PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 04

CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) Version 04

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SECTION A. General description of the proposed A/R CDM project activity:

A.1. Title of the proposed A/R CDM project activity:

>> **Humbo Ethiopia Assisted Natural Regeneration Project**

Version 01
Date: August 18, 2008

A.2. Description of the proposed A/R CDM project activity:

>> The proposed afforestation / reforestation activity, the Humbo Assisted Regeneration project, involves the restoration of indigenous tree species in a mountainous region of South Western Ethiopia. The project contributes to climate change mitigation objectives by contributing to the GHG removals by sinks through assisted natural regeneration project. Furthermore, the project compliments to the natural resource management goals of the Ethiopian Agricultural and Rural Development Coordination Office (ARDCO), and social development goals of the Ethiopian government, and the World Vision Australia, the humanitarian organization implementing the project.

The latest estimates show that Ethiopia has less than 2.7% of its original high forest. It is reported that about 40,000 hectares or 0.8% of total forest cover has lost between 1995 and 2000 (GPG for LULUCF 2003, table 3A.1.1). The loss of forest cover has adverse affect on livelihoods of communities and as well as biodiversity. It is reported that Ethiopia has some 119 species on the IUCN Red List of threatened species, and eight of which are considered critically endangered. This project seeks to establish biodiverse native forest and support income and employment generation activities through assisted natural regeneration of the Humbo area.

Photo A-1. Humbo Project Site (in the background)

The project activities contribute 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 income stream for communities through sustainable harvesting of forest resources.

To achieve these goals, this project seeks to undertake the following activities:

- Restoration of approximately 2728 hectares of biodiverse natural forest in the Humbo Woreda, using indigenous and naturalized species.
- Community management of public land with multiple objectives of promoting natural resource management, poverty alleviation and biodiversity enhancement
- Development of a model of community land use that would enhance GHG removals by sinks from regenerating native vegetation, which can be replicable in other regions of Ethiopia.
- Formation of seven community cooperative societies and securing legal title to manage the proposed regeneration area, and adopting a constitution and by-laws to manage the project.
- Establishment of institutional structure with right to the Certified Emissions Reductions (CERs) generated from the site.
- Establishment of a system to monitor the carbon stocks and recording and reporting on the changes in carbon stocks.
- Establishment of a system to monitor the environmental and social issues relevant to the project.

The implementation of farmer managed natural regeneration (FMNR) will be done over a period of three to five years. Species endemic to the area are used to restore the forest. These will include *Acacia spp*., *Aningeria adolfifericii*, *Podocarpus facutus*, *Olea africana*, *Cordia Africana*, *Croton macrostachytus*, *Erthrina spp*., *Ficus spp*, *Hagenia abyssinica*,, among others. The naturalized species such as *Gravilea robusta* and *Eucalyptus globulus* are also considered for planting in blocks and on the perimeter of the sites.

No generically modified organisms or invasive alien species are used in this project

The project developer, World Vision, has experience in community capacity building, and in protecting and restoring forest ecosystems in Ethiopia and other countries of Sub-Saharan Africa. This project fits within the goals of World Vision, the local government and the local community goals of transforming communities through sustainable development activities and offers the following benefits.

- Development of more robust land use and land access rights
- Protection of fragile water catchment areas
- Protection against land erosion
- Facilitation of income generation and community asset creation and awareness generation.

The Humbo Assisted regeneration project seeks to establish seven community cooperative societies, which have legal ownership to 2728 hectares of community land. These groups intend to manage the areas for the purposes of carbon removal using the Farmer Managed Natural Regeneration techniques (see section A.4.4) environmental benefits (biodiversity, water quality, and habitat) and income producing activities for the local population. Bylaws agreed upon at project inception will form the rules for community cooperative societies to manage the project. The cooperative societies will comprise representatives from World Vision, the ARDCO, local community and gender categories.

A.3. Project participants:

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Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Indicate if the Party involved wishes to be considered as a project participant (Yes/No)
Federal Democratic Republic of Ethiopia (host)	World Vision Ethiopia and World Vision Australia	No
Government of Canada	International Bank for Reconstruction and Development as a trustee of BioCarbon Fund	Yes
(*) In accordance with the CDM A/R modalities and procedures, at the time of making the CDM-AR-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		
Note: When the CDM-AR-PDD is prepared to support a proposed new baseline and monitoring methodology (form CDM-AR-NM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

A.4. Description of location and boundaries of the A/R CDM project activity:

A.4.1. Location of the proposed A/R CDM project activity:

The proposed activity is located in the Humbo Woreda, Wolayita zone, Southern Nations Nationalities and Peoples Region (SNNPR), South Western Ethiopia.

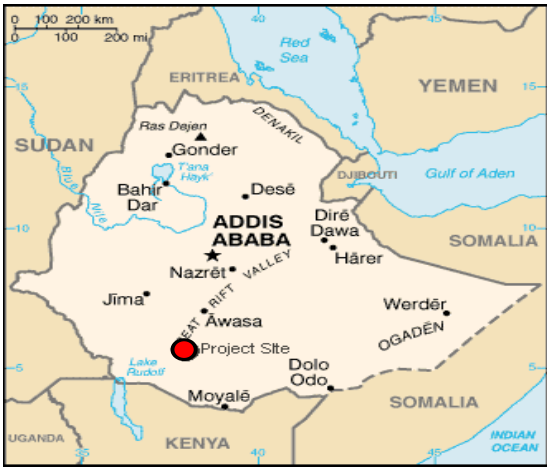


Figure A –1 ● Location of the proposed CDM activity within Ethiopia

A.4.1.1. Host Party(ies):

>> Federal Democratic Republic of Ethiopia

A.4.1.2. Region/State/Province etc.:

>> Southern Nations Nationalities and Peoples Region (SNNPR), Wolayita zone, Humbo Woreda.

A.4.1.3. City/Town/Community etc:

>> The community of Humbo, and the mountainous areas to the North West and South East, as demonstrated on the map in section 4.1.4.

Humbo (Tebella) Township approximate coordinates:

Latitude	From 6° 46'48.47 to 6° 41'04.28 N
Longitude	From 37° 48'35.44 to 37° 55'14.51 E

A.4.2 Detailed geographic delineation of the project boundary, including information allowing the unique identification(s) of the proposed A/R CDM project activity:

>> An project comprises an area of 2728 hectares delineated using GPS. The project lands are administered by Kebele (village regions). .

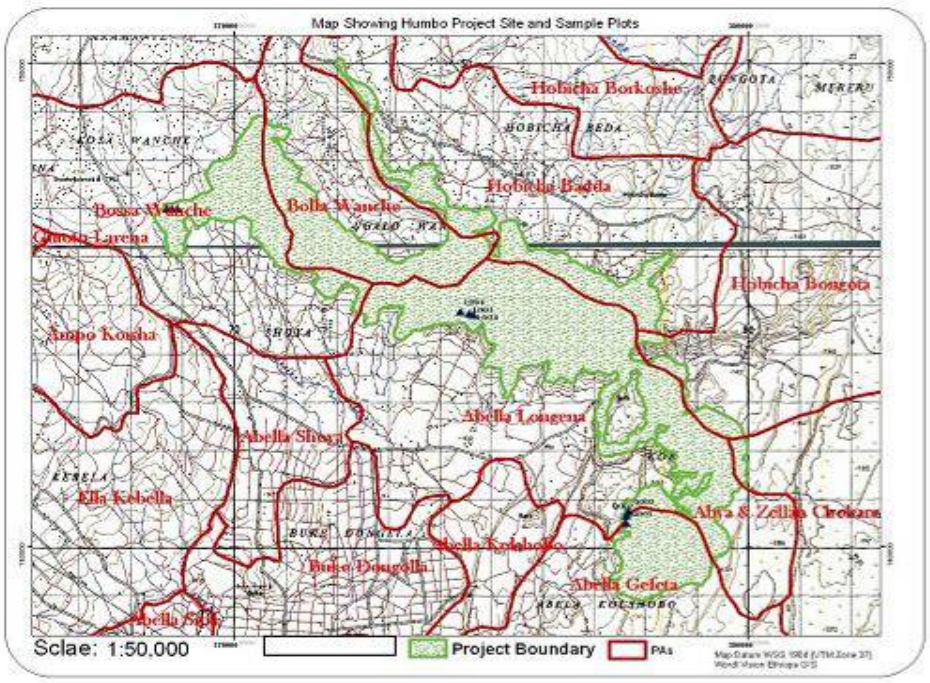


Figure A-2 Area to be regenerated in the Humbo Woreda

A.5. Technical description of the A/R CDM project activity:

A.5.1. Description of the present environmental conditions of the area planned for the proposed A/R CDM project activity, including a concise description of climate, hydrology, soils, ecosystems (including land use):

>> **Climate**

The Inter Tropical Convergence Zone (ITCZ) has influence on the climate in the Humbo region. With the northward movement of the ITCZ between May and October, warm moist air is drawn from the Indian Ocean, which causes rainfall on the southern slopes of the Ethiopian Highlands. During the remainder of the year, the ITCZ lies south of the highlands, and the winds move from the Red Sea to the north and east. These winds typically contain less moisture and cause rainfall on the northern side of the highland massif. From May to October, winds blow from the southwest and bring rainfall. During the rest of the year, onshore winds from the Red Sea bring moisture to the Northern regions of the country while the areas around Humbo remain drier. Overall, the highest annual rainfall (up to 2,500 mm) is on the south-western scarp faces of the highlands, which support montane or transitional forests.

Humidity is sometimes high due to cloud precipitation and local interactions between topography and weather. Unlike the moist equatorial mountains, the effects of cold descend further down on these dry highlands. Temperatures vary according to the season and elevation, but mean maxima range from 18 to 24^{o}C and mean minima from 12 to 15^{o}C

Surface Hydrology

Rainfall in the project region varies from 700-1000mm (see Map 1). Due to the steep terrain and denuded soil, erosion can be severe, and heavy rains cause flooding of low-lying areas. In times of extreme rainfall, mudslides damage roads, bridges and other infrastructure and cause localized flooding.

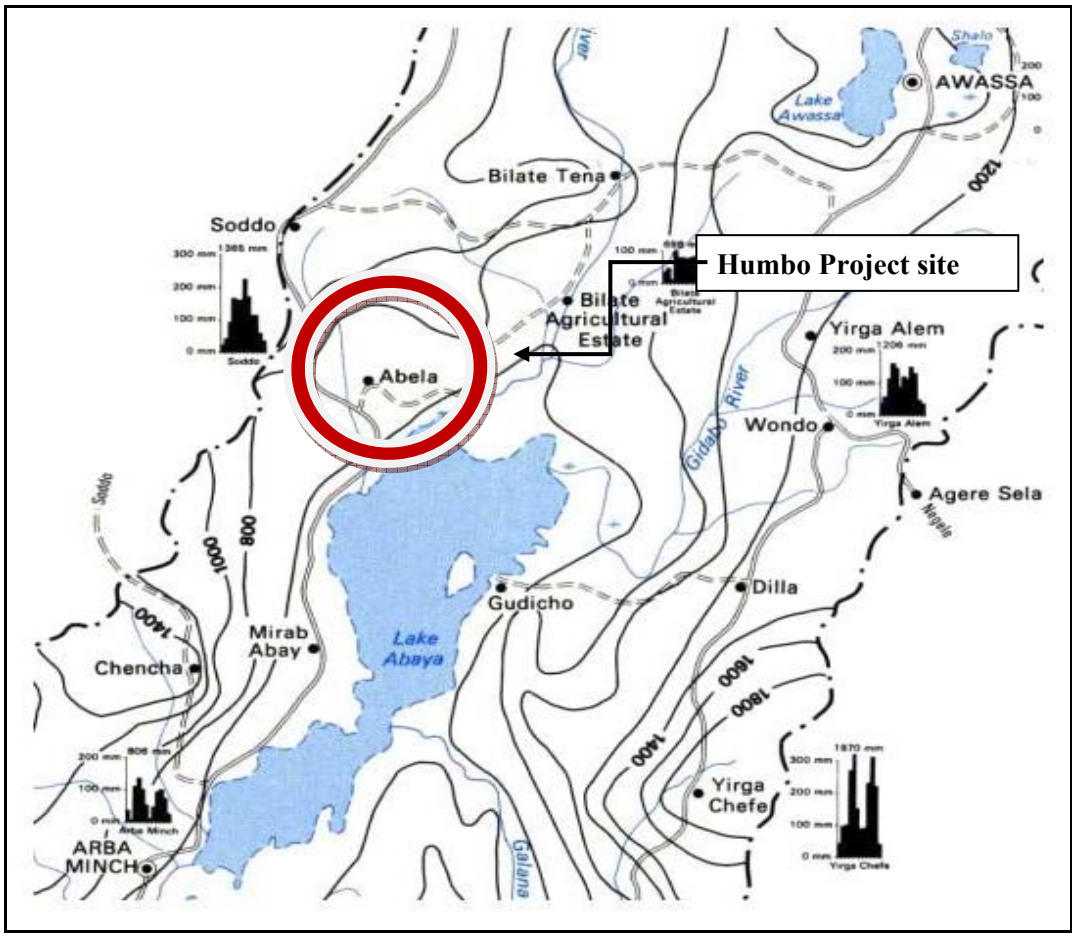
The catchment of the Abaya - Chamo Basin covers an area of approximately 18,000 km², so the Humbo and Soddo areas form a small part of this large hydrological system. Lake Chamo and Lake Abaya have a combined surface area of 1,440 km². The headwater areas also extend into the Western and Eastern Ethiopian Highlands and the lakes are located at the bottom of the Rift Valley. Decades of erosion has turned the waters of Lake Abaya to a murky brown colour due to high ferrous hydroxide and sediment load which are threats to the lake ecosystem.

Subsurface Hydrology

The site is located immediately above the Likemse springs, a hydrological system which deliver potable water to a population of over 65,000 people in and around Humbo. Reduction in vegetation cover, clearing for agriculture and grazing, has resulted in a loss of groundwater. The project could play a significant role in reducing the runoff and helping to conserve the water supplies required for meeting the potable water needs in the region.

Geology

The project site runs along the edge of the Ethiopian portion of the Great Rift Valley. This geological feature runs north to south for some 5,000 km, from northern Syria in Southwest Asia to central Mozambique in East Africa. The valley formed in the rifts of African and Arabian tectonic plates varies in width from 30-100 km and a few hundred to several thousand meters in depth.



Map A-1 Rainfall in the Abaya district

The southern end of the Red Sea marks a fork in the rift. The Afar Triangle or Danakil Depression of Ethiopia is the probable location of a triple junction that is underlain by a mantle plume. The Gulf of Aden is an eastward continuation of the rift and before the rift opened, the Arabian Peninsula was attached to the Horn of Africa. From this point the rift continues as part of the Mid-oceanic ridge of the Indian Ocean. In a southwest direction the fault continues as the Great Rift Valley, which split the older Ethiopian highlands into two halves.

The Ethiopian Highlands are a rugged mass of mountains in Ethiopia and Eritrea in northeastern Africa and form the largest continuous area of its altitude in the continent with over 1500 m (5000 ft). The summits reach up to 4900 m (15,000 to 16,000 ft).

Soils

Soils in the project area have been identified as Vertisols/Nitosols, underlain with ancient Precambrian basement rocks in the plains and calcareous soils at the hills These soil types are common in the Ethiopian Highlands with a Nitosol / Vertisol gradient often occurring between the higher/steeper areas

and the lower flatter areas. Nitosols are highly erodible and often acidic. Over-clearing has led to significant soil erosion problems, with mudslides occurring on the site[1].

Biodiversity

The project offers a significant opportunity to realize biodiversity outcomes alongside those of climate protection through the reestablishment of natural habitat. Indigenous species will be naturally regenerated or planted resulting in biodiversity. Natural regeneration will improve ecological succession, creating the conditions for establishing climax species for ecological community, and for maintenance of forest cover.

Fast-growing naturalized species will also be planted on the perimeter and within the project boundary to enhance fuel wood and charcoal supply. The naturalized species have been used by the communities over a long period. The re-establishment of native forests will provide wildlife habitat and improve floral and faunal diversity and will enhance natural regeneration through improved seed dispersal.

Vegetation of the project area
The vegetation categories of the project area includes Ethiopian montane grassland and woodland and Ethiopian montane forest.[2]

Ethiopian montane grasslands and woodlands[3]

Conservation status: *critical/endangered*
The montane vegetation includes Hagenia abyssinica, Podocarpus falcatus and Juniperus procera. A variety of Ethiopian endemic species including the critically endangered Walia ibex (Capra walie) and endangered mountain Nyala (Tragelaphus buxtoni) are found in the region. The endemism peaks in the forest/ woodland/ grassland complex. As the region is densely populated, there is significant anthropogenic pressure on the vegetation areas. The area of the proposed Humbo Community Forest was cleared in the mid 1970's (see Annex 6).

Biodiversity features

The ecoregion has a number of endemics in all taxonomic groups, and covers the two endemic bird areas[4]. The south Ethiopian Highlands endemic bird area is centered on the forests, grasslands and thickets to the southwest of the Bale Mountains and around the town of Yabello. Ruppell's chat (*Myrmecocichla melaena*) and Ankober serin (*Serinus ankoberensis*) are two notable near-endemic areas. Among the birds, only the lineated pytilia (*Pytilia lineata*) is endemic to this ecoregion. A number of Ethiopian endemics occur only in this ecoregion and the Ethiopian Montane Moorland ecoregion. These high altitude ecoregions are especially known for their diversity of small mammals with over 10 near-endemic species, but also harbour notable near-endemic large mammals, such as the Walia ibex *(Capra walie),* the

[1] See fao.org/Wairdocs/ILRI/x5493E/x5493e19.htm

[2] These two biological communities and the threats they face have been detailed by the World Wildlife Fund, and can be found at www.worldwildlife.org.

[3] Ecological descriptions were sourced from wwf.org.

[4] *Stattersfield, A.J., Crosby, M.J., Long, A.J. & Wege, D.C. 1998.* Endemic Bird Areas of the World. Priorities for Biodiversity Conservation. *BirdLife Conservation Series No. 7. BirdLife International, Cambridge, UK. 846 pp.*

mountain Nyala *(Tragelaphus buxtoni),* and the Gelada Baboon *(Theropithecus gelada).* Most of these species are shared with the Ethiopian Montane Moorland ecoregion.

At least 10 amphibians are endemic or near-endemic to the ecoregion, together with five species of near-endemic reptiles. Most of the species are shared either with the lower altitude Ethiopian Montane Woodland ecoregion, or with the higher altitude Ethiopian Montane Moorland ecoregion.
The mountain Nyala is not a montane specialist, but has been restricted to Afromontane areas through habitat loss. Found only in the southern part of the highlands, the lower reaches of its altitudinal range are more suitable to the mountain Nyala than the higher, less vegetated ones, but the lower habitat has mostly been converted to cultivation and pastoralism[5]. The mountain Nyala population in Bale Mountains National Park was thriving until 1991 when it was severely reduced by local people, in protests and upheaval associated with the change in government. Another antelope commonly found at lower elevations is Menelik's bushbuck *(Tragelaphus scriptus meneliki*), a subspecies of bushbuck endemic to Ethiopia.

A number of the endemic species are endangered. Threatened bird species include two near-endemics, the Ankober serin (*Serinus ankoberensis*, EN) and the white-winged flufftail (*Sarothrura ayresi*, EN). Several distinctive mammalian endemics face global extinction. The walia ibex numbers fewer than 400 individuals (Nievergelt et al. 1998), and it is threatened through habitat loss and hybridization with free-ranging domestic goats. Other mammals found in this ecoregion include olive baboon (Papio *anubis*), black and white colobus monkey (*Colobus guereza*), golden jackal (*Canis aureus*), leopard (*Panthera pardus*), lion (*Panthera leo*), spotted hyaena (*Crocuta crocuta*), caracal (*Caracal caracal*), serval (*Felis serval*), bush duiker (*Sylvicapra grimmia*) and bush pig (*Potamochoerus porcus*). Two different subspecies of the *Cercopithecus* superspecies are found in this ecoregion: the Djam-djam or Bale monkey (*Cercopithecus aethiops djamdjamensis*, DD), which is restricted to the southern highlands and the black-faced vervet (*Cercopithecus aethiops aethiops*). All these species, including the black and white colobus monkey, are suffering from a decrease in suitable habitat. Colobus populations are increasingly fragmented, with groups living in small remnant forest patches, often a single church graveyard.

Ethiopian montane forests

Conservation Status: *critical/endangered*

The Ethiopian montane woodland ecoregion is biodiverse, poorly known and highly threatened. The rugged topography of this ecoregion rings the highlands of Ethiopia and Eritrea, extending to outlying massifs in Sudan. Remnant patches of natural vegetation consist mostly of podocarp and juniper forests, with some acacias found at lower elevations. While soils are rather infertile, this area is densely populated and most land has been converted to agriculture where the topography permits, however there is no agriculture practiced within the boundary of the project. Notable endemics found here include the yellow-throated serin and Prince Ruspoli's turaco. Many of the endemic species are threatened due to the loss of their habitat

Biodiversity features

[5] Kingdon, J. 1989. Island Africa: The evolution of Africa's rare animals and plants. Princeton University Press. Princeton, NJ, USA. 287 pp

Forest types present in this ecoregion range from wet to dry, giving the area high biodiversity values. The patterns of endemism and their association with the forests of the area are complex and have been presented previously[6,7]. There is an area of bird endemism on the southeast corner of the southern Ethiopian highlands and another one in the higher plateau of the northern Ethiopian highlands and Eritrea[8]. Other plant and animal endemics are found along the drier northeastern margins of the Ethiopian highlands, which link to the mountains of northern Eritrea and Somalia as well as the Day Forest in the Goda Massif in Djibouti.

Threatened species include four strict endemics, including Djibouti francolin (*Francolinus ochropectus*, CR), Harwood's francolin (*Francolinus harwoodi*, VU), Prince Ruspoli's turaco (*Tauraco ruspoli*, VU) and yellow-throated seedeater (*Serinus flavigula*, VU), all of which are primarily threatened by habitat loss[9] (Magin 2001). Prince Ruspoli's turaco is further restricted where its range overlaps with the near-endemic white-cheeked turaco (*Tauraco leucotis*). Where both species are present, Prince Ruspoli's turaco is only found in juniper forest, but where it occurs alone, it inhabits both broad-leaved and juniper forest. Both birds are part of a recent radiation of small, red-winged turacos. However, the white-cheeked turaco is extremely adaptable and the regional representative of a type that is found across all of Africa. Prince Ruspoli's turaco has not become significantly distinct and is declining as the white-cheeked turaco advances[19].

The ecoregion also contains part of the South Ethiopian highlands endemic bird area[22], centered on the forests, grasslands and thickets to the southwest of the Bale Mountains and including the Yabello Sanctuary at around 1,700 m where the endemic Sidamo lark (*Heteromirafra sidamoensis*, EN), white-tailed swallow (*Hirundo megaensis*, VU) and Ethiopian bush-crow (*Zavattariornis stresemanni*, VU) occur. Other birds considered as near-endemic to this ecoregion include dark-headed oriole (Oriolus *monacha*), Abyssinian catbird (*Parophasma galinieri*), Abyssinian slaty flycatcher (*Dioptrornis chocolatinus*), and yellow-fronted parrot (*Poicephalus flavifrons*).

Mammals with ranges restricted to Ethiopia that occur in this ecoregion include the shrew, (*Crocidura harenna*) CR, the narrow-footed woodland mouse (*Grammomys minnae*), and Menelik's bushbuck (*Tragelaphus scriptus meneliki*), a subspecies of bushbuck with long, dark fur. Males are black while females are chestnut colored with white spots. Some other mammals found in this ecoregion are: olive baboons (*Papio anubis*), black and white colobus monkeys (*Colobus guereza*), black-faced vervet monkey (*Cercopithecus aethiops aethiops*), bush duikers (*Sylvicapra grimmia*), warthogs (*Phacochoerus aethiopicus*), bush pigs (*Potamochoerus porcus*) and hippopotamus (*Hippopotamus amphibius*). Predators include caracals (*Caracal caracal*), golden jackals (*Canis aureus*), black backed jackals (*Canis mesomelas*), leopards (*Panthera pardus*, EN), lions (*Panthera leo*, VU), spotted hyaenas (*Crocuta*

6 Friis, I. 1992. *Forests and Forest Trees of Northeast Tropical Africa*. HMSO, Kew Bulletin Additional Series XV

7 Lovett, J. C. and I. Friis. 1996. Patterns of endemism in the woody flora of north-east and east Africa. Pages 582-601 in L. J. G. van der Maesen, X. M. van der Burgt, J. M. van Medenbach de Rooy, editors. The Biodiversity of African Plants. The Netherlands: Kluwer Academic Publishers

8 Stattersfield, A.J., Crosby, M.J., Long, A.J. & Wege, D.C. 1998. *Endemic Bird Areas of the World. Priorities for Biodiversity Conservation*. BirdLife Conservation Series No. 7. BirdLife International, Cambridge, UK. 846 pp

9 Magin, G. 2001. Djibouti chapter in: Fishpool, L.D.C. and Evans, M.I. (eds). Important Bird Areas in Africa and associated islands: priority sites for conservation. Newbury and Cambridge, U.K: Pisces Publications and BirdLife International (BirdLife Conservation Series No. 11)

crocuta) and servels (*Felis serval*). Antelope species found here include Swayne's hartebeest (*Alcelaphus buselaphus swaynei*, EN), Guenther's dikdik (*Madoqua guentheri*) and greater kudu (*Tragelaphus strepsiceros*). Many of these larger mammals are only found in protected areas, most notably Nechisar National Park and Sikele reserve. In the early 1900s, elephant (*Loxodonta africana*), black rhinocerus (*Diceros bicornis*), buffalo (*Syncerus caffer*) and oryx (*Oryx gazella*) were found in the Nechisar area but all have been eliminated[10].

Although accurately ascribing species of amphibian and reptile to this complex ecoregion has proven problematic, there are believed to be a number of near-endemic species of both taxonomic groups in these forests. Of the five endemic amphibians two are tree frogs (*Afrixalus clarkei* and *Afrixalus enseticola*), two are ranid frogs (*Phrynobatrachus bottegi* and *Phrynobatrachus sciangallarum*), and one is a caecilian (*Sylvacaecilia grandisonae*). Two endemic chameleons are found, including two species of chameleons, *Chamaeleo balebicornutus* and *Chamaeleo harennae.*

A.5.2. Description of the presence, if any, of rare or endangered species and their habitats:

>> This region contains several threatened species, identified in the World Conservation Union (IUCN) red list, associated with the temperate and tropical mountain forest habitats which are anticipated to benefit directly from the proposed project. These are identified in Table A-1.

Table A-1. IUCN Red List Species endemic to the project area

Afrixalus enseticola	Ethiopian Banana Frog (E)
Caprimulgus solala	Nechisar Nightjar (E)
Grammomys minnae	Ethiopian Thicket Rat (E)
Heteromirafra sidamoensis	Sidamo Bushlark
Hipposideros megalotis	Ethiopian Large-Eared Roundleaf Bat (E)
Kerivoula eriophora	Ethiopian Woolly Bat (E)
Lycaon pictus	African Wild Dog
Panthera leo	African Lion
Vulpes pallida	African Sand Fox
Phoenicopterus minor	Lesser Flamingo

A.5.3. Species and varieties selected for the proposed A/R CDM project activity:

>> Tree species to be included in reforestation schedules include those indigenous to the project area, and other naturalized species that are widely used[11]. It is envisaged there will be many grass, ground layer, and shrub species, which will establish on the site with the progress in project implementation. The species proposed for planting include:

Table A-2 Species proposed for planting in the project.

Supplemental planting	Buffer zone plantation	Live fence & erosion control
Shinus molle		*Euphorbia abyssinica*
Eucalyptus camaldulensis	*Azadiractha indica*	*Euphorbia tirucalli*
Acacia saligna	*Casuarina cunninghamia*	*Agave americana*

[10] Yalden, D.W., Largen, M.J., Kock, D., Hillman, J.C. 1996. Catalogue of the mammals of Ethiopia and Eritrea. 7. Revised checklist, zoogeography and conservation. *Tropical Zoology* **9:** 3-164

[11] A Forestry analysis has been prepared and is available as annex 6.

Moringa stenopetela	*Casuarina equisitiolia*	*Aloe abyssinica*
Bahuinia tomentosa	*Shinus molle*	*Euphorbia scoparia*
Acacia nilotica	*Eucalyptus camaldulensis*	*Euphorbia candelabrum*
Pakinsonia aculeata	*Eucalyptus saligna*	
Podocarpus falcatus *Eucalyptus globulus* *Pygeum africanu* *Hagenia abyssinica* *Syzygium guineesense* *Cordia africana* *Olea africana* *Albizia gummifer* *Azadiractha indic* *Phytolacca dodecandera* *Vernonia amygadalina* *Crotolaria anchnocarpoides* *Acacia saligna* *Acacia melanoxylon* *Psidium guajava* *Rosa abyssinica* *Erythrina brucei* *Grevillea robusta* *Rubus apetalus* *Morus alba* *Delonix regia* *Robinia pseudoacacia* *Juglans regia* *Ficus* spp. *Croton macrostachys* *Carisa edulis* *Maytenus ovatus,* *Hibiscus rosa* *Acacia abyssinica*		

A.5.4. Technology to be employed by the proposed A/R CDM project activity:

>> The Technology to be employed in this project is Farmer Managed Natural Regeneration[12] (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.[13]

The Farmer Managed Natural Revegetation Technique

[12] For more information on FMNR www.irinnews.org/report.asp?ReportID=55911&SelectRegion=West_Africa

[13] IPCC definition: Afforestation/ reforestation is defined as the direct human induced conversion of non forested land to forested land through planting seeding and/or the human induced promotion of natural seed sources. AR-AM0003 classifies the management of resprouting shoots as one example of 'natural seed sources'.

Farmer managed Natural Revegetation (FMNR) is a system of farm and forest vegetation established by poor 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[14] and Dr. Peter Cunningham, SIM International, has documented the technique, and this work is publicly available[15].

Implementation of FMNR

FMNR is 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 ago 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 found suitable for application of the FMNR technique.

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 the best 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 revisit the project area every 2-4 months to re-prune as necessary. Heavy equipment is not required as a result there will be 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 will be used to augment the FMNR established forests. The nursery will have the capacity to deliver up to 1,000,000 seedlings per year for the first two years, sufficient to reforest 500 hectares at 1000 stems per hectare. The nursery will be set up in a conventional manner. Seedlings will be planted in small pits (0.3m x 0.3m x 0.2m), which are pre-dug through community labor schemes. Seedlings will be planted at the start of the rainy season and follow up weed control will be undertaken.

Harvest

14 Farmer Managed Natural Regeneration. Impressions of a short field trip. June 9-11, 2004. Reij. C. Vrije Universiteit, Amsterdam).

15 Reforesting the Sahel: Farmer Managed Natural Regeneration. Cunningham P.J and Abas. T.

The project area is expected to be harvested at years 12, 21 and 31 years. The management plan will maintain 50% of the standing biomass for the benefits of biodiversity, environmental protection and other ongoing services. Forest products are transported by donkey. Therefore, no leakage emission from the transport of harvested produce is expected. The forest products will be processed at the city of Soddo, approximately 40km from the project site.

A.5.5. Transfer of technology/know-how, if applicable:

>> The project will provide training in reforestation and regeneration techniques to the local communities through community society cooperatives. Additionally, the cooperatives will offer training in a range of activities including sustainable forest management; agro-forestry, improved agricultural practices, eco tourism; fire management; community conflict resolution and cooperatives management; project and leakage monitoring; poultry management, alternative energy sources, apiculture and fodder development.

A.5.6. Proposed measures to be implemented to minimize potential leakage:

>> To minimize the potential leakage in the form of fuel wood collection this project will establish some fuel wood plantations to offset potential project leakage, however these are a small proportion of the project area, and will be used for the communities' fuel wood supply rather than commercial purposes.

During project implementation, grazing activity will be discontinued and it will need to be minimized in areas where pruning and tending of existing root material is practiced. Landholders will still have access to the forest to 'cut and carry' the fodder which grows under the trees. The existing beneficiaries of grazing access in these areas have been included in discussion regarding the proposed changes in the management of the land resources, and their agreement to the process of area closure/restricted access will be required. At the project design stage, a reasonable sub-sample was contacted and they expressed strong support for the reforestation to proceed. The users understand the environmental impacts caused by the deforestation and see the importance of re-establishing the forest vegetation.

Additionally, leakage is also prevented by implementing following measures.

- The project will seek to identify alternate community grazing areas for the individuals impacted for the period of exclusion. The large contiguous nature of sites will make monitoring of grazing restrictions easier to manage.
- User rights will be granted to individuals, groups of families, or communities. This is expected to help reduce over-exploitation and encourage management of forest and fodder resources.
- There will be an opportunities for long-term employment to some of the existing beneficiaries in the planting, tending and protection roles required for forest management.
- There will be an opportunity to protect the forest from excessive grazing and over exploitation once a certificate of ownership is delivered to a definite number of peasant associations.
- Training will be imparted to community members on livestock management as well as general forest management through the network of the seven community cooperatives.

A.6. Description of legal title to the land, current land tenure and rights to tCERs / lCERs issued for the proposed A/R CDM project activity:

>> The area where the proposed project is to be implemented (as with all land in Ethiopia) is the property of the Federal Government of Ethiopia. The land is degraded and is not managed by any community

group. It is however utilized *ad hoc* by community members for fuel wood collection and grazing by the surrounding community.

The Federal Rural Land Administration and Land Use Proclamation No. 456/2005, and the SNNPRS (Regional) Rural Land Administration and Utilization Proclamation No. 53/2003, are the legal instruments that specify the content of rights a rural landholder may have over an area of land. The proclamations also specify the types of holdings pertaining to rural land; provisions on land measurement, registration and holding certificate; duration of rural land use rights and transfer of rights; obligations of rural land users etc. The Federal Proclamation requires enactment of land administration and land use law consisting provisions to implement the federal law.

> "Holding Right" or "Possessory Right" (the term used in the SNNPRS Proclamation) is defined as the right of any peasant or pastoralist to use rural land for the purpose of agricultural and natural resources development and the right includes the right to lease and bequeath it to family members. Similar to what is provided in the respective Federal and Regional Constitutions, the Rural Land Administration and Use Proclamations also provide for the right to acquire property produced on the land by the labour or capital of the holder of the right and to sell, exchange and bequeath same. Thus, the bundle of rights included within the term "land holding right" includes the right to use, lease and bequeath the land to heirs and acquire private property over both immovable and movable property that is produced by the labour or capital of the landholder concerned.

There are three different types of land holdings provided in the Proclamations, namely, private holding, state holding and communal holding. The definition given to the latter types of land holdings in both the Federal and Regional Proclamations is more or less similar in nature. "Private holdings" is defined as rural land under the holding of peasants or pastoralists or other bodies legally entitled to use rural land (e.g private investors). " State holdings" is defined as rural land demarcated or to be demarcated as Federal or Regional state holding and includes forest lands, wildlife protected areas, state farms etc. "Communal holdings" are defined as rural land which is allocated by the government to local communities for common grazing, forestry and other social services.

The SNNPRS Proclamation defines "community holdings" in a slightly different manner, being "land which is not designated as state or private holding and is being used by the local community as common holding for the purpose of grazing, forestry or other social services". Thus, the Regional Proclamation takes into account the existing use of land. Land that community uses for grazing and fuel wood falls under the term "community holding".

For the purpose of the reforestation project, the most important definition is that given to "community holdings". Accordingly, the definition given under both the Federal and Regional laws allows the designation of the potential project sites as community holdings. The law also provides that holding certificates (title deeds) will also be issued as proof of rural land use right. Thus, once the potential project sites are designated as communal holdings, a holding certificate or title deed will be given to the holders of the right (see Art 8 of the SNNPRS Proclamation No. 53/2003). In discussions with the authorities at both the Regional and Woreda (local) levels, officials have shown their full support to the project and their readiness to transfer the land rights to the communities participating in the project. They have also confirmed that they will issue holding certificates to the communities in accordance with the law.

Although the regional land proclamation does not specifically identify carbon sequestration, An independent consultant in Ethiopian law confirmed that those who possess community holdings have the right to all the products produced from the land, and that the products produced from the land would

therefore necessarily include sequestered carbon. Annex 5 presents detailed information on the legal status of the lands included in the project.

A.7. Assessment of the eligibility of the land:

>> The Ethiopian DNA has determined that within Ethiopia, a forest is defined as land with trees that has:

- A minimum area of 0.05 hectares;
- A minimum tree crown cover of 20 per cent;
- A minimum average tree height above 2 m.

The minimum tree crown cover value falls between 10 and 30 per cent and the minimum land area value falls between 0.05 and 1 hectare defined by paragraph 8 in decision 19/CP.9. Therefore, the forest definition of the Ethiopian government complies with the UNFCCC definition of a forest and can be used for the purposes of the Kyoto Protocol.

Field survey assessments have confirmed that no area in the project boundary could be considered a forest. Although the sites have vegetation below the threshold of a forest, these sites are not expected to become forest in the future without the project due to anthropogenic pressure from grazing and fuelwood collection. Forest destruction on communal land has been a major problem for the past 30 years. This problem is well documented:

- The Good practice guidance sourcebook for LULUCF projects identifies that Ethiopia is losing as much as 40,000 hectares of vegetation annually. As the project region is densely populated, it has lost almost all of its native forest.
- According to the UN report 'Forest fires in Ethiopia' compiled for the UN Emergencies Unit for Ethiopia (UN-EUE), land tenure is the single most important factor in natural resources management, environmental degradation and fire use. The report notes "without changing ownership either literally or symbolically to give local communities a greater sense of investment in the land, environmental disasters will continue and the 2.7% of the country that is forested will rapidly diminish".
- The IUCN Red list confirms the state of forest destruction 'Forest destruction has been dramatic in Ethiopia's highlands. Measures to stop further deforestation and reforestation with indigenous trees are urgently needed.
- The Nechisar National Park, some 50 kilometres from the project site holds a documented example of forest destruction. Tilahun *et al.* (1996) in 'Bird Areas of Ethiopia' identify the threats of intensive natural resource use, fueled by the fast growth in the nearby town of Arba Minch. Previously one of the best protected areas in the country, the park is now exploited for livestock grazing and wood for construction and fuel.

Photo A-2 Grazing in the project area

Photo A-3 Charcoal production near the project area

The aerial photographic information for the project sites is provided in section B2. Additionally, evidence in the form of affidavits and written testimony provided by village leaders through participatory rural appraisal confirms that the project sites did not have vegetation since December 31 1989 (Annex 6).

A.8. Approach for addressing non-permanence:

>> The project team chooses to utilize the tCER mechanism for the net anthropogenic GHG removals by sinks achieved by the proposed A/R CDM project activity. The project is designed to facilitate the long-term establishment of mature trees, as well as the sustainable harvesting of forest products.

Issues relating to permanence will be addressed in the project area in the following ways.

Measures to strengthen the protection of forest

Protection measures will be implemented to protect the regenerated and reforested areas. The community will be given the responsibility of protecting the forestry resources created under the project.

Establishment of alternate sources of fuel wood, fodder and building materials
The project will establish alternate forest for the production of alternative sources of fuel wood and building materials on currently cleared areas within the project boundary in order to reduce pressure on the natural forests. This action is more clearly articulated in the leakage section of this document (C4). The project will also facilitate the use of alternate areas for grazing in nearby grasslands, to compensate for the loss of grazing lands with the area occupied by the project.

Provision of user rights to communities
The delineation of user rights to communities will motivate families to protect the forests created under the project.

Economic gains from the CERs delivered to the communities
The communities will be the direct beneficiaries of the economic gains from the project, and therefore will be motivated to protect their source of economic gain, minimizing the risk of non-permanence.

Training and knowledge management on forest protection measures
The project proponent will conduct training and knowledge management on forest protection initiatives through the community society cooperatives.

A.9. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:

>>

Table A-3: Estimates of net anthropogenic GHG removals by sinks

Summary of results obtained in Sections C.7., D.1., and D.2.				
Year	**Estimation of baseline net GHG removals by sinks (tonnes of CO_2 e)**	**Estimation of actual net GHG removals by sinks (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of net anthropogenic GHG removals by sinks (tonnes of CO_2 e)**
2007	0	(25,594)		(25,594)
2008	0	14,330		14,330
2009	0	19,083		19,083
2010	0	27,258		27,258
2011	0	33,613		33,613
2012	0	37,586		37,586
2013	0	40,725		40,725
2014	0	43,418		43,418
2015	0	45,945		45,945
2016	0	49,734		49,734
2017	0	47,120		47,120
2018	0	(86,666)		(86,666)
2019	0	31,279		31,279
2020	0	34,003		34,003

2021	0	41,314		41,314
2022	0	45,756		45,756
2023	0	44,185		44,185
2024	0	45,235		45,235
2025	0	46,439		46,439
2026	0	46,439		46,439
2027	0	46,439		46,439
2028	0	(83,249)		(83,249)
2029	0	28,113		28,113
2030	0	28,113		28,113
2031	0	37,276		37,276
2032	0	46,439		46,439
2033	0	46,439		46,439
2034	0	46,439		46,439
2035	0	46,439		46,439
2036	0	46,439		46,439
Total (tonnes of CO2 e)		870,088		870,088

A.10. Public funding of the proposed A/R CDM project activity:

>> No public funding is involved in undertaking this A/R CDM project activity.

The costs of project development will be from a long-term loan/grant from World Vision Australia. Landholders and other land managers will contribute to the management and maintenance of the forest. Direct operating and maintenance costs will be covered by World Vision Australia through discretionary philanthropic funds contributed from churches, corporations and individuals.

There is no public finance involved in this project that will result in a diversion of official development assistance.

SECTION B. Duration of the project activity / crediting period

B.1 Starting date of the proposed A/R CDM project activity and of the crediting period:

>> October 1, 2006 is the starting date of the AR CDM project activity, and is the beginning of the first crediting period.

B. 2. Expected operational lifetime of the proposed A/R CDM project activity:

>>60 years

B.3 Choice of crediting period:

>>30 years

B.3.1. Length of the renewable crediting period (in years and months), if selected:

>>N.A

B.3.2. Length of the fixed crediting period (in years and months), if selected:

>>30 years

SECTION C. Application of an approved baseline and monitoring methodology

C.1. Title and reference of the approved baseline and monitoring methodology applied to the proposed A/R CDM project activity:

>> This project activity uses the approved baseline methodology AR-AM0003, *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 Additionality in A/R CDM Project Activities*[16]**.**

C.2. Assessment of the applicability of the selected approved methodology to the proposed A/R CDM project activity and justification of the choice of the methodology:

>> The proposed AR CDM activity complies with the following applicability conditions of AR-AM0003.

- *The project activity can lead to a shift of pre-project activities outside the project boundary, e.g. a displacement of grazing and fuelwood collection activities, including charcoal production;*
  - There will be temporary displacement of both grazing and fuel-wood collection (including charcoal production) activities from the project sites, these are articulated section D.2 of this document.

- *Lands to be afforested or reforested are severely degraded and the lands are still degrading or remain in a low carbon steady state;*
  - The proposed project areas have been denuded and anthropogenic pressures prohibit natural regeneration. This is attested to in the PRA workshops, which have been held in the region (see annex 4), and in the foresters report (available upon request). Without a change in ownership and forest management (FMNR), as proposed in this project the forest vegetation is not expected to get reestablished on the site. The details of which are presented in section C.5.1.

- *Environmental conditions or anthropogenic pressures do not permit the encroachment of natural tree vegetation that leads to the establishment of forests according to the threshold values of the national definition of forest for CDM purposes;*
  - Anthropogenic pressures do not permit the encroachment of natural forest vegetation, and is discussed in section C.6.

[16] http://cdm.unfccc.int/Reference/tools/ar/methAR_tool01_v02.pdf

- *Lands will be afforested or reforested through promotion of natural regeneration and or direct planting or seeding*;
    - Lands will be afforested or reforested through promotion of natural regeneration and/or direct planting and seeding. The FMRN technique is a form of assisted natural regeneration technique pioneered in West Africa and considered appropriate to this region. FMNR will be practiced on the project sites, as described in section A.5.4

- *Site preparation does not cause significant longer term net decreases of soil carbon stocks or increases of non-CO_2 emissions from soil;*
    - Using the FMRN techniques very limited levels of soil disturbance will occur on a small number of hectares, the potential decrease in soil carbon is extremely low, see section A.5.4.

- *Carbon stocks in soil organic carbon, litter and dead wood can be expected to decrease more due to soil erosion and human intervention or increase less in the absence of the project activity, relative to the project scenario*;
    - Soil erosion data produced by the World Bank[17] indicated that the project area is losing an average of between 4 and 10 tonnes of topsoil erosion per hectare per year due to erosion. Due to their steep terrain, the sites are subject to higher levels of erosion and as a consequence, the soil carbon levels in the baseline scenario are expected to show a gradual decline. Due to anthropogenic pressures, the dead wood and litter levels are also expected to decrease in the baseline scenario (see PRA workshop report- Annex 6). While in the project scenario, the deadwood, litter and soil carbon pools are expected to increase. Therefore, not accounting their changes in the project scenario is conservative.

- *Flooding irrigation is not permitted;*
    - The project is not expected to practice irrigation as discussed in section A.4.5.1.

- *Soil drainage and disturbance are insignificant, so that non CO_2-greenhouse gas emissions from this type of activities can be neglected;*
    - Site preparation is not expected to cause significant longer-term net decreases of soil carbon stocks or increases of non-CO_2 emissions from soil. As very limited levels of soil disturbance will occur, the potential change in soil carbon as result of project site preparation activities is insignificant (see section A.5.4). As no irrigation or fertilizers will be utilized, there is no anticipated increase in the levels of non-CO_2 GHG from the soil.

- *The amount of nitrogen-fixing species (NFS) used in the AR CDM project activity is not significant, so that greenhouse gas emissions from denitrification can be neglected in the estimation of actual net greenhouse gas removals by sinks;*
    - The number of nitrogen fixing shrub species included in the project activity are anticipated to be insignificant (less than 5%). These species are also indigenous to the region (see A.5.3)

- *The AR CDM project activity is implemented on land where there are no other on-going or planned AR activities*.
    - Theere are no on-going or alternate AR activities in the project area, and this has been confirmed by the official agencies in the region.

[17] World Bank Background report, assessing Ethiopia growth potential and potential obstacles, April 2004:31

C.3. Assessment of the selected carbon pools and emission sources of the approved methodology to the proposed CDM project activity:

>> The methodology includes **above-ground biomass** and **below-ground biomass**. Both carbon pools are considered appropriate given that the objective and technology of the project is natural regeneration of degraded areas with supplementary planting.

C.4. Description of strata identified using the *ex ante* stratification:

>> Stratification is undertaken as prescribed in section II.3 of the approved methodology AR-AM0003.

Step 1: **Stratification according to pre-existing conditions and baseline projections.**

a) Factors influencing carbon stock changes in the baseline scenario were considered. These included soil type, soil depth, rainfall, aspect, landform, erosion intensity, and level of anthropogenic pressure.

Photo C-1 Soil pit used to assess soil type.

b) Site classification information was collected and collated. This included information and maps on topographical, soil erosion, rainfall, aerial photography, vegetation, population, land management aspects and testimonies of village elders..

c) Information on the pre-project distribution of ruminant animals was collected, and this indicated that there were 3998 ruminant animals on site, a mixture of oxen, bulls, cows and goats.

d) A preliminary stratification showed that the anthropogenic pressure influence the baseline scenario, the details of which presented in section C.6.

e) The information used in the preliminary stratification included:

   a. Preliminary measurements of pre-existing biomass on the project site.

   b. Discussions with elderly residents of the area to determine previous land use, and the extent to which anthropogenic pressures have fluctuated.

   c. Historical records to determine changes in land tenure and the legal aspects of land use.

   d. Events that had in the past led to deforestation

f) Final stratification was then undertaken based upon all the information collected from the above processes. The project team considered that the legal and political changes which had occurred between 1972 and 1975 had caused deforestation of the project area, and that the

resulting land tenure system had facilitated significant anthropogenic pressure. This pressure affects all land within the project site and as a result, the baseline strata are in a state of decline, which is applicable to all the project sites.

Step 2: **Stratification according to the planned AR CDM project activity:**

Based on the species proposed for planting in the project and their growth characteristics, the project area is categorized into eight strata. The characteristic features of stand models are defined in Table C-1, and the species proposed in each stand model are outlined in Table C-2 below.

Table C-1: Characteristic features of stand models in the project scenario.

Stand Model Name	Species planted	Growth Assumptions	Date of establishment	Area	Geographical location	Fertilizer application	Thin	Harvest	Coppicing	Replanting
Humbo 1	See table C-2	See graph C-1	Jan-June 07	234	See Map C-1	None	None	None	Ongoing	None
Humbo 2a	See table C-2	See graph C-1	Jan-June 07	745	See Map C-1	None	None	None	Ongoing	None
Humbo 2b	See table C-2	See graph C-1	Jan-June 07		See Map C-1	None	None	None	Ongoing	None
Humbo 3a	See table C-2	See graph C-1	Jan-June 07	1404	See Map C-1	None	None	None	Ongoing	None
Humbo 3b	See table C-2	See graph C-1	Jan-June 07	100	See Map C-1	None	None	None	Ongoing	None
Humbo 3c	See table C-2	See graph C-1	Jan 07–June08	100	See Map C-1	None	None	None	Ongoing	None
Humbo 3d	See table C-2	See graph C-1	Jan 07–June09	50	See Map C-1	None	None	None	Ongoing	None
Humbo 4	See table C-2	See graph C-1	Jan-June 07	95	See Map C-1	None	None	None	Ongoing	None

Table C-2: Species proposed for planting in the stand models of the project.

Humbo 1	Humbo 2a	Humbo 2b	Humbo 3a	Humbo 3b	Humbo 3c	Humbo 3d	Humbo 4
Pygeum africanu	*Shinus molle*	*Shinus molle*	*Pygeum africanu*	*Shinus molle*	*Shinus molle*	*Shinus molle*	*Pygeum africanu*
Hagenia abyssinica	*Eucalyptus camaldulensis*	*Eucalyptus camaldulensis*	*Hagenia abyssinica*	*Eucalyptus camaldulensis*	*Eucalyptus camaldulensis*	*Eucalyptus camaldulensis*	*Hagenia abyssinica*
Syzygium guineense	*Acacia saligna*	*Acacia saligna*	*Syzygium guineense*	*Acacia saligna*	*Acacia saligna*	*Acacia saligna*	*Syzygium guineense*
Cordia africana	*Moringa stenopetela*	*Moringa stenopetela*	*Cordia africana*	*Moringa stenopetela*	*Moringa stenopetela*	*Moringa stenopetela*	*Cordia africana*
Olea africana	*Bahuinia tomentosa*	*Bahuinia tomentosa*	*Olea africana*	*Bahuinia tomentosa*	*Bahuinia tomentosa*	*Bahuinia tomentosa*	*Olea africana*
Albizia gummifera	*Acacia nilotica*	*Acacia nilotica*	*Albizia gummifera*	*Acacia nilotica*	*Acacia nilotica*	*Acacia nilotica*	*Albizia gummifera*
Phytolacca	*Pakinsonia*	*Pakinsonia aculeata*	*Phytolacca*	*Pakinsonia*	*Pakinsonia*	*Pakinsonia*	*Phytolacca dodecandra*

dodecandra	*aculeata*		*dodecandra*	*aculeata*	*aculeata*	*aculeata*	
Vernonia amygdalina	*Podocarpus falcatus*	*Podocarpus falcatus*	*Vernonia amygdalina*	*Podocarpus falcatus*	*Podocarpus falcatus*	*Podocarpus falcatus*	*Vernonia amygdalina*
Crotolaria anchnocarpoides	*Azadiractha indica*	*Azadiractha indica*	*Crotolaria anchnocarpoides*	*Azadiractha indica*	*Azadiractha indica*	*Azadiractha indica*	*Crotolaria anchnocarpoides*
Rosa abyssinica	*Acacia saligna*	*Acacia saligna*	*Rosa abyssinica*	*Acacia saligna*	*Acacia saligna*	*Acacia saligna*	*Rosa abyssinica*
Erythrina brucei	*Acacia melanoxylon*	*Acacia melanoxylon*	*Erythrina brucei*	*Acacia melanoxylon*	*Acacia melanoxylon*	*Acacia melanoxylon*	*Erythrina brucei*
Rubus apetalus	*Psidium guajava*	*Psidium guajava*	*Rubus apetalus*	*Psidium guajava*	*Psidium guajava*	*Psidium guajava*	*Rubus apetalus*
Ficus spp.	*Grevillea robusta*	*Grevillea robusta*	*Ficus spp.*	*Grevillea robusta*	*Grevillea robusta*	*Grevillea robusta*	*Ficus spp.*
Croton macrostachys	*Morus alba*	*Morus alba*	*Croton macrostachys*	*Morus alba*	*Morus alba*	*Morus alba*	*Croton macrostachys*
Carisa edulis	*Delonix regia*	*Delonix regia*	*Carisa edulis*	*Delonix regia*	*Delonix regia*	*Delonix regia*	*Carisa edulis*
Maytenus ovatus,	*Robinia pseudoacacia*	*Robinia pseudoacacia*	*Maytenus ovatus,*	*Robinia pseudoacacia*	*Robinia pseudoacacia*	*Robinia pseudoacacia*	*Maytenus ovatus,*
Acacia abyssinica	*Juglans regia*	*Juglans regia*	*Acacia abyssinica*	*Juglans regia*	*Juglans regia*	*Juglans regia*	*Acacia abyssinica*
	Hibiscus rosa	*Hibiscus rosa*		*Hibiscus rosa*	*Hibiscus rosa*	*Hibiscus rosa*	
Live Fence	*Pygeum africanu*	*Pygeum africanu*	**Live Fence**	*Pygeum africanu*	*Pygeum africanu*	*Pygeum africanu*	**Live Fence**
Euphorbia abyssinica	*Hagenia abyssinica*	*Hagenia abyssinica*	*Euphorbia abyssinica*	*Hagenia abyssinica*	*Hagenia abyssinica*	*Hagenia abyssinica*	*Euphorbia abyssinica*
Euphorbia tirucalli	*Syzygium guineense*	*Syzygium guineense*	*Euphorbia tirucalli*	*Syzygium guineense*	*Syzygium guineense*	*Syzygium guineense*	*Euphorbia tirucalli*
Agave americana	*Cordia africana*	*Cordia africana*	*Agave americana*	*Cordia africana*	*Cordia africana*	*Cordia africana*	*Agave americana*
Aloe abyssinica	*Olea africana*	*Olea africana*	*Aloe abyssinica*	*Olea africana*	*Olea africana*	*Olea africana*	*Aloe abyssinica*
Euphorbia scoparia	*Albizia gummifera*	*Albizia gummifera*	*Euphorbia scoparia*	*Albizia gummifera*	*Albizia gummifera*	*Albizia gummifera*	*Euphorbia scoparia*
Euphorbia candelabrum	*Phytolacca dodecandra*	*Phytolacca dodecandra*	*Euphorbia candelabrum*	*Phytolacca dodecandra*	*Phytolacca dodecandra*	*Phytolacca dodecandra*	*Euphorbia candelabrum*
Aningeria adolfifericii	*Vernonia amygdalina*	*Vernonia amygdalina*	*Aningeria adolfifericii*	*Vernonia amygdalina*	*Vernonia amygdalina*	*Vernonia amygdalina*	*Aningeria adolfifericii*
Erthrina spp	*Crotolaria anchnocarpoides*	*Crotolaria anchnocarpoides*	*Erthrina spp*	*Crotolaria anchnocarpoides*	*Crotolaria anchnocarpoides*	*Crotolaria anchnocarpoides*	*Erthrina spp*
	Rosa abyssinica	*Rosa abyssinica*		*Rosa abyssinica*	*Rosa abyssinica*	*Rosa abyssinica*	
	Erythrina brucei	*Erythrina brucei*		*Erythrina brucei*	*Erythrina brucei*	*Erythrina brucei*	
	Rubus apetalus	*Rubus apetalus*		*Rubus apetalus*	*Rubus apetalus*	*Rubus apetalus*	
	Ficus spp.	*Ficus spp.*		*Ficus spp.*	*Ficus spp.*	*Ficus spp.*	
	Croton macrostachys	*Croton macrostachys*		*Croton macrostachys*	*Croton macrostachys*	*Croton macrostachys*	
	Carisa edulis	*Carisa edulis*		*Carisa edulis*	*Carisa edulis*	*Carisa edulis*	
	Maytenus ovatus,	*Maytenus ovatus,*		*Maytenus ovatus,*	*Maytenus ovatus,*	*Maytenus ovatus,*	
	Acacia abyssinica	*Acacia abyssinica*		*Acacia abyssinica*	*Acacia abyssinica*	*Acacia abyssinica*	
	Aningeria adolfifericii	*Aningeria adolfifericii*		*Aningeria adolfifericii*	*Aningeria adolfifericii*	*Aningeria adolfifericii*	
	Erthrina spp	*Erthrina spp*		*Erthrina spp*	*Erthrina spp*	*Erthrina spp*	
	Live Fence	**Live Fence**		**Live Fence**	**Live Fence**	**Live Fence**	
	Euphorbia abyssinica	*Euphorbia abyssinica*		*Euphorbia abyssinica*	*Euphorbia abyssinica*	*Euphorbia abyssinica*	
	Euphorbia tirucalli	*Euphorbia tirucalli*		*Euphorbia tirucalli*	*Euphorbia tirucalli*	*Euphorbia tirucalli*	
	Agave americana	*Agave americana*		*Agave americana*	*Agave americana*	*Agave americana*	
	Aloe abyssinica	*Aloe abyssinica*		*Aloe abyssinica*	*Aloe abyssinica*	*Aloe abyssinica*	
	Euphorbia scoparia	*Euphorbia scoparia*		*Euphorbia scoparia*	*Euphorbia scoparia*	*Euphorbia scoparia*	
	Euphorbia candelabrum	*Euphorbia candelabrum*		*Euphorbia candelabrum*	*Euphorbia candelabrum*	*Euphorbia candelabrum*	

Step 3: **Final ex-ante stratification:**

Final ex-ante stratification is demonstrated in Map C-1. The map depicts the 4 that correspond to the baseline strata. The strata have the following general characteristics.

Stratum 1: It is the southern most part of the project and has scattered trees over the area.

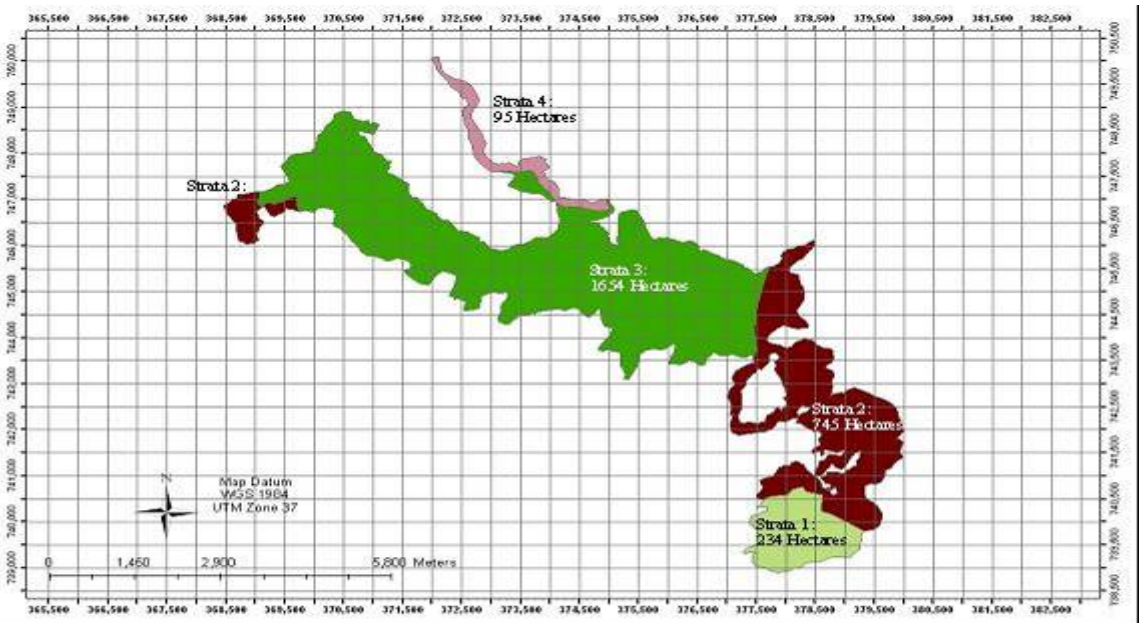
Stratum 2: It is in the north of stratum 1 and major part of the stratum lies between stratum 1 and stratum 3. It has scattered trees and grass cover.

Stratum 3: It has the largest area and accounts for about 40% of the project area. It has dense shrubs.

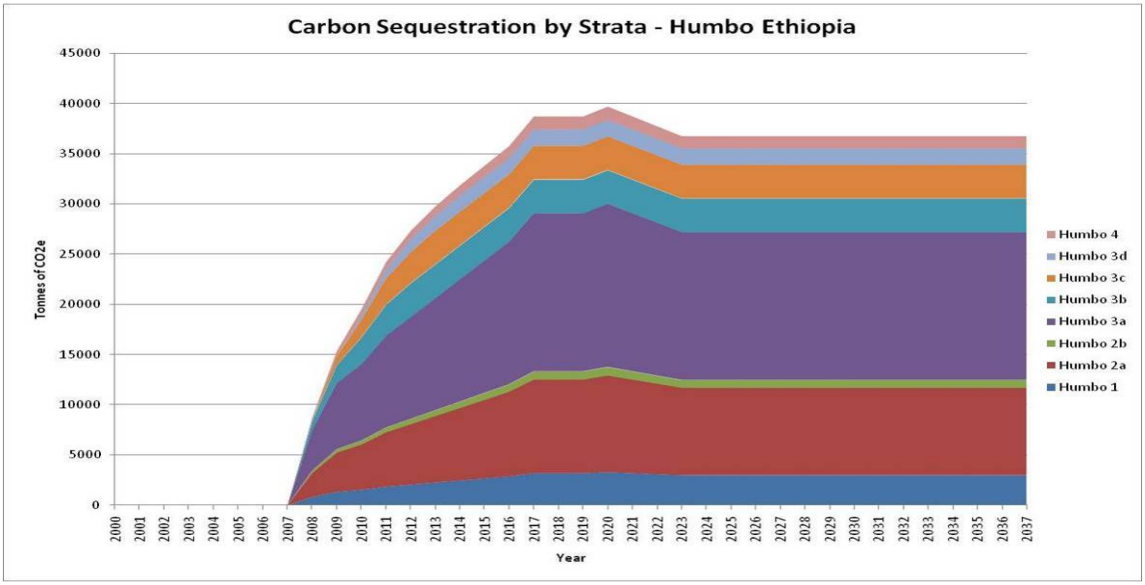
Stratum 4: It is the northern most part of the project and has shrub vegetation on rocky hillsides.

Stratum 5: This stratum represents planting of mixed naturalized species – Eucalyptus and Grevillia on 500 ha of land that is identified as part of the baseline stratum 3

In the project scenario there are two stand models. The first stand model is assisted natural regeneration. This will be implemented on strata 1, 2, 3 and 4 described above. The second stand model, a mixed Eucalyptus and Grevillia plantation, will be implemented on stratum 5, the



Map C-1: Humbo ex-ante stratification (project stratum 5 is the sub-division of baseline stratum 3).



Graph C: 1 Carbon Sequestration by Strata.

Analysis of the project sites determined that there is no possibility for establishment of natural regeneration in the baseline scenario due to anthropogenic pressure. Therefore in the absence of the project, the project sites will see a continuing net decrease in carbon stored in the above- and- below ground biomass. However to be conservative, the projected growth of existing trees is calculated and included as part of the baseline (see section C-5).

C.5. Identification of the baseline scenario:

C.5.1. Description of the application of the procedure to identify the most plausible baseline scenario (separately for each stratum defined in C.4.):

>> The steps outlined in AR AM0003 are applied below to identify the most plausible baseline scenario.

Step 1: Define the project boundary.

The process followed in delineating the project boundary is described in section A.4.2 above, and the forest boundary perimeter coordinates are identified in Annex 3.

Step2: Analyze historical land use, local and sectoral land-use policies or regulations and land use alternatives.

a) Analyze the historical and existing land-use / land-cover changes in the context of the socioeconomic conditions prevailing within the boundary of the proposed AR CDM project activity and identify key factors that influence the land-use / land-cover changes over time.

The site on which the project is to be established was reported as having vegetation prior to 1972 (the earliest aerial photographs are from this period). Interviews with local Kebele leaders indicated that the area was cleared between 1975 and 1985 and was subjected to severe soil erosion. The following aerial photographs taken in 1975 demonstrate that at this point in time, the area had been substantially cleared and could not be considered a forest. The evidence from aerial photographs of the project area in 1973 and 1979 indicate that the area was subjected to deforestation.

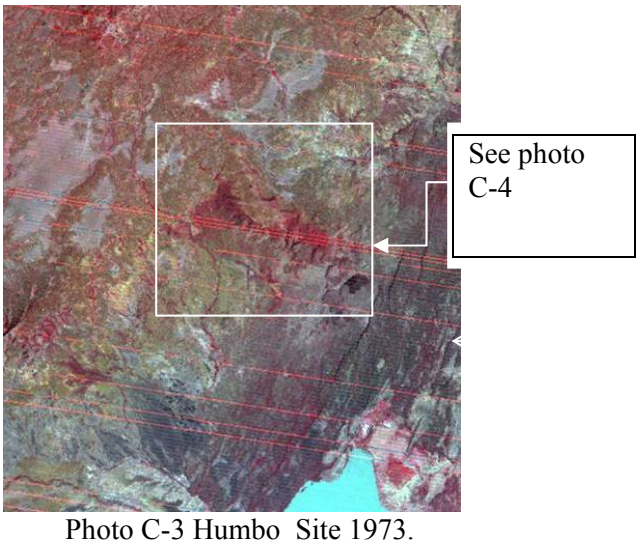


Photo C-3 Humbo Site 1973.

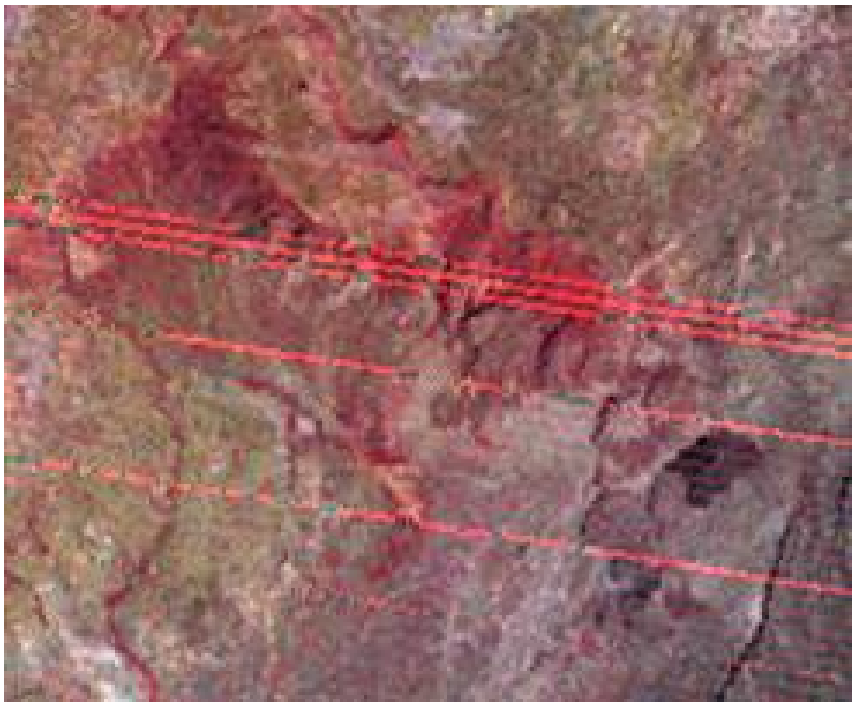


Photo C-4 Humbo Site 1973 enlargement.

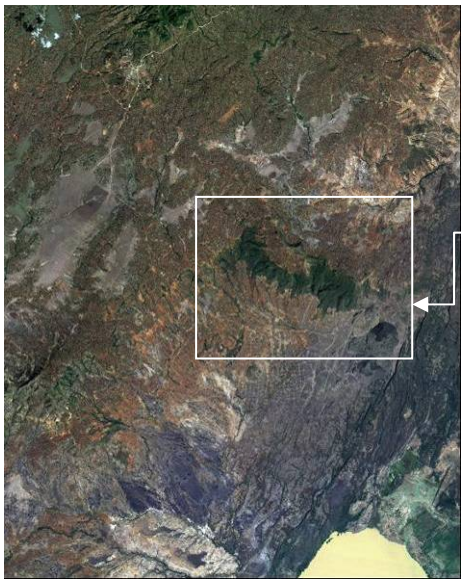


Photo C-5 Humbo Site 1979

Photo C-6 Humbo Site 1979

The two project sites are severely degraded areas and the community has depended on these lands for grazing and limited firewood collection.

b) Show that historical and current land-use / land-cover change has lead to progressive degradation of the land over time including a decrease or steady state of the carbon stocks in the carbon pools.

- Data on the historical and current land use/land cover change has been collated from participatory rural appraisals (PRAs) in the Soddo and Humbo project. The PRA concluded that in the period between 1975 and 1985 there had been a progression of land degradation, which had lead to a low but decreasing carbon state (see annex 6). It was further confirmed that carbon stocks are declining and will continue to decline if land management remains in the status quo. The available aerial photographs of the site confirm this.

The following published information on the destruction of Ethiopia's high forests since the early 1970s also provides supporting evidence.

- In a 2005 paper entitled *Institutional Factors shaping Coffee Forest Management in Ethiopia:The Case of Bonga Forest/Kaffa Zone*, Till Stellmacher observes '*Since nationalisation of land holdings in 1975, stewardship for forest resources is a governmental matter. Nevertheless, ever since, forest use and conservation has been a low priority topic in the governmental framework of Ethiopia, facing drastic financial and personnel shortage. For example, for the entire Southern Province (SNNPRS), which comprises largest areas of Ethiopian high forests, workforce responsible for natural resource conservation consists of two persons only, based at the Regional Agricultural Office in Awassa, the Province capital.*

- The Good practice guidance sourcebook for LULUCF projects identifies that Ethiopia is loosing as much as 40,000 hectares of vegetation annually, and this region being relatively densely populated has lost almost all its native forest.
- According to the UN report 'Forest fires in Ethiopia' complied for the UN Emergencies Unit for Ethiopia (UN-EUE), land tenure is reported as the single most important factor in natural resources management, environmental degradation and fire use. "Without changing ownership either literally or symbolically to give local communities a greater sense of investment in the land, environmental disasters will continue and the 2.7% of the country that is forested will rapidly diminish".
- The IUCN Red list confirms that the 'forest destruction has been dramatic in Ethiopia's highlands. Measures to stop further deforestation and reforestation with indigenous trees are urgently needed.
- The Nechisar National Park, some 50 kilometres from the project site holds a documented example of forest destruction. Tilahun *et al.* (1996) in 'Bird Areas of Ethiopia' identify "the threats of intensive natural resource use, fueled by the fast growth in the nearby town of Arba Minch. Previously one of the best protected areas in the country, the park is now exploited for livestock grazing and wood for construction and fuel."

c) Assessment of the National and/or sectoral policies.

Several decades of political instability have led to very limited implementation of activities involving the protection and enhancement of natural forest resources. Since the removal of the communist regime in 1993, laws relating to environmental protection have been passed. One example at a federal level is the establishment of an Environmental Protection Organs Proclamation[18] governing environmental regulations, and overseeing the targeted increase in Ethiopia's forest cover. While biodiversity preservation and enhancement are broad governmental objectives, these objectives are neither binding nor enforced (Stellmacher 2005 documents this in the proceedings of the International Trade and the Protection of Natural Resources in Ethiopia Conference, 2005, hosted by the German Ethiopian Association). Government resources are prioritized on the more pressing domestic issues of food security and national economic development, prohibiting widespread investment in biodiversity enhancement and protection in areas such as Humbo. It has been identified that despite laws prohibiting clearing, this practice continues in Ethiopia to this day. Ethiopia's total forest cover is being reduced by between 40,000 and 140,000 hectares annually[19,20]. It is clear that in the absence of the proposed A/R project this area will not be reforested, and the current degrading land management regime will continue.

d) Identify alternative land uses including alternative future public or private activities on the degraded lands including any similar AR activity or any other feasible land development activities, that are not in contradiction with the identified local, national or sectoral land-use policies and regulations and that could be implemented within the boundary of the proposed AR CDM project activity. In doing so, use land records, field surveys, data and feedback from stakeholders, and other appropriate sources.

[18] Proclamation No 295/2002 Federal Democratic Republic of Ethiopia

[19] GPG for LULUCF projects, IPCC

[20] National Meterological Services Agency *Initial National Communication of Ethiopia to the United Nations Framework Convention on Climate Change (UNFCCC)*June 2001

Given the topography and the obvious soil degradation problems on the site, the only alternative land use to the proposed A/R project is a continuation of the current management regime, leading to further land and biodiversity degradation.

e) Demonstrate that the land use change/cover would either not change, or would lead to further degradation and carbon stock decrease in the absence of the proposed project activity. Given that there are no suitable alternate land uses aside from the proposed project activity, the land would continue to be managed in the current manner, and carbon stocks would continue to decline. Significant technical and financial barriers prohibit the transformation of lands from the current land use to the proposed alternate land management regime. These barriers include the divulging of user rights to the appropriate community groups, the education in the FMNR techniques, and the costs associated with these activities.

Step 3: Stratification of the A/R CDM project area

The AR CDM Project area has been stratified, and ex-ante stratification is described in section C.4.

C.5.2. Description of the identified baseline scenario (separately for each stratum defined in Section C.4.):

>>

Step 4. Determination of baseline scenario for each stratum

As the baseline scenario is not likely to change from their current status of degraded and subject to further degradation. The baseline is identified as the *continuation of the pre-project land use*.

The carbon stocks in all the baseline strata are in a state of continued decline. This conclusion is justified in sections A.4.2, A.6, A.7, and C.2, as well as in field survey assessments. There is no possibility for the establishment of natural regeneration in the baseline scenario due to anthropogenic pressures. In the absence of the project, each strata will see a net decrease in carbon stored above and below ground biomass. However to be conservative, baseline assessment considered the changes in carbon stocks of few isolated standing trees in each baseline strata (this scenario is very conservative as it much more likely the existing vegetation would be cleared in the baseline scenario), and accounted in the calculation of the baseline GHG removals by sinks..

C.6. Assessment and demonstration of additionality:

>> The version 02 of the *Tool for the Demonstration and Assessment of Additionality in A/R CDM Project Activities* is used to demonstrate the additionality of the project below.

STEP 0: Preliminary screening based on the starting date of the project activity

The starting date of the project is 1 October 2006.

STEP 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a: Define alternatives to the project activity

The alternative activities relevant to this project include:

- Continuation of the current land use activity, grazing and fuelwood collection.

- Assisted regeneration and reforestation of the land in the project boundary performed without being registered as the A/R CDM project activity
- Commercial timber production

Sub-step 1b. Enforcement of applicable laws and regulations

The Ethiopian government has identified its desire to see afforestation/reforestation works extended, however, specific regulation supporting the implementation of such projects is not available. Funds for this activity are severely limited and very little forestry related resources are available in the Humbo Woreda. The baseline scenario is compliant with all Ethiopian legal and regulatory requirements, and this situation is not likely to change.

STEP 2: Investment analysis

Not undertaken for this project.

STEP 3: Barrier analysis

Sub-step 3a: Identify barriers proposed project activity:

This project faces following barriers, which prohibit it from getting implemented in the absence of income derived from the sale of carbon credits. These barriers are:

a) Investment barriers

This project faces investment barriers, which prohibit its implementation without income derived from the sale of carbon credits. Firstly, the costs of nursery establishment and of implementing a training program among the forest users regarding the implementation of FMNR are significant, and the communities of Humbo are particularly poor, with the average per capita income in these Woredas is less that $100 per year[21]. It is not possible that these costs could be borne by the communities financed by a system of royalties from increased forest production. Secondly, the costs of establishing the legal and socio-economic framework for the efficient running of the seven community cooperatives are also significant, and it would not be possible without the additional revenue provided by carbon finance (see Table C-3).

Table C-3 Costs of project implementation

Humbo ADP
Humbo Community Based Forest Management Project Plan

S/N	Activities	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	Nursery establishment	$8,700	$2,200										
2	Nursery inputs	$9,500	$4,300	$4,300									
3	Nursery management	$25,500	$24,500	$24,500									
4	Forest management	$24,550	$11,500	$4,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
5	Soil and water conservation	Community											
6	Staff	$46,600	$47,000	$45,000	$29,000	$29,000	$29,000	$29,000	$29,000	$29,000	$29,000	$29,000	$29,000
7	Transportation	$4,500	$6,000	$6,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
8	Dissemination	$9,000											
9	Community Training	$16,750	$2,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
10	Legal	$9,800	$750	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250
11	Other Project Costs	$7,275	$2,000	$2,000	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600
12	Evaluation Expenses			$10,000			$8,000			$8,000			$8,000
13	Project Management	$8,000	$6,000	$6,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
14	Contingency	12,763	8,006	7,804	3,214	3,214	3,814	3,214	3,214	3,814	3,214	3,214	3,814
	Grand Total	$157,188	$124,256	$132,354	$52,564	$52,564	$69,164	$52,564	$52,564	$69,164	$52,564	$52,564	$69,164

[21] SNNPR statistics department, *Regional basic Socio-economic and Demographic Information*, 2003

The Ethiopian government although expressed its desire to see revegetation works extended, however it is unlikely to become so as funds for forestry activities are severely limited and very little forestry related resources are available in Ethiopia and specifically in the Humbo Woreda. This can be evidenced through statements from local financial institutions.

The revenue from sale of CERs would partially support the costs of implementing the project Considering the lack of alternative sources to fund the project, the project costs can not be met without the revenue from the sale of CERs, which would only be possible as a registered CDM project. Therefore, registration of this project as a CDM activity would facilitate in partially overcoming the investment barriers.

b) Limited capacity of local institutions

Despite the environmental needs of the Humbo region, there has been no institution with requisite capacity to implement a program of forest restoration on the proposed project sites. In the absence of financial resources and capacity of local institutions, the restoration of these areas could not occur so far.

c) Barriers related to prevailing practice

The unsustainable use of community lands is a major cause of forest loss in the region. This project is a first of its kind in the country, which seeks to demonstrate that protecting highly degraded land against over-grazing would lead to regrowth of forest biomass without the need to make costly investment in planting.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity).

The pre-project land use (continuing degradation as communal land) does not face the above-mentioned barriers. Given that the *status quo* of continuing degradation as communal land for the past three decades, it is clear that the above-mentioned barriers do not prohibit the land use that results in continued degradation.

STEP 4. Common practice analysis

Activities similar to this project have **not** been implemented in the region, as a first of its kind project, it several major barriers. Some of the barriers are highlighted above.

Based on the information and evidence presented under the above steps, the proposed CDM project activity is not the baseline scenario, and is thus additional.

C.7. Estimation of the *ex ante* baseline net GHG removals by sinks:

>> Based on the approved methodology AR-AM0003, the baseline net GHG removals by sinks are considered as zero.

Due to lack of satellite imagery, a Participatory Rural Appraisal (PRA) was conducted to gather data from the residents on the trends of the forest and the changes it has undergone in the last thirty years. There is evidence of a progression of land clearing and degradation within this region with escalation since the 1970s. The true baseline scenario is therefore a total removal of all vegetation on the project site, and a

continued diminishing of the carbon stocks of the region. The scenario of no net increase or decrease in carbon stocks has been chosen for the baseline scenario – and this is a conservative estimation. For further details see Annex 6 Participatory Rural Appraisal. **T**

Table C-5: Baseline net GHG removals by sinks

Please present final results of your calculations using the following tabular format.	
Year	**Annual estimation of baseline net anthropogenic GHG removals by sinks in tonnes of CO_2 e**
2007	0
2008	0
2009	0
2010	0
2011	0
2012	0
2013	0
2014	0
2015	0
2016	0
2017	0
2018	0
2019	0
2020	0
2021	0
2022	0
2023	0
2024	0
2025	0
2026	0
2027	0
2028	0
2029	0
2030	0
2031	0
2032	0
2033	0
2034	0
2035	0
2036	0
Total estimated baseline net GHG removals by sinks (tonnes of CO2 e)	0
Total number of crediting years	0
Annual average over the crediting period of estimated baseline net GHG removals by sinks	0

(tonnes of CO2 e)	

C.8. Date of completion of the baseline study and the name of person(s)/entity(ies) determining the baseline:

>> Name of persons/entity determining the baseline:

- World Vision Forestry Ethiopia
  - Asfaw Mariane (asfaw_mariane@wvi.org)
- World Vision Ethiopia
  - Assefa Tofu (assefa_tofu@wvi.org)

With assistance from consultants:
Ethiopian Forestry Department
  - Dr. Deribe Gurmu (deribe12@yahoo.com)

- Joanneum Research, Austria
  - Dr. Bernhard Schlamadinger (bernhard.schlamadinger@joanneum.at)
- Greenhouse Balanced
  - Paul Dettmann (paul.dettmann@bigpond.com)

SECTION D. Estimation of *ex ante* actual net GHG removals by sinks, leakage and estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period

D.1. Estimate of the *ex ante* actual net GHG removals by sinks:

>> The GPG-LULUFC manual recommends the use of following data sources to estimate biomass increase.

a) Existing local sources and specific species;
b) National and species specific (e.g. from national GHG inventory);
c) Species specific from neighboring countries with similar conditions. (sometimes c) might be preferable to b;
d) Species specific relevant at the global level (e.g. GPG-LULUCF).

In Ethiopia there is a lack of local growth data available to estimate the biomass stock change achieved by the proposed A/R CDM project activity. For the first stand model of mix of native species being naturally regenerated a stand model projection was made from a mix of the IPCCs GPG-LULUCF default data tables (3A.1.2 and 3A.1.3) as well as in field measurements of remnant vegetation on farmland, and stumps of pre-existing trees. Expert input was provided by Dr. Deribe Gurmu, a specialist in Ethiopian forestry who estimated the overall growth of the forest using the abovementioned data sources, with an average above-ground biomass of 95 tonnes/ha over the initial 20 years of forest growth.

For the second stand model of Eucalyptus and Grevillia inter-planted a stand model projection was made on the following assumptions. For *Eucalyptus globulus,* an average growth rate of 30 m3/ha/yr in Ethiopia was used (Davidson 1989, Pohjonen and Pukkala 1990)[22]. However, when inter-planted with *Gervillia robusta,* it is assumed to have an average MAI of 6 m^3/ha/, at a stocking density of 500 stems per hectare (total 1000 stems per hectare when including both species)

[22] http://www.fao.org/docrep/004/ac121e/ac121e04.htm#bm04.3

In terms of *Grevillia Robusta* a growth rate of 10-12 m^3/ha/yr has been applied[23]. When mixed with *Eucalyptus globolus* it is assumed to have an average MAI of 3 m^3/ha/yr at a stocking density of 500 stems per hectare (total 1000 stems per hectare when including both species). For the mixed plantation the MAI of 8.9 m^3/ha/yr is adopted.

Table D-1 Estimate of actual net CO2 removals by sinks

S.No	Year	Annual carbon stock change (t CO_2-e.yr^{-1})	Annual Project emissions (t CO_2-e.yr^{-1})	Actual net GHG removals by sinks (t CO_2-e.yr^{-1})
1	2007	(25,594)	0	(25,594)
2	2008	14,330	0	14,330
3	2009	19,083	0	19,083
4	2010	27,258	0	27,258
5	2011	33,613	0	33,613
6	2012	37,586	0	37,586
7	2013	40,725	0	40,725
8	2014	43,418	0	43,418
9	2015	45,945	0	45,945
10	2016	49,734	0	49,734
11	2017	47,120	0	47,120
12	2018	(86,666)	0	(86,666)
13	2019	31,279	0	31,279
14	2020	34,003	0	34,003
15	2021	41,314	0	41,314
16	2022	45,756	0	45,756
17	2023	44,185	0	44,185
18	2024	45,235	0	45,235
19	2025	46,439	0	46,439
20	2026	46,439	0	46,439
21	2027	46,439	0	46,439
22	2028	(83,249)	0	(83,249)
23	2029	28,113	0	28,113
24	2030	28,113	0	28,113
25	2031	37,276	0	37,276
26	2032	46,439	0	46,439
27	2033	46,439	0	46,439
28	2034	46,439	0	46,439
29	2035	46,439	0	46,439
30	2036	46,439	0	46,439
	Total	**870,088**	**0**	**870,088**

[23] http://www.fao.org/docrep/s4550e/s4550e0b.htm

D.2. Estimate of the *ex ante* leakage:

>> Laborers used for the proposed A/R CDM project activity are from local villages; hence transportation for laborers is not needed. All seedlings will be raised on or near the site and will be transported to the project sites by manpower and project vehicles, whose emissions are calculated in the project scenario. Timber harvested from site will be transported using manpower, or existing donkeys and carts. There will be no clearing of vegetation for fencing material; rather live fences will be utilized.

Equation 22 in the approved methodology is used for the calculation of leakage:

$$LK = LK_{Vehicle} + LK_{ActivityDisplacement} + LK_{fencing}$$

where:
LK = total GHG emissions due to leakage; tonnes CO_2-e.
$LK_{Vehicle}$ = total GHG emissions due to fossil fuel combustion from vehicles; tonnes CO_2-e.
$LK_{ActivityDisplacement}$ = leakage due to activity displacement; tonnes CO_2-e.
$LK_{fencing}$ = leakage due to increased use of wood posts for fencing up to year t^*; tonnes CO_2-e.

However given that live fences will be utilised $LK_{fencing} = 0$

Leakage is therefore calculated from two sources, fossil fuel emissions from vehicles, and activity displacement.

Vehicles
Calculation of leakage from vehicles uses the formulae 32-34 in the approved methodology AR-AM0003.

$$LK_{Vehicle} = LK_{Vehicle,CO_2}$$

$$LK_{Vehicle,CO_2} = \sum_{t=1}^{t^*} \sum_{x} \sum_{y} (EF_{xy} \cdot FuelConsumption_{xyt})$$

$$FuelConsumption_{xyt} = n_{zyt} \cdot k_{xyt} \cdot e_{xyt}$$

where:

$LK_{Vehicle}$ = total GHG emissions due to fossil fuel combustion from vehicles; tonnes CO_2-e.
$LK_{Vehicle,CO2}$ = total CO_2 emissions due to fossil fuel combustion from vehicles; tonnes CO_2-e.
x = vehicle type
y = fuel type
EF_{xy} = CO_2 emission factor for vehicle type x with fuel type y; dimensionless
$FuelConsumption_{xyt}$ = consumption of fuel type y of vehicle type x at time t; liters
n_{xyt} = number of vehicles
k_{xyt} = kilometers traveled by each of vehicle type x with fuel type y at time t; km

e_{xyt} = fuel efficiency of vehicle type *x* with fuel type *y* at time *t*; liters km^{-1}

Within the region, world Vision uses diesel powered four-wheel drive vehicles, and petrol powered motorcycles. For a mid-size diesel vehicle that is commonly used by World Vision in the project area the emission factor is 2.713[24]kg CO_2 $litre^{-1}$ The two vehicles will be employed by the project, are anticipated travel an average of 75,000 kilometers per year (World Vision).

Therefore the above formula is applied as:

Fuel consumption diesel four wheel drive per annum = (2 * 75000 * 0.2) = 30,000 l

CO2 leakage for four wheel drive vehicles = (2.713 * 30000) * .001 = 81.39 t CO2 y^{-1}

For a gasoline motorcycles currently utilized by World Vision in the project area the emission factor is 2.2265[25]kg CO_2 $litre^{-1}$. Four motorcycles will be employed by the project, are anticipated to travel use an average of 2000 kilometers per year (World Vision).

Therefore the above formula is applied as:

Fuel consumption gasoline motorcycle per annum = (4 * 2000 * 0.1) = 800 l

CO2 leakage for motorcycles = (2.226 * 800) * .001
= 1.808 t CO2 y^{-1}

Therefore the total vehicle related emissions of the project can be calculated as:

81.39 + 1.808 = 83.198 t CO2 per y^{-1}

Activity displacement

Leakage associated with fuelwood collection

There is no leakage expected from fuel wood collection. The project will generate enough fuel wood within the project area, initially through pruning of existing vegetation to assist natural regeneration and later from planted woodlots, to satisfy the pre-project fuel wood collection. $FG_{outside,t} - FG_{NGL,t} = 0$. During project preparation pre-project fuel wood collection was estimated to 4,3 m3 per hectare. The estimates was based on interviews and focus groups with a representative sample of the community. During the first year of implementation the communities have been collecting fuel wood from the pruned branches, thorny bushes and small shrubs. The volume of fuel wood removed as a result of pruning was collected from four sample areas of 100m2 each from four cooperatives randomly and then weighed separately. The average was then computed and the result converted to hectare. Based on this procedure the fuel wood collection during project implementation to date was estimated to 5.1 m3 per hectare. Through interviews with some community members, it was clarified that the communities are collecting a large amount of these pruned branches to be used later on as the volume collected represents more than their current demand.

[24] Diesel 2.713 kg $CO2^{-1}$ (Ethiopian specific emissions factor)

[25] Gasoline 2.26 kg $CO2^{-1}$ (Ethiopian specific emissions factor)

Leakage associated with grazing

There is anticipated to be no net leakage due to the relocation of animals from the project, as there are significant areas of land which have already been cleared and are under the control of the project participants (see Figure A-2), and there are no areas of significant forest in the project vicinity which can be cleared to undertake animal grazing (See Photo D-1). The high forests of Ethiopia are continuing in a state of decline, and the closest forest, between Lake Abaya and Lake Charmo, is currently being cleared. During the period of closure to facilitate forest establishment, farmers have the ability to practice cut and carry methods of harvesting fodder from within the project area, and this is a traditional method of fodder collection that facilitates the forest growth as the young regeneration is freed from the competition of grasses. (see Photo D-2) site.

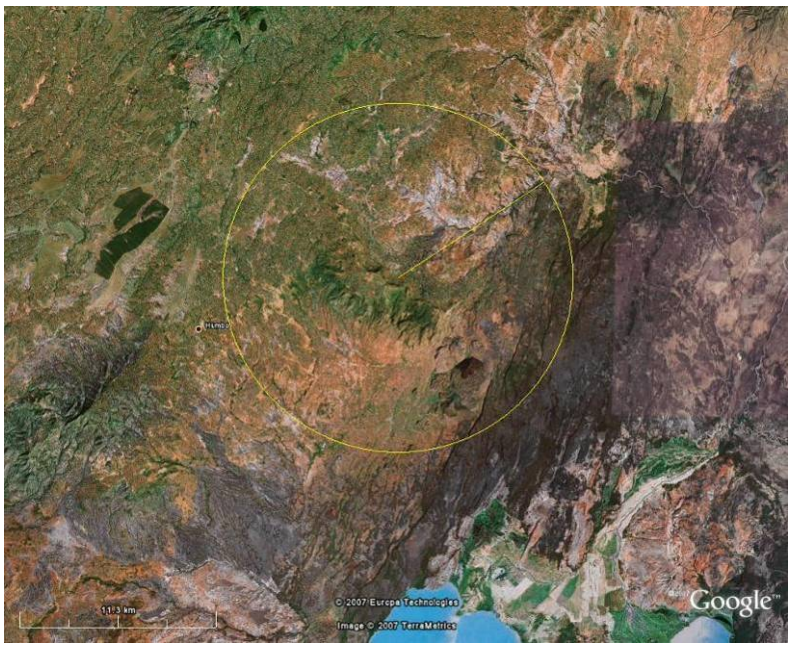


Photo D - 1 Humbo Site radius of 10km demonstrating no areas of remaining forest cover.

Photo D-2 Farmers carrying grass after cutting – the 'cut and carry' method.

Leakage from the clearing of vegetation for fencing material
There will be no leakage due to the clearing of vegetation for fencing material, as live fences will be utilised.

Table D-2: Annual and cumulative leakage emissions associated with the project

Year	Annual leakage emissions ($t\ CO_2\text{-}e.yr^{-1}$)
2007	-
2008	-
2009	-
2010	-
2011	-
2012	-
2013	-
2014	-
2015	-
2016	-
2017	-
2018	-
2019	-
2020	-
2021	-
2022	-
2023	-
2024	-
2025	-

2026	-
2027	-
2028	-
2029	-
2030	-
2031	-
2032	-
2033	-
2034	-
2035	-
2036	-
Total Estimated leakage (t CO2 e)	-
Total number of crediting years	-
Annual average leakage over the crediting period (t CO2 e)	-

SECTION E. Monitoring plan

E.1. Monitoring of the project implementation:

>>

The approved methodology proposes methods for monitoring the following elements:

- The proposed CDM AR **project activity** including the project boundary, forest establishment, and forest management activities;
- Actual net **GHG removals** by sinks including changes in carbon stock in above-ground biomass and below-ground biomass, increase in GHG emissions within the project boundary due to site preparation, transportation, thinning, logging and fertilization;
- **Leakage** due to displacement of grazing and fuelwood collection activities, vehicle use for transportation of staff, products and services, and increased use of wood posts for fencing;
- A **Quality Assurance/Quality Control** plan, including field measurements, data collection verification, data entry and archiving, as an integral part of the monitoring plan of the proposed AR CDM project activity, to ensure the integrity of data collected.

E.1.1. Monitoring of forest establishment and management:

>>

a) Monitoring of the project boundary

The project boundary is used to delineate the project area. The location of each node of the project boundary will be measured during fieldwork and archived in the database. The project boundary would need to be monitored at periodic intervals such as site preparation, planting, silvicultural operations, fire risk assessment etc. Results of the monitoring will be inserted in the database and stored electronically and in paper formats.

Table E-1 Data for monitoring of the project boundary

ID number[26]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[27]	Recording frequency	Number of data points / Other measure of number of collected data	Comment

[26] Please provide ID number for cross-referencing in the PDD.

E 1.1.1	*GPS points to be measured*	*%*	*m*	*At verification*	*1%*	*A random sample of 1% of original GPS points will be monitored at each verification to ensure accuracy of project boundary*

b) Monitoring of the forest establishment

To ensure the planting quality and forest establishment, the following monitoring activities will be conducted:

- Confirm that site and soil preparation are implemented based on practice documented in section A, no slash and burn and overall tillage will be used in the site and soil preparation.
- Survival rate checking
  - The initial survival rate of planted trees will be checked within one to three months after the planting, and re-planting will be conducted if the survival rate is lower than 90%.
  - Final survival checking will be carried out three years after the planting.
  - Survival checking will be conducted for each plantation site.
- 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 stratum and sub-stratum.

Table E-2 Data for monitoring forest establishment

ID number[28]	Data variable	Data unit	Measured (m), calculated (c)	Recording frequency	Number of data points /	Comment

[27] Please provide full reference to data source.

[28] Please provide ID number for cross-referencing in the PDD.

			estimated (e) or default (d)[29]		**Other measure of number of collected data**	
E 1.2.1	*Planting Technique correctly applied*	*Yes / No*	*Measured*	*Daily during planting*	*Entire project area*	
E 1.2.2	*Seedling survival*	*%*	*Measured*	*Quarterly year 1, then annually up to year 3*	*Use permanent sample plots*	*Replanting required if less than 90% survival*
E1.2.3	*Weeding efficacy*	*Yes / No*	*Measured*	*Quarterly year 1, then annually*	*Standard forestry transect*	*Weeding may need to be reimplementation*
E 1.2.4	*Area of planted strata*	*Ha*	*Measured*	*At end of year 1*	*All boundaries monitored*	
E1.2.5	*Pruning efficacy*	*Yes / No*	*Measured*	*Annually*	*Use permanent sample plots*	

c) Monitoring of forest management:

To ensure the forest management is well implemented the following monitoring activities will be conducted in the first three years after planting:

- Checking and ensuring that good conditions exist for natural regeneration by natural re-sprouting.

[29] Please provide full reference to data source.

- Checking that pruning and coppicing are being implemented in an appropriate manner
- Harvesting: information on location, area, tree species of harvested sites are recoded and activities monitored;

Table E-3

ID number[30]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[31]	Recording frequency	Number of sample plots at which the data will be monitored / Other measure of number of collected data	Comment
E 1.3.1	*Pruning volume*	*Wood products*	*Estimated and calculated*	*Quarterly*	*PRA techniques*	*Assessment of pruning volume, utilization of coppice and application of FMRN (see Section A4.4)*
E 1.3.2	*Replanting*	*Stems/Ha*	*Measured*	*ongoing*	*Seedlings replanted*	*As required there will be some ongoing replanting in gaps due to natural mortality*
E 1.3.1	*Pruning efficacy*	*Yes / No*	*Measured*	*Annually*	*Use permanent sample plots*	

[30] Please provide ID number for cross-referencing in the PDD.

[31] Please provide full reference to data source.

E.1.2. If required by the selected approved methodology, describe or provide reference to, SOPs and quality control/quality assurance (QA/QC) procedures applied.

>>

To ensure the net anthropogenic GHG removals by sinks to be measured and monitored precisely, credibly, verifiably and transparently, a quality assurance and quality control (QA/QC) procedure will be implemented,

a) Reliable field measurements

To ensure the reliable field measurements:
Standard Operating Procedures (SOPs) for each step of the field measurements, including the field measurements are followed.
Training programs on the field data collection and data analyses will be held for persons involving in the field measurement works. The training programs will ensure that each field-team members is fully aware of all procedures and the importance of collecting data as accurately as possible. To achieve this, both classroom examination and field examination will be conducted.

b) Verification of field data collection

To verify that plots have been installed and the measurements taken correctly:
- Randomly selected plots will be re-measured by teams other than those involved in the prior plot measurements
- Key re-measurement elements include the location of plots, DBH, and tree height.
- The re-measurement data will be compared with the original measurement data. Errors assessed in the prior measurements will be corrected and recorded and would be used to calculate the measurement error.

c) Verification of data entry and analysis
To minimize the possible errors in the process of data entry, the entry of field data and laboratory data will be reviewed by an independent team. Direct communication between all personnel involved in measuring and analyzing data will be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed.

d) Data maintenance and archiving
Data archiving will take both electronic and paper forms, and copies of all data will be provided to each project participant. All electronic data and reports will also be copied on durable media such as CDs and copies of the CDs are stored in multiple locations. The archives include:

- Copies of all original field measurement data, laboratory data, data analysis spreadsheet;
- Estimates of the carbon stock changes in all pools and non-CO_2 GHG and corresponding calculation spreadsheets;
- Copies of the measurement and monitoring reports.

E.2. Sampling design and stratification

>> The sampling procedures used in this project are described in AR-AM0003, section III 2.1 & 2.2.

a) Sampling Design

The project will establish nested plots in accordance with the guidelines of AR-AM0003

i)Type of plots

In order to monitor the project through time, permanent-sampling plots will be established and maintained. These will be managed in an identical way to the rest of the project, and will permit the most cost and labor effective form of forest monitoring.

ii) Shape and Size

Circular nested plots have been determined to be the most appropriate shape and type of plot for this type of project. Circular nested plots of 1m, 4m, 14m, and 20m in diameter will be established using distance measuring equipment and a fixed central point. Clinometer and relevant correction factor will be used for measurements of sloping lands .

iii) Number of Plots

The sample size (number of plots) will depend on the species variation within the stratified areas, however given that this is a biodiverse forest of mixed ages variation will be high. Precision has been predetermined at ±5%. Preliminary data will be collected to evaluate variance, and following this the number of plots required per strata will be determined using equations 60 – 64 of AR-AM0003.

iv) Location of sampling plots

In order to avoid bias with regard to plot locations, permanent sample plots will be been located systematically with a random start. The geographical position (GPS coordinate), location, stratum and sub-stratum series number of each plot is recorded and archived. It is to be ensured that the sampling plots are distributed randomly, and as evenly spread as possible.

v) Monitoring frequency

Forest establishment will be conducted from 2006 to 2009. Permanent plots will be monitored every five years to assess actual above and below ground biomass accumulation.

vi) Measuring and estimating carbon stock changes over time

Carbon stock changes in above- and below-ground biomass on each plot are estimated using Biomass Expansion Factors (BEF) method The below–ground biomass is estimated using root/shoot ratio read from Table 3A1.8 of the GPG LULUCF.

b) Stratification of the project area

Stratification has been described in section C.4. Stratification will be reviewed as per AR-AM0003 should there be need to develop additional strata or sub strata. Strata boundaries may be modified at time points in the future in order to address changes in project implementation, including areas actually established using the implementation techniques, actual forest management applied to each area, variation in carbon stock change between strata. Strata and substrata will be combined where possible.

The project team will use permanent sample plots in the project monitoring. These are regarded as statistically more efficient in estimating changes in forest carbon stocks than temporary plots because there is high covariance between observations at successive sampling events. Moreover, permanent plots will permit efficient verification, and a verifying organization can find and measure permanent plots at random to verify, in quantitative terms, the design and implementation of the carbon-monitoring plan.

c) Sample size

Considering that the regeneration improvements expected in the project are dependent upon the state of pre-project vegetation, the project stratification takes into account the stratification used in the baseline scenario.

A total of *five* project strata are identified for the project scenario. The four strata identified in the baseline scenario were also adopted in the project scenario and the regeneration measures implemented in each of the four strata as part of the project scenario are considered as the project interventions. An additional stratum (stratum 5) is adopted for planting naturalized species in the bare areas under the project.

The average carbon stock in the region, expert judgment and literature information on the mean and standard deviation of the carbon stock under conditions similar to those expected under the project are used to calculate the sample size.

The steps and equations of AR AM0003 are used to calculate the sample size. The number of sample plots for each stratum is estimated as per the required accuracy. The costs of establishing sample plots across the strata were assumed to remain constant; therefore, these were not taken into account the sample size calculations.

A sample size of 88 plots is estimated for the project. The allocation of plots to the strata is presented below.

S.No	Stratum	No. of sample plots
1	Project stratum–1 (regeneration improvement of native species	9
2	Project stratum–2 (regeneration improvement of native species	27
3	Project stratum–3 (regeneration improvement of native species	42
4	Project stratum–4 (regeneration improvement of native species	4
5	Project stratum –5 (planting of naturalized species	6
	Total number of sample plots	**88**

The adequacy of number of plots are assessed based on the growth measurements of the project scenario and the sample size is revised accordingly in order to calculate the carbon stock changes as per the targeted precision and within 95% confidence interval.

E.3. Monitoring of the baseline net GHG removals by sinks, if required by the selected approved methodology:

>> 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.

E.4. Monitoring of the actual net GHG removals by sinks:

>>

Actual GHG removals will be estimated using data for biomass growth. The biomass growth will be calculated as a function of growth volume estimated. The estimated growth volume for the first stand model of mixed native species is based on the GPG-LULUCF data tables (3A.1.2 and 3A.1.3) as well as in field measurements. For the second stand model involving a mixed plantation of *Eucalyptus globulus* and *Gervillia robusta* the growth volume is based on available literature[32] [33].

[32] http://www.fao.org/docrep/004/ac121e/ac121e04.htm#bm04.3

1. Native species stand model: The data on forest type relevant for the region based on the GPG-LULUCF data tables (3A.1.2 and 3A.1.3) is used for projecting the carbon stock. In addition, expert consultations to assess the stand density improvement as a result of measures implemented to protect and promote the project regeneration. The monitoring data will be used to assess the overlap of *ex ante* and *ex post* forest growth projections.

2. Plantation stand model: In areas without regeneration, naturalized species, *Eucalyptus globulus* and *Grevillia robusta* are planted. The monitoring data on plantation growth will be used to make the ex post biomass projection.

Table E-4: Monitoring data to be collected on the actual net GHG removals by sinks

ID number [34]	Data variable	Data unit	Measured (m), calculated (c), estimated (e) or default (d)[35] Source of data		Recording frequency	Number of sample plots at which the data will be monitored	Comment
28	*Stratum ID*	*Alpha numeric*	*m, e*	*Stratification map*	*Before the start of the project*	*100%*	*Each stratum has a particular combination of soil type, and possibly tree species, etc.*
29	*Sample plot ID*	*Alpha numeric*		*Project and plot map*	*Before the start of the project*	*100%*	*Numeric series ID will be assigned to each permanent sample plot*
30	*Plot location*		*m*	*Project and plot map and GPS locating*	*5 years*	*100%*	*Location of the plot and field measurement*

[33] http://www.fao.org/docrep/s4550e/s4550e0b.htm

[34] Please provide ID number for cross-referencing in the PDD.

[35] Please provide full reference to data source.

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ID number [34]	Data variable	Data unit	Measured (m), calculated (c), estimated (e) or default (d)[35] Source of data		Recording frequency	Number of sample plots at which the data will be monitored	Comment
31	*Confidence level*	*%*		*CDM*	*Before the start of the project*	*100%*	*For the purpose of QA/QC and measuring and monitoring precision control*
32	*Precision level*	*%*		*CDM*	*Before the start of the project*	*100%*	*For the purpose of QA/QC and measuring and monitoring precision control*
33	*Tree species*			*Project design map*	*5 years*	*100%*	
34	*Age of plantation*	*year*	*m*	*Plot measurement*	*5 years*	*100% sampling plot*	*Counted since the planted year*
35	*Number of trees by species*	*number*	*m*	*Plot measurement*	*5 years*	*100% trees in plots*	*Counted in plot measurement*
36	*Diameter at breast height (DBH)*	*cm*	*m*	*Plot measurement*	*5 year*	*100% trees in plots*	*Measuring at each monitoring time per sampling method*
37	*Mean DBH*	*cm*	*c*	*Calculated*	*5 year*	*100% of sampling plots*	
38	*Tree height*	*m*	*m*	*Plot measurement*	*5 year*	*100% trees in plots*	
39	*Mean tree height*	*m*	*c*	*Calculated*	*5 year*	*100% of sampling plots*	
40	*Wood density*	*t d.m. m^{-3}*	*d*	*Project data, GPG LULUCF*	*5 year*	*100% of sampling plots*	*Species specific*
41	*Biomass expansion factor (BEF)*	*dimensionless*	*d*	*GPG LULUCF*	*5 year*	*100% of sampling plots*	*constant=1*
42	*Carbon fraction*	*t C.(t d.m)$^{-1}$*	*d*	*IPCC*	*5 year*	*100% of sampling plots*	*IPCC default value*

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ID number [34]	Data variable	Data unit	Measured (m), calculated (c), estimated (e) or default (d)[35] Source of data		Recording frequency	Number of sample plots at which the data will be monitored	Comment
43	*Root-shoot ratio*	*dimensionless*	*d*	*national inventory for LULUCF*	*5 year*	*100% of sampling plots*	*Species specific or GPG LULUCF default value for Quercus ilex = 0.35*
44	*Carbon stock in above-ground biomass of plots*	*t C ha^{-1}*	*c*	*Calculated from equation*	*5 year*	*100% of sampling plots*	
45	*Carbon stock in below-ground biomass of plots*	*t C ha^{-1}*	*c*	*Calculated from equation*	*5 year*	*100% of sampling plots*	
46	*Mean Carbon stock in aboveground biomass per unit area per stratum per species*	*t C ha^{-1}*	*c*	*Calculated from plot data*	*5 year*	*100% of strata and sub-strata*	
47	*Mean Carbon stock in belowground biomass per unit area per stratum per species*	*t C ha^{-1}*	*c*	*Calculated from plot data*	*5 year*	*100% of strata and sub-strata*	
48	*Area of stratum and sub-stratum*	*ha*	*m*	*Stratification map and data*	*5 year*	*100% of strata and sub-strata*	*Actual area of each stratum and sub-stratum*
49	*Carbon stock in aboveground biomass of stratum per species*	*t C*	*c*	*Calculated using equation*	*5 year*	*100% of strata and sub-strata*	
50	*Carbon stock in belowground biomass of r stratum per species*	*t C*	*c*	*Calculated using equation*	*5 year*	*100% of strata and sub-strata*	

ID number [34]	Data variable	Data unit	Measured (m), calculated (c), estimated (e) or default (d)[35] Source of data		Recording frequency	Number of sample plots at which the data will be monitored	Comment
51	*Annual carbon stock change in aboveground biomass of stratum per species*	*t C yr^{-1}*	*c*	*Calculated using equation*	*5 year*	*100% of strata and sub-strata*	
52	*Annual carbon stock change in belowground biomass of stratum per species*	*t C yr^{-1}*	*c*	*Calculated using equation*	*5 year*	*100% of strata and sub-strata*	
53	*Total carbon stock change in CO_2 eq.*	*t CO_2-e yr^{-1}*	*c*	*Calculated using equation*	*5 year*	*100% project area*	*Summing up carbon stock change in for all strata, sub-strata and tree species*

E.4.1. Data to be collected in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed A/R CDM project activity:

>>

Step-wise procedures (BEF method) and equation (66)-(73) in Section III.5.1 of the approved baseline and monitoring methodology (AR-AM0003/version 03) will be followed to monitor the verifiable carbon stock changes in the above-ground and below-ground living biomass within the project boundary.

Table E-5: Data to be collected and archived for actual net GHG removals by sinks

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ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
2.1.1.04	p	Desired level of precision (e.g. 10%)		%	Defined	Before the start of the project	100 %	For the purpose of QA/QC and measuring and monitoring precision control
2.1.2.08	PBB_{ikt}	Average proportion of biomass burnt for stratum i, stand model k, time t	Measured after slash and burn	Dimensionless	m	Annually	100 %	Sampling survey after slash and burn
2.1.1.07	PL_{ID}	Sample plot ID (1, 2, 3, … pl, …)	Project and plot map, GIS	Alpha numeric	Defined	Before the start of the project	100%	Numeric series ID will be assigned to each permanent sample plot
	PL_{ik}	Total number of plots in stratum i, stand model k	Field measurement	Dimensionless	m	5-year	100%	
2.1.1.20	R_j	Root-shoot ratio	Local-derived, national inventory,	Dimensionless	e	5 year	100% of sampling plots	Local-derived and species-specific value have the priority
	$16/12$	Ration of molecular weights of CH_4 and carbon	Universal constant	Dimensionless	Universal constant			
	$44/12$	Ration of molecular weights of carbon and CO_2	Universal constant	Dimensionless	Universal constant			
	$44/28$	Ration of molecular weights of N_2O and nitrogen	Universal constant	Dimensionless	Universal constant			
2.1.1.03		Confidence level (e.g. 95%)	AR-CDM-PDD	%	Defined	Before the start of the project	100%	For the purpose of QA/QC and measuring and monitoring precision control

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ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
	A	Total size of all strata (A), e.g. the total project area	GIS or/and GPS	Hectares	m	Before the start of the project and adjusted thereafter every 5-year	100%	
	A_i	Area of stratum i	GIS or/and GPS	Hectares	m	Before the start of the project and adjusted thereafter every 5-year	100%	
2.1.2.18	$A_{N,ikt}$	Area of with N applied in stratum i, stand model k, at time t	Monitoring activity	Hectares	m	yearly	100 %	For different tree species or management intensity
2.1.1.25	A_{ikt}	Area of stratum i, stand model k, at time t	GIS or/and GPS	Hectares	m	yearly	100%	Measured for different strata and stands
2.1.2.06	$A_{B,ikt}$	Area of slash and burn in stratum i, species j, at time t	Measurement	Hectares	m	yearly	100%	Measured for different strata and stands
	AP	Sample plot area	Field measurement	m^2	m	5-year	100%	
2.1.1.18	BEF	Biomass expansion factor (BEF)	Local-derived, national inventory, IPCC GPG LULUCF	dimensionless	e	5 year	100 % of sampling plots	Local-derived and species-specific value have the priority (IPCC default in LULUCF GPG 2003, Table 3A.1.10)
2.1.2.07	B_{ijt}	Average above-ground biomass stock before burning for stratum i, species j, time t	Field measurement	tonnes d.m. ha^{-1}	m	Before burning	Sample p lots	
2.1.2.12	$N/C\ ratio$	Nitrogen-carbon ratio	Literature	dimensionless	e	Once per species or group of species		IPCC default value (0.01) is used if no appropriate value

ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
2.1.1.21	$C_{AB,ijt}$	Carbon stock in above-ground biomass for stratum *i*, species *j*, time *t*	Calculations	tonnes C	c	5-year	100%	(Eq. 70)
	C_{ACTUAL}	Actual net greenhouse gas removals by sinks	Calculations	tonnes CO_2-e.	c	5-year	100%	(Eq. 65)
2.1.1.22	$C_{BB,ijt}$	Carbon stock in below-ground biomass for stratum *i*, species *j*, time *t*	Calculations	tonnes C	c	5-year	100%	(Eq. 71)
2.1.2.09	*CE*	Average biomass combustion efficiency	GPG LULUCF, National inventory	dimensionless	e	Before the start of the project	100 %	IPCC default value (0.5) is used if no appropriate value
2.1.2.10	*CF*	Carbon fraction of biomass burnt	Local , national , IPCC	tonnes C (tonne d.m.)$^{-1}$	e	Once per crediting period		Local-derived and species-specific value have the priority (IPCC default = 0.5)
2.1.1.19	CF_j	Carbon fraction of species *j*	Local, national, GPG for LULUCF IPCC	tonne C tonne^{-1}	e	Once per species	100% of species or species group	Local-derived and species-specific value have the priority (IPCC default = 0.5)
	C_i	Cost of establishment of a sample plot for each stratum *i*	measurement	US $ or local currency	m	5-years	100%	
2.1.2.01	$CS^P_{diesel\ t}$	Amount of diesel consumption for year *t*	measurement	liter (l)	m	Yearly	100 %	Measuring either diesel consumption per unit area for site preparation, or per unit volume logged or thinned
2.1.2.02	$CS^P_{gasoline\ t}$	Amount of gasoline consumption for year *t*	measurement	liter (l)	m	Yearly	100 %	Measuring either diesel consumption per unit area for site preparation, or per unit volume

ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
								logged or thinned
2.1.1.12	DBH	Diameter at breast height of living and standing dead trees	Plot measurement	cm (living/dead)	m	5 year	100% trees in plots	Measuring at each monitoring time per sampling method
2.1.1.17	D_j	Wood density of species j	Local-derived, national inventory, IPCC GPG LULUCF	t d.m. m^{-3}	e	5 year	100% of sampling plots	Local-derived and species-specific value have the priority
	E	Allowable error	Calculations	Depends on the variable calculated	c	5-year	100% of the variables	(Eq. 59)
2.1.2.15	$E_{BiomassBurn}$	Increase in GHG emission as a result of biomass burning within the project boundary	Calculations	tonnes CO_2-e.	c	5-year	100%	(Eq. 90)
2.1.2.14	$E_{BiomassBurn,CH4}$	CH_4 emission from biomass burning in slash and burn	Calculations	tonnes CO_2-e.	c	5-year	100%	(Eq. 93)
2.1.2.13	$E_{BiomassBurn,N2O}$	N_2O emission from biomass burning in slash and burn	Calculations	tonnes CO_2-e.	c	5-year	100%	(Eq. 92)
2.1.2.11	$E_{BiomassBurn,CO2}$	CO_2 emission from biomass burning in slash and burn	Calculations	tonnes CO_2-e.	c	5-year	100%	(Eq. 91)
2.1.2.23	$EF1$	Emission factor for emission from N input	GPG 2000, GPG LULUCF, IPCC Guidelines, National inventory	tonnes N_2O-N (tonnes N input)$^{-1}$	e	Before start of monitoring, once per crediting period	100%	IPCC default value (1.25 %) is used if no more appropriate data
2.1.2.03	EF_{diesel}	Emission factor for diesel	GPG 2000, IPPCC Guidelines, national inventory	kg CO_2 r^{-1}	e	At beginning of the project		National inventory value should has priority

ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
2.1.2.04	$EF_{gasoline}$	Emission factor for gasoline	GPG 2000, IPPCC Guidelines, national inventory	kg $CO_{2\ r1}$	e	At beginning of the project		National inventory value should has priority
2.1.2.05	$E_{FuelBurn}$	Increase in GHG emission as a result of burning of fossil fuels within the project boundary	Calculations	tonnes CO_2-e.	c	5-year	100%	(Eq. 89)
	ER_{N20}	Emission ratio for N_2O	Literature	Dimensionless	e	Yearly		(IPCC default = 0.007)
	ER_{CH4}	Emission ratio for CH_4	Literature	Dimensionless	e	Yearly		(IPCC default = 0.012)
	$f_j(DBH,H)$	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	Literature or field measurements	kg tree^{-1}	m-e-c	Once per species	For all major species or group of species	Use local/global equations validated for local conditions
	F_{ON}	Total amount of organic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NO_x	Calculations	tonnes N	c	5-year	100 %	(Eq. 98)
2.1.2.21-22	$Frac_{GASF}$	Fraction that volatilizes as NH_3 and NO_x for synthetic fertilizers	GPG 2000, GPG LULUCF , IPCC Guideline , National inventory	Dimensionless	e	Once per fertilizer type used		IPCC default value (0.1) is used if no more appropriate data

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ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
	F_{SN}	Total amount of synthetic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NO_x	Calculations	tonnes N	c	5-year	100 %	(Eq. 97)
2.1.2.25	GHG_E	Increase in GHG emission as a result of the implementation of the proposed AR CDM project activity within the project boundary	Calculations	tonnes CO_2-e.	c	5-year	100%	(Eq. 88)
	GW^P_{CH4}	Global Warming Potential for CH_4	IPCC literature - EB decisions		e	Once per commitment period		(IPCC default = 21)
	GWP_{N2O}	Global Warming Potential for N_2O	IPCC literature - EB decisions		e	Once per commitment period		(IPCC default = 310)
2.1.1.38	H_{ijt}	Annually harvested volume and fuel wood for stratum i, species j, at time t	Harvesting statistics	m^3	c	Annually	100% stands	Annually recorded
2.1.1.01	i_{ID}	Stratum ID (1, 2, 3, … m_{SP} project scenario (ex-post) strata)	Stand map, GIS	Alpha numeric	Defined	At stand establishment	100 %	Each stand has a particular year to be planted under each stratum
2.1.1.02	ID_{ikt}	Stand ID	Stand map, GIS	Alpha numeric	Defined	At stand establishment	100%	Each stand has a particular year to be planted under each stratum
2.1.1.09	j	Tree species	Project list		m	5 years	100%	Arranged in PDD
	kID	Stand model ID (1, 2, 3, … i …S_{PS})	AR-CDM-PDD	Dimensionless		5 years	100%	May require $ex\text{-}post$ adjustments

ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
2.1.1.08	*lat/long*	Plot location	Project and plot map and GPS locating, GIS		m	5 years	100%	Using GPS to locate before start of the project and at time of each field measurement
2.1.1.23	$^{M}C_{AB,ijt}$	Mean carbon stock in above-ground biomass per unit area for stratum *i*, species *j*, time *t*	Calculations	tonnes C ha^{-1}	c	5-year	100%	(Eq. 68)
2.1.1.24	$^{M}C_{BB,ijt}$	Mean carbon stock in below-ground biomass per unit area for stratum *i*, species *j*, time *t*	Calculations	tonnes C ha^{-1}	c	5-year	100%	(Eq. 69)
2.1.1.16	MV_{ijt}	Mean merchantable volume per unit area for stratum *i*, species *j*, time *t*		m_3 ha^{-1}	m^3	5 year	100% of sampling plots	Calculated from 2.1.1.13 and possibly 2.1.1.15 using local-derived equations, or directly measured by field instrument
	N	Maximum possible number of sample plots in the project area	Calculations	Dimensionless	c	5-years	100%	(Eq. 59)
	n	Sample size (total number of sample plots required) in the project area	Calculations	Dimensionless	c	5-years	100%	(Eq. 60 or Eq. 62)
	N_i	Maximum possible number of sample plots in stratum *i*	Calculations	Dimensionless	c	Before the project start; thereafter adjusted tevery 5-year	100 %	(Eq. 59)

ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
2.1.1.06	n_i	Sample size for stratum i	Calculations	Dimensionless	c	Before the project start; adjusted thereafter every 5-year	100%	(Eq. 61 or Eq. 63) Calculated for each stratum
2.1.2.20	$N_{ON\text{-}Fert}$	Total amount of organic fertilizer used within the project boundary	Calculations	tonnes N	c	5-year	100%	(Eq. 95)
2.1.2.17	$N_{ON\text{-}Fert,ikt}$	Use of organic fertilizer per unit area for stratum i, stand model k, at time t	Field measurement	kg N ha^{-1} yr^{-1}	m	Yearly	100%	For the purpose of QA/QC and measuring and monitoring precision control
2.1.2.19	$N_{SN\text{-}Fert}$	Total amount of synthetic fertilizer used within the project boundary	Calculations	tonnes N	c	5-year	100%	(Eq. 92)
2.1.2.16	$N_{SN\text{-}Fert,ikt}$	Use of synthetic fertilizer per unit area for stratum i, stand model k, at time t	Field measurement	kg N ha^{-1} yr^{-1}	m	Yearly	100%	
2.1.1.11	$n_{TRPLikt}$	Number of trees in the sample plot	Plot measurement	Number	m	5 years	100% trees in plots	Counted in plot measurement
2.1.2.24	$N_2O_{direct\text{-}N_{fertilizer}}$	Increase in N_2O emission as a result of direct nitrogen application within the project boundary	Calculations	tonnes CO_2-e..	c	5-year	100%	(Eq. 96)
2.1.1.04	p	Desired level of precision (e.g. 10%)		%	defined	Before the start of the project	100 %	For QA/QC and measuring and monitoring precision control

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ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
2.1.2.08	PBB_{ikt}	Proportion of biomass burnt	Measured after slash and burn	Dimensionless	m	Annually	100%	Sampling survey after slash and burn
	PBB_{ikt}	Average proportion of biomass burnt for stratum i, stand model k, time t	Field estimates or literature	Dimensionless	e	Before burning	sample plots	Used for estimating numbers of sample plots of each stratum and stand, as necessary
2.1.1.07	PL_{ID}	Sample plot ID (1, 2, 3, … pl)	Project and plot map, GIS	Alpha numeric	defined	Before the start of the project	100%	Numeric series ID will be assigned to each permanent sample plot
	PL_{ik}	Total number of plots in stratum i, stand model k	Field measurement	Dimensionless	m	5-year	100%	
2.1.1.20	R_j	Root-shoot ratio	Local-derived, national inventory,	Dimensionless	e	5 year	100% of sampling plots	Local-derived and species-specific value have the priority
2.1.1.05	st_i	Standard deviation for each stratum i			e	At each monitoring event	100%	Used for estimating numbers of sample plots of each stratum and stand, as necessary
	TB_{ABj}	Above-ground biomass of a tree of species j	Calculations	kg dry matter $tree^{-1}$	c	5-year	100%	(Eq. 74)
	$^{T}C_{ABj}$	Carbon stock in above-ground biomass per tree of species j	Calculations	k g C $tree^{-1}$	c	5- y ear	100%	(Eq. 75)
	$^{T}C_{BBj}$	Carbon stock in below-ground biomass per tree of species j	Calculations	k g C $tree^{-1}$	c	5- y ear	100%	(Eq. 75)
2.1.1.10	tID	Age of plantation (1, 2… years)	GIS	Year	m	At stand establishment	100%	Counted since the planted year
	t^{r}_{ID}	Tree ID (1, 2, 3, … tr … TR = total number of trees in plot)	Field measurement	Dimensionless	m	5-year	100%	

ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
	XF	Plot expansion factor from per plot values to per hectare values (Eq. 76)	Calculations	Dimensionless	c	5-year	100%	(Eq. 78)
	$z_{\alpha/2}$	Value of the statistic z (normal probability density functio n), for $\alpha = 0.05$ (implying a 95 % confidence level)	Statistic book	Dimensionless	m	5-years	0%	
2.1.1.28	$\Delta C_{AB,ijt}$	Annual carbon stock change in above-ground biomass for stratum i, species j, time t	Calculations	tonnes C yr^{-1}	c	5-year	100%	(Eq. 86)
2.1.1.28	$\Delta C_{AB,ikt}$	Annual carbon stock change in above-ground biomass for stratum i, stand model k, time t	Calculations	tonnes C yr^{-1}	c	5-year	100%	(Eq. 72)
2.1.1.29	$\Delta C_{BB,ijt}$	Annual carbon stock change in below-ground biomass for stratum i, species j, time t	Calculations	tonnes C yr^{-1}	c	5-year	100%	(Eq. 87)
2.1.1.29	$\Delta C_{BB,ikt}$	Annual carbon stock change in below-ground biomass for stratum i, stand model k, time t	Calculations	tonnes C yr^{-1}	c	5-year	100%	(Eq. 73)
	$\sim C_{B,ikt}$	Annual carbon stock change in living biomass in the baseline for stratum i, stand model k, time t	Calculations	tonnes CO_2-e. yr^{-1}	c	5-year	100 %	(Eq. 67)

ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
	$\sim C_{LB,ikt}$	Annual carbon stock change in living biomass in the project scenario for stratum *i*, stand model *k*, time *t*	Calculations	tonnes CO_2-e. yr^{-1}	c	5-year	100 %	(Eq. 67)
	$\sim C_{P,LB}$	Sum of the changes in living biomass carbon stocks in the project scenario (above- and below-ground)	Calculations	tonnes CO_2-e.	c	5-year	100%	(Eq. 66)
	$\sim {}^{M}C_{AB,ikt}$	Mean carbons stock change in above-ground biomass stratum *i*, stand model *k* at year *t*	Calculations	tonnes C ha^{-1} yr^{-1}	c	5-year	100%	(Eq. 79)
	$\sim {}^{M}C_{AB,ikT}$	Mean carbons stock change in above-ground biomass stratum *i*, stand model *k*, between two monitoring events	Calculations	tonnes C ha^{-1}	c	5-year	100%	(Eq. 84)
	$\sim {}^{M}C_{BB,ikt}$	Mean carbons stock change in below-ground biomass stratum *i*, species *j* at year *t*	Calculations	year t tonnes C ha^{-1} yr^{-1}	c	5-year	100 %	(Eq. 85)
	$\sim {}^{M}C_{BB,ikT}$	Mean carbons stock change in below-ground biomass stratum *i*, species *j*, between two monitoring events	Calculations	tonnes C ha^{-1}	c	5-year	100%	(Eq. 83)
	$\sim PC_{AB,ijT}$	Plot level mean carbon stock change in above-ground biomass in stratum *i*, species *j* between two monitoring events	Calculations	tonnes C ha^{-1}	c	5-year	100%	(Eq. 77)

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ID number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
	$\sim {}^{P}C_{BB,ijT}$	Plot level mean carbon stock change below-ground biomass in stratum *i*, species *j* between between two monitoring events	Calculations	t C ha^{-1}	c	5-year	100%	(Eq. 82)
	$\sim {}^{TC}{}_{ABjt}$	Carbon stock change in above-ground biomass per tree of species *j* in year *t*	Calculations	kg C $tree^{-1}$ yr^{-1}	c	5-year	100%	(Eq. 76)
	$\sim {}^{T}C_{ABjT}$	Carbon stock change in above-ground biomass per tree of species *j* between two monitoring events	Calculations	kg C $tree^{-1}$	c	5-year	100%	(Eq. 76)
	$\sim TC_{AB,jt}$	Carbon stock change in below-ground biomass per tree of species *j* in year *t*	Calculations	kg C $tree^{-1}$ yr^{-1}	c	5-year	100%	(Eq. 76)
	$\sim {}^{T}C_{BBjT}$	Carbon stock change in below-ground biomass per tree of species *j* between two monitoring events	Calculations	kg C $tree^{-1}$	c	5-year	100%	(Eq. 81)

E.4.2. Data to be collected in order to monitor the GHG emissions by the sources, measured in units of CO_2 equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within the project boundary:

>>

The project is not expected to result in emissions for the following reasons:

- Manual methods are used for carrying out the project tasks. Therefore, no emissions associated with the use of fossil fuels are relevant for the project context.
- There is no clearance of vegetation for site preparation
- 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.

Therefore, the project emissions are expected to be zero.

E.5. Leakage:

>>

Emissions associated with transport activities and activity displacement will be monitored as part of leakage.

E.5.1. If applicable, please describe the data and information that will be collected in order to monitor leakage of the proposed A/R CDM project activity:

>>

For the AR CDM project activity, leakage from transport and activity displacement will be estimated as follows:

$LK_{Vehicle}$ = total GHG emissions due to fossil fuel combustion from vehicles; tonnes CO_2-e.
$LK_{ActivityDisplacement}$ = leakage due to activity displacement; tonnes CO2-e.

$LK_{Vehicle}$ - Kilometres travelled by vehicles by type will be monitored through self-reporting of project participants and the data will be used for calculation of the travel compensation for the employees undertaking the work.

- Fuel consumption per km by type of vehicle will be monitored according to factory data corrected for travelling through mountains.
- Number of vehicle used by type will be monitored through self-reporting of project participants
- The self reporting will not lead to underestimation of the actual emissions due to the fact that underestimation of transportation distances would reduce the travel compensation for employees of the project participant.

$LK_{ActivityDisplacement}$ - Leakage due to conversion of land to grazing land is not attributable to the AR-CDM project activity if the conversion of land to grazing land occurs 5 years after the last measure taken to reduce animal populations in the project area. There is anticipated to be no net leakage due to the relocation of animals from the project area in the 5-year period, as there are significant areas of land which have already been cleared and are under the control of the project participants.

It is expected that the project will generate enough fuel wood within the project area, initially through pruning of existing vegetation to assist natural regeneration and later from planted woodlots, to satisfy the pre-project fuel wood collection. FG outside,t - FGNGL,t = 0. Leakage due to fuelwood collection will be assessed through survey of households in the vicinity of households during the initial two-year period through a random sample of at least 100 households. The monitoring of fuel wood collection will be based on interviews with a representative sample of community members involved in the project (rapid rural appraisal) undertaken annually and with the monitoring data presented in m3/ha/year. If the reported fuelwood collection of majority of households is from areas that are more degraded than those of the project, then leakage is assumed to be zero. The data to be monitored for leakage assessment is listed below.

Table E-6: Data to be collected and archived for leakage

ID Number		Data Variable	Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
	44/12	Ration of molecular weights of carbon and CO_2	universal constant	dimensionless	universal constant			

	BEF_2	Biomass expansion factor (BEF)	Local-derived, national inventory, IPCC GPG LULUCF	dimensionless	e	5 year	100% of sampling plots	Local-derived and species-specific value have the priority (IPCC default in LULUCF GPG 2003, Table 3A.1.10)
	CF_j	Carbon fraction of dry matter of species *j*	Literature, own studies	tonnes C (tonne d.m.)$^{-1}$	e	Once per species or group of species	100 %	Local/national data or IPCC default (= 0.5)
	Dj	Wood density of species *j*	Local-derived, national inventory, IPCC GPG LULUCF	t d.m. m^{-3}	e	5 year	100% of sampling plots	Local-derived and species-specific value have the priority
3.1.02	EF_{xy}	CO_2 emission factor for vehicle type *x* with fuel type *y*	GPG 2000, IPPC Guidelines , national inventory	kg CO_2 l^{-1}	e	At beginning of the project	100%	National inventory value should have priority
3.1.04	e_{xyt}	Fuel efficiency of Vehicle type *x* with fuel type *y* at time *t*	Local data, nationnal data, IPCC	liter km^{-1}	e	5 years	100 %	Estimated for each vehicle type and fuel type used
	$^{F}G_{AR,t}$	Volume of fuelwood gathered in the project area according to monitoring results	Field sampling	m^3 yr^{-1}	m	Yearly	S^{FR}_{PAfw}	
	FG_{BL}	Average pre-project annual volume of fuelwood gathering in the project area – estimated *ex-ante* and specified in the AR-	AR-CDM-PDD	m^3 yr^{-1}	c - e	*Ex-ante* in AR-CDM-		*Ex-ante* estimate in the AR-CDM-PDD
	$^{F}G_{NGL,t}$	Monitored volume of fuelwood gathering in *NGL* areas and supplied to pre-project fuelwood collectors or charcoal producers –	Field measurements	m^3 yr^{-1}	m	Yearly	S^{FR}_{NGL}	

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ID Number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
	$FG_{outside,t}$	Volume of fuelwood gathering displaced outside the project area at year t – as per step 1	Calculations	$m_3\ yr^{-1}$	c	Yearly	100%	(Eq. 111)
	FG_t	Volume of fuelwood gathering displaced in unidentified areas	Calculations	$m_3\ yr^{-1}$	c	Yearly	100%	(Eq. 113)
3.1.05	$FuelConsumption_{xy,t}$	Consumption of fuel type *x* of vehicle type *y* at time *t*	Calculations	liters	c	Yearly	100%	(Eq. 102)
3.1.03	k_{xyt}	Kilometers traveled by each of vehicle type *y* with fuel type *x* at time *t*	Monitoring of project activity	kilometers	m	Yearly	100 %	Monitoring kilometers for each vehicle type and fuel type used
3.1.19	*LK*	Total project leakage	Calculations	tonnes CO_2-e.	c	Yearly	100%	(Eq. 99)
	$LK_{fuelwood}$	Leakage due to the displacement of fuelwood collection	Calculations	tonnes CO_2-e.	c	Yearly	100%	(Eq. 112)

ID Number	Data Variable		Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	Comment
3.1.06	$LK_{Vehicle}$	Total GHG emissions due to fossil fuel combustion from vehicles	Calculations	tonnes CO_2-e.	c	Yearly	100%	(Eq. 100)
	$LK_{Vehicle,CH4}$	Total CH_4 emissions due to fossil fuel combustion from vehicles	Calculations	tonnes CO_2-e.	c	Yearly	100%	(Eq. 101)
	$LK_{Vehicle,CO2}$	Total CO_2 emissions due to fossil fuel combustion from vehicles	Calculations	tonnes CO_2-e.	c	Yearly	100%	(Eq. 101)
	$LK_{Vehicle,N2O}$	Total N_2O emissions due to fossil fuel combustion from vehicles	Calculations	tonnes CO_2-e.	c	Yearly	100%	(Eq. 101)
3.1.01	n_{xyt}	Number of each vehicle type used	Monitoring of	dimensionless	m	Yearly	100%	Monitoring number of each
	SFR_{PAfw}	Fraction of sampled project areas sampled for fuelwood collection	CDM-AR-PDD	dimensionless	Defined using statistical criteria	*Ex-ante* in AR-CDM-PDD		*Ex-ante* estimate in the AR-CDM-PDD
	x	Vehicle type	Monitoring of project activity	dimensionless	m	Yearly	100%	

E.5.2. Specify the procedures for the periodic review of implementation of activities and measures to minimize leakage, if required by the selected approved methodology:

>>

The project proposes to monitor activities that cause leakage and seeks to implement measures to minimize. In this context, the project proposes to monitor and review following activities.

- The project will monitor fossil fuel consumption for transport of personnel and products outside the project boundary
- Leakage from fuel wood collection will be monitored and measures will be implemented to minimize it through the establishment of sustainably managed wood lots supplying communities with pre-project levels of fuel wood and managed thinning from regenerated natural forest.

- The fodder production and collection methods implemented will lead to avoidance of leakage associated with grazing.

E.6. Provide any additional quality control (QC) and quality assurance (QA) procedures undertaken for data monitored not included in section E.1.3:

>>

The quality control procedures to implemented to address the uncertainty of monitored data are presented below.

Table E-7 Data pertaining to quality control and quality assurance procedures

Data ***(Indicate ID number)***	**Uncertainty level of data (High/Medium/Low)**	**Explain QA/QC procedures planned for these data, or why such procedures are not necessary.**
3.3.1.17 Plot location	*low*	*Random plot verification using GPS to ensure the consistent measuring and monitoring of the carbon stock change over time*
3.2.06 Plot Area	*low*	*Random verification over the project area to ensure the area of each plot is correctly measured*
3.3.1.20 Number of trees	*low*	*Random plot verification*
3.3.1.21 Diameter at breast height (DBH)	*low*	*- Field staff will be trained in advance* *- Data checked by a qualified person in cooperation with the field team* *- To re-measure independently every 8-10 plots, and to compare the measurements to check for errors; any errors found should be resolved, corrected and recorded. The re-measurement of permanent plots is to verify that measurement procedures were conducted properly.* *- ca. 10% of the sample plots are checked after field work*
3.3.1.23 Tree height	*low*	*Random plot verification*
3.2.11 Root-shoot ratio	*low*	*Data that divert significantly from IPCC default value shall be verified*
4.1.7 Number of travelling vehicles	*low*	*The trip data are available in the project records and can be verified.*
4.1.9 Kilometres travelled by vehicles	*low*	*Project record shall be available and verified*

4.1.4 Number of animals	*low*	*Random verification by plot or village*
4.1.5 Number of months	*low*	*Random verification*

E.7. Please describe the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity:

>> The proposed A/R CDM project activity will be implemented within the larger umbrella of the World Vision Humbo Area Development Program (ADP). Resources for the implementation of this project will be provided through World Vision Australia. Other programs within the Humbo ADP include HIV/AIDS prevention, food security, agricultural development, health and education.

The project management is based on community forestry association models used elsewhere in sub-Saharan Africa, and will be based on the seven community cooperative societies which will be established. This type of associations is non-governmental, consisting of members of the public that are using and benefiting from the forest resources as well as government representatives and World Vision. The main role of the cooperatives is to manage the communal forests in close cooperation with the Ethiopian Agricultural, Rural Development & Forestry Development Coordination Office (ARDFCO), World Vision Ethiopia and World Vision Australia.

The community cooperatives will utilize the Southern National Nationalities and Peoples Region Rural land Administration and Utilization Proclamation No 53/2003. This legislation allows for community groups such as these to manage and benefit from the forest resources, including 'the making of local laws issued by the group, which are not in contravention with the proclamation' and 'being responsible for natural and artificial resources found on the communally possessed land'.

World Vision through the cooperatives will be responsible for the establishment and management of the trees, facilitating and supervising the implementation of the proposed A/R CDM project activity, and organizing and coordinating the measuring and monitoring of the actual GHG removals by sinks and leakage associated with the proposed A/R CDM project activity. All monitoring and measurement data will be archived in electronic and paper formats.

The ARDFCO and its district forestry offices will provide technical instruction on reforestation and forest management, and help to conduct the specific supervision of the implementation of the proposed A/R CDM project activity.

An expert team will be established to assist if any technical issues arise and also conducting verification of measured and monitored data.

E.8. Name of person(s)/entity(ies) applying the monitoring plan:

>>

Name	Institution	Contact
Joseph Kamara	World Vision Australia	Joseph.kamara@worldvision.com.au
Assefa Tofu	World Vision Ethiopia	Assefa_tofu@wvi.org
Mr. Paul Dettmann	Consultant	paul.dettmann@bigpond.com
Dr. Bernhard Schlamadinger	Joanneum Research	bernhard.schlamadinger@joanneum.at

SECTION F. Environmental impacts of the proposed A/R CDM project activity:

F.1. Documentation on the analysis of the environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed A/R CDM project activity:

>> Regional and National Significance

The Humbo region has 1% of its original forest cover, and Ethiopia nationally only 2.7% of the high forests. Consequently any large areas of native endemic vegetation are of high significance. Ethiopia has the fifth largest floral diversity of tropical Africa. It is estimated that Ethiopia is home to between 6500 and 7000 species of higher plants, of which about 12 per cent are endemic, therefore the potential biodiversity of this project is extremely significant.

The project area is approximately 20 km upstream from Lake Abaya, one of the biggest rift valley lakes, known for its crocodile, hippopotamus and fish resources. The lake ecosystem is in danger of sedimentation due to the high levels of eroded soil entering it each year. There is concern that, if large areas of steeper country are not revegetated, Lake Abaya may follow the same progression as Lake Alemaya in eastern Ethiopia, which has become completely depleted due to sedimentation.

Biodiversity

This region contains threatened species included in the IUCN red list associated with the temperate and tropical mountain forest habitats. Species identified within this region and belonging to this habitat include:

Afrixalus enseticola	Ethiopian Banana Frog (E)
Caprimulgus solala	Nechisar Nightjar (E)
Grammomys minnae	Ethiopian Thicket Rat (E)
Heteromirafra sidamoensis	Sidamo Bushlark
Hipposideros megalotis	Ethiopian Large-Eared Roundleaf Bat (E)
Kerivoula eriophora	Ethiopian Woolly Bat (E)
Lycaon pictus	African Wild Dog
Panthera leo	African Lion
Vulpes pallida	African Sand Fox
Phoenicopterus minor	Lesser Flamingo

The project activities will enable the following biodiversity outcomes:

- The Humbo forest will provide habitat for birds, mammals and other native animals as well as species identified on the IUCN red list. The forest will provide a strategic corridor link between the Nechisar National Park, Lake Abaya and Lake Chomo. The Nechisar National Park has some 73 species of mammals and 342 species of birds including two endemic birds.

- Forest restoration and enrichment planting will directly increase the health and diversity of flora while improved habitat will result in breeding opportunities for fauna. Valuable tree species which are threatened will be targeted for enrichment planting. The areas that are bare lands and vulnerable to erosion will be re-vegetated through enrichment planting.

Soil protection

The project activities will enable the following soil protection outcomes:

- Revegetation will act as an anti-erosion mechanism and will help protect Lake Abaya and its natural habitat through reduction in soil erosion and improvement in water filtration. There will be fewer surges of water carrying heavy sediment loads into the lake.

- Reduced flash flooding and consequent deepening of erosion gullies will result in reduced loss of life and damage to property and to more stable agricultural production. This in turn will increase household income and reduce poverty levels. As poverty is reduced, there will be less pressure on community members to undertake activities that cause result in damage to forest lands.

Hydrology

The project activities will enable the following hydrological outcomes:

- Greater infiltration of water and build up of topsoil will enhance forest growth.

- Greater infiltration of water will enhance water table re-charge thus ensuring continued potable water supplies for over 65,000 inhabitants downstream from the forest.

- As water supply becomes more stable for longer periods of year, wildlife will remain in the area for longer periods.

- The project activities will result in reduced flooding and landslide risks

Building incentives to people to invest in sustainable land use

The project will model sustainable land management techniques, and will introduce incentive for communities to proactively manage forest resources for carbon outcomes, that will lead to other environmental benefits.

The project will enhance land management and contribute to ecosystem improvement throughout Ethiopia through demonstration and extension of project experience to other areas.

Risk analysis and countermeasures:

- **Species:** The use of native and naturalized species in mixed and mosaic planting patterns enable in promoting species that are suitable to the project sites.
- **Fire and pest risk:** The risk of burning is a threat to the forests. This can be alleviated through technical and awareness raising programs to local farmers/communities, strengthening patrolling and monitoring, as well as maintaining a fire belt/break around the forest areas.
- **Site preparation:** Site preparation will disturb soil in the planting sites. The main technical measures to be employed in mitigating the impacts are to plant the trees with low density (1250-2500 trees per hectare), minimum site preparation cover the planting dimensions (40 cm X 50 cm in diameter or 0.2 m^2), retaining the existing vegetation as much as possible (see section A.4.8). As a result, the surface area disturbed by site preparation is estimated to account for 2-5% of the total land surface. The hole will be dug along the landform contour in triangle

form to reduce the soil loss. Therefore the site and soil preparation will have minor negative impacts on original soil and vegetation.

None of these risks and/or negative impacts is considered significant to the long-term GHG removal potential of the proposed project.

F.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

>> No significant negative environmental impacts which will occur as a result of this project have been identified.

F.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section F.2. above:

>> No significant negative impacts have been identified which are anticipated to occur as a result of this project, however an ongoing monitoring plan will be established by World Vision for the entire project to ensure that if problems do arise they can be dealt with immediately.

It is anticipated that community members formed into user groups will meet weekly to discuss problems and share experiences. Each month user group representatives will meet with local government and World Vision Ethiopia staff, who will prepare quarterly financial and narrative reports.

SECTION G. Socio-economic impacts of the proposed A/R CDM project activity:

>>Agriculture is the main source of income for local communities in the project area. However, due to severe soil erosion, agricultural production has been negatively impacted. The mean annual income per capita in the region is US$ 81, with 68% of this coming from the agricultural sector. The population impacted by the project for site 1 is 48,893, and site 2 is 28,407

In order to maximize the community benefits of the project, a participatory approach -involving community development specialist, sociologist, legal specialist and economist was implemented. Participatory rural appraisal (RRA) methods were adopted in interviewing and consulting with farmer households in the project areas to understand the local farmers/communities' preferences, wishes and concerns, so that the proposed A/R CDM project activity would better respond to their desires for livelihood development. Farmers have significant impact to the contractual agreement they enter into, including the legal nature of the organisation actually selling the emissions reductions. Local farmers will participate in the reforestation activities such as site preparation, planting, weeding, pruning, thinning, harvesting, coppicing etc. It is expected that 15 kebeles will benefit from the proposed project. The main socio-economic benefits of the project include:

(1) Income generation: All the communities will benefit either directly or indirectly from the project. The total income anticipated from the projects is approximately US$ 1.5 million in CER revenue within the crediting period. The revenue from the sale of CERs will be used to meet the costs of project management, operations, maintenance and building the capacity of local community. The project will increase the availability of wood resources in the project area with the establishment of fast-growing naturalized species such as Eucalyptus and the improved productivity of the existing natural forest. It is

anticipated that some 160,000 dollars of fuelwood will be harvested from the project over the crediting period.

(2) Benefit sharing. As indicated above, nearly all Kebeles, except Kokate, indicated that their communal land should not be subdivided into their respective sub-Kebeles. Accordingly, all Kebeles believe that the benefit accrued from the closed area should be shared by all members of the Kebele. They also indicated that the benefits from the project should be spent on community priority development areas amongst which, water, both for drinking and irrigation, was the most suggested priority area by most Kebeles. Flour mill, school (higher grades), road, health facilities (clinics, health officers and drugs) maintenance and control of gully formation are also the other priority areas suggested.

(3) Creating employment: The proposed A/R CDM project activity will create approximately 9000 person-days of temporary employment in planting, weeding, and harvesting and resin collection activities. It will also create 12 long-term job positions during the crediting period (Table F-3). Most employment opportunities will be taken by the local farmers/communities involved in the proposed A/R CDM project activity.

(4) Sustainable fuelwood supply: The local communities depend on fuelwood for cooking and heating The proposed A/R CDM activity, especially the fast growing naturalized species, will provide a more sustainable fuel source for local farmers.

(2) Technical training and demonstration.

Technical capacity building: Training on the application of the FMNR technique will occur during project establishment. This technique is a useful and cost effective means of reestablishing vegetation on farmlands. The project will serve as a demonstration of the potential for the root systems of existing natural vegetation to assist landholders in meeting their fuelwood needs.

Community ownership: The ability for this project to be replicated throughout other areas of Ethiopia will be influenced in large part by the legal structure upon which it rests. The concept of community forestry, with forest user rights is not new to Ethiopia, the GTZ project at Dodolla is one example of forest restoration following the incorporation of a community management group. However examples of successful implementation are limited. This project will serve as a model to other communities on the inception of appropriate legal mechanisms which benefit both the community and the environment.

Potential socio-economic risks and countermeasures

a) Cultural resources

There are no cultural relics and/or cultural reserve that have been identified in the project area, and consequently, no damage to non-replicable cultural property will occur under the proposed A/R CDM project activity. The project does not involve any sites for local social gatherings or spiritual activities, thus the project activities will not impact the normal local gatherings and religious activities. The protection and reestablishment of the natural forest has widespread support from all the communities visited in the community consultation, and does not conflict with any significant cultural practices or sites.

b) Economic risk

The only significant economic risk will be inability of the project to realize its full potential and loss or potential income to the community from the project and failure to realize the projected CERs. This risk will be mitigated through technical assistance and training to communities, sound project management

and capacity building activities of World Vision. Coordination with local forestry agencies, forestry research and design institutions, as well as by the extension network of the forestry sector will assist in realizing the full potential of the project as sustainable natural resources management, climate mitigation and community development project.

G.1. Documentation on the analysis of the major socio-economic impacts, including impacts outside the project boundary of the proposed A/R CDM project activity:

>> A community social mitigation action plan is being prepared to both monitor and respond to and socio-economic impacts including impacts outside the boundary of the proposed project.

G.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socio-economic impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to supporting documentation:

>>N/A

G.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section G.2 above:

>>N/A

SECTION H. Stakeholders' comments:

H.1. Brief description of how comments by local stakeholders have been invited and compiled:

>> A consultative workshop was held at Soddo during April 10-12, 2006. During this workshop, policy makers from Federal Environmental Protection Authority (EPA), Regional Bureau of Agriculture and rural development (BoARD), Cooperatives, Bureau of Forestry (BoFPD) and from Zonal and Woreda level various GO staff including Justice, Women Affairs and farmers' representative from 15 Kebeles. In addition people from WVA, WVE and WB Consultants presented their findings. A list of stakeholders endorsing the project is attached as Annex 9.
In addition, a participatory rural appraisal (PRA) was conducted in 2008, in which communities were given the opportunity to comment on the project design and implementation so far, as well as identifying needs and suggesting ways of improving project design and implementation. The PRA is attached in Annex 6.

H.2. Summary of the comments received:

>> One of the main issues that came up during workshop discussion was the need for formation of farmers groups in to Cooperatives, and the importance of this task. Following all workshops, government staff agreed to play a role as active stakeholders during the preparation and implementation of the project. A further important commitment was the local Government agreeing to take the initiative to involve negatively impacted minority in the safety net program.

H.3. Report on how due account was taken of any comments received:

>>In responding to the comments and conclusions from the stakeholder consultations a Social Mitigation Action plan was prepared (included in Annex 7). The main objectives of the Social Mitigation Action Plan are to:

- Ensure that the project fully benefits the local communities and is culturally appropriate and acceptable to the participating communities and other concerned stakeholders.
- Undertake adequate consultations with the communities living around the project area in order to ensure that the project is undertaken with their full consent and active participation.
- Identify and carry out full consultations with all members of the community that would be disproportionately affected by restricted access.
- Create appropriate mechanisms to avoid, minimize or mitigate the potential adverse impacts on the vulnerable members of the communities as a result of restricted access to the project area.
- Ensure that the members of the community that are affected by restricted access to the natural resources in the project area themselves define and propose activities as mitigation measures.

With the support of local government formation of the community cooperative societies was completed.

Papers on Federal Environment Policy, Regional Land Use Policy and Strategy, Climate Change and Global response, the respective Woreda Natural Resource Conservation strategy, the experience of Niger Regeneration Project, CDM, and WB Forestry, Community Development and Legal consultants' findings were presented. A group discussion/plenary presentation followed, with participants being invited to comment on the project. At the conclusion of the workshop all attendees endorsed and applauded the project.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No funding for the project is coming from Official Development Assistance.

Annex 3

BASELINE INFORMATION

Humbo Site Baseline Stratification

Introduction:
During forest biomass assessment forestland is stratified so that the heterogeneous forest will be divided into homogeneous areas in order to reduce variation and increase accuracy and precision between sample plots.

Objectives:
1. To stratify the project sites into homogenous group(s)
2. To increase accuracy and precision of the biomass stock estimate

Procedure:
The procedure followed for stratification is attached below. The major parameter used for stratification is vegetation cover (number of trees per hectare).Additionally, expert judgment for crown cover is applied to clearly differentiate one stratum from the other.

Steps followed:
1. Map of the desired site with defined boundary is obtained
2. Project site was stratified into four strata using the parameters indicated in the procedure specified for the stratification. Accordingly, four strata were identified. These are:
    a) **Stratum 1**: - is relatively dense area of the site with some big trees found in different parts. Number of trees per ha in this particular area is 207. 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. Number of trees per ha is 127. There are two separate areas with similar vegetation cover categorized under the same stratum. The first part is adjacent to stratum 1 and geographically located at its North position while the other part is to the extreme North-West end of stratum 3. This second part has high potential for enrichment planting.
    c) **Stratum 3:** -is covered with dense bushes and shrub on hillsides in a Kebele named as Abela Longena. Number of trees per hectare is estimated to be 183. It is located between the two separate parts of stratum 2.
    d) **Stratum 4**: - is situated extreme North, on opposite hillside of stratum 3 that is separated by Bolla Wanche Kebele administration. The stratum is characterized by scattered vegetation grown on a very rocky area that is difficult for planting. The number of tree per hectare is 95.

3. **Carbon pool determination**: - For the preliminary sample assessment, it was agreed to consider the aboveground live tree pool because the assessment is simply to determine the sample size for the baseline data collection.
4. **Shape and size of plots**: - To calculate the required number of sample size for the baseline survey, nested plots containing sub units of different sizes (1m; 4m; 14m and 20m radius) were used because of the presence of trees with changing diameter and stem density . In practice, the circle with radius 20m is not used because there was no trees with diameter >50cm at those plots.
5. **Number of plots**: - Employing ±10% precision level that will give better confidence to estimate change in carbon stock, it was decided to assess 18 plots distributed proportionally over the entire site to each stratum. Sample plots were systematically distributed in the respective stratum according to the following procedure:
    a) Systematic sampling method is applied to locate the preliminary sample plots. To this end, a stratum is selected one after the other and the first plot is randomly located after crossing the forest boundary and moving 500 meter into the forest and the same distance is used between successive plots. Distance between plots is measured by fiberglass tape and compass is used for bearing.
    b) Nested circular sample plots are used (the smallest circle with 1m; the second 4m, the third 14m and the fourth 20m radius). Since there was no trees found in diameter class >50 cm, the fourth circle was practically omitted.
    c) In the first circle, diameter of trees at breast height (DBH) <5 cm; in the second 5 - 20 cm and in the third, outer circle 20 - 50cm were measured using caliper and diameter tape.
    d) Slope in percent of each plot was measured to estimate the actual plot radius because distance on slope and horizontal surface is different. Hence conversion factor is needed to adjust the radius so that each plot radius will be horizontal distance. In practice we did not convert this time because this is not very steep slopes that could bring about significant difference. For biomass assessment whatever be the slope will apply the conversion factor and use the result for calculation.
6. **Carbon stock estimation**: - Based on the preliminary data collected from different plots of each stratum and using this formula (Biomass = 0.2035 x dbh2.3196) for 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), the **carbon stock** was calculated. From this, number of plots to be assessed for baseline estimate was calculated.
7. **Number of plots for baseline survey: -** Using the preliminary data collected, number of plots required for good estimate of carbon stock for the whole site was calculated. According to the result it is only 1 plot to be assessed. This could indicate that the variance between and within each stratum is insignificant. Though the result shows that the vegetation cover for the whole area is similar, we decided to take the maximum number of plots (11 plots for the whole site) and distributed to each stratum proportionally. With this we believe we could get better estimate of the biomass with the given confidence limit.

8. **Baseline data assessment**: - The site map with different strata was divided into grids of 500m interval. Each grid is given serial number out of which numbers corresponding to the number of plots in each stratum were selected using random number in a scientific calculator and these numbers are registered. The coordinates corresponding with those numbers were identified from the map with the given scale and entered to GPS for navigation to the plots to be assessed. Now, three teams of experts are organized for data collection. They will collect all necessary data that could be used for the baseline biomass estimation.

Table 1: shows distribution of sample plots to be assessed for carbon stock estimation

Strata #	Description of strata	Area (ha)	Plot #	Coordinates of the plots	
				North	East
1	Relatively dense with big trees distribute over the area; located at the most South part	233.88	1	377717	740217
			2	378717	740217
			3	378717	739717
2	Relatively scattered tree with grass cover; located next to North of stratum 1 and North end of stratum 3	745.16	1	378717	741717
			2	377717	740717
3	Dense bush and shrubs; located next to North of stratum 2	1653.9	1	373717	745217
			2	369717	747717
			3	370717	746717
			4	376717	744217
			5	375217	744717
4	Bushes on rocky hillside located at Very North of the rest of the other strata	95.14	1	373717	747717

9. **Strata map**: The map showing different strata with different colours is attached for better understanding of the whole site. The strata start with South and extend to North with successive division up to 4. For more clarification it is explained with color reference below.
    a) Yellowish colored area is stratum 1
    b) Brown color is stratum 2
    c) Green color is stratum 3 and
    d) Pink color is stratum 4
10. **Materials used:**
    1. GPS
    2. Diameter tape
    3. Caliper
    4. Compass
    5. Fiberglass tape
    6. Clinometer
    7. Digital measuring device (DME)
    8. Scientific calculator

NB: The same materials are used for the baseline assessment but different sampling method is applied.

11. In nested sample plots, we omit smaller diameter trees in the next bigger circles than the circle with radius 1m. .

Annex: 1

Table 3: shows the data collected for sample size determination

Strata	**Diameter class**	**Diameter of stems (cm) at each plot**					
		Plot1	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 6**
1	<5cm	1.7	2.8, 1, 2	3.1	-	-	-

	5 – 20 cm	5, 6	20, 11.5, 14.7	6.8, 6.5	-	-	-
	20 – 50cm	24.6	20	30	NA	NA	NA
2	<5cm	NA	NA	1, 1	3, 2.4, 2.1	3.4	3.3
	5 – 20 cm	5	NA	NA	5.2, 5	5.1	NA
	20 – 50cm	27.6	26.8	NA	NA	NA	NA
3	<5cm	3	1.8, 2.9, 2.5	2.3, 2.7, 1.9, 2	2.3, 1.2, 3.2, 4.1	4.9	2.5, 2.2
	5 – 20 cm	NA	5	5.3, 5, 5	7	6, 5.1, 6.1, 5.1	6, 10, 5.8
	20 – 50cm	NA	NA	NA	NA	NA	NA
4	<5cm	1.5, 1.6, 1.4, 1.6, 0.5, 0.5	2.3	3.1	-	-	-
	5 – 20 cm	NA	5.2, 5.1, 5.2	NA	-	-	-
	20 – 50cm	20	NA	NA	-	-	-

NB: Strata 1 and 4 are smaller than the rest. Therefore, the number of plots assessed was limited to 3 plots to keep proportionality of area of the strata.

Annex 4

MONITORING PLAN

1. Monitoring of the baseline net GHG 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. The proposed project activity proposes a fixed 30-year crediting period.

2. Monitoring of the proposed A/R CDM project activity

a) Monitoring of the actual project boundary

The procedures for monitoring of the project boundary are reflected in section E.1.1

b) Monitoring of forest establishment

- Information on planting and area closure schedule, location, area and species planted will be recorded in plot journals and archived in the project database
- Information on area planted and closed for assisted natural regeneration each year in each stratum is confirmed through field surveys.
- Information on species composition and characteristics of planted species as well as pre-existing vegetation are recorded;

- The characteristics of stand models are recorded in the project database;
- The area and location of supplemental plantings undertaken to fill the gaps is recorded in the project database and identified on the strata maps;

Monitoring of post-planting activities to demonstrate the forest establishment

- Information on drainage, drought, and other climatic extremes that can impact stand establishment and stand growth will be recorded; Surveys are conducted annually for first 3-years to evaluate the survivals rates and to fill the gaps and survival rates of planted stock should be established by undertaking surveys during the initial establishment period.

Final survival check is conducted in the permanent sample plots at the end of third year of plantation and survival percent estimated from surveys conducted at the end of 3 rd year is recorded in the project database. The survival percent at the end of the 3rd year will be reported for verification purposes.

- The number and periodicity of weeding, pruning, coppicing, and tending practices and frequency of the herbicide use will be monitored and recorded.
- Information pertaining to droughts and floods and other emergencies will be monitored and recorded and the area affected by them will be taken into account the ex post calculations of the carbon stock changes.
- In case of fires, the causes, area affected, season, and duration of fire occurrence shall be also recorded and the emissions associated with the burning of biomass shall be calculated and accounted as part of project emissions. As per the fire management plan (see Annex 10) a fuel inventory shall be maintained, and regular monitoring of fire risk indicators, fire risk mapping, fire-weather prediction carried out.

c) Monitoring of forest management

- Information on silvicultural management activities such as thinning, tending, pruning, harvesting, and other operations that influence the GHG removals by sinks will be monitored and the information recorded in the project database.
- Quantity of fossil fuels used in silvicultural operations, transport of equipment and personnel and other management activities carried out in the project boundary will be monitored and recorded and the quantity of fossil fuels used in the operations will be calculated and archived;
- As the project does not use fertilizer, GHG emissions fertilizer application will not be monitored and the emissions from this source are treated as zero in the project database.
- Information on the occurrence of natural fires or other natural or human induced disturbances and the area and the biomass affected shall be recorded and reported;
- Deviations, if any, in the forest management activities from those outlined in the project design document and the nursery and plantation establishment guidelines will be monitored and the reasons for such deviations will be recorded.

3. Monitoring the actual net GHG removals by sinks data

a) Stratification

Post stratification will be conducted to address the possible changes in project boundary and planting scheme in comparison to the project design. The post-stratification will address the changes in carbon stocks in comparison to the details outlined in the project design. Strata or substrata could be aggregated

if they represent similar carbon stock changes. Otherwise, new strata could be defined.

b) Sampling frame and sample size

Considering that the regeneration improvements expected in the project are dependent upon the state of pre-project vegetation, the project stratification takes into account the stratification used in the baseline scenario.

A total of *five* project strata are identified for the project scenario. The four strata identified in the baseline scenario were also adopted in the project scenario and the regeneration measures implemented in each of the four strata as part of the project scenario are considered as the project interventions. An additional stratum (stratum 5) is adopted for planting naturalized species in the bare areas under the project.

The average carbon stock in the region, expert judgment and literature information on the mean and standard deviation of the carbon stock under conditions similar to those expected under the project are used to calculate the sample size.

The steps and equations of AR AM0003 are used to calculate the sample size. The number of sample plots for each stratum is estimated as per the required accuracy. The costs of establishing sample plots across the strata were assumed to remain constant; therefore, these were not taken into account the sample size calculations.

A sample size of 88 plots is estimated for the project. The allocation of plots to the strata is presented below.

S.No	Stratum	No. of sample plots
1	Project stratum–1 (regeneration improvement of native species	9
2	Project stratum–2 (regeneration improvement of native species	27
3	Project stratum–3 (regeneration improvement of native species	42
4	Project stratum–4 (regeneration improvement of native species	4
5	Project stratum –5 (planting of naturalized species	6
	Total number of sample plots	**88**

The adequacy of number of plots are assessed based on the growth measurements of the project scenario and the sample size is revised accordingly in order to calculate the carbon stock changes as per the targeted precision and within 95% confidence interval.

c) Location of sampling plots

The permanent sample plots will be located systematically with a random start, which is considered good practice in GPG-LULUCF. This can be accomplished with the help of a GPS in the field. The geographical position (GPS coordinate), administrative location, stratum and sub-stratum series number of each plots will be recorded and archived. The sampling plots will be distributed randomly and evenly.

d) Plot size and shape

The following procedure will be followed:

12. Systematic sampling method is applied to locate the preliminary sample plots. To this end, a stratum is selected one after the other and the first plot is randomly located after crossing the

forest boundary and moving 500 meter into the forest and the same distance is used between successive plots. Distance between plots is measured by tape and compass is used for bearing.

13. The circular sample plots are proposed for monitoring and measurement.
14. Slope in percent of each plot will be used to estimate the actual plots using conversion factor is needed to adjust the plot dimensions.

The centers of the circular permanent sample plots are marked to facilitate the measurement of trees located on the plot at each inventory and subsequent inventories. The location of plots is recorded as they would need to be identified at the subsequent verification.

e) Frequency of monitoring

Permanent plots will be monitored every five years to assess actual above and below ground biomass accumulation.

f) Procedures for measurements of tree biomass

Tree diameter

The tree diameter is the diameter of a tree stem measured at breast height (1.3 m). (See Figure 1)

- The diameter is measured with a caliper. In cases of irregular stem forms or diameters above 80 cm the circumference is measured with the distance tape.
- The caliper is held perpendicular to the stem axis with the axis of the caliper pointing towards the plot center.
- The measurement is rounded down to full centimeters.
- The minimum diameter to be measured is 4 cm.

Trees with inclined stem axis are skipped if the measurement point at 1.3 m is outside the plot. Trees with inclined stem are measured if the bottom of the stem is outside but the measurement point of dbh is inside the plot.

Special cases of tree diameter measurement

1. Branch or knot at 1.3 m: One diameter measurement is done above and one below the disturbance, calculating the diameter as average of the two measurements.
2. Forked tree/twin stem above 1.3 m: It is considered as one single tree.
3. Forked tree/twin stem below 1.3 m: It is considered as two trees. Each stem is measured separately (and gets its own tree number).
4. Bifurcation at 1.3 m: In this case the measurement is taken below the bifurcation.
5. Measurement impossible: The diameter at breast height gets the value ‘0’ and the reason is given as remark in Figure below.

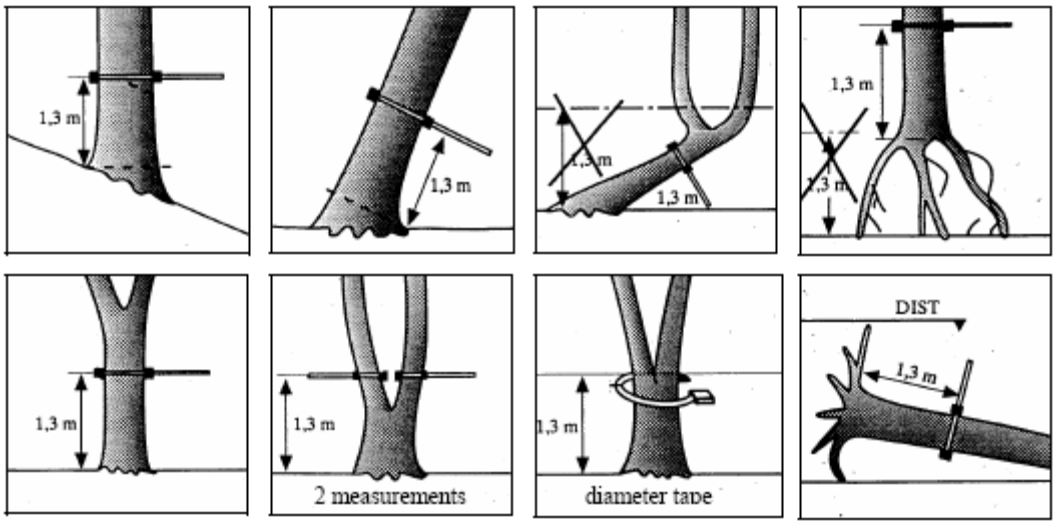

Figure 1: Examples of diameter measurements.

Tree height

For each site, the yield class will be determined by measuring minimum three tree heights. If the tree heights of several trees are the same, one measurement can be used for several trees.

g) Procedures for the maintenance of equipment used in vegetation measurement

The procedures for maintenance of equipment used in vegetation measurement are outlined below. In case no ready guidance on the procedures is available, the recommendations of local forest management agency will be followed.

- When compass is used in the field, it is calibrated to compensate for the local difference between magnetic and true north (magnetic declination) and adjustment is completed in order to facilitate the recording of accurate bearing.

- It is recommended to use DBH tapes made of steel or aluminum, and cloth tapes should be avoided considering their propensity for wear and tear that could result in measurement inaccuracies.

- Pacing can be useful to establish the relationship between map and photo information with the measurements on the ground. One step represents half of a pace and two steps equal one pace. Therefore, crew should be trained in pacing on flat ground.

Field recording of vegetation measurement data

The formats outlined below illustrate the details that would be collected during plot measurements. In addition, information specific to each stratum would also be collected as relevant.

Plot data form

Stand /Plot ID	/	Overstory	/
Starting point		Type class	/
Date	/ /	Understorey	/ /
Aspect/Slope	/	Groundcover	/ /
Crew initials		Weather	1 2 3 4

Plot tree summary

SNo	Spp	Crown class	DBH	Ht	Remarks

h) Calculation of volume

The pre-existing trees are common to the baseline scenario and the project scenario. Therefore, their volumes are expected to be similar. The volume of pre-existing trees will be measured in the subsequent inventories together with the new growing trees and subtracted from the measured volumes of the periodic inventories..

As the carbon stock in the baseline is in degraded state and survey results from participatory rural appraisal results indicate that the vegetation in the baseline is expected to degrade further under unsustainable use, the net baseline GHG removals by sinks are expected to be zero.

i) Measuring and estimating carbon stock change over time.

Step-wise procedures (BEF method) and equation (66)-(73) in Section III.5.1 of the approved baseline and monitoring methodology (AR-AM0003/version 03) will be followed to monitor the verifiable carbon stock changes in the above-ground and below-ground living biomass within the project boundary.

4. Monitoring GHG emissions by sources as the results of the A/R CDM project activity

There are no emission sources within the project boundary as there will be no clearing of vegetation for fencing material; rather live fences will be utilized.

Procedures for emergency preparedness for cases where emergencies could cause unintended emissions are adopted to address the fire risk.

The project will implement a fire management plan (see Annex 10). The management plan includes guidelines on community participation in fire protection; fire prevention (e.g., fuel management, fire breaks.); fire pre-suppression (e.g. collection of fire intelligence); detection and early warning and reporting system, fuel assessment, equipment, communications, water supplies and training of fire fighters; law enforcement and incentive systems; training, extension and public awareness programs

The area subjected to biomass burning would be assessed through field survey methods and recorded in the project database. The amount of non-CO2 emissions is assessed based on the CO2 emissions from biomass burning, to the estimation of non-CO2 emissions.

The data on combustion efficiencies adopted from the Tables 3A.1.12, 3A.1.14 GPG/LULUCF) and data on emission factors of non-CO2 gases adopted from Tables 3.A 15 and 3.A.16 of GPG-LULUCF will be used to estimate the emissions. The mean emission factors of CH_4 (0.012) and N2O (0.007) released from biomass burning will be used in assessing the emissions from natural fires.

5. Monitoring the leakage

All emissions resulting from transport activities and activity displacement will be covered under leakage.

a) Leakage emissions resulting from transport activities

The leakage from transport of project staff for activities associated with project and transport to areas outside the project boundary is calculated by monitoring the project activities that involve staff travel and product transportation to areas outside the project boundary. No transport activities such as movement of nursery inputs, planting material from nursery to planting sites, movement of labour, transport of harvested products to markets and for other uses outside the project boundary are expected and will also not be monitored. All seedlings will be raised on or near the site and will be transported to the project sites by manpower and project vehicles, whose emissions are calculated in the project scenario. Timber harvested from site will be transported using manpower, or existing donkeys and carts. There will be no clearing of vegetation for fencing material; rather live fences will be utilized.

The fossil fuel emissions will be estimated based on the numbers of vehicles, distance travelled, fuel consumption, and emission factors. The data required for the estimation of leakage such as the distance travelled by the project to areas outside the project each year and amount of fossil fuels consumed in the transportation of the project personnel would be collected from the project database. The annual leakage associated with the transportation of project personnel and products to areas outside the project would be calculated using the steps outlined below.

*Step 1***:** Collection of information on the distance travelled using different types of vehicles and their fuel consumption.

Variable	**Source of data**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**
Number of vehicle used by type	*Monitoring of project activity, transportation*	*number*	*m*	*Annually, monthly, daily as appropriate*	*100%*	*Electronic and paper*	*Monitoring number of each vehicle type used*

Kilometres travelled by vehicles by type	*Monitoring of project activity, transportation*	*km*	*m*	*Annually, monthly, daily as appropriate*	*100%*	*Electronic and paper*	*Monitoring kilometers for each vehicle type and fuel type used*
Fuel consumption per km by type of vehicle	*Local data, national data, IPCC*	*Litre km^{-1}*	*e*	*5 years*	*100%*	*Electronic and paper*	*Estimated for each vehicle type and fuel type used*

Step 2: Adoption of emission factors for different types of fuel types

Fossil fuels	Emission factors (kg/litre) CO2e
Diesel	
Petrol	

The additional parameter from local studies, IPCC default factors and God Practice Guidance on LULUCF and published literature relevant to the project context would be used.

b) Leakage due to activity displacement

Leakage due to fuelwood collection will be monitored in the first two years through field sampling. After the first two years of project implementation the project will generate enough fuel wood within the project area, initially through pruning of existing vegetation to assist natural regeneration and later from planted woodlots, to satisfy the pre-project fuel wood collection. *FG outside,t - FGNGL,t* = 0.

There is anticipated to be no net leakage due to the relocation of animals from the project area in the initial 5-year period, as there are significant areas of land which have already been cleared and are under the control of the project participants.

Leakage from the displacement of pre-project harvesting of fuel wood (including charcoal production) is calculated using equations 50 and 51 in the approved methodology AR-AM0003.

$$LK_{fuelwood} = \sum_{t=1}^{t^*} FG_t \cdot D \cdot BEF_2 \cdot CF \cdot \frac{44}{12}$$

$$FG_t = FG_{outside,t} - FG_{NGL,t}$$

where:

LK fuelwood = leakage due to displacement of fuelwood collection up to year *t**; tonnes CO2-e.
FGt = volume of fuelwood gathering displaced in unidentified areas; m3 yr-1
FGoutside,t = volume of fuelwood gathering displaced outside the project area at year *t*; m3 yr-1

FGNGL,t = volume of fuelwood gathering in *NGL* areas and supplied to pre-project fuelwood collectors or charcoal producers; m3 yr-1
D = basic wood density; tonnes d.m. m-3 (see IPCC GPG-LULUCF, Table 3A.1.9)
BEF2 = biomass expansion factor for converting volumes of extracted round wood to total above-ground biomass (including bark); dimensionless Table 3A.1.10
CF = carbon fraction of dry matter (default = 0.5); tonnes C (tonnes d.m.)-1

(pre-project fuel wood collection in the project areas has been estimated based on community consultations during project preparation and the baseline survey)

Variable	Data Type	Unit	Source
Biomass Expansion Factor	Absolute number	ratio	From GPG tables
Basic Wood density	Absolute number	ratio	From GPG tables
Volume of fuelwood collection displaced to alternative location	Absolute number	Cubic meters	Measurement

6. Quality Assurance and Quality Control (QA/QC)

To ensure the net anthropogenic GHG removals by sinks to be measured and monitored precisely, credibly, verifiably and transparently, a quality assurance and quality control (QA/QC) procedure will be implemented,

a) Reliable field measurements

To ensure the reliable field measurements,

- Standard Operating Procedures (SOPs) for each step of the field measurements, including all detail phases of the field measurements and provisions for documentation for verification purposes are proposed in this document and they will be adjusted periodically.
- Training courses on the field data collection and data analyses will be held for persons involving in the field measurement works. The training courses will ensure that each field-team members is fully aware of all procedures and the importance of collecting data as accurately as possible.

b) Verification of field data

To verify that plots have been installed and the measurements taken correctly,
- Randomly selected plots will be re-measured by teams other than those involved in the prior plot measurements
- Key re-measurement elements include the location of plots, DBH and tree height.
- The re-measurement data will be compared with the original measurement data. Errors assessed in the prior measurements will be corrected and recorded and would be used to calculate the measurement error.

c) Verification of data entry and analysis

To minimize the possible errors in the process of data entry, the entry of both field data and laboratory data will be reviewed by an independent expert team and compared with independent data to ensure that the data are realistic. Communication between all personnel involved in measuring and analyzing data

will be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed.

d) Data maintenance and archiving

Data archiving will take both electronic and paper forms, and copies of all data will be provided to each project participant. All electronic data and reports will also be copied on durable media such as CDs and copies of the CDs are stored in multiple locations. The archives include:

- Copies of all original field measurement data, laboratory data, data analysis spreadsheet;
- Estimates of the carbon stock changes in all pools and non-CO_2 GHG and corresponding calculation spreadsheets;
- GIS products;
- Copies of the measuring and monitoring reports.

7. Monitoring of socioeconomic issues

A Social Mitigation Action Plan has been developed (see Annex 7) and monitoring and evaluation of the actual implementation of the mitigation action plan will be done in a participatory manner with the active involvement of the beneficiary communities. Such participatory monitoring and evaluation will be incorporated in each project implementation phase throughout the implementation period. This will help to generate feedback on the on-going activities and to take timely corrective actions where necessary. Relevant and measurable monitoring indicators will be put in place to effectively monitor actual results and identify possible gaps of social mitigation action plan.

Training schedule for field staff

The Project will employ an estimated 5 additional staff on site who will implement the project monitoring for net carbon sequestration from the project areas. Table below identifies the specific staff training activities that will take place.

Table : Staff training activities for the implementation of the AR activity

Activity	Trainer	Individuals Involved
GPS training	Ayele Admassu (World Vision Ethiopia GIS specialist)	Humbo ADP staff connected to the project
General Training on AR aspects of the Kyoto Protocol	Paul Dettmann (via power point presentations)	Assefa Tofu, Tesafaye Bekele, Asfaw Mariame
Training on monitoring and the requirements of the CDM, and project inception	Paul Dettmann / Bernhard Schlamadinger	Existing and new project staff
Farmer training on implementation techniques	World Vision Staff	Farmers and other community members

Annex 5
LEGAL ANALYSIS

Enclosed as separate document

Annex 6
PARTICIPATORY RURAL APPRAISAL

Enclosed as separate document

Annex 7
SOCIAL MITITGATION ACTION PLAN

Enclosed as separate document

Annex 8
PROJECT COORDINATES

Enclosed as separate document

Annex 9
LIST AND REPORT ON STAKEHOLDER CONSULTATIONS
Enclosed as separate document

Annex 10
FIRE MANAGEMENT PLAN
Enclosed as separate document

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History of the document

Version	Date	Nature of revision
04	EB35, Annex 20 19 October 2007	• Restructuring of section A; • Section “Monitoring of forest establishment and management” replaces sections: “Monitoring of the project boundary”, and “Monitoring of forest management”; • Introduced a new section allowing for explicit description of SOPs and quality control/quality assurance (QA/QC) procedures if required by the selected approved methodology; • Change in design of the section “Monitoring of the baseline net GHG removals by sinks” allowing for more efficient presentation of data.

03	EB26, Annex 19 29 September 2006	Revisions in different sections to reflect equivalent forms used by the Meth Panel and assist in making more transparent the selection of an approved methodology for a proposed A/R CDM project activity.
02	EB23, Annex 15a/b 24 February 2006	Inclusion of a section on the assessment of the eligibility of land and the Sampling design and stratification during monitoring
01	EB15, Annex 6 03 September 2004	Initial adoption