 4m 14m and 20m. Plots are measured with a fibreglass tape from a fixed central point according to the process commonly used in forest inventories.
Value(s) of monitored parameter	3.142m^2, 50.265m^2, 615.75m^2 and 1256.36m^2
Monitoring equipment	Fibreglass tape (Craftech 30m/100ft) and Bouncing RABIT 50/165ft Zhongya measuring tape)
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	Not applicable

QA/QC procedures	Fibreglass tapes are checked for accuracy before undertaking field measurements against a new fibreglass tape. Review of measured data carried out in accordance with section c as and when data is collected.
Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	DBH
Unit	cm (living/dead)
Description	Diameter at breast height of living and standing dead trees
Measured/calculated/ default	Measured using a calliper or diameter tape, with 1.3m being measured with a fixed 1.3m measuring implement. Minimum DBH is 2 cm
Source of data	Plot measurements
Value(s) of monitored parameter	See data in permanent sample plots, Humbo data management template
Monitoring equipment	Diameter tape (Forestry suppliers, 160cm DBH, Cloth) and Calliper (metal Forestry Supplies 20cm diameter)
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	Equipment checked for accuracy against steel tape before measurements were undertaken in November 2017. Review of measured data carried out in accordance with section c as and when data is collected.
Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	Hj
Unit	M
Description	Height of species, j
Measured/calculated/ default	Measured
Source of data	Plot measurements
Value(s) of monitored parameter	As per EB 63 decision on minor amendments to AR projects, the Humbo project has modified the project design from BEF to the use of allometric equations therefore this parameter is not monitored. See Humbo CDM Data Management Template
Monitoring equipment	Measurement stick calibrated at 1 cm intervals
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	Review of measured data carried out in accordance with section c as and when data is collected.
Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	*T* ID
Unit	Years
Description	Age of plantation
Measured/calculated/ default	Calculated - counted since tree planted. Trees have different ages as they are planted at different years (2007=118,808, 2008=345,158, 2009= 168,676, 2010=75,350, 2011=17,365)
Source of data	Date of establishment
Value(s) of monitored parameter	See Humbo CDM Data Management Template
Monitoring equipment	Measurement stick calibrated at 1 cm intervals
Measuring/reading/recording frequency	At stand establishment
Calculation method (if applicable)	Not applicable
QA/QC procedures	Review of measured data carried out in accordance with section c as and when data is collected.
Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	*Volume of Fuel wood utilised from thinning and pruning*
Unit	tonnes
Description	Annually utilised volume of fuel wood *t.*
Measured/calculated/ default	Measured from sample plots
Source of data	Sample plots of Fuel wood utilised from pruning and thinning
Value(s) of monitored parameter	No timber has been harvested, however pruning and thinning generated as a result of the project have been utilised for fuel wood. Sample plots calculations show that between 6.4 and 8.2t of fuel wood has been harvested per hectare per year, and this is evenly distributed across all strata and species. See Humbo CDM Data Management Template and section E below.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	To estimate the amount of fuel wood that has been collected per hectare, sample plots of 100m^2 have been taken randomly from four cooperative areas. The selected cooperatives are Abela Longena, Bossa Wanche, Hobicha Bada and Hobicha Bongota where major pruning and tinning activities have been carried out. Five plots from each site have been taken for measurement. Branches and twigs removed as a result of this forest management has been collected into a bundle and measured separately. Finally, the average is computed for each cooperative site and converted in to hectare. See the value in table E1.
QA/QC procedures	Review of measured data carried out in accordance with section c as and when data is collected.
Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	*J*
Unit	Latin name
Description	Tree species.

Measured/calculated/ default	Measured
Source of data	Project List
Value(s) of monitored parameter	See Humbo CDM Data Management Template
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	Data cross checked against literature and species identified in Addis Ababa university by project manager after data collection
Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	*lat / long*
Unit	
Description	Plot location
Measured/calculated/ default	Measured
Source of data	Project and plot map and GPS Locating, GIS
Value(s) of monitored parameter	X, Y coordinates, see excel sheet permanent sample plot attached See Humbo CDM Data Management Template
Monitoring equipment	GPS equipment Model (Garmin GPS 72) adjusted in WSG 84 projection
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	GPS cannot be calibrated 10% of sample plots is remeasured. More information can be found in the QAQC report for Monitoring Period 2.
Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	nTR_{PLikt}
Unit	Numeric
Description	Number of trees in the sample plot
Measured/calculated/ default	Measured
Source of data	Plot measurement
Value(s) of monitored parameter	See Humbo CDM Data Management Template
Monitoring equipment	Chalk or coloured ribbon used to mark trees that have been measured to avoid double counting. No calibration needed.
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	

Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	*dNa EGL*
Unit	Dimensionless
Description	Number of animals displaced in *EGL* areas at time *t*
Measured/calculated/ default	Calculated
Source of data	Government Statistics on livestock numbers
Value(s) of monitored parameter	Zero, no animals have been displaced in EGL areas at time t. See Humbo CDM Data Management Template.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	
Purpose of data/parameter	Leakage calculations
Additional comments	Not applicable

Data/Parameter	*Na EGL t*
Unit	Dimensionless
Description	Number of animals present in the sampled *EGL* areas at time *t*
Measured/calculated/ default	Measured
Source of data	Government staff has collected data on the number of animals from the entire households in the project area. Number of animals has been taken from the government census results.
Value(s) of monitored parameter	Survey data attached “no of animals’ taken from government statistics, (16,031) see section E.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	Not applicable
QA/QC procedures	Data reviewed by project manager
Purpose of data/parameter	Leakage calculations
Additional comments	Not applicable

Data/Parameter	*PLi k*
Unit	Dimensionless
Description	Total number of plots in stratum i , stand model k
Measured/calculated/ default	Measured
Source of data	Field measurements
Value(s) of monitored parameter	ST1= 8, ST2=14, ST3= 57, ST4= 4, ST5 = 2. See sampling design attached to this monitoring report

Monitoring equipment	Not applicable
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	See sample design in section c
QA/QC procedures	Data reviewed by project manager
Purpose of data/parameter	Leakage calculations
Additional comments	Not applicable

Data/Parameter	*Slope*
Unit	%
Description	Slope of sample plots
Measured/calculated/ default	Measured
Source of data	Field measurements
Value(s) of monitored parameter	See Humbo Carbon Stock Data Analysis spreadsheet
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	See CDM operations manual
QA/QC procedures	Data reviewed by project manager
Purpose of data/parameter	Emission calculations
Additional comments	Not applicable

Data/Parameter	Project boundaries
Unit	**%**
Description	GPS points to be re-measured to ensure accuracy of project boundaries
Measured/calculated/ default	Measured
Source of data	Field measurements
Value(s) of monitored parameter	See excel sheet 'QA boundary'
Monitoring equipment	Garmin GPS 72 Accuracy • Position: < 15m, 95% typical • Velocity: 0.05m/sec steady state Garmin GPS 72 Cannot be calibrated
Measuring/reading/recording frequency	5 yearly
Calculation method (if applicable)	See sample design in section c
QA/QC procedures	A random sample of 10% of original GPS points has been monitored at this monitoring period to ensure accuracy of project boundaries.
Purpose of data/parameter	Emissions calculations
Additional comments	Not applicable

Data/Parameter	Seedling Survival
Unit	%
Description	% of seedlings relative to target stocking density
Measured/calculated/ default	Measured
Source of data	Field measurements
Value(s) of monitored parameter	Survival rates are 2012: 80%
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	3 months after planting then annually
Calculation method (if applicable)	Number of seedlings surviving / target stocking density
QA/QC procedures	A random sample of 10% of original GPS points has been monitored at this monitoring period to ensure accuracy of project boundaries.
Purpose of data/parameter	Not applicable
Additional comments	2012 was final year of assessing seedling survival

Data/Parameter	Site preparation/pitting/
Unit	Yes/No
Description	Sites that were disturbed during pit preparation
Measured/calculated/ default	Measured
Source of data	Field measurements
Value(s) of monitored parameter	Zero as there were not pits dug in the second monitoring period
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	At vegetation removal
Calculation method (if applicable)	Not applicable
QA/QC procedures	Not applicable
Purpose of data/parameter	Baseline emissions calulations
Additional comments	2012 was final year of assessing seedling survival

Data/Parameter	Weeding efficacy
Unit	%
Description	Efficacy of weeding
Measured/calculated/ default	Measured
Source of data	Field measurements
Value(s) of monitored parameter	Weeding have been carried out in all trees planted (100%)
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Quarterly year 1, then annually
Calculation method (if applicable)	Number of seedlings with insufficient weeding/number of seedlings measured

QA/QC procedures	Not applicable
Purpose of data/parameter	Baseline emissions calculations
Additional comments	2012 was final year of assessing seedling survival

D.3. Implementation of sampling plan

The project site required re-stratification in Monitoring Period 1 as a result of changes in the size of strata three and five. Once the project strata were revised and the area of each stratum identified, the sampling design was developed following the procedures in the approved methodology AM0003, Sourcebook for LULUCF projects, and monitoring manual developed by the World Bank

The sourcebook was used as the procedural guide as it was consistent with the methodology, and at the time when the project team was developing the sampling design, the tool for sample design 'Calculation of the number of sample plots for measurements with A/R CDM Project Activities' had not been developed at the time. Given the sourcebook could be easily adopted by the field staff, it was considered the most appropriate template for the stratification and sampling design.

Once re-stratification and revised map production has been completed, the preliminary 6 sample plots from each stratum was laid out according to the recommendation on page 15 in the source book for land use, land use and forestry projects (Timothy Pearson, Sarah Walker and Sandra Brown, 2005) employing +10% precision level from which required tree data to be collected to calculate mean carbon stock and standard deviation. The carbon mean stock and standard deviation would enable us to determine the actual number of permanent sample plots required in each stratum and the whole project site to meet the targeted precision level within 90% confidence interval as defined in the PDD. These permanent sample plots will be monitored over the crediting period to check the biomass changes throughout the project life time. Preliminary sample plots were located in the respective stratum randomly using software, called 'Hawths analysis tools" working in Arc GIS applying the following procedures:

a) a grid of points with a size equivalent to sample plots size (0.0625ha) have been created throughout the map of the project site
b) a sequential ID has been assigned to each point of grids inside the stratum starting from North to south, west to East
c) Using software operating in ARC GIS, preliminary sample plots locations (6 from each stratum) have been fixed.
d) Nested circular sample plots are used (the smallest circle with 1m; the second 4m, the third 14m and the fourth 20m radius). Since there were no trees found in diameter class >50 cm, the fourth circle was practically omitted.
e) In the first circle, diameter of trees at breast height (DBH) <5 cm; in the second circle, trees with 5-20 cm DBH and in the third, outer circle, trees with 20 - 50cm DBH were measured using calipers and diameter tape. Required tree data (DBH) from the 30 sample plots (6 from each stratum) were taken according to the source book for LULUCF page 15-16 and the data have been recorded - see the DBH collected from 24 sample plots (Annex -Table 1).

Using the dbh data collected from 30 preliminary sample plots, the mean density per each stratum was calculated using the formula (Biomass = 10(-0.535+log10basal area) developed for tropical dry lands from page 43 of the Sourcebook for Land Use, Land Use Change, and Forestry Projects (Timothy Pearson, Sarah Walker, and Sandra Brown, Winrock 2005).

Following this procedure, the total sample plots calculated was 77, with 10% contingency the total number of permanent sample plots is 85.

Once the total sample plots required from the project site to meet the targeted precision was calculated, the next step was to calculate the number of sample plots required to be distributed to each stratum. This is done using the following equation as indicated in page 17 in the sourcebook

for Land Use, Land Use Change, and Forestry Projects (Timothy Pearson, Sarah Walker, and Sandra Brown, Winrock 2005). Using this formula, the number of sample plots that have to be allocated to each stratum are 8 in stratum 1, 14 in stratum 2, 57 in stratum 3, 4 in stratum 4 and 2 in stratum 5.

To maintain statistical rigor and avoid subjective choice of plot locations, the permanent sample plots were located systematically with a random start Using ArcGIS randomization tool in ArcMap, random points are generated for each of the strata using a 25 x 25 m grid. This was accomplished in the field with the help of a GPS. The geographical position (GPS coordinate), number of stratum and series number of each plot and respective grid number has been recorded and archived. The sampling plots were evenly distributed and plot locations were over laid on the map as shown in the map below. The first plot in each stratum was randomly located using software called 'Hawth's analysis tools" operating in ARC GIS and the next sample plot was systematically located maintaining equal interval between successive sample plots. The following steps depict all the procedures followed.

1. A grid of points with a size equivalent to sample plots size (0.0625ha) has been created over the map of the project site (See figure 2).
2. A sequential ID has been assigned to each point of grids in side in the map starting from North to south, west to East.
3. The total possible sample plots in each stratum have been identified by archiving from the ARC GIS or by dividing the area of each stratum by the area of sample size see table 2.
4. Interval between each successive sample plots have been identified by dividing the total sampling (grids) points in each stratum to the number of required sample plots. The value is then rounded to the next integer.
5. Using "Hawths analysis tools" a soft ware operating in ARC GIS, the first sampling points in each stratum have been randomly selected and respective grid (ID) number as well as corresponding GPS point has also been recorded.
6. The next sampling point in each stratum has been identified systematically by adding or subtracting the interval to or from the grid (ID) number randomly selected as a first sample point and this has been continued until all the location of required sample plots have been identified.
7. Finally, locations of the sample plots identified from the whole project site have been displayed on the map using their corresponding geographic coordinates. These GPS points have been recorded to be fixed on the ground through navigation technique once the sampling design is approved see the distribution from the map below (figure-3).
8. Once the coordinates of each sample plot were identified in the ground, the DBH and tree height within each nested circular sample plots were measured (in 1m radius, tree DBH <5cm; the second 4m radius, DBH 5-20cm and in the third 14m radius, DBH 20-50cm) to estimate the carbon stock change over time. The centre of each circular sample plot was fixed with pointed stone for the time being and will then be replaced with metal bar. The metal bar will be buried 5-10cm below the ground to be detected by magnet during monitoring.

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

According to the methodology, the baseline carbon stock changes do not need to be monitored because the accepted baseline approach 22(a) assumes continuation of existing changes in carbon stock resulting in its further loss of regeneration ability. Baseline emissions are conservatively estimated at zero in the PDD based on the formula[2]:

[2] Equation numbering follows AR-AM0003 v4.

$$C_{BSL} = 0 \ for\ all\ t^* \leq t_{cp} \quad (1)$$

where:
CBSL = baseline net greenhouse gas removals by sinks; tonnes CO_2-e.
*t** = number of years elapsed since the start of the AR project activity; yr
tcp = year at which the first crediting period ends; yr

Verification Period	Baseline Emissions
02/12/2011 – 01/12/2017	0

E.2. Calculation of project emissions or actual net removals

According to the PDD the project is not expected to result in emissions. Several potential emissions sources were considered for the project including burning of fossil fuels and clearance of vegetation for site preparation and fertiliser application as per the methodology (equation 22).

$$GHG_E = E_{FuelBurn} + E_{BiomassBurn} \quad (22)$$

where:
GHGE = increase in GHG emission as a result of the implementation of the proposed AR CDM project activity within the project boundary; tonnes CO_2-e.
EFuelBurn = increase in GHG emission as a result of burning of fossil fuels within the project boundary; tonnes CO_2-e.
EBiomassBurn = increase in GHG emission as a result of biomass burning within the project boundary; tonnes CO_2-e.

However manual methods are used for carrying out the project tasks, therefore, minimal emissions associated with the use of fossil fuels are relevant for the project. Further to this, the recent decision at EB 63 Annex 26 page 3 identifies regarding estimation and accounting of emissions from burning of fossil fuel, both within and outside the project boundary. 'The project participant shall not be required to monitor data and parameters related to these emissions.'

There is no clearance or burning of vegetation for site preparation. The only emissions expected was due to pit preparation for new plantation. The area disturbed while preparing 725,357 pits is only 4.35ha as described above which is below 2% of the actual net greenhouse removals by sinks and therefore considered insignificant.

To summarise, project emissions are expected to be negligible because:

- Biomass burning is not undertaken in the project.
- The project does not use fertilizers

Live fences are used for fencing. Therefore, wood from project area is not used as the fencing material.

Given these criteria have been met in the monitoring period; the project emissions are identified to be zero.

Verification Period	Project Emissions
02/12/2011 – 01/12/2017	0

E.3. Calculation of leakage emissions

According to the methodology leakage is possible from several sources, and can be calculated from the formula:

$$LK = LK_{Activity Displacement} + LK_{fencing} \quad (28)$$

Leakage due to activity displacement (fuel wood collection and grazing) outside project boundary

To determine the amount of fuel wood being collected by the community from the project area is adequate or not, sample plots of 100m^2 have been taken randomly from four cooperative areas. The selected cooperatives are Abela Longena, Bossa Wanche, Hobicha Bada and Hobicha Bongota. Five plots from each site have been taken for measurement except for 2008, where only four sample plots from each cooperative were taken. Branches and twigs removed as a result of this forest management have been collected into a bundle and measured (by weight (kilograms)) separately. Finally, the average fuel wood collected per each year/ha is computed for each cooperative site and converted in to hectare see table E-1. The type of species pruned and collected include *Maytenus senegalensis, Terminalia brownie, Acacia brevispica, Grewia bicolour, Euclea racemosa, Balanites aegyptica, Combretum molle, Syzygium guineese.*

Table E-1 Fuel wood collected over the last ten years

Year	Abella Longena (t/ha)	Bossa Wanche (t/ha)	Hibicha Bada (t/ha)	Hobicha Bongota (t/ha)	Total (t/ha)	Average (t/ha)
Monitoring Period 1						
2008	4.2	4.9	5.45	5.85	20.4	5.1
2009	4.37	4.97	5.94	5.99	21.27	5.3
2010	4.71	5.16	5.81	6.50	22.19	5.5
2011	4.97	5.48	6.97	7.07	24.50	6.1
Monitoring Period 2						
2012	5.11	5.78	7.02	7.5	25.41	6.4
2013	5.35	5.9	7.52	7.95	26.72	6.7
2014	5.71	6.04	8.11	8.01	27.87	7.0
2015	5.94	6.5	8.92	8.4	29.76	7.4
2016	6.32	6.78	9.12	8.72	30.94	7.7
2017	6.48	7.4	9.79	8.99	32.66	8.2

From this table we can understand that leakage due to fuel wood displacement is zero as per the condition $FG_{BL}<FG_{AR,t}$, described on page 78 of AM0003-V4 where FG_{BLt} is average pre-project annual volume of fuel wood gathering in the project estimated ex ante and specified in the AR-CDM-PDD; tonnes YR^{-1} and $FG_{AR,t}$ is fuel wood gathered in the project area according to the monitoring result. As it is indicated in the PDD the pre-project annual volume of fuel wood gathering in the project area was 4.3 tonnes/ha. However, as shown in the table above, the fuel wood being collected in the project scenario is greater than pre-project volume of fuel wood collected.

Leakage due to livestock displacement is also considered through census results obtained from government statistics. The number of existing animals grazing on the non-project area before the project was 8,684 cow/ox/bulls and 2,288 goats. The current number of animals after the eleven-year project intervention is 12,194 (cow/ox/bulls/heifer/donkey) and 3,837 goats and sheep according to the government statistics shown in table E-2. The data shows farmers are increasing the number of livestock in the project scenario. The reason is that there was extra existing grazing land under the control of animal owners as described in the PDD that has been used to maintain the displaced animals, better management of the existing land due to various capacity building

training events given to the farmers on this sector and ample amount of grass being harvested from the project site since the closure. Some of the farmers are even selling grass harvested from the closed project site and generate income out of it. This evidence shows the project activity has not displaced the grazing animal population and leakage due to conversion of land to grazing land can be set as zero and no further monitoring step is needed as the condition NaBL<NaARt specified on page 76 of AM0003-V4 is met.

Table E-2 Livestock census of project area during the monitoring period

S/No	KA	Type of livestock									Total
		Ox	Cow	Heifer	Bull	Calf	Goat	Sheep	Donkey	Mule	
1	Abela Longena	492	486	311	296	293	439	548	223	0	**3088**
2	Abela Shoya	461	370	231	140	185	227	211	239	4	**2068**
3	Abela Gefeta	473	484	380	288	245	496	262	502	2	**3132**
4	Bosa Wanchie	287	261	120	220	192	200	170	42	0	**1492**
5	Bola Wanchie	159	150	111	107	132	103	121	121	2	**1006**
6	Hobicha Badda	450	282	297	292	331	32	112	73	2	**1871**
7	Hobicha Bongota	455	483	410	362	312	526	390	432	4	**3374**
	Total	**2777**	**2516**	**1860**	**1705**	**1690**	**2023**	**1814**	**1632**	**14**	**16031**

Emissions from fencing material

The project does not use any fencing material, only live fences and rocks delineating the project boundary have been used for fencing. Therefore, leakage resulting from fencing is considered to be zero.

Verification Period	Emissions from Leakage
02/12/2011 – 01/12/2017	0

E.4. Calculation of emission reductions or net anthropogenic removals

This section shall include the formulae used to calculate the emission reductions and the total of the emission reductions achieved during the monitoring period
The project emission reductions calculation is calculated using the methodology (AR-AM0003 version 4).

The project uses the Stock Change method, and within the method, tree dimensions are converted to tree biomass by applying allometric equations. The process uses equations 60-61 and 68-81. The process is followed in the spreadsheet 'Sample plot data – biomass – ARAM0003' as part of the data management template.

$$\Delta C_{P,LB} = \sum_{t=1}^{t^*} \sum_{i=1}^{m_{PS}} \sum_{k=1}^{K} \Delta C_{P,ikt} \qquad (60)$$

Where:

ΔCP,LB = sum of the changes in living biomass carbon stocks in the project scenario (above- and below-ground); tonnes CO2-e.

ΔCP,ikt = annual carbon stock change in living biomass in the project scenario for stratum *i,* stand model *k*, time *t;* tonnes CO2-e. yr-1

i = 1, 2, 3*, … mPS* ex-post strata

k = 1, 2, 3, … *K* stand models

t = 1, 2, 3, …*t** years elapsed since the start of the AR project activity

$$\Delta C_{P,ikt} = (\Delta C_{AB,ikt} + \Delta C_{BB,ikt}) \cdot \frac{44}{12} \quad (61)$$

Where:

ΔCP,ikt = annual carbon stock change in living biomass for stratum i, stand model k, time t; tonnes CO2-e. yr-1

ΔCAB,ik t = annual carbon stock change in above-ground biomass for stratum i, stand model k, time t; tonnes C yr-1

ΔCBB,ikt = annual carbon stock change in below-ground biomass for stratum i, stand model k, time t; tonnes C yr-1

Allometric method

Step 1 of the allometric method requires diameter at breast height (DBH) to be measured at 1.3m above ground.

Step 2 – Establish appropriate allometric equations

$$TB_{ABj} = f_j(DBH, H) \quad (68)$$

Where:

TBABj = above-ground biomass of a tree of species j; kg tree-1

fj(DBH,H) = an allometric equation for species j linking above-ground tree biomass (kg tree-1) to diameter at breast height (DBH) and possibly tree height (H) measured in plots for stratum i, species j, time t.

Step 3 - Once above ground biomass has been estimated using selected allometric equations in Step 2, the carbon stock in above ground biomass is estimated using equation 69.

$$TC_{AB} = TB_{ABj} \cdot CF_j \quad (69)$$

Where:

TCABj = carbon stock in above-ground biomass per tree; tonnes kg C tree-1

TBABj = above-ground biomass of a tree of species j; kg tree-1

CFj = carbon fraction of species j, tonnes C (tonne d.m.)-1, IPCC default value = 0.5

Step 4 - Calculate the increment of above-ground biomass carbon accumulation at the tree level as per equation 70

$$\Delta TC_{ABjT} = TC_{ABj,t2} - TC_{ABj,t1} \quad (70)$$

Where:

ΔTCABjT = carbon stock change in above-ground biomass per tree of species *j* between two monitoring events; kg C tree-1

ΔTCABj,t2 = carbon stock change in above-ground biomass per tree of species *j* at monitoring event *t2*; kg C tree-1

ΔTCABj,t1 = carbon stock change in above-ground biomass per tree of species *j* at monitoring event *t1*; kg C tree-1

Step 5 - Calculate the increment in above-ground biomass carbon of a tree species per plot on a per area basis.

$$\Delta PC_{AB,ijT} = \frac{\left(\sum_{tr=1}^{TR} \Delta TC_{ABjT} \cdot XF\right)}{1000} \quad (71)$$

$$XF = \frac{10{,}000}{AP} \quad (72)$$

Where:

ΔPCAB,ijT = plot level mean carbon stock change in above-ground biomass in stratum *i*, species *j*, between two monitoring events; tonnes C ha-1.

ΔTCABT = carbon stock change in above-ground biomass per tree between two monitoring events; kg C tree-1

XF = plot expansion factor from per plot values to per hectare values

AP = plot area; m2

tr = tree (TR = total number of trees in the plot)

Step 6 - Calculate mean carbon stock change within each stratum and stand model.

$$\Delta MC_{AB,ikT} = \frac{\sum_{pl=1}^{PL_{ik}} \sum_{j}^{J} \Delta PC_{AB,ijT}}{PL_{ik}} \quad (73)$$

Where:

ΔMCAB,ikT = mean carbon stock change in above-ground biomass in stratum *i*, stand model *k*, between two monitoring events; tonnes C ha-1

ΔPCAB,ijT = plot level mean carbon stock change in above-ground biomass in stratum *i*, species *j*, between two monitoring events; tonnes C ha-1

pl = plot number in stratum *i*, stand model *k*; dimensionless

PLik = total number of plots in stratum *i*, stand model *k*; dimensionless

Step 7 - Estimate carbon stock in below-ground biomass using root-shoot ratios and above-ground carbon stock and apply steps 4 and 5 to below-ground biomass for single trees of a species.

$$TC_{BBj} = TC_{ABj} \cdot R_j \quad (74)$$

$$\Delta TC_{BBjT} = TC_{BBj,t2} - TC_{BBj,t1} \quad (75)$$

$$\Delta PC_{BB,ijT} = \frac{\left(\sum_{tr=1}^{TR} \Delta TC_{BBjT} \cdot XF \right)}{1000} \quad (76)$$

$$\Delta MC_{BB,ikT} = \frac{\sum_{pl=1}^{PL_{ik}} \sum_{j}^{J} \Delta PC_{BB,ijT}}{PL_{ik}} \quad (77)$$

Where:

TCBBj = carbon stock in below-ground biomass per tree of species j; kg C tree-1

TCABj = carbon stock in above-ground biomass per tree of species j as calculated in step 1; kg C tree-1

Rj = root-shoot ratio appropriate to increments for species j; dimensionless

ΔTCBBjT = carbon stock change in below-ground biomass per tree of species j between two monitoring events; kg C tree-1

ΔPCBB,ijT = plot level carbon stock change in below-ground biomass of species j between two monitoring events; tonnes C ha-1

XF = plot expansion factor from per plot values to per hectare values; dimensionless

tr = tree (TR = total number of trees in the plot)

ΔMCBB,ikT = mean carbon stock change in below-ground biomass for stratum i, stand model k, between two monitoring events; tonnes C ha-1

ΔPCBB,ijT = plot level carbon stock change in below-ground biomass for stratum i, species j, between two monitoring events; tonnes C ha-1

pl = plot number in stratum i, stand model k; dimensionless

PLik = total number of plots in stratum i, stand model k; dimensionless

Step 8 - Calculate the annual carbon stock change by dividing by the number of years between monitoring events.

$$\Delta MC_{AB,ikt} = \frac{\Delta MC_{AB,ikT}}{T} \quad (78)$$

$$\Delta MC_{BB,ikt} = \frac{\Delta MC_{BB,ikT}}{T} \quad (79)$$

Where:

ΔMCAB,ikt = annual mean carbon stock change in above-ground biomass for stratum i, stand model k, at year t; tonnes C ha-1 yr-1

ΔMCBB,ikt = annual mean carbon stock change in below-ground biomass for stratum i, stand model k, at year t; tonnes C ha-1 yr-1

ΔMCABikT = mean carbon stock change in above-ground biomass for stratum i, stand models k, between two monitoring events; tonnes C ha-1

ΔMCBBikT = mean carbon stock change in below-ground biomass for stratum i, stand model k, between two monitoring events; tonnes C ha-1

T = number of years between two monitoring events which in this methodology is 5 years

Step 9 - The annual carbon stock change in living biomass for each stratum i, species j at time t is calculated from the area of each stratum i, species j at time t and the annual mean carbon stock change in above-ground biomass and below-ground biomass per unit area, given by:

$$\Delta C_{AB,ikt} = A_{ikt} \cdot \Delta MC_{AB,ikt} \quad (80)$$

$$\Delta C_{BB,ikt} = A_{ikt} \cdot \Delta MC_{BB,ijt} \quad (81)$$

Where:

Aikt = area of stratum i, stand model k, at time t; hectare (ha)

ΔCAB,ikt = changes in carbon stock in above-ground biomass for stratum i, stand model k, at time t; tonnes C yr-1

ΔCBB,ikt = changes in carbon stock in below-ground biomass for stratum i, stand model k, at time t; tonnes C yr-1

ΔMCAB,ikt = annual mean carbon stock change in above-ground biomass for stratum i, stand model k, at year t; tonnes C ha-1 yr-1

ΔMCBB,ikt = annual mean carbon stock change in below-ground biomass for stratum i, stand model k, at year t; tonnes C ha-1 yr-1

The above process is followed in the spreadsheet 'Sample plot data – biomass – ARAM0003' with the estimation of net anthropogenic GHF removals by sink summarised in Table E-3.

Table E-3 estimation of baseline GHG emissions or baseline net GHG removals, GHG project emissions by source, leakage and net anthropogenic GHF removals by sink

	Baseline GHG emissions or baseline net GHG removals ($t CO_2e$)	Project GHG emissions or actual net GHG removals ($t CO_2e$)	Leakage GHG emissions ($t CO_2e$)	GHG emission reductions or net anthropogenic GHG removals ($t CO_2e$)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	0	0	0	0	109,583.8	109,583.8

Actual GHG removals by sinks therefore can be calculated by taking the pre-existing biomass from the project, established at validation (43,711.7 tonnes of CO2e), and subtracting this from the total biomass calculated from the permanent sample plots (226,634.5). Since there are no project emissions, the total net actual GHG removal by sinks is 182,922.8. Net actual GHG removals by sinks was 73,339 for the first monitoring period. Therefore, the CERs accrued from the project activity in this monitoring period is 109,584 (182,923 - 73,339).

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period ($t CO_2e$)	Amount estimated ex ante ($t CO_2e$)
109,583.8	268,182.8

E.6. Remarks on increase in achieved emission reductions

Emissions reductions are lower in the MR than were anticipated *ex ante* in the registered CDM PDD. Possible factors which may have influenced changes in emission reductions include:

- Lower growth than expected possibly due to drier than expected conditions.

These reasons have led to an overall decrease in emissions reductions of approximately 59%.

Document information

Version	*Date*	*Description*
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		