Monitoring report form

(Version 05.1)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT		
Title of the project activity	Commercial reforestation on lands dedicated to extensive cattle grazing activities in the region of Magdalena Bajo Seco.	
UNFCCC reference number of the project activity	4861	
Version number of the monitoring report	Version 01	
Completion date of the monitoring report	Date 31/10/2016	
Monitoring period number and duration of this monitoring period	Second monitoring period. Monitoring period: 31 oct 2011 – 22 mar 2016	
Project participant(s)	ONF International (ONFI)	
Host Party	Colombia	
Sectoral scope(s)	Afforestation and Reforestation (14).	
Selected methodology(ies)	Reference of the methodology: AR-AM0004 / Version 04.	
Selected standardized baseline(s)		
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	1,210,255 tCO2eq.	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
		1,033,238.2 tCO2eq

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

(a) Purpose of the project activity and the measures taken for GHG emission reductions or net GHG removals by sinks;

The proposed A/R CDM project activity, consists in the reforestation of 3 137.32 ha of land traditionally devoted to extensive cattle grazing in the North of Colombia[1], department of Magdalena, in six municipalities located along the Magdalena River.

Traditional extensive cattle ranching have been so far the dominant agricultural activity, which has lead to 7 699 ha deforested that represents 0.007% of the area of Colombia. This large-scale of deforestation has dramatically increased the threat of desertification due to the dry climate.

Consequently, increasing environmental and social issues are spurred because:

- Deforestation has affected very negatively on soils erosion, which is responsible for the loss of river navigability, the diminution of fish resources and the degradation of the corals in the Caribbean Sea[2].
- Very low productivity of traditional cattle ranching and the quasi absence of alternatives to such an activity along with the natural increase of demography, lead to a worrying social situation with important risks for the region, to follow into a spiral of violence[3].

The reforestation project aims at stopping and reversing this situation through:

- The most optimal use of the land traditionally devoted to extensive livestock in the Magdalena Bajo, through higher cattle densities per surface unit in order to release areas for the establishment of commercial forest stands.
- The reforestation on private lands dedicated to extensive cattle grazing activities, of which 3 137.32 ha in first instance will be under A/R CDM project activities, implementing single plantations of *Gmelina arborea* (2 380.00 ha), *Tectona grandis* (225.60 ha), *Bombacopsis quinata* (320.36 ha), *Tabebuia rosea* (165.67 ha) and *Eucalyptus tereticornis* (45,69 ha).
- The creation of a forest sector integrated to the regional wood sector.

According to SIG report (Annex 1) satellite imagery interpretation and processing were applied and it was determinated that at the moment of second verification, the project has 2.672,76 ha with forest, of which 2 032.36 ha with *Gmelina arborea*, 187.55 ha *withTectona grandis*), 264.76 ha *with Bombacopsis quinata* , 165.68 ha *Tabebuia rosea* and 22,41 ha *with Eucalyptus tereticornis*.

To achieve this objective, the Corporación Autónoma Regional del Río Grande de la Magdalena (CORMAGDALENA), initiated in 2000[4] a program of forest plantations with local landowners considering as a decisive factor the possibilities offered by the CDM as financiering mechanism.

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[1] Becerra, 2004a. “Los múltiples servicios de los bosques y el desarrollo sostenible en Colombia”, en Peter Saile y María A. Torres (Eds.), Conferencia Internacional de Bosques, Colombia País de Bosques y Vida, Memorias, págs. 99-114. Bogotá:GTZ.

[2] Payen, 2003. Informe de presentación del Proyecto FFEM Control de la erosión y de la sedimentación de origen antrópico y sus efectos sobre los ecosistemas fluviales y lacustres del Magdalena y su zona de influencia, incluyendo la zona costera Caribe. pag 8-9.

[3] ONF Andina, 2004. Elaboración de un catálogo de proyectos de manejo sostenible de los recursos naturales y de lucha contra el efecto invernadero en Azerbaidjan, Chili, Colombia y Gabón. Reforestación de pastos en la región del Magdalena Bajo. Informe final – agosto 2004. pag 1.

[4] The first plantations carried out under the project activity were established by under the Especial agreement of cooperation signed at 2 August 2000 for the Farm “La Gloria”.

The forest plantation program was designed through an innovated commercial reforestation model, with the purpose to overtake those prohibitive barriers that historically had not allowed the development of commercial forestry by landowners (see C.6. Step 3 of the PDD, Barriers Analysis). This model identified three key factors: i) Production factors and its property, ii) expected benefits of implementation, and iii) the strategy of development and financing[5], launching an associative and participatory forest program.

The first key factor was conceptualized through the "Reforestation Equilateral Triangle" (RET):

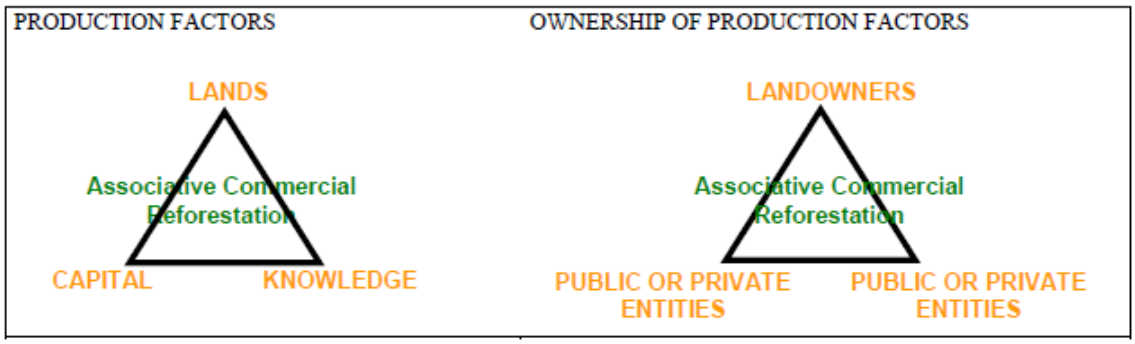

Figure 1: Associative Commercial Reforestation Model

The second key factor was designed with the concept of "benefits distribution model": It focused on the balance between the rates of funds gave from each of the stakeholders and the same rate of the expected benefits from the project to them. The benefits are wood and carbon.

The third key factor was conceptualized with the design of a "strategy of development and financing". With this, the project could set a gradual process up in order to overtake some barriers, go with the mode evolution and integration of the different partners to the associative commercial forest business. This strategy splits on three next phases:

· Initial phase of breaking barriers: Plantations phase 2000 – 2003.
· Transition phase of becoming to a business scheme: Plantations phase 2004 – 2006
· Implementation phase of business scheme: Plantations phase 2009 – 2013

The core of the project participants has always been CORMAGDALENA, and investment schemes have always included private landowners, which takes share into the project by provision of their lands to be reforested. The project activity related to plantation establishment and management is implemented by CORMAGDALENA[6], FINAGRO[7], the landowners or A.W. FABER CASTELL & T.H. REFORESTATION S.A.S[8], depends on the project phase. ONFI[9] has conducted the project

[5] ONF Andina, 2004, Op.Cit. pag 38 y 39.

[6] CORMAGDALENA, Corporación Autónoma Regional del Río Grande de la Magdalena, is a Colombian public institution with industrial and commercial purpose in charge of the river Magdalena management, which has among its functions besides the sustainable use and preservation of the environment, fishing resources and other renewable natural resources in the basin of the Magdalena River.

[7] FINAGRO, Fondo para el Financiamiento del Sector Agropecuario de Colombia, a fund for the agricultural development of Colombia, which is fed from mandatory deposits of the Colombian financial sector.

[8] A.W. FABER CASTELL & T.H. REFORESTATION S.A.S, is a private company formed to continue funding and conducting from 2009 commercial reforestation activities under the project activity.

[9] ONFI, ONF International, an international environmental and expertise bureau specializing in sustainable management of ecosystems (especially related to forest) and climate change mitigation. With subsidiaries in different parts of the world, one of which is ONF ANDINA, whose headquarters are located in Colombia and has an area for action to the Andean countries, Central America and the Caribbean.

implementation, regarding its carbon components, and has been involved in the project activity since its start.

The proposed A/R CDM activity will result in several important contributions to the sustainable development of the region:

- The reforestation of lands dedicated to extensive cattle grazing activities to reduce soil erosion and its related negative impacts.
- Reduction of pressure on the exploitation of natural forest.
- Contribution to reduction of the risk for desertification of the region, preservation of biodiversity, improvement of the hydrological cycle; climate change mitigation.
- Demonstration of the technical and financial viability of reforestation activities and transfer of technical knowledge and capacity building.
- Diversification of incomes for small-scale farmers and substantial creation of jobs.
- Contribution to equilibrate the wood sector balance at the national level.

(b) Installed technology and equipment

Five species have been planted for the A/R CMD project activities: *Bombacopsis quinata* (Red Ceiba) and *Tabebuia rosea* (Oak) for native species, and *Gmelina arborea* (Melina), *Tectona grandis* (Teak) and *Eucalyptus tereticornis* (Eucalyptus) for exotic species. These are selected for their results in the ecological conditions of the region, availability of vegetal material and genetic quality, forest technological knowledge, and for their local (national and international) economic potential.

In Table 1, the main characteristics of the selected species are summarized and the Figure 2 presents the actual condition of some stand.

Table 1: Selected species and their main characteristics for cultivation

Common Name	Scientific Name Family	Origin Geographical Distribution	Botanical Description	Life zone	Suitable value					
					Elevation m.s.n.m	Temperature °C	Mean annual precipitation mm	Topography %	pH	Texture and drainage
Melina[10] Gmelina, gmelina, yemani	*Gmelina Arborea* Verbenaceae	Origin in India and is widely distributed in the tropical and sub-tropical Asian regions. It is cultivated in Africa, Brasil, Costa Rica, Venezuela and Colombia	Melina has good shape and fast growing characteristics Height: 20 a 30 m. Diameter: 60 a 100 cm. Deciduous specie	Dry tropical forest Humid tropical forest	0 – 1 000	24 - 35	750 – 2 000	0 – 7 Plains and hills	6.5-7.5	Loam and clay loam Well drained, does not resist to floods
Teca[11] Teak, saca, teka	*Tectona grandis* Verbenaceae	Origin in Myanmar and is widely distributed in tropical and sub-tropical Asian regions. It is cultivated in Central America and northern countries of the south of America.	Height: 40 a 45 m. Diameter: 100 a 150 cm. Deciduous specie	Dry tropical forest Humid tropical forest	0 – 1 200	22 - 27	1,000 – 2 000	0 – 25 Plains and hills	6.5 - 7.5	Clay loam to sandy loam Well drained, does not resist to floods
Ceiba[12] Cedro macho, ceiba tolúa, ceiba roja, saqui saqui,	Pachira / *Bombacopsis Quinata* Bombacaceae	Origin in Central America and can be found also in Colombia and Venezuela	Height: 32 m. Diameter: 4,2 m. Deciduous specie	Dry tropical forest Humid premountain tropical forest Very dry forest	0 - 600	25 - 28	1 000 – 3 000	0 – 25 Plain	6.5 - 7.5	Sandy, clay loam or clayey Moderate to well drained
Roble[13] Roble morado, guayacán morado, flor rosado, flormorado, ocobo	*Tabebuia rosea* Bignoniaceae	Origin in south of Mexico, Central America and northern countries of the south of America	Height: 30 m. Diameter: 40 a 100 cm. Deciduous specie	Dry tropical forest Humid tropical forest	0 – 1 900	21 - 30	1 200 – 2 500	0 - 15	5.5-6.5	Loam Regular drainage, resist to floods
Eucalipto[14]	Eucalyptus tereticornis Myrtaceae	Origin from Australia to New Guinea	Height 45 m. Diameter: 100 a 140 cm.	Dry tropical forest	0 – 1 000	24 - 35	1 000 – 2 000		6.5-7.5	Silty, sandy Well drained

[10] CONIF. 2002a Guía Forestal para de Melina (*Gmelina arborea*). Bogotá
[11] CONIF, 2002b Guía Forestal para Teca (*Tectona grandis*). Bogotá
[12] CONIF, 2002c Guía Forestal para Ceiba (*Bombacopsis quinata*). Bogotá
[13] CONIF, 2002d Guía Forestal para Roble (*Tabebuia rosea*). Bogotá
[14] CONIF, 2003 Guía Forestal para Eucalipto (*Eucalyptus tereticornis*). Bogotá

Figure 2: Pictures of current conditions of some stands that are part of the project. A. Ceiba, B. Teak, C. Melina.

Establishment:

- ✓ Site Preparation: Removal, collection and/or distribution of plant debris, plowing, raking, subsoiling, building roads and firebreaks, isolation and fencing
- ✓ Fertilization: If soils require fertilization according to the results of soil analysis, it is performed using generally NPK fertilizer and/or urea, applying 150 g/tree of NPK and 50 g/tree of urea.
- ✓ Planting: Internal and external transport plant material, distribution of trees in the seed lot, layout, planting, straightening trees, planting control, replanting. Replanting is done only if the mortality rate exceeds 10% or if there is evidence of mortality concentration sectioned.

The establishment process was divided into three stages of planting:

- The first period during the years 2000-2003, growing Melina, Teak, Ceiba, Oak and Eucalyptus; with an initial density of 1 098 trees ha-1 for each species, and a planting distance of 3.5m x 2.6m in rectangular shape.
- The second period covers 2004 to 2006, growing Melina, Teak and Ceiba; the initial density of 833 trees was ha-1 (4m x3m) for each species.
- In the last period, considered between 2009 and 2012, Melina was seeded with an initial planting density of 1 000 trees ha-1 at a distance of 4m x 2.5m.

Forest management activities:

- Weeding: Manual clean, mechanical clean, chemical clean.
- Pruning: Low pruning and high pruning, to remove branches in order to improve tree form or wood quality.
- Phytosanitary Control: Plant and firebreaks control.
- Firebreaks: Strip at least 3.5 meters wide at the perimeter of the planting area, which should be free of anything that could cause or transfer a fire, such as pasture, stubble and fallen trees. It is carried out annually and usually using a mechanical cut weeds, raking and plowing.

Thinning:

Silvicultural operation to reduce competition between trees; thus, improving quality of the wood of trees left standing, increasing so the value of the final harvest.

Techniques for thinning:

- Realized by local manpower.
- Realized at years 3 and 7 for *Gmelina arborea.*
- Realized at years 5, 12 and 19, for *Tectona grandis*.
- Realized at years 6 and 13 for *Bombacopsis quinata.*
- Realized at years 6, 11 and 15 for *Tabebuia rosea.*
- Realized at years 3 and 7 for *Eucalyptus tereticornis.*

This may change depending on plantation growth because local soil fertility and weather conditions.

Final harvest:

Final harvest is planned as follows but this may change depending on plantation growth because local soil fertility and weather conditions (no final harvesting has been made so far):
- It will be realized at year 12 to 15 for *Gmelina arborea.*
- It will be realized at year 20 to 25 for *Tectona grandis* and *Bombacopsis quinata*.
- It will be realized at year 20 for *Tabebuia rosea*.
- It will be realized at year 10 for *Eucalyptus tereticornis.*

(c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.);

NA

(d) Total GHG emission reductions or net GHG removals by sinks achieved in this monitoring period.

Table 2 to Table 4, show the calculations developed for the amount of net removals obtained in the project.

Table 2, refers to changes in carbon content for the period t (ΔCp,ikt). Table 3, presents estimates of carbon emitted as a result of the preparation of the sites to be planted. This estimation was done by multiplying the average carbon baseline by the area of each stratum. This estimation was done because the project started in 2000, and neither historical records nor precise measurements were carried out until the registration date, which is when the whole process of monitoring methodology was put into practice. Values are the same as presented in the PDD. Table 4, summarizes the changes in carbon content by the project, estimates of carbon emitted [emissions that according to the PDD were zero (0) equal to zero leakage (0)], and shows the net anthropogenic removal by the project (Cactual.) in terms of tCER's. For calculations of carbon removals by the project, it was used the information processing database CAMARA developed by ONFI[15].

Table 2: Removals for each stratum of the project and total.

ID stratum	Stratum	Mean carbon stock (tC.ha-1)	Area (ha)	Mean carbon stock in stratum (tC)	Mean carbon stock in stratum (tCO2eq)
Ceiba_G1	*Bombacopsis quinata*_13- 16 years	95.62	205.430	19,643.23	72,025.19
Ceiba_G2	*Bombacopsis quinata*_10-12 years	71.93	59.330	4,267.38	15,647.06
Eucalipto_G1	*Eucalyptus tereticornis*_13-16 years	129.59	22.410	2,904.19	10,648.69
Melina_G1	*Gmelina arborea*_13-16 years	117.83	1,149.730	135,478.06	496,752.89
Melina_G2	*Gmelina arborea*_10-12 years	155.46	452.970	70,418.64	258,201.67
Melina_G3	*Gmelina arborea*_6-10 years	100.74	429.660	43,284.73	158,710.69
Roble_G1	*Tabebuia rosea*_13-16 years	95.76	165.680	15,865.26	58,172.63
Teca_G1	*Tectona grandis*_13-16 years	40.79	146.720	5,984.73	21,944.00
Teca_G2	*Tectona grandis*_10-12 years	50.66	40.830	2,068.41	7,584.17
Total					***1,099,686.99***

Table 3: Carbon content in the baseline, which is removed to establish the project stratum ($E_{biomassloss}$).

ID stratum	Stratum	Mean biomass stock in AGB (t d.m.ha^{-1})	Mean biomass stock in BGB (t d.m.ha^{-1})	Mean carbon stock in stratum (tC)	Mean carbon stock in stratum (tCO_{2eq})
BLS1	Clean pastures	0.72	1.09	888.37	3,257.37
BLS2	Pastures with fallows	14.09	3.09	9,758.33	35,780.56
BLS3	Fallows	18.17	3.32	5,390.41	19,764.82
Total baseline carbon stock in ABG and BGB within project boundary.				***16,037.11***	**58802.75**

Table 4: Final removals in tonnes CO_{2eq}. (Table 2-Table 3).

$\Delta C_{P,LB}$ **Sum of the changes in living biomass carbon stocks (above- and below-ground); t CO2-e**	C_{BSL} **Baseline net GHG removals by sinks (t CO2-e)**	GHG_E **Emissions (t CO2-e)**	**LK Leakage (t CO2-e)**	**tCERs**
1,040,988.50	0	**7,646.05**	0	***1,033,238.2***

[15] Anexo 2. CAMARA_AJUSTADA_PRC_2016.

A.2. Location of project activity

>>

(a) Host Party

Republic of Colombia.

(b) Region/state/province

The project activity is located in the Republic of Colombia, in the Caribbean region, North-East of the country, in the lower part of the Magdalena River basin, called Magdalena Bajo seco, which includes the departments of Atlántico, Bolivar y Magdalena, and covers a surface of 917,165 ha, corresponding to 19.93% of the entire basin of the Magdalena River.

The proposed A/R CDM project activity is located in the Department of Magdalena.

(c) City/town/community

The area where the A/R CDM project activities will take place is named “Magdalena Bajo nucleus”. It includes 6 municipalities – municipios –, all located in the CORMAGDALENA jurisdiction: El Piñón, Zapayán, Tenerife, Pedraza, Plato and Santa Bárbara de Pinto (Department of Magdalena). The nucleus stretches between 9°23’22’’ and 10°28’19’’ of latitude North, and between 74º20’39’’ and 74º56’60’’ of longitude West, **Figure 3**: Compilation of maps locating the country, department and municipalities of the project.
shows the location of these municipalities and **Figure 4**: Location of the plantation project in the municipalities of El Piñón, Pedraza and Zapayan.
- **Figure 5**: Location of the plantation project in the municipality of Chivolo.
- **Figure 6**: Location of the plantation project in the municipality of Chivolo Plato.
, the site of the project boundary.

The Magdalena bajo nucleus is contiguous to the Magdalena department of Magdalena contiguous with the department of Bolivar, and in the south of the department of Atlántico.

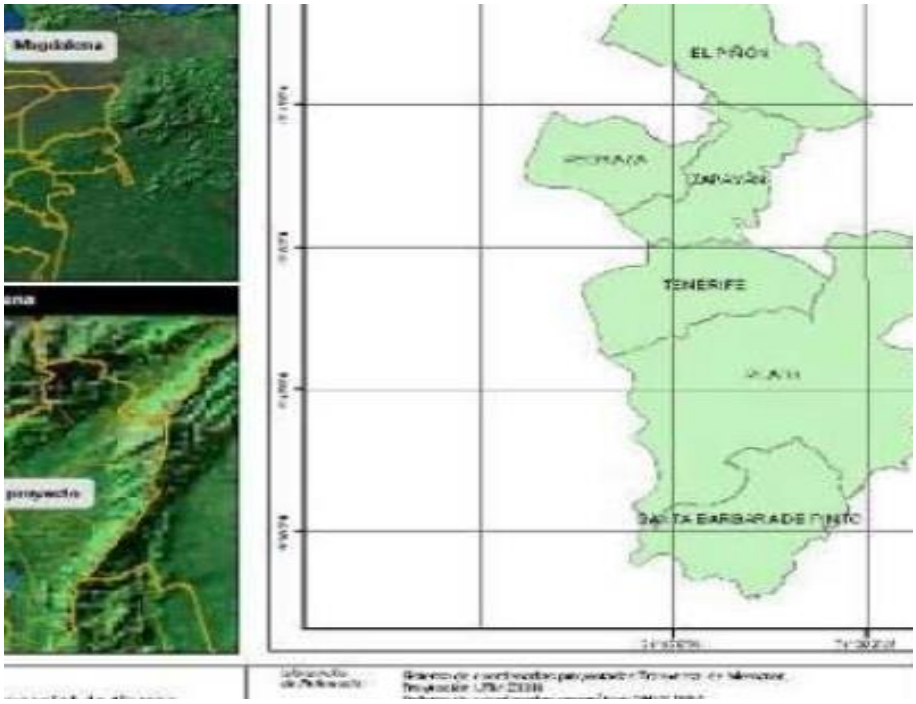

Figure 3: Compilation of maps locating the country, department and municipalities of the project**.**

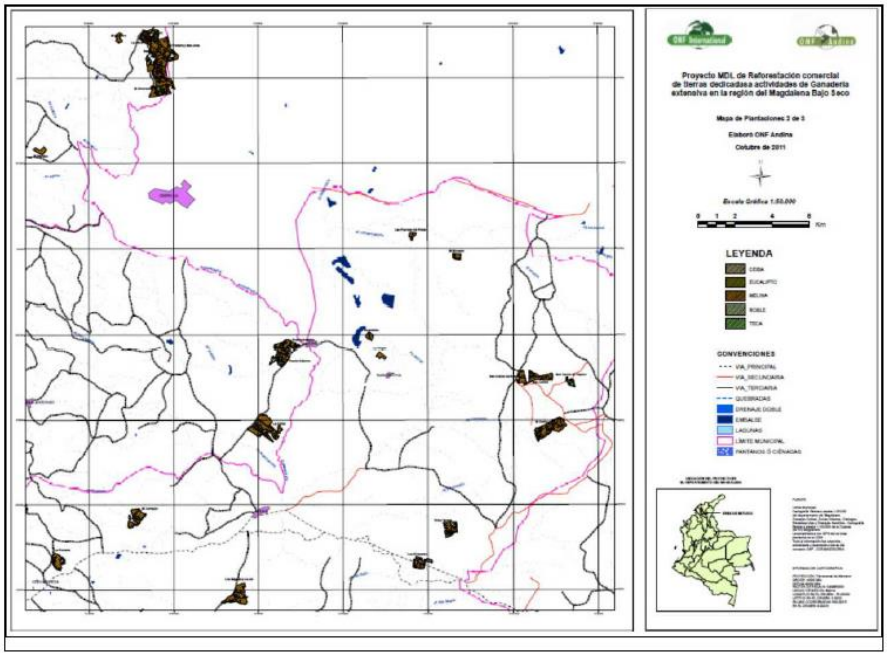

Figure 4: Location of the plantation project in the municipalities of El Piñón, Pedraza and Zapayan.

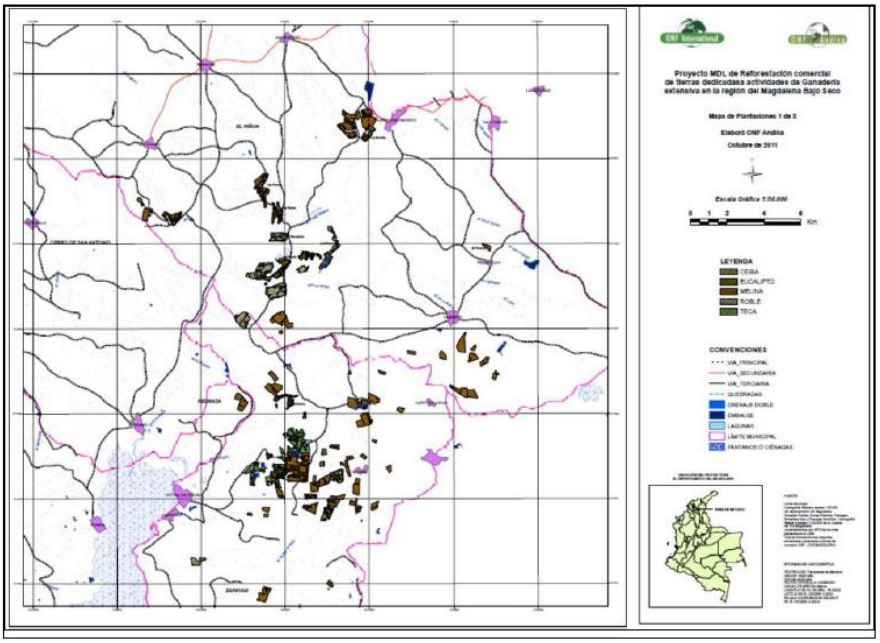

Figure 5: Location of the plantation project in the municipality of Chivolo.

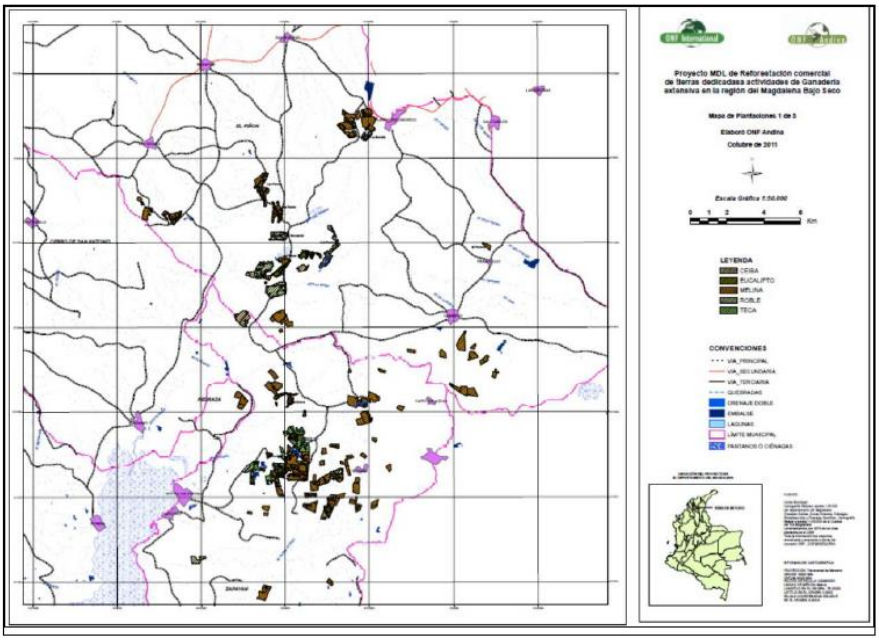

Figure 6: Location of the plantation project in the municipality of Chivolo Plato.

It is attached the database, with the processing in ArcGIS, of the information taken in the field. This information is subjected of coarse-scale visual verification using Landsat images[16]. All the GIS database was provided to the DOE.

(d) Physical/geographical location.

The nucleus of Magdalena Bajo is located in the Inter Tropical Convergence Zone characterized by a monomodal climate. During the dry season, the evapo-transpiration (ETP) (which representing the water-loss to atmosphere from vegetation and soil), is very high (up to 1,600 mm) and causes high water deficit between December and April. The rainy season occurs from May to November, with a concentration of rainfall from August to October. The mean annual rainfall is 1.300 mm. The relative humidity is around 70% on the year. The mean annual temperature is 27.9°C with low variations. The hottest months, from February to April, present temperatures oscillating between 28.4°C and 28.8°C.

The project area presents an important influence of the Magdalena River and its complexes of lakes on the eastern margin. Located on the eastern side of the Magdalena River, in the heart of the Magdalena watershed, the project area presents some relatively flat landscapes. Five landscape units compose the horizon: alluvial terraces on river margin and, while moving away towards east, plains, slopes, small valleys and piedmont

[16] Anexo 1. Informe SIG. METODOLOGÍA PROCESO SIG PARA LA CUANTIFICACIÓN DE LAS ÁREAS CON COBERTURA VEGETAL EN LOS LOTES PLANTADOS DELPRC ONF Andina 2016

A.3. Parties and project participant(s)

Erreur ! Source du renvoi introuvable. lists the project participants and Party (ies) involved. The Colombian parties involved in the project activity (CORMAGDALENA, FINAGRO, A.W. FABER CASTELL & T.H. REFORESTATION S.A.S and Private landowners of Magdalena Bajo) have authorized ONF International to represent them and act on their behalf, regarding all aspects related to the CDM component of the project activity.

As mentioned before, ONFI has a subsidiary located in Colombia, which is ONF ANDINA, and has been working since 15 years ago in Colombia in projects of sustainable management of ecosystems (especially related to forest) and climate change mitigation.

Table 5: Project participants

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
Colombia (Host)	ONF International (ONFI)	No

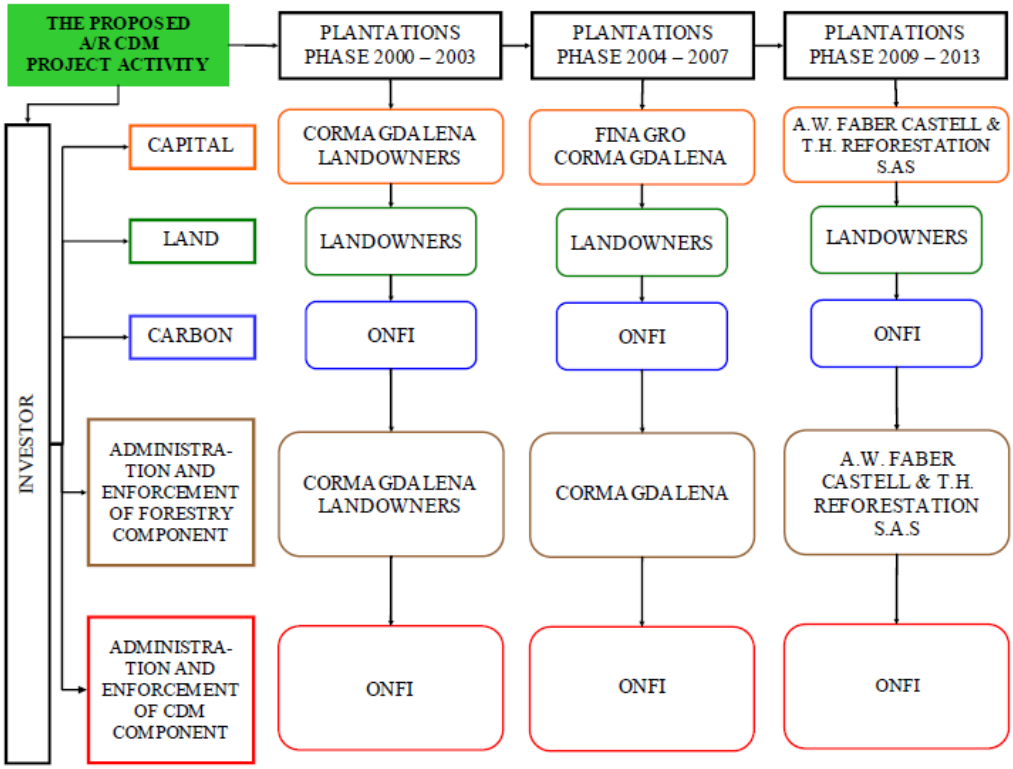

Figure 7: Project activity organization chart.

A.4. Reference of applied methodology and standardized baseline

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(a) The applied methodology(ies)

Reference of the methodology: AR-AM0004 / Version 04

(b) Tools and other methodologies to which the applied methodology(ies)
Tools for A/R CDM project activity applied:

- Guidance on the application of the definition of project boundary to A/R CDM project activities, Version 01. http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid22.pdf
- Guidance on accounting GHG Emissions in A/R CDM Project Activities (paragraph 35 in the report of the EB 42 meeting). http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid23.pdf
- Tool for the demonstration and assessment of additionality in A/R CDM project activities, Version 02. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-01-v2.pdf
- Guidance on conditions under which the change in carbon stocks in existing live woody vegetation are insignificant, Version 01 (EB46, Annex 16). http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid25.pdf
- Calculation of the number of sample plots for measurements within A/R CDM project activities, Version 02. http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-03-v2.1.0.pdf
- Anthropogenic GHG Removals by Sinks. Version 02 (EB 50, Annex 23). http://cdm.unfccc.int/EB/050/eb50_repan23.pdf
- Guidelines for objective demonstration and assessment of barriers. Version 01, (EB 50, Annex 13). http://cdm.unfccc.int/EB/050/eb50_repan13.pdf
- Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in AR CDM project activities (version 01.0.1), Annex 24, EB67 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-18-v1.0.1.pdf
- Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in AR CDM project activities (version 1.0.0), Annex 28, EB65 http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-17-v1.pdf
- Guidelines on application of specified versions of AR CDM methodologies in verification of registered AR CDM project activities (version 1.1), Annex 26, EB63 http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid30.pdf
- Guidelines on accounting of specified types of changes in AR CDM project activities from the description in registered PDD (version 02.0), Annex 24, EB66 http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid32.pdf

A.5. Crediting period of project activity

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The project uses a fixed crediting period of 30 years. The crediting period began on August 2nd 2000.
The actual monitoring period: October 30th 2011 – March 22nd 2016
This project qualifies with retroactive crediting in accordance with UNFCCC Executive Board guidance[17]

A.6. Contact information of responsible persons/entities

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[17] The Board, at its twenty-first meeting, clarified those provisions of paragraphs 12 and 13 of decision 17/CP.7 do not apply to CDM afforestation and reforestation project activities. A CDM afforestation and reforestation project activity starting after 1 January 2000 can also be validated and registered after 31 December 2005 as long as the first verification of the project activity occurs after the date of registration of this project activity. Given that the crediting period starts at the same date as the starting date of the project activity, the projects starting 2000 onwards can accrue tCERs/lCERs as of the starting date". (CDM GUIDELINES FOR COMPLETING THE PROJECT DESIGN DOCUMENT FOR A/R ACTIVIES, V.4, p.9).

The entity responsible for completing the CDM MR FORM is ONF International, which is a project participant. The contact person is Danny Torres and contact information is provided in Appendix 1.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

>>

August 2nd, 2000 is the starting date of the project activity. This date corresponds to the Cooperation Contract signature date of first plantation establishment, under the project activities[18].

For the first verification period, the project had a planted area of 3.125,52 hectares. In the second verification the area planted is 2,672.76 hectares, this difference (about 453 ha) is mainly because several plantations were at the end of forest rotation at the time of verification. There are also some unplanted areas due to natural mortality mainly linked with floods and droughts.

Table 6: Distribution of planted area by species for the year 2016.

Year	*Bombacopsis quinata*	Eucalyptus tereticornis)	*Gmelina arborea*	*Tabebuia rosea*	*Tectona grandis*	General Total
2016	264.76	22.41	2032.36	165.68	187.55	**2672.76**

Values in hectares (ha).

The project was implemented in three stages. The actors and hectares per stage are presented in table below.

Table 7: Phases of the project in which the actors, species and intervened areas are presented for year 2016.

Date of establishment of plantation	Component of the project activity	Partners involved in the project activity	*Species*	*Area*
2000 - 2003	Plantations phase 2000 – 2003	CORMAGDALENA[19], ONFI[20] and landowners (20 farms of 16 landowners)	*Gmelina arborea, Tectona grandis, Bombacopsis quinata, Tabebuia rosea,*	2 055 (1689.98 still planted in 2016)

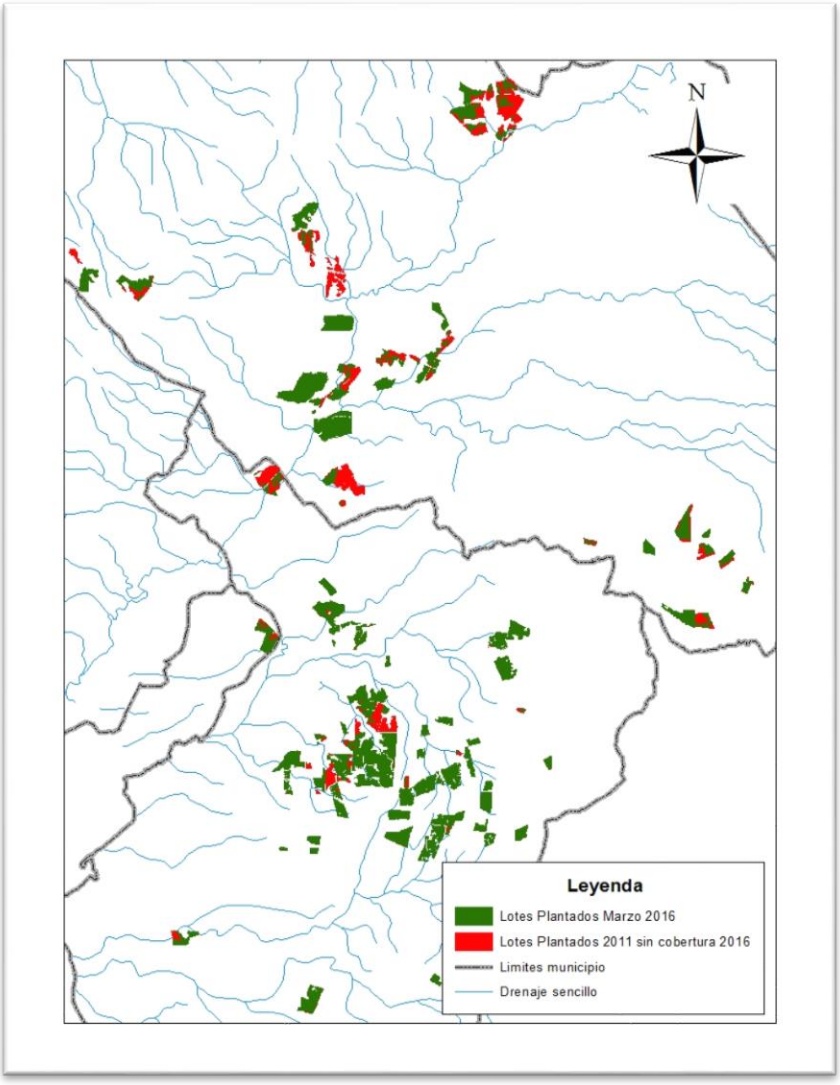
[18] CONIF, 2000. Special Agreement for Cooperation on project implementation and transfer of technology adoption in the form of protective - producer afforestation in the municipalities bordering the Rio Magdalena. Colombia.

[19] CORMAGDALENA, Corporación Autónoma Regional del Río Grande de la Magdalena, is a Colombian public institution with industrial and commercial purpose in charge of the river Magdalena management, which has among its functions besides the sustainable use and preservation of the environment, fishing resources and other renewable natural resources in the basin of the Magdalena River.

[20] ONFI, ONF International, an international environmental and expertise bureau specializing in sustainable management of ecosystems (especially related to forest) and climate change mitigation. With subsidiaries in different parts of the world, one of which is ONF ANDINA, whose headquarters are located in Colombia and has an area for action to the Andean countries, Central America and the Caribbean.

			Eucalyptus tereticornis	
2004 - 2007	Plantations phase 2004 – 2006	CORMAGDALENA, FINAGRO[21], ONFI and landowners (18 farms of 16 landowners)	*Gmelina arborea, Tectona grandis, Bombacopsis quinata*	571 (559.45 still planted in 2016)
2009 - 2013	Plantations phase 2009 – 2013	A.W. FABER CASTELL & T.H. REFORESTATION S.A.S[22], ONFI and landowners (43 farms of 42 landowners and 55 farm in area will be controlled)	*Gmelina arborea*	423.34 (433.18 still planted in 2016)

Figures 9 to 11 show the changes in planted area for the period 2016. The changes by planted lot between 2011 and 2016 are presented in Annex 1.



[21] FINAGRO, Fondo para el Financiamiento del Sector Agropecuario de Colombia, a fund for the agricultural development of Colombia, which is fed from mandatory deposits of the Colombian financial sector.

[22] A.W. FABER CASTELL & T.H. REFORESTATION S.A.S, is a private company formed to continue funding and conducting from 2009 commercial reforestation activities under the project activity.

Figure 8: Change in planted area by 2016 - High Zone.

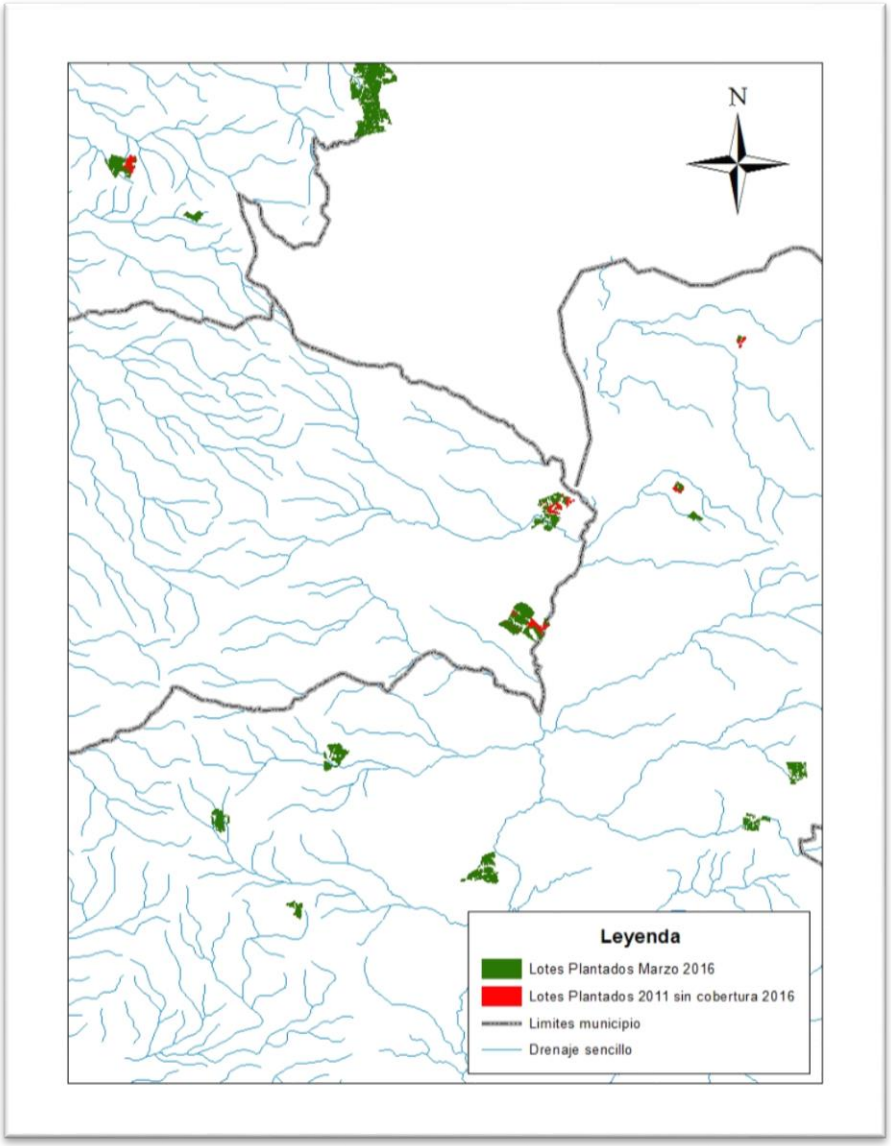


Figure 9: Change in planted area by 2016 - Media Zone.

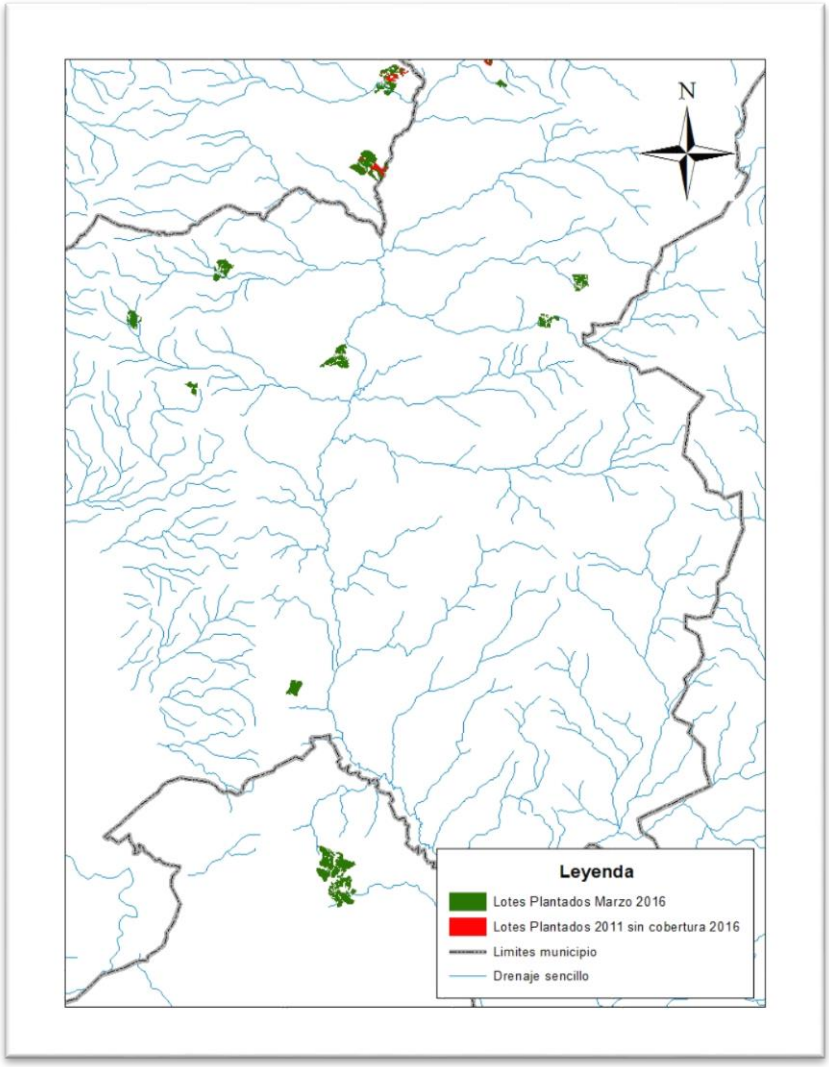


Figure 10: Change in planted area by 2016 - Low Zone.

B.2. Post-registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

>>
NA

B.2.2. Corrections

>>
NA

B.2.3. Changes to start date of crediting period

>>
NA

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

>>

NA

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>
NA

B.2.6. Changes to project design of registered project activity

>>
NA

B.2.7. Types of changes specific to afforestation or reforestation project activity

Parameters, equations and methods used in tree biomass estimation

As authorized that CDM procedures, in accordance with Annex 24 of EB 66, paragraph 4(p) – "Guidelines on accounting of specified types of changes in AR CDM project activities from the description in registered PDD' (version 9)" – a change that does not decrease precision of tree biomass estimations was made and considered as a minor change that does not require CDM EB approval.

Indeed, for some species, more specific allometric models were used in first and second verification, especially the equations by Lopez *et al.* (2011) were added for Eucalyptus.

Table 8: Volume models used by species.

SPECIES	MATHEMATICAL EXPRESSION	Source
	Age ≥ 5 year $v = \frac{0.32932 \cdot (d/100)^2 \cdot (h-0.1)^{2.62}}{(h-1.3)^{1.62}}$	Vallejo (1991)[23]
Teak	$TB_{AB} = 0.131748 \cdot d^{2.406413}$ $R^2 = 98.7\%\ n = 102$	Torres (2004)
Ceiba	$V = 0.910.H^{0.620}.G^{0.965}$ $R^2 = 98.0\%\ n = 64$	CIRAD-Forêt (2003)
Oak	$V = \left[\sum_{i=1}^{n} v_i\right].F_e$ *Where* $v_i = 0.01195 + 0.0001407.d^{2.3414} + 0.00009.d^2 + 0.0059094.d^{0.3414}$ $F_e = \frac{10000}{Sizeplot}$	Tabares (2002)

[23] Vallejo, A. ,1991. Ecuaciones de conicidad y volumen para Bombacopsis quinata y Gmelina arbórea. Informe de Investigación No. 16 . Monterrey Forestal., Colombia

Eucalyptus	$V = \left[\sum_{i=1}^{n} v_i\right].F_e$ *Where* $v_i = 0.017039 + 0.00003639.d^2.h - 0.00019893.d^2$ $F_e = \frac{10000}{Size\ plot}$ $R^2 = 98\%\ ;\ Sy.x = 0.02\ ;\ n = 102$	López *et al.* (2011)

Where V is the volume in cubic meters per hectare, v is the volume in cubic meters of individual trees, *Fe* is the expansion factor, *d* is the diameter at breast height, h is total tree height, n is the sample size, H is the height calculated as the dominant height of the 100 trees of greater d per hectare, and G is the basal area per hectare.

As shown in table above, for *Gmelina arborea* two allometric models were used depending on plantation age, less than 4 years López et al. (2011)[24] or 4 years and more (Vallejo1991)[25], in order to minimize uncertainties.
Likewise, basic densities for Eucalyptus tereticornis and Gmelina arborea, were updated in the same way as in the first verification and described in section D and summarized in the table below. And since for Tectona grandis, allometric method was used, basic density was not necessary for this species.

Species	Basic density	
	ex-ante estimations	ex-post estimations
Eucalyptus tereticornis	0.54	0.69
Tabebuia rosea	0.53	0.54

SECTION C. Description of monitoring system

The structure of responsibilities in the monitoring process was coordinated by ONF International with support from various professionals and institutions as it is detailed in the **Erreur ! Source du renvoi introuvable.** below.

The project monitoring system was based on the following aspects:

[24] LÓPEZ A.M.; BARRIOS, A.; NIETO V.; TRINCADO G. 2011. Monitoreo y modelamiento de crecimiento como herramienta para el manejo de plantaciones forestales comerciales. Corporación Nacional de Investigación y Fomento Forestal CONIF® – Ministerio de Agricultura y Desarrollo Rural. Bogotá D.C. 100p.

[25] Vallejo, A. ,1991. Ecuaciones de conicidad y volumen para Bombacopsis quinata y Gmelina arbórea. Informe de Investigación No. 16. Monterrey Forestal., Colombia

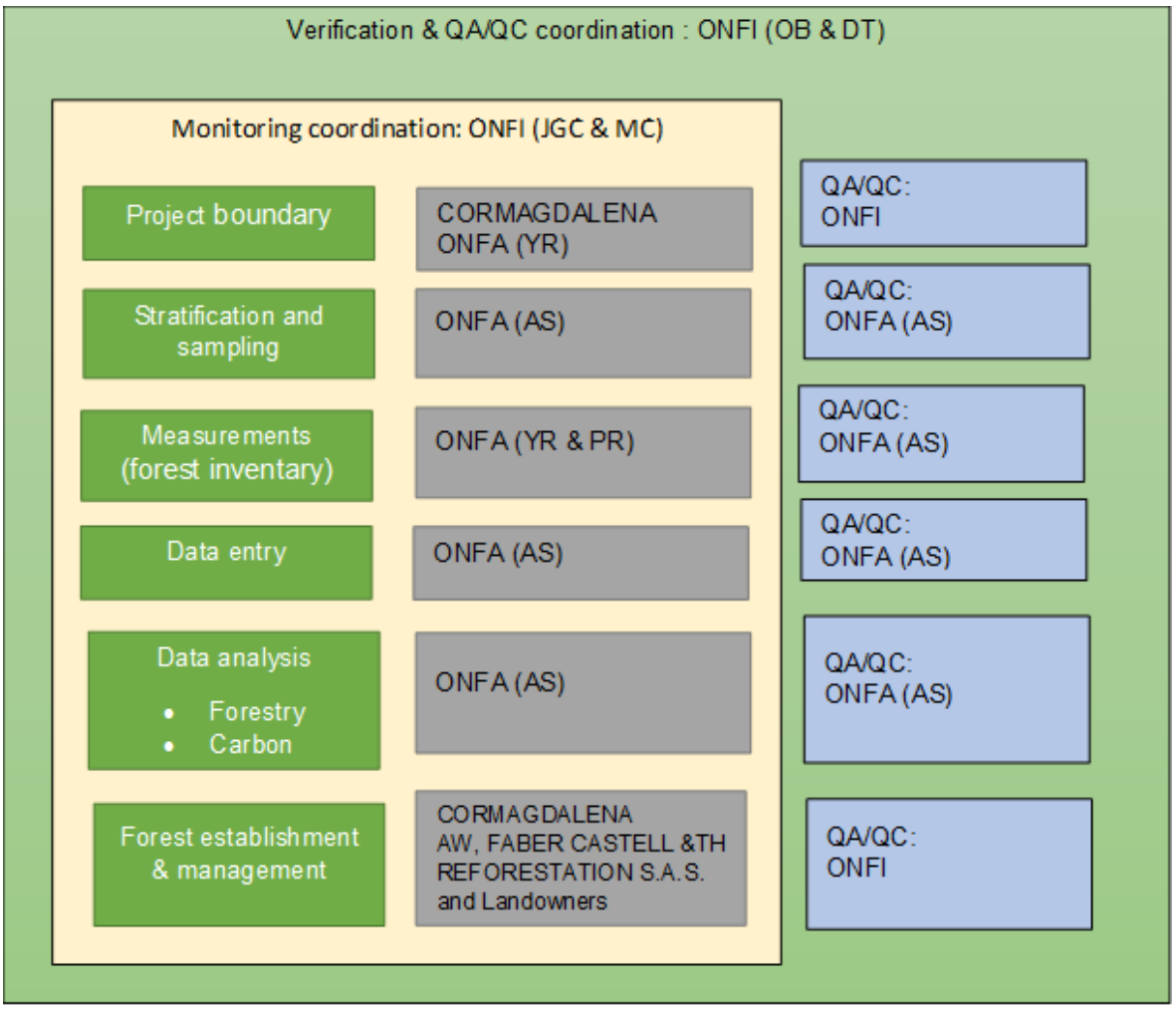


Figure 11: Structure of the monitoring CDM and inventory process of carbon stocks in the project. JGC: Jean Guénolé CORNET, MC: Marion CHESNES, DT : Danny Torres ; AS: Andrés Sierra, YR: Yesid Ríos, PR: Paola Reyes

C.1. Monitoring of the project boundary

The activity was developed following the methodological process described in the PDD. For this process, was used the cartographic base of the project generated for the first verification. During the process of GIS, developed by ONF Andina, areas effectively planted to 2012 were subjected of visual check using Landsat 2016 images. This process consists of:

With the latest version of the GIS database provided by ONF Andina, the cartographic information that shows all plantations seeded was derived from data that was taken directly in the field, and reviewed. The review was done by selecting only areas under control of project participants.

Following the footsteps of the PDD, and in order to identify consistency between field surveys of the stands effectively planted and the ones identified in a recent satellite image, a review was done by overlapping polygons planted and the satellite image. It was done for all stands in all stratums. Afterwards, it was verified that the data of clean pastures, pastures with fallows and fallows were consistent with the spectral response showed in the satellite image, to thereby be more precise about the area effectively planted in the project.

An exhaustive review of the different stratums compared with current land cover (satellite image) was conducted, for which the attributes of the last Geodatabase of the project were transferred and compared with the Landsat satellite image of 2016 in the project area.

Synergism processing of the Landsat 2016. This process allowed increasing the spatial resolution of the image to be analyzed and provides better clarity of the covers. The synergism of the image was done to perform a combination of the multispectral image bands, which are at a resolution of 30 meters, and panchromatic band that has a spatial resolution of 15 meters. The multispectral image includes the visible spectrum (red, blue and green), the medium infrared and the near infrared. When making this combination, the result is an image with all multispectral data, at a resolution of 15 meters, allowing for visual perception and clarity of the data, as well as a finer scale.

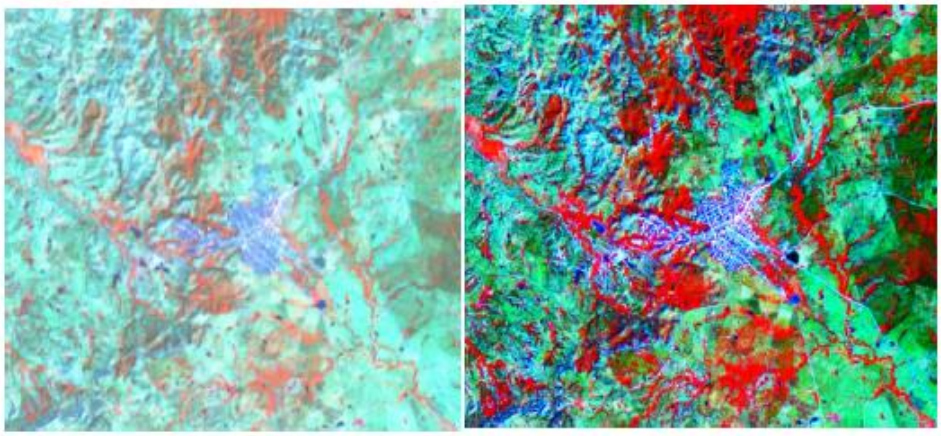


Figure 12: Landsat Image with 15m (left) and 30m (right) resolution

In order to improve the information of the image, two vegetation indexes were constructed by operating with bands to highlight special characteristics of the objects captured by the sensor.

A classification process was carried out under a supervised classification methodology, which consists in taking several representative samples of each class present in the project area.

Validation of the information was made through control points that were taken directly in the field, in this case, this information took into account the characteristics of the vegetation that was present in a specific plot, and this information includes data on thinning or loss of planted areas by natural causes such as fires. Finally the areas with and without vegetation were quantified and a final classification was produced considering the seasonal variations of the vegetation.

Figure 13 below summarize the process of boundaries monitoring and all this process is given in the SIG database which is provided to the DOE.

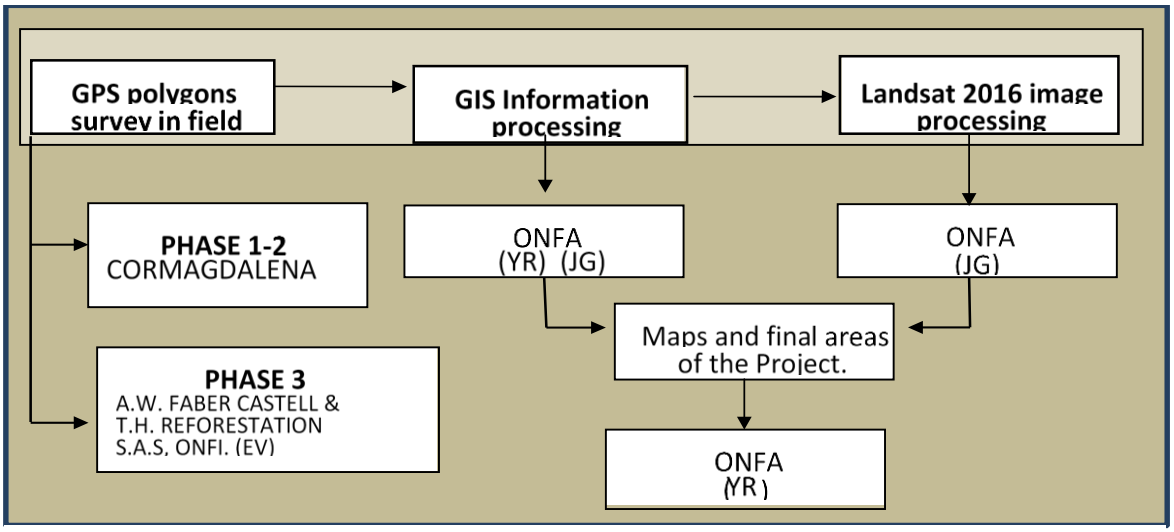


Figure 13: Monitoring structure of the areas under control of the Project. JG: Juan Guarnizo, YR: Yesid Ríos

C.2. Monitoring of forest management

The control process of establishment and management of activities, as well as the inventory of carbon stocks, also included three phases in which different entities got involved as shown in Figure 14.

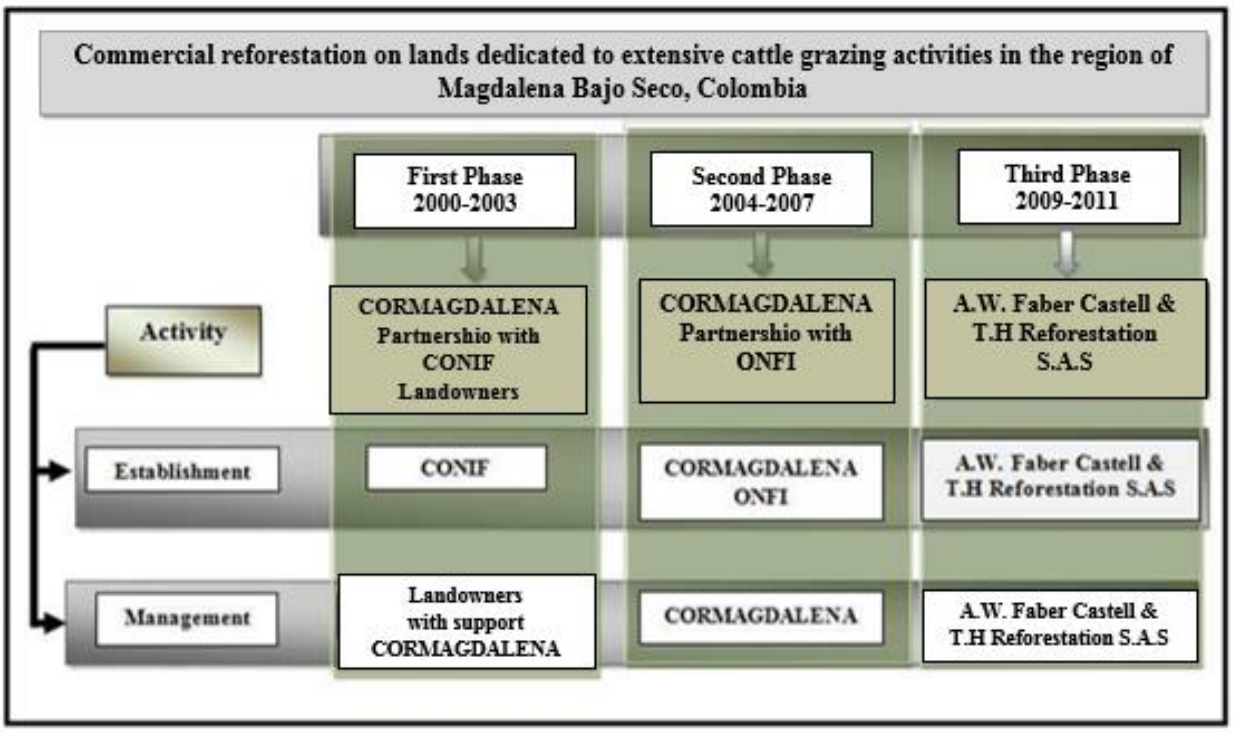


Figure 14: Participation Scheme of the entities involved in the activities of forest establishment and management of the project. These entities are responsible for documenting and responding to the management of information that is supplied to the ONFAndina for CDM processes.

In 2016, the environmental performance in the forest plantations of the MDL PRC Project was evaluated (Annex 3), through semi-structured interviews with the plantation owners of the three project phases, and field visits.

For the phase n°1, plantations owners expressed that no tree pruning has been done since the last verification. For phase 1 in relation to the silvicultural management aspects, the plantation owners stated that in their plantations the pruning was suspended more than 8 years ago and the waste generated at that time was arranged in plantation areas' ground, so that by natural processes they were incorporated into the soil.

The thinning activities consisted of interventions that included the elimination of individuals in competition and phytosanitary thinning, according to the species, age and type of phytosanitary affectation. In terms of weed management and control, manual eradication activities were carried out.

According to the information provided by CORMAGDALENA (Annex 3b) on the management activities implemented in the plantations corresponding to phase 2, it can be observed that in the period between 2011 and 2016 the recommendations of the Environmental Management Plan were followed, for the maintenance of plantations and appropriate attention to eventualities presented and to reduce possible impacts.

During this period there were no reports of damage caused by erosion or landslides. In relation to the watercourses located in the plantations, there were no interventions on these that altered its usual current, in the practices developed there have been no spills of dangerous substances in soil or water sources and no burnings have been done. Concerning the use of hazardous

substances for the management of stumps, directed poisoning with herbicides has been implemented.

In this period of monitoring some forest fires have been registered:

- In April 2014 a fire was reported in the area of the Bagres.
- In February 2016 a fire was reported in the Chimborazo property.
- In March 2016 a fire was reported in the property San Carlos de Ospino.

By 2015, pruning activities were practiced in the teak plantations located in La Gloria, El Atravesado and Pradera, Cuatro Esquinas and El Chimborazo farms. For the farms reporting management activities in this report regarding to melina plantations, the first pruning was done between 2014 and 2016. In the period covered by this monitoring report there were no work-related accidents during maintenance activities.

Table 9: Report of silvicultural management activities in phase 2.

N°	FARM	PARCEL	PRUNING	PRUNING DATE (YEAR)	THINNING	THINNING DATE (YEAR)
1	Atravesado y Pradera		Teak pruning at 6 meters	2015	First thinning leaving density of approximately 420 trees / ha in melina and 500 trees / ha in teak	2015
2	La Gloria		Teak pruning at 6 meters	2015	First thinning leaving density of approximately 500 arb/ha in teak	2014
3	La Unión	2004C0224 2004M0176	No pruning	N.A	First thinning leaving density of approximately 420 trees / ha in melina	2015
4	Quindio y Peralonzo	2004C0219 2004C0225 2004C0226 2004M0203 2004M0204 2004M0205 2004M0207	No pruning	N.A	First thinning leaving density of approximately 420 trees / ha in melina.	2014
5	Chimborazo	2004M0170 2004M0171 2004M0172 2004M0173 2004M0174 2004M0175 2004C0212 2004C0213 2004C0214 2004C0216 2004C0217 2004C0218 2004T0208 2004T0209	Teak pruning at 6 meters	2015	First thinning leaving density of approximately 420 trees / ha in melina and 500 trees / ha in teak	2014
6	Cuatro Esquinas	2005M0227 2005M0228 2005M0229 2005M0230 2005C0252 2005C0253 2005C0254 2005C0255 2005T0250 2005T0251	Teak pruning at 6 meters	2015	First thinning leaving density of approximately 450 trees / ha in melina and 500 trees / ha in teak	2014

7	Ruby Teresa	2005M0243 2005M0244 2005M0245 2005M0246 2005M0247	No pruning	N.A	First thinning leaving density of approximately 450 trees / ha in melina	2014 y 2015
8	Los Bagres	2005M0232 2005M0233 2005M0234 2005M0235 2005M0236 2005M0238 2005M0239	No pruning	N.A	First thinning leaving density of approximately 450 trees / ha in melina	2014
9	Las Llaves 10	2005M0248 2005M0249	No pruning	N.A	First thinning leaving density of approximately 450 trees / ha in melina	2014
10	San Carlos de Rozo	2005M0231	No pruning	N.A	First thinning leaving density of approximately 450 trees / ha in melina	2014
11	Los Alcázares	2005M0240 2005M0241 2005M0242	No pruning	N.A	No thinning activities	N.A
12	La Floresta	2006M0261	No pruning	N.A	First thinning leaving density of approximately 450 trees / ha in melina	2014
13	San Carlos de Ospino	2005T0268	No pruning	N.A	First thinning leaving density of approximately 500 trees / ha in teak	2014
14	La Virgen	2007M0264	No pruning	N.A	First thinning leaving density of approximately 540 trees / ha in melina, In addition 1.3781 hectares has been clearcut by the owner, who also practiced some extraction as thinning activities in the plantations	2014 y 2015
15	Panorama	2006M0266	No pruning	N.A	First thinning leaving density of approximately 450 trees / ha in melina, In addition the owner practiced some extraction as thinning activities in the plantations	2014 y 2015

Taking into account the information reported by A.W Faber Castell & T.H. Reforestation S.A.S on the environmental and social performance of phase 3 forest plantations for the period 2011-2016 (Annex 3c), the recommendations suggested in the Environmental Management Plan have been broadly followed.

For the period reported, in El Socorro, El Desvío, Madre Selva, Santo Domingo and Los Mangos parcels, there were affectations in the bark of some trees due to the presence of livestock, while the plantations located in the San José, Nuevo Oriente, Campo Alegre and Pajonal also recorded some affectations due to presence of livestock and mortality in some sectors during summer season and presence of salts in the soil.

Figure 15: Bark affectations due to the presence of livestock

In the Berlin I parcel, in some areas of the plantations there was a downward mortality due to the summer season and the presence of salts in the soil. In the Doncello parcel some wood extractions have occasionally been made without the owner authorization, nevertheless the respective review of the case is being carried out. For the other farms it was indicated that their plantations are in excellent condition. The farms did not report alterations due to erosion and / or landslides, nor recorderd burning practices.

The application of glyphosate has been used in weed control practices, however no related damage has occurred. No forest fires have been registered for the reporting period.

Between 2012 and 2014 pruning activities were carried out according to the different ages of the planted parcels and their respective needs, in order to guarantee the quality of the wood products to be obtained, following the Environmental Management Plan guidelines.

In 2014, El Socorro, El Desvío and El Atravezado parcels developed thinning works, while Santo Domingo, El Doncello and Los Mangos parcels were thinned in 2015. In the table 2 are listed sylvicultural activities done in the plantations of the phase 3.

Figure 16: Pruning and thinning activities in *Gmelina arbórea* plantation.

Table 10: Sylvicultural activities report for the plantations of the phase 3.

N°	FARM	PARCEL	PRUNING	PRUNING DATE (YEAR)	THINNING	THINNING DATE (YEAR)
1	San Jose	2009M0324	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
2	Nuevo Oriente	2009M0320	Pruning until 4meters	2013 y 2014	No thinning activities	N.A
3	Las Colinas	2009M0315	Pruning until 2 and 4 meters	2013 y 2014	No thinning activities	N.A
4	Cambio Vida	2009M0288	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
5	Berlin I	2009M0284 2009M0285 2009M0286	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
6	El Socorro	2009M0278	Pruning until 6 meters	2012 y 2013	First thinning	2014
7	San Antonio	2009M0323 2009M0323	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
8	El Desvio	2009M0275 2009M0299	Pruning until 6 meters	2012 y 2013	First thinning	2014
9	Madre Selva	2009M0319	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
10	Campo Alegre	2009M0289	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
11	El Recuerdo	2009M0307	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
12	El Sinu	2009M0310	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A

13	Santo Domingo	2009M0280 2009M0281	Pruning until 6 meters	2012 y 2013	First thinning	2015
14	El Doncello	2009M0276	Pruning until 6 meters	2012 y 2013	First thinning	2015
15	Los Mangos	2009M0279	Pruning until 6 meters	2012 y 2013	First thinning	2015
16	Pajonal	2009M0321	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
17	Villa de la Mata	2009M0326	Pruning until 6 meters	2012 y 2013	No thinning activities	N.A
18	El Atravezado	2009M0272 2009M0296	Pruning until 6 meters in 4,27 ha and pruning until 4 meters in 8,94 ha	2012, 2013 y 2014	Thinning only on 4,27 ha	2014

C.3. Measurement of carbon pools

Dendrometric measurement variables and forest inventory.

Measurement procedures of dendrometric variables followed the protocols developed for the project (protocol PRC_06). The measurement was take with Suunto clinometer tandem (Figure 17).

Figure 17: Total height were measured with SUUNTO TANDEM mechanical. Hypsometer.

The diameter measurements were taken using diameter tape with accuracy of 0.1 cm, and a caliper for measuring the diameter of the Ceiba trees due to the abundant presence of spines.

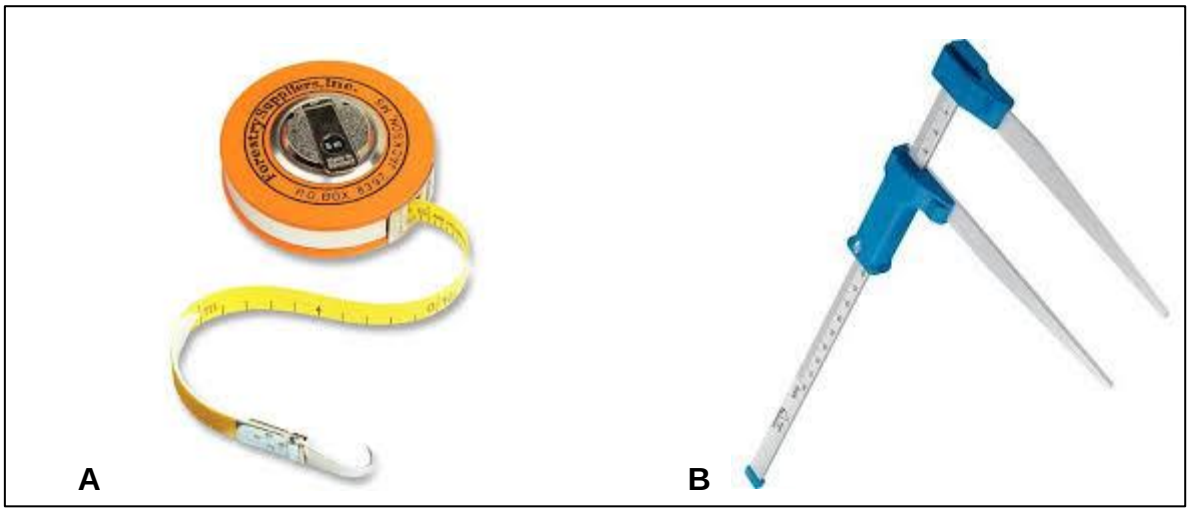


Figure 18: Equipment for measuring diameters: A: Diameter tape, B: Caliper.

The measuring team consisted of a Forest Engineer in charge of taking measurements, a Forest Technician as support for measurements and a field assistant.

Table 11: Description of the groups for field inventories ONFA 2016

FUNCTION	GROUP 1	GROUP 2
Leader of the group	Yesid Ríos	Paola Reyes
Measurement Assistant	Deivis Mendoza	Orlando Mejia
Field assistance	Local worker	Local worker
Field assistance	Local worker	Local worker

Estimates of forest stocks in terms of volume (m3ha-1).

As shown in Table 13, the forest inventory included 160 permanent plots established according to the stratification proposed. The volume estimates were developed using the equations in Table 12. For all species, we used the equations presented in the PDD and the equations by Lopez *et al.* (2011) were added for Melina, with age under 4 years, and Eucalyptus.

Table 12: Volume models used by species.

SPECIES	MATHEMATICAL EXPRESSION	Source
Melina	$V(m3) = (0.32932 * (d/100)^2 * (H-0.1)^{2.62})/(H-1.3)^{1.62}$	Vallejo (1991)
Teak	$V = \left[\sum_{i=1}^{n} v_i\right].F_e$ $where$ $v_i = \left(\frac{\pi}{4}\right).\left(\frac{d}{100}\right)^2.h.0.48$ $F_e = \frac{10000}{Tamaño\ parcela}$	Tabares (2002)
Ceiba	$V = 0.910.H^{0.620}.G^{0.965}$	CIRAD-Forêt (2003)
Oak	$V = \left[\sum_{i=1}^{n} v_i\right].F_e$ $where$ $v_i = 0.01195 + 0.0001407.d^{2.3414} + 0.00009.d^2 + 0.0059094.d^{0.3414}$ $F_e = \frac{10000}{Sizeplot}$	Tabares (2002)
Eucalyptus	$V = \left[\sum_{i=1}^{n} v_i\right].F_e$ $where$ $v_i = 0.017039 + 0.00003639.d^2.h - 0.00019893.d^2$ $F_e = \frac{10000}{Size\ plot}$	López *et al.* (2011)

Where *V* is the volume in cubic meters per hectare, *v* is the volume in cubic meters of individual trees, F_e is the expansion factor, *d* is the diameter at breast height, *h* is total tree height, *n* is the number of trees in each plot, H is the height calculated as the dominant height of the 100 trees of greater d per hectare, and G is the basal area per hectare.

The statistical results of field sampling are presented in Table 13 and Table 14. It can be seen that increasing the sample size, it was possible to achieve the total error adjustment (6.48%), based on the proportional share of each stratum in the whole project.

Table 13: Results of statistical confidence level of 95% and an error of less than 10% of the inventory of growing stock for the strata of the project and for each species.

SPECIES	GROUP	PLOTS	AREA (ha)	P_j	S_{xj}	E_j	E_{st}
Ceiba	C_G1	26	205.43	0.07686	28.17	4.63	0.36
Ceiba	C_G2	10	59.33	0.02220	19.09	5.66	0.13
Eucalyptus	E_G1	5	22.41	0.00838	25.48	11.04	0.09
Melina	M_G1	43	1,149.73	0.43017	51.24	5.73	2.46
Melina	M_G2	18	452.97	0.16948	53.55	11.21	1.90
Melina	M_G3	23	429.66	0.16076	32.06	5.73	0.92
Oak	R_G1	8	165.68	0.06199	23.43	7.87	0.49
Teak	T_G1	23	146.72	0.05489	12.35	2.15	0.12
Teak	T_G2	4	40.83	0.01528	1.769	0.86	0.01
TOTAL		**160**	**2672.76**	**1.0000**			**6.48**

P_j: Weighting of participation by area of each species, S_{xj}: standard error of the estimate, E_j: stratum error, E_{st}: proportional error of the stratum.

Table 14: Results of mean values for the height and diameter.

GROUP	DIÁMETER (cm)		HEIGHT (m)	
	Mean	**SD**	**Mean**	**SD**
Ceiba_G1	20.76	5.47	15.36	2.97
Ceiba_G2	20.57	5.19	13.71	2.92
Eucalipto_G1	18.26	4.19	22.78	3.42
Melina_G1	22.22	4.31	20.57	2.98
Melina_G2	21.79	4.66	20.96	3.54
Melina_G3	16.20	3.67	16.80	2.24
Roble_G1	18.40	4.34	15.44	3.49
Teca_G1	20.39	2.74	17.33	2.23
Teca_G2	18.68	2.97	17.81	1.64

Information processing and estimates of the removal of CO2e.

For the second verification, all field information was digitized directly in the field with the help of digital pocket. The tool CAMARA, developed by ONF International to estimate actual net GHG removals by sinks in AR projects, was used in its latest version (CAMARA v1.2) for the calculation of carbon stocks in each stratum within project boundary based on field measurements within permanent sample plots. Procedures are detailed in the protocol to used CAMARA.

C.4.Quality Assurance and Quality Control

The procedures for forest establishment and management activities were designed in the PDD according to the procedures effectively developed since the start year of the project. This guarantees that these activities were executed in accordance with procedures**.**

ONF Andina developed procedures for auditing the activities related to the proposed AR CDM project activities, which consisted in:

1. Auditing the plots establishment: the forest inventory teams were visited and the compliance of the described activities was verified in terms of plot location and measurement of dendrometric variables.

2. Control of the staff training process: ONF Andina, has conducted forest inventory activities in a permanent. These activities were related to follow-up forest establishment and management, sampling procedures and forest inventories sensu stricto. Hence ONFA counts with qualified staff for developing forest inventories (Two forest engineer trained in forest inventories).

3. Control of measurement equipment quality: ONFA counts with appropriate measuring equipment for the measurement of dendrometric variables. This fact guarantees the quality of data gathered in the field. Moreover, the audior team, realize quality control of the measurement equipment's.

4. Control of field measurements and data entry: 10% of samples plots were controlled among the total number of sample plots, where the activities were developed and where the location, establishment and measurements were in line with the protocols. **Erreur ! Source du renvoi introuvable.** presents the sample plots selected in the auditing process. The results of the measurements developed in the auditing were saved in hard and digital files for its analysis.

5. For the selected sample plots, the control of measurements was done by one auditing team of ONF Andina. The team including two people. The auditing teams took new measurements of the dendrometric variables previously measured. This was done for cross checking the measurements. Afterwards, the results were compared to the values reported by the inventory teams.

Hierarchical scheme implemented in the quality control process. This identifies the responsibilities in the process of monitoring Figure 19.

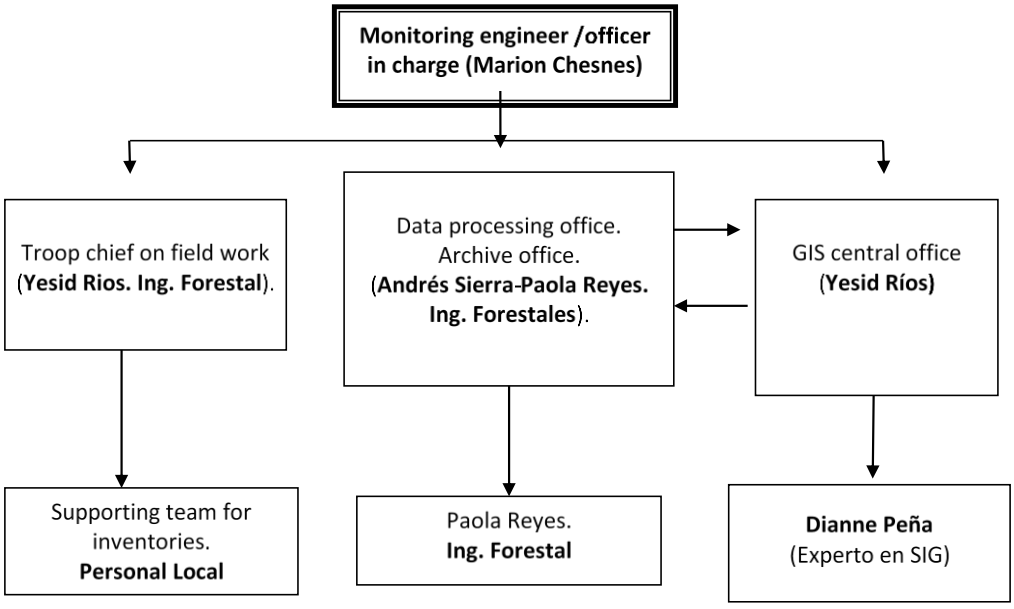


Figure 19: Hierarchical Order for the implementation of the quality control. See PDD V9.

During this process, digital forms were used, which allowed to directly enter the field data in EXCEL forms, with the help of mobile devices like Digital Tablets, therefore, the process of control of input data is directed to the revision in the digitization of data entered in the templates.

Table 15: Plots selected for the audit of field measurement and data entry. The sampling developed in 160 growing permanent sample plots; hence the 19 plots audited correspond to a the 12% of the sample plots something that is in line with the procedure of quality control

Plot	Plot_ID	FARM
1	Teca N-18	Puerto Adentro
2	Melina 154	La Siberia
3	Melina 117	La Siberia
4	Melina 120	Cuatro Esquinas
5	Melina 41	Los Bagres y la Jar
6	Melina 42	Floresta
7	Melina 54	Puerto Adentro
8	Ceiba 16	Chimborazo
9	Ceiba 17	Chimborazo
10	Teca 44	Chimborazo
11	Melina 31	Camachera
12	Melina 32	Camachera
13	Ceiba 24	La Gloria
14	Melina 16	La Gloria
15	Teca 45	Chimborazo
16	Teca 28	La Gloria
17	Teca R1	Montevideo
18	Melina_45	Rubi Teresa
19	Melina_44	El Otoño

6. Error estimation on dasometric variable (mean DAP and mean Ht) was calculated for inconsistent values between the field average values like the DBH and Ht the values obtained by the auditing teams. The formula applied was:

$$Measur.error\ (\%) = \frac{Dasometric\ variable\ (DAP\ or\ Ht)_{first\ medition} - Dasometric\ variable\ (DAP\ or\ Ht)_{Audit}}{asometric\ variable\ (DAP\ or\ Ht)_{Audit}} x100$$

Some the results, are presented in the Table 16: Sample selected for identifying data entry errors. The process followed the steps mentioned in the monitroing plan and in the verification data entry protocols. N: No tree ha-1 DBH: Diameter at breast height, Ht: total height.

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Table 16: Sample selected for identifying data entry errors. The process followed the steps mentioned in the monitroing plan and in the verification data entry protocols. N: No tree ha^{-1} DBH: Diameter at breast height, Ht: total height.

Código Parcela	No Parcela	Especie	Área de la Parcela	Año de Siembra	N àrbol/ parcela	N àrbol/parcela Auditoria	% diferencia (N / N auditoria)	DAP promedio (cm)	DAP promedio (cm) Auditoria	% diferencia (DAP / DAP auditoria)	Ht Promedio (m)	Ht Promedio (m) Auditoria	% diferencia (Ht / Ht auditoria)
Ceiba_16	16	Ceiba	500	2004	40	40	0,0%	19,98	20,94	4,6%	11,94	12,18	2,0%
Melina_16	16	Melina	800	2004	36	36	0,0%	23,06	23,6	2,3%	20,36	19,76	3,0%
Ceiba_17	17	Ceiba	500	2004	38	38	0,0%	23,29	23,63	1,4%	13,63	14,63	6,8%
Ceiba_24	24	Ceiba	800	2004	54	54	0,0%	20,12	20,67	2,7%	13,33	13,93	4,3%
Teca_28	28	Teca	800	2004	38	38	0,0%	19,26	20,04	3,9%	18,02	17,77	1,4%
Melina_31	31	Melina	500	2003	39	39	0,0%	19,98	20,48	2,4%	22,51	21,18	6,3%
Melina_32	32	Melina	500	2003	39	39	0,0%	18,33	19,05	3,8%	18,63	19,02	2,1%
Melina_41	41	Melina	500	2005	36	36	0,0%	20,51	21,06	2,6%	19,93	19,9	0,2%
Melina_42	42	Melina	800	2006	56	56	0,0%	19,75	20,02	1,3%	20,07	19,02	5,5%
Teca_44	44	Teca	500	2004	33	33	0,0%	18,64	19	1,9%	17,33	16,21	6,9%
Teca_45	45	Teca	500	2004	36	36	0,0%	19,04	20,33	6,3%	18,64	17,52	6,4%
Melina_54	54	Melina	500	2001	34	35	2,9%	25,69	26,75	4,0%	23,43	21,72	7,9%
Melina_117	117	Melina	500	2010	44	44	0,0%	12,6	13,59	7,3%	13,4	13,87	3,4%
Melina_120	120	Melina	500	2005	37	37	0,0%	21,94	23,37	6,1%	19,81	19,26	2,9%
Melina_154	154	Melina	500	2010	34	34	0,0%	15,76	17,97	12,3%	16,11	16,45	2,1%
Teca_N18	N18	Teca	800	2001	41	41	0,0%	18,73	20,38	8,1%	16,35	16,24	0,7%
Teca_R1	R1	Teca	500	2003	23	23	0,0%	18,23	20,03	9,0%	16,39	16,47	0,5%
Melina_45	**45**	**Melina**	**500**		**22**	**22**	**0%**	**21.86**	**23.16**	**6%**	**21.55**	**20.53**	**5%**
Melina_N44	44	Melina	500		44	35	26%	19.3	20.76	7%	19.344	19.93	3%

The results presented in the audit process, show that the values of DAP and Ht obtained in audit are slightly higher than values found in first measurement process, except for the number of individuals (n). This is due to the fact that the audit was done few months after the field Work.

In general, the errors in average were under 5% for DAP variable (4.89%) and for Ht (3.7%), it means that DAP and Ht values are in accordance with the requirement of the quality control. The results are presented in more detail in the attached quality control report.

7. All the information gathered is saved in digital files, hard drives and CDs, under custody of ONF Andina.

8. ONF Andina auditing team:

   - Andrés Sierra B. Forest Engineer
   - Robinson Martínez Forest Engineer

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

(Copy this table for each piece of data and parameter)

The next parameters were used in the estimated net carbon removals in the monitoring of the project, applied in the CAMARA tool (see Annex 2). Some of these parameters changed to the set up defined in the PDD, according to methodological recommendations of AR-AM0004 version 04, when it is possible to have local/national values.

Data/parameter:	***DLP***
Unit	%

Description	Desired level of precision.
Source of data	Value suggested by the methodology applied (AR-AM0004 v.04)
Value(s) applied)	10 %
Choice of data or measurement methods and procedures	
Purpose of data	Setting value considered for inventory estimates of forest stocks.
Additional comments	Applied for adjustment of the statistical sampling. Applied in the eq. 57 of the methodology AR-AM0004 v.04

Data/parameter:	$Z_{\alpha/2}$
Unit	Dimensionless
Description	Value of the statistic z (normal probability density function), for α = 0.1 (implying a 90% confidence level).
Source of data	Statistic book
Value(s) applied)	1.645
Choice of data or measurement methods and procedures	
Purpose of data	Setting value considered for plot monitoring project.
Additional comments	To develop an accurate inventory of timber volume and carbon, and applied for adjustment of the statistical sampling. See eq. 59 of the methodology AR-AM0004 v.04.

Data/parameter:	BEF_j
Unit	Dimensionless
Description	Biomass expansion factor for conversion of merchantable volume to above-ground tree biomass for species j. The IPPC defined for tropical broadleaf, BEF2 (overbark) to be used in connection to growing stock biomass data.
Source of data	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003. Table 3A.1.10
Value(s) applied)	2.7
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by each species in the project activity. Applied in the eq. 67 of the methodology AR-AM0004 v.04
Additional comments	It was applied to each stand model except for Teak stand models as the allometric method was used for this species

Data/parameter:	***Root-shoot ratio, R_j***
Unit	Dimensionless
Description	Relationship between root biomass and shoot biomass
Source of data	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003. Table 3A.1.8
Value(s) applied)	0.27
Choice of data or measurement methods and procedures	

Purpose of data	Actual net GHG removals by each species in the project activity. Applied in the eq. 68 of the methodology AR-AM0004 v.04
Additional comments	It was applied to each stand model, species.

Data/parameter:	***Carbon fraction, CF_j***
Unit	Dimensionless
Description	Carbon fraction content in the biomass
Source of data	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003.
Value(s) applied)	0.5
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by each species in the project activity. Applied in the eq. 68 of the methodology AR-AM0004 v.04
Additional comments	It was applied to each stand model.

Data/parameter:	***D_j***
Unit	t d.m. m^{-3}
Description	Basic wood density for species *Bombacopsis quinata*.
Source of data	Cordero y Boshier (2003)[26]
Value(s) applied)	0.45
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by *Bombacopsis quinata* in the project activity. Applied in the eq. 67 of the methodology AR-AM0004 v.04
Additional comments	Data from national reference.

Data/parameter:	***D_j***
Unit	t d.m. m^{-3}
Description	Basic wood density for species *Tabebuia Rosea*
Source of data	Universidad Nacional de Colombia[27]
Value(s) applied)	0.54
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by *Tabebuia rosea* in the project activity. Applied in the eq. 67 of the methodology AR-AM0004 v.04
Additional comments	Data from local reference.

[26] Cordero, J; Boshier, D. 2003. Árboles de Centroamérica: Un manual para extensionistas. OFI–CATIE. p.399.

[27] Universidad Nacional de Colombia. 1989. Laboratorio de productos Forestales, Madera, boletín técnico informativo sobre tecnología de maderas. Vol VIII N° 1.

Data/parameter:	D_j
Unit	t d.m. m^{-3}
Description	Basic wood density for species *Eucalyptus tereticornis*
Source of data	Refocosta[28]
Value(s) applied)	0.69
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by Eucalyptus tereticornis in the project activity. Applied in the eq. 67 of the methodology AR-AM0004 v.04
Additional comments	Data from local reference.

Data/parameter:	D_j
Unit	t d.m. m^{-3}
Description	Basic wood density for species *Gmelina arborea.*
Source of data	Obregon (2006)[29], Trujillo, 2007[30]
Value(s) applied)	0.53
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by Gmelina arborea in the project activity. Applied in the eq. 67 of the methodology AR-AM0004 v.04
Additional comments	Date derived from the local and national reference.

Data/parameter:	$B_{pre,ikt}$
Unit	t d.m. ha^{-1}
Description	Average pre-existing stock non-tree pre-project biomass on land to be planted before the start of a proposed A/R CDM project activity for baseline stratum *i,* stand model *k,* time *t*
Source of data	Study of carbon stock in the baseline, Dufour 2005.
Value(s) applied)	BLS1 Clean pastures 1.81 BLS2 Pastures with fallows 17.18 BLS3 Fallows 21.49
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of actual net GHG removal by sinks
Additional comments	Applied in the equation 15 of the methodology AR-AM0004 v.04.

[28] http://www.refocosta.com/en_refocosta_03especies05.html.

[29] Obregon, C. 2006. Gmelina arbórea. Versatilidad, Renovación y Productividad Sostenible para el Futuro. Revista del Mueble y la Madera. No 50. Pág 14-20. http://www.revistamm.com/ediciones/rev50/especie.pdf.

[30] Trujillo, 2007. Guía de Reforestación, Primera Edición 2007. Bogotá Colombia. 267 p. basado en información para Colombia.

Data/parameter:	B_{ikt}
Unit	t d.m. ha^{-1}
Description	Average pre-existing stock tree biomass on land to be planted before the start of a proposed A/R CDM project activity for baseline stratum *i,* stand model *k*, time *t*
Source of data	ONFA y C&B, 2010. Inventario de Árboles dispersos en los escenarios de línea base.
Value(s) applied)	1.66
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of GHG_E
Additional comments	Applied in the equation 89 of the methodology AR-AM0004 v.04, in accordance with the PDD in order to estimate tree biomass loss as tree biomass is not considered in the calculation of $E_{biomassloss}$. Tree biomass loss is thus estimated through calculation of GHGE even if trees are not burnt but only slashed. Therefore, as trees are slashed (complete loss) and not burnet, in equation 89 of the methodology PBB_{ikt} and CE are set at maximum, so equal to 1.

Data/parameter:	PBB_{ikt}
Unit	dimensionless
Description	Average proportion of biomass burnt for stratum *i,* stand model *k,* time *t*
Source of data	Set as maximum possible
Value(s) applied)	1
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of GHG_E
Additional comments	Applied in the equation 89 of the methodology AR-AM0004 v.04, in accordance with the PDD in order to estimate tree biomass loss as tree biomass is not considered in the calculation of $E_{biomassloss}$. Tree biomass loss is thus estimated through calculation of GHGE even if trees are not burnt but only slashed. Therefore, as trees are slashed (complete loss) and not burnet, in equation 89 of the methodology PBBikt and CE are set at maximum, so equal to 1.

Data/parameter:	*CE*
Unit	dimensionless
Description	Average biomass combustion efficiency
Source of data	Set as maximum possible
Value(s) applied)	1
Choice of data or measurement methods and procedures	

Purpose of data	Calculation of GHG_E
Additional comments	Applied in the equation 89 of the methodology AR-AM0004 v.04, in accordance with the PDD in order to estimate tree biomass loss as tree biomass is not considered in the calculation of $E_{biomassloss}$. Tree biomass loss is thus estimated through calculation of GHGE even if trees are not burnt but only slashed. Therefore, as trees are slashed (complete loss) and not burnet, in equation 89 of the methodology PBB_{ikt} and CE are set at maximum, so equal to 1.

Data/parameter:	***CF_{pre}***
Unit	t C (t d.m.)$^{-1}$
Description	The carbon fraction of dry biomass in pre-existing vegetation
Source of data	Study of carbon stock in the baseline, Dufour 2005
Value(s) applied)	
Choice of data or measurement methods and procedures	BLS1 Clean pastures 0.49 BLS2 Pastures with fallows 0.49 BLS3 Fallows 0.49
Purpose of data	Calculation of actual net GHG removal by sinks
Additional comments	Applied in the equation 15 of the methodology AR-AM0004 v.04

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter)

The next parameters were used in the estimation of net anthropogenic GHG removals during for the monitoring period by being applied in the CAMARA tool.

Data/parameter:	***Geographical position***
Unit	Latitude and longitude
Description	Geographical coordinates of all polygons, corresponding to all lands added to the project area
Measured/calculated/default	Measured
Source of data	Survey databases of each polygon that is part of the project and is under control of project participants.
Value(s) of monitored parameter	Values compiled in the GIS of the project provided to the DOE at each verification event
Monitoring equipment	Global Position System (GPS). 1- GPS Trimble Geo Explorer module PN: 46502-00 2- GPS Trimble Geo Explorer module PN: 50950-20 , and used with GIS software Arcgis 10
Measuring/reading/recording frequency:	At each inclusion of a new land to complete the project area
Calculation method (if applicable):	NA
QA/QC procedures:	Before planting, each lot is measured with GPS, taking here geographical coordinates boundary. Then the information is processed with Arcgis software. All lot are re-measured at the end of planting. -Protocol for project boundary delimitation. It is applied on the same way for each parcel to be planted or managed.
Purpose of data:	Monitoring of forest establishment, in particular to determine project area

Additional comments:	The set of geographic coordinates are defined as effectively intervened areas. See geographic coordinates of the polygons in the annex 1 on the MR. GIS database provided to DOE at each verification event.

Data/parameter:	***Location***
Unit	Latitude and longitude
Description	Defined grid in a defined coordinate system in which project boundaries are located.
Measured/calculated/default	Measured
Source of data	Field measurement with GPS.
Value(s) of monitored parameter	Coordinate system used is WGS 84 The following are the corners of the project grid N 9°34' W74°46' N 9°34' W74°24' N 10°22' W74°24' N 10°22' W74°46'
Monitoring equipment	Global Positioning System (GPS) and Geographic Information System Submetric GPS, Ashtech™ Mobile Mapper™ CX
Measuring/reading/recording frequency:	At the beginning of the project
Calculation method (if applicable):	NA
QA/QC procedures:	ONF Andina was in charge of controlling the quality of the Geographic information system through internal review by at least two GIS experts.
Purpose of data:	Geo-referencing of project area for forest establishment and management
Additional comments:	NA

Data/parameter:	***Site preparation***
Unit	ha
Description	Area of each parcel prepared to be planted (only slash), that corresponds also to A_{B,ikt_sb}
Measured/calculated/default	Measured
Source of data	Field measurement
Value(s) of monitored parameter	Values compiled in the GIS of the project provided to the DOE at each verification event
Monitoring equipment	GPS, and used the SIG Arcgis 10.
Measuring/reading/recording frequency:	At the end of site preparation activities
Calculation method (if applicable):	NA
QA/QC procedures:	- Protocol for project boundary delimitation. This are applied, same each lot to planted or management.
Purpose of data:	Area of each parcel by farm planted for monitoring of forest establishment
Additional comments:	Each parcel is measured before establishment. The set of geographic coordinates are defined as effectively intervened areas. This information is confirmed with the GIS database created for the project and with the forest management monitoring. In the project burning is not used as it is not allowed within the management plan.

Data/parameter:	*Check for survival* $_{i,j,k}$
Unit	tres ha^{-1}
Description	Check for survival expressed in number of seedlings per hectare
Measured/calculated/default	Measured
Source of data	Field measurements
Value(s) of monitored parameter	See annex 3 of monitoring report, forest management of project.
Monitoring equipment	NA
Measuring/reading/recording frequency:	At third month after planting.
Calculation method (if applicable):	Number of seedlings surviving / target stocking density
QA/QC procedures:	Survival assessment through temporary plots. Initial amount of planted trees is checked through the inventory final amount.
Purpose of data:	Control of tree density per ha in the framework of the forest establishment.
Additional comments:	Replanting required if less than 90% survival

Data/parameter:	*Date of planting*
Unit	Alphanumeric
Description	Date of establishment of each lot by species
Measured/calculated/default	NA
Source of data	Book report
Value(s) of monitored parameter	See book report that is provided to DOE at each verification event (Annex 3 of the monitoring report
Monitoring equipment	NA
Measuring/reading/recording frequency:	At each new plantation.
Calculation method (if applicable):	NA
QA/QC procedures:	The description of parcel to be planted carried on in the field is checked by the responsible of monitoring in ONFA.
Purpose of data:	Define effective age of the parcels planted for the monitoring of forest establishment.
Additional comments:	See annex 3 of monitoring report (reporte_de_manejo_forestal).

Data/parameter:	*Area planting*$_{i,j,k.}$
Unit	ha
Description	Area of stratum i, stand model k, at time t. All area under control that have been established up to 2011. And it corresponds to parameter A_{ikt}
Measured/calculated/default	Measured
Source of data	Project GIS. Data by GPS.

Value(s) of monitored parameter	2,672.76 ha Ceiba_G1 205.43 Ceiba_G2 59.33 Eucalipto_G1 22.41 Melina_G1 1,149.73 Melina_G2 452.97 Melina_G3 429.66 Roble_G1 165.68 Teca_G1 146.72 Teca_G2 40.83 Total 2,672.76
Monitoring equipment	GlobalPosition System (GPS). 1- GPS TrimbleGeo ExplorermodulePN:46502-00 2- GPS TrimbleGeo ExplorermodulePN:50950-20
Measuring/reading/recording frequency:	Yearly
Calculation method (if applicable):	NA
QA/QC procedures:	Areas/parcels are measured with GPS, before establishment, and re-measured after plantation. This is done for every species and date of plantation. Then, information is processed in GIS. Measurements comply the next protocol: -Protocol for project boundary delimitation.
Purpose of data:	Area of each strata in the framework of forest establishment
Additional comments:	Applied in the eq. 69-70 of the methodology AR-AM0004 v.04

Data/parameter:	**Area cleaning$_{i,j,k}$**
Unit	ha
Description	Area that was subject to effective weeding.
Measured/calculated/default	Measured
Source of data	Book report
Value(s) of monitored parameter	See book report that is provided to DOE at each verification event (Annex 3)
Monitoring equipment	GlobalPosition System(GPS). 1- GPS TrimbleGeo ExplorermodulePN:46502-00 2- GPS TrimbleGeo ExplorermodulePN:50950-20
Measuring/reading/recording frequency:	Areas are measured with GPS after each maintenance event.
Calculation method (if applicable):	NA
QA/QC procedures:	Forester's team that provides technical assistance to the project makes a check of the areas that have been effectively under maintenance, measured and verifying the quality of activity. Their results are reported in the field report book.
Purpose of data:	Control of quality plantation in the framework of forest management.
Additional comments:	All project area is subject to maintenance including cleaning. See the annex 3 of the monitoring report. (Annex 3). Algunas áreas fueron aprovechadas, dado el cumplimiento de su ciclo para corta, el análisis para determinar el área plantada a 2016 se realizó a través de un proceso de interpretación de imágenes de satélite.

Data/parameter:	***Area replanted***
Unit	ha
Description	Area replanted where there is a high mortality during the first three months of planting.
Measured/calculated/default	Measured
Source of data	Field measurement
Value(s) of monitored parameter	Report book (Annex 3) provided to DOE at each verification
Monitoring equipment	GlobalPosition System(GPS). 1- GPS TrimbleGeo ExplorermodulePN:46502-00 2- GPS TrimbleGeo ExplorermodulePN:50950-20
Measuring/reading/recording frequency:	Continuously.
Calculation method (if applicable):	NA
QA/QC procedures:	Protocol for project boundary delimitation including QA/QC. This is applied on the same way for each parcel affected by mortality. Forester's team that provides technical assistance to the project makes a check of the areas that have been replanted at the end of replanting.
Purpose of data:	Control of quality plantation in the framework of forest management
Additional comments:	The affected areas were deducted from the total project area, see Annex 3

Data/parameter:	***Area disturbed***
Unit	ha
Description	Area that has been affected by pests or other natural agents affecting the development of plantations
Measured/calculated/default	Measured
Source of data	Field measurement
Value(s) of monitored parameter	Report book (Annex 3) provided to DOE at each verification
Monitoring equipment	GlobalPosition System(GPS). 1- GPS TrimbleGeo ExplorermodulePN:46502-00 2- GPS TrimbleGeo ExplorermodulePN:50950-20 , and used the SIG Arcgis 10.
Measuring/reading/recording frequency:	Continuously.
Calculation method (if applicable):	NA
QA/QC procedures:	Protocol for project boundary delimitation. This is applied on the same way to each parcel affected by pest or other natural agents affecting the development of plantations. Forester's team that provides technical assistance to the project makes a check of the areas that have been affected by pest or natural agents, measuring the boundary the areas affected.
Purpose of data:	Control of quality plantation in the framework of forest management
Additional comments:	The affected areas were deducted from the total project area, see Annex 3

Data/parameter:	***Thinning***
Unit	ha yr^{-1}
Description	Area with thinning from the species j , that has been thinned in year *t*.

Measured/calculated/default	Measured
Source of data	Area of each lot, its value is correlated with the area planted and managed during the time t, before thinning.
Value(s) of monitored parameter	See annex 3 of the monitoring report
Monitoring equipment	GPS, and used the SIG *Arcgis* 10.
Measuring/reading/recording frequency:	Continually at thinning event.
Calculation method (if applicable):	NA
QA/QC procedures:	From data pre-harvest inventory is evaluated the need for thinning and its intensity. The area of the parcel is corroborated with the GIS database to determine which area is intervened with thinning. These values are checked by field technicians after thinning was performed. These values are reported in field reports and archived for each lot involved. - Protocol for project boundary delimitation. This is applied on the same way for each parcel to be thinned
Purpose of data:	Monitoring of forest management.
Additional comments:	NA

Data/parameter:	***A***
Unit	ha
Description	Project area, in accordance with the GIS database of the project.
Measured/calculated/default	Measured
Source of data	Survey databases of each polygon that is part of the project and is under control of project participants.
Value(s) of monitored parameter	3,137.32 ha.
Monitoring equipment	Global Position System (GPS). 1- GPS Trimble Geo Explorer module PN: 46502-00 2- GPS Trimble Geo Explorer module PN: 50950-20
Measuring/reading/recording frequency:	At the start of the project, and adjusted every 5 years
Calculation method (if applicable):	Direct in the project boundary.
QA/QC procedures:	Areas are measured with GPS before intervention, and GIS must be used in verification in compliance with the eligible areas defined in PDD. After locating and established the areas, a second measurement of boundaries is done to verify the effective-area of plantation (re-checked). All this exercise is executed with calibrated GPS for all the plots of the project, and information is processed following the protocols below -Protocol for project boundary delimitation. - Protocol of project boundary control with the addition of new areas under control.
Purpose of data:	Calculation of the number of sample plots
Additional comments:	It GPS has an internal antenna and power source, and a high-performance 12- channel GPS receiver. Its precision varies with meteorological conditions and can range between 1 and 5 m. The base data was corroborated with satellite image and GIS. Applied in the eq. 57 of the methodology AR-AM0004 v.04

Data/parameter:	A_i
Unit	ha
Description	Area of each stratum.
Measured/calculated/default	Measured
Source of data	Databases of all polygons that are part of the project and under the control of project participants. Áreas calculadas de acuerdo al proceso de revision 2016
Value(s) of monitored parameter	Ceiba_G1 205.43 Ceiba_G2 59.33 Eucalipto_G1 22.41 Melina_G1 1,149.73 Melina_G2 452.97 Melina_G3 429.66 Roble_G1 165.68 Teca_G1 146.72 Teca_G2 40.83 Total 2,672.76 In 2016, there is a total project area of 2 67276 ha
Monitoring equipment	Global Position System (GPS). 1- GPS Trimble Geo Explorer module PN: 46502-00 2- GPS Trimble Geo Explorer module PN: 50950-20 It has an internal antenna and power source, and a high-performance 12 channel GPS receiver. Its precision varies with meteorological conditions and can range between 1 and 5 m.
Measuring/reading/recording frequency:	At the start of the project, and adjusted every 5 years
Calculation method (if applicable):	NA
QA/QC procedures:	Areas are measured with GPS before establishment, and they are re-measured after planting activities. This is done for each species, and planting date. Afterwards, information is processed in GIS. Values are verified following the next protocol: - Protocol for project boundary delimitation.
Purpose of data:	Calculation of the number of sample plots
Additional comments:	Applied in the eq. 57 of the methodology AR-AM0004 v.04

Data/parameter:	A_{ikt}
Unit	ha
Description	Área of stratum *i*, stand model *k*, at time *t*. All area under control that have been established since 2011
Measured/calculated/default	Measured
Source of data	GIS project. Data by GPS.

Value(s) of monitored parameter	Ceiba_G1 205.43 Ceiba_G2 59.33 Eucalipto_G1 22.41 Melina_G1 1,149.73 Melina_G2 452.97 Melina_G3 429.66 Roble_G1 165.68 Teca_G1 146.72 Teca_G2 40.83 Total 2,672.76
Monitoring equipment	Global Position System (GPS). 1- GPS Trimble Geo Explorer module PN: 46502-00 2- GPS Trimble Geo Explorer module PN: 50950-20
Measuring/reading/recording frequency:	Yearly,
Calculation method (if applicable):	NA
QA/QC procedures:	Areas/plots/lots are measured with GPS, before establishment, and remeasured after plantation. This for every species and date of plantation. Then, information is processed in GIS. Measurements comply the next protocol: - Protocol for project boundary delimitation.
Purpose of data:	Calculation of the changes in carbon stocks.
Additional comments:	Applied in the eq. 69-70 of the methodology AR-AM0004 v.04

Data/parameter:	A_{B,ikt_sb}
Unit	ha
Description	Area of each lot prepared to be planted (only slash).
Measured/calculated/default	Measured
Source of data	Field measurement
Value(s) of monitored parameter	2 672.76 (total)
Monitoring equipment	GPS, and used the SIG *Arcgis* 10.
Measuring/reading/recording frequency:	At the end of land preparation activities
Calculation method (if applicable):	Measured
QA/QC procedures:	- Protocol for project boundary delimitation. This are applied, same each lot to planted or management.
Purpose of data:	Area of each lots by farm planted
Additional comments:	Each plot is been measured before establishment. The set of geographic coordinates, are defined as intervened effective areas. This information is been confirmed with a SIG data base, this is created for the project and with the forest management monitoring. In the project no applied burn, it is not allowed within the management plan. Used in equation 89 of the methodology AR-AM0004 v.04

Data/parameter:	***AP***
Unit	m^2
Description	Sample plot area
Measured/calculated/default	Measured

Source of data	Field measurement
Value(s) of monitored parameter	500 m2 and 800 m2. Radius 12.61 m and 15.95 m respectively
Monitoring equipment	Metric tape of 30 m. Precision of 2 mm.
Measuring/reading/recording frequency:	5 years
Calculation method (if applicable):	NA
QA/QC procedures:	- Protocol for project boundary delimitation.
Purpose of data:	Calculation of the changes in carbon stocks.
Additional comments:	Applied in the eq. 57 of the methodology AR-AM0004 v.04

Data/parameter:	***DBH***
Unit	cm
Description	Diameter at breast height
Measured/calculated/default	Measured
Source of data	Field measurement
Value(s) of monitored parameter	All trees within simple plots.
Monitoring equipment	Diametric tape and Caliper. Precision of 1 mm.
Measuring/reading/recording frequency:	Five years
Calculation method (if applicable):	NA
QA/QC procedures:	Data cross checking is done in the sample plots. Diameter tapes are calibrated with new equipment before monitoring. The measurement activity applies the following protocol: -Protocol for taking dendrometric measurement variables
Purpose of data:	Applied in the allometric or volume equations, for each species.
Additional comments:	Applied in the equation 73 of the methodology AR-AM0004 v.04

Data/parameter:	***H***
Unit	m
Description	Tree height
Measured/calculated/default	Measured
Source of data	Field measurement
Value(s) of monitored parameter	NA
Monitoring equipment	- SUUNTO TANDEM CLINÓMETRO/BRÚJULA /360PC/360R G
Measuring/reading/recording frequency:	5 years

Calculation method (if applicable):	As it is physically not possible to measure all tree heights because of crown cover, for the trees whom height is not measured, a statistical regression is elaborated as an intermediary calculation. The regression, of H as a function of DBH, is elaborated with trees of the same stratum for which both diameter and height have been measured and integrated to CAMARA. The statistical regressions are elaborated for *Gmelina arborea*, *Eucalyptus tereticornis* and *Bombacopsis quinata*, the threes species for which H is considered in allometric models. The regressions are presented and used in the CAMARA tool provided to the DOE as Annex 2
QA/QC procedures:	-Protocol for taking dendrometric measurement variables
Purpose of data:	Applied in the allometric or volume equations, for each species.
Additional comments:	Applied in the equation 73 of the methodology AR-AM0004 v.04

D.3. Implementation of sampling plan

D.3.1. Stratification and sample size

Stratification *ex-post*.

The project started in 2000, consisting of Ceiba, Eucalyptus, Melina, Oak and Teak tree species. It was developed in different phases and it had be re-stratified in the first verification activity. This was because the stands have different ages and stages of development.

According to the methodology applied, the ex-post stratification shall be based on the actual implementation of the project planting/management plan. The expost stratification was therefore established through an analysis of forest establishment activities and forest management activities since 2016 within all Project area. For 2016, it maintains the same stratification that first verification (year 2011).

The steps followed to determine ex-post stratification, according to the recommandations of the methodology applied, are described in the table and figure below.

Table 17: Steps focusing on key aspects of establishing and managing ex-post stratification

Step	Diference	Characteristics	Analysis of the project
1.	**Species**	Five species that differ significantly in their growth behaviour were planted: - **Teak:** slow-growing species with high - medium wood density, crop rotations longer than 20 years (Wadsworth, 2009[31]). - **Oak:** Species of slow growth, medium wood density, crop shifts longer than 25 years (OFICatie, 2003[32])).	Clearly differ in their growth behavior, characteristics of wood and crop shifts. Generating a first stratification by species

[31] Wasworth, F.H. (ED) 2009. “Managment of Teak plantations for solid wood products. International Society of Tropical Foresters. Special Report, Dic. 2009. 25 pp.

[32] OFI-CATIE, 2003. *Tabebuia rosea*. Trees of Central America. Cordero, j. y Boshier, D. A. Editors. 4 p.

		- **Ceiba**: Species of slow growth, medium wood density. Crop rotation longer than 20years (OFICatie, 2003[33]). - **Melina:** fast-growing species, medium to low wood density. Rotations less than 15 years (Ladrach, 2004[34])). -**Eucalyptus:** Species of slow growth, high – medium wood density in long-rotation conditions (Alvarado, C.R, et al s,f, a[35]).It is proposed for the project activity of short rotations of 10 years.	
2.	Planting	Three phases of planting were developed .**Phase 1:** 2000 to 2004 with a planting density of 1,098 trees ha^{-1} for the five species of the project **Phase 2**: 2004 to 2006, with planting densities of 833 trees ha^{-1} for the species Melina, Teak and Ceiba. Eucalyptus was not planted. **Phase 3**. Planting density 1000 trees ha^{-1} and only Melina was planted.	The phases present different participation of species, starting with four species in phase 1 and ending up with only one species in phase 3. Each phase presents different establishment proposal in terms of planting density, differentiating stratums according to the methodological recommendations.
3.	Ages	Stands by species, due to the different project phases, differ in age **Phase 1**: Teak, Melina, *Eucalipo, Oak, Ceiba*. Age stands by 2016 are between 13 to 16 years. **Phase 2:** *Teak, Melina, Ceiba*. Ages between 10 to 12 years. **Phase 3**: Melina. Young stands between 6 to 10 years old.	The phases of establishment have generated differences in ages for each species, showing different levels of development, according to management plans. The stands have had management interventions as thinning, weeding, fertilization, among others, that shows their differential treatment.

[33] OFI-CATIE**,** *2003 Bombacopsis quinata.* Trees of Central America. Cordero, j. y Boshier, D. A. Editors. 4 p.

[34] Ladrach, W.E. 2004 Harvesting and comparative thinning alternatives in Gmelina arborea plantations. New Forest 28: 255–268.

[35] Alvarado, C.R.; Alvarado C. A y Mondeoza O. O. *s,f,a*. *Eucalyptus tereticornis* Sm. Tropical Tree Seed Manual.

Recurso on line http://www.rngr.net/publications/ttsm

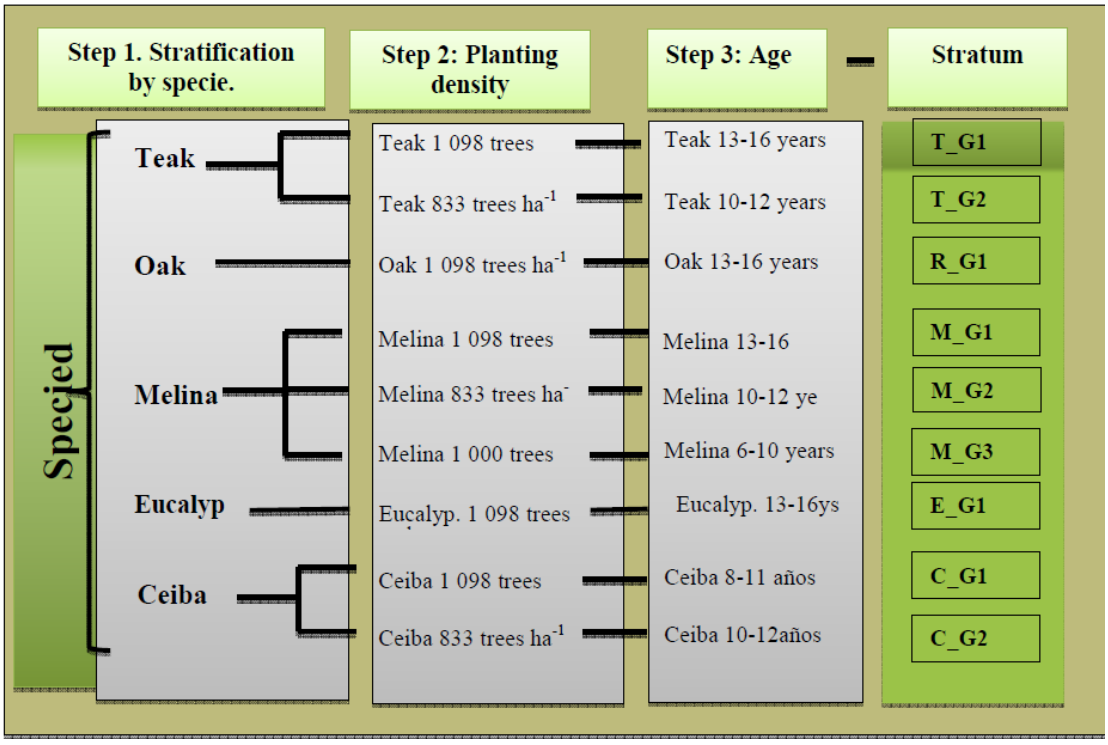

Figure 20: Scheme followed to determine the ex-post stratification of the project year 2016.

D.3.2. Sample size

For the process of inventorying timber stocks during monitoring, the initial calculation of sample plots was developed with equations 2, 5 and 6 of the A /R Methodological Tool[36].

The step to calculate the number of sample plots is described below.

Step 1) Parameters required for the estimate:

A = total project area; ha
i = stratum, adimensional
A_i = size of each stratum i; ha
AP = sample plot area, (constant for all strata); ha
st_i = standard deviation for stratum i

Then:

$$N = \frac{A}{AP}\ ;\quad N_i = \frac{A_i}{AP}\ , \qquad \text{(Eq 1 tool)}$$

Where:

N = maximum possible number of sample units, in the project area
N_i = maximum number of sample units for stratum i

Step 2)

The parameters required in this step are:

[36] A/R Methodological Tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" V.02. UNFCCC.

Q_1 = approximate average value of the estimated quantity Q, (aboveground biomass, vol, etc); t ha^{-1}, m^3 ha^{-1}.
p = desired level of precision (*e.g.* 10%); dimensionless

Then:

$$E_1 = Q_1 * p \qquad \text{(Eq 2 tool)}$$

Where:

E_1 = allowable error (± 10% of mean)
$z_{\alpha/2}$ = value of statistical *z*, for α = 0.05 (indicating a 95% confidence level), $z_{\alpha/2}$ = 1.9599

Supposing that the cost of establishing a lot is unknown, the Equation 5 from the tool is used.

$$n = \frac{\left(\sum_{i=1}^{m_{PS}} N_i \cdot st_i\right)^2}{\left(N \cdot \frac{E}{z_{\alpha/2}}\right) + \left(\sum_{i=1}^{m_{PS}} N_i \cdot (st_i)^2\right)} \qquad \text{(Eq 5 tool)}$$

And the sample number by stratum

$$n_i = \frac{\sum_{h=1}^{m_{PS}} N_i \cdot st_i}{\left(N \cdot \frac{E}{z_{\alpha/2}}\right)^2 + \left(\sum_{i=1}^{m_{PS}} N_i \cdot (st_i)^2\right)} \cdot N_i \cdot st_i \qquad \text{(Eq 6 tool)}$$

Where:

st_i = standard deviation for each stratum *i*; dimensionless
I = 1, 2, 3, … *L* project strata
A = 1-α is the probability that the estimate of the mean is within the error bound E
$z_{\alpha/2}$ = value of the statistic z (embedded in Excel as: inverse of standard normal probability cumulative distribution), for *e.g*. 1-α = 0.05 (implying a 95% confidence level) $z_{\alpha/2}$ =1.9599

In compliance with the applied methodology, the targeted precision level for biomass estimation within each stratum is +/- 10% of the mean at a 90 % confidence level. The sample size for subsequent monitoring interval will be modified if variation observed in carbon stock changes after the first monitoring event based on *n* samples.

$$n_i = \frac{\sum_{h=1}^{m_{PS}} N_i \cdot st_i}{\left(N \cdot \frac{E}{z_{\alpha/2}}\right)^2 + \left(\sum_{i=1}^{m_{PS}} N_i \cdot (st_i)^2\right)} \cdot N_i \cdot st_i \qquad \text{(Ecn 6 Tool)}$$

The results of the new distribution by number of plots according to stratum. For the second verification, 161 plots were measured in the 2016. For all strata's, it was fulfilled by the minimum of required plots (Table 18).

Table 18: Results of calculation of the new sample size based on the ex-post stratification for the inventory of carbon stocks in the project (See CAMARA_PRC).

	Number of sample plot per stratum required	Number of plots measured (year 2016)	Area
Stratum	***ni***	***ni***	**(ha)**
Ceiba_G1	**7**	26	205.43
Ceiba_G2	**3**	10	59.33
Eucalipto_G1	**3**	5	22.41
Melina_G1	**27**	43	1,149.73
Melina_G2	**13**	18	452.97
Melina_G3	**11**	23	429.66
Roble_G1	**7**	8	165.68
Teca_G1	**3**	23	146.72
Teca_G2	**3**	4	40.83
Total	77	160	**2672.8**

D.3.3. Allocation of permanent sample plots

Distribution of plots

The sampling procedures, applied the established in the monitoring plan, defined with permanent parcels. Therefore, the same plots of the first verification were measured, and they relocated 16 plot and placed 11 new plots.
The distribution of these lastest was developed through the following steps (PRC_15):

1. Identify the amount of sample plots required.
2. Distribute the sample plots by strata ni (Table 19)
3. Establish a plot size according to the monitoring plan (500m2)
4. Define a minimum distance from the edges of the project boundary to prevent the edge effect, which was 20m.
5. Load polygons per stratum of the Geodatabase in the ArcGis software.
6. Open the application Random point of Arcgis
7. Enter the parameters of steps 2, 3 and 4, for a random distribution of sampling points in each stratum, according to the monitoring plan of the PDD.
8. Generate a distribution table of the points, according to the results of step 7.
9. Generate a table of distribution of points with their respective coordinates.
10. According to partial results of the inventories of forest stocks that are developed in the field, the sample size is re-calculated, and if necessary, also the increase of sample plots to be within the statistical adjustment and permissible error. Steps 3 to 9 are followed to generate as many additional sampling points are required.
11. The basis of points generated is save as Shapefile format and Excel.

The results of the distribution of plots are presented on maps such as Figure 21, which served as inputs to the field teams for their initial location on the ground. Their correspondent coordinates are given in Table 19.

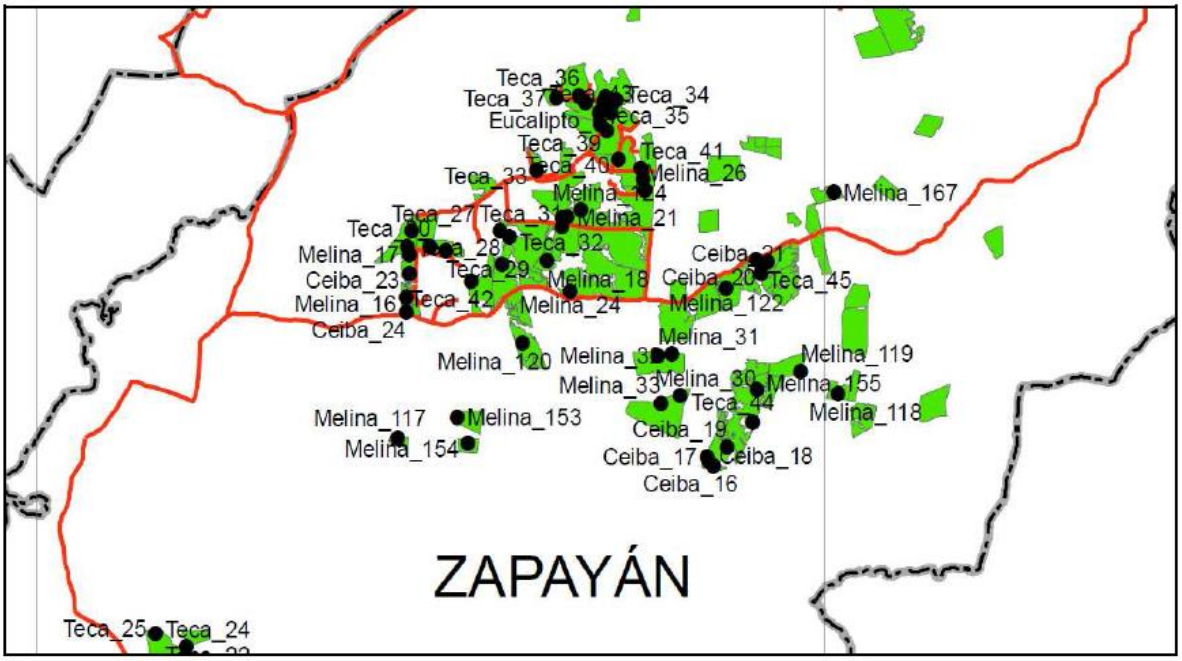

Figure 21: Example of the sampling points. Results of the stratified random distribution generated by the tool Random point of Argis

Table 19: Distribution of sampling points according to the ex-post stratification. COD_Par: Plot Code, Coordinates: flat, Est.Expost: Strata ex-post.

Plot	*St.Expst*	*COD_Par*	Coordinates		SPECIE	FARM
			X	Y		
1	C_G1	Ceiba_1	538640,28	1136739,68	Ceiba	Las Pavas
2	C_G1	Ceiba_2	539202,92	1137380,60	Ceiba	Las Pavas
3	C_G1	Ceiba_3	538798,67	1136896,54	Ceiba	Las Pavas
4	C_G1	Ceiba_4	538870,22	1136863,44	Ceiba	Las Pavas
5	C_G1	Ceiba_5	535971,24	1135398,40	Ceiba	Las Pavas
6	C_G1	Ceiba_6	535521,56	1134944,74	Ceiba	Las Pavas
7	C_G1	Ceiba_7	538945,12	1138582,68	Ceiba	Las Pavas
8	C_G1	Ceiba_8	537625,75	1136234,95	Ceiba	Las Pavas
9	C_G1	Ceiba_R1	539051.64	1138438.35	Ceiba	Las pavas
10	C_G1	Ceiba_R2	539048.64	1138379.97	Ceiba	Las Pavas
11	C_G1	Ceiba_R3	538908.54	1138518.02	Ceiba	Las pavas
12	C_G1	Ceiba_R4	536831.55	1129400.07	Ceiba	Las pavas
13	C_G1	Ceiba_22	536687,27	1129266,98	Ceiba	La Gloria
14	C_G1	Ceiba_25	536963,22	1127202,71	Ceiba	La Gloria
15	C_G1	Ceiba_26	537216,94	1127140,81	Ceiba	La Gloria
16	C_G1	Ceiba_27	536581,11	1129453,23	Ceiba	La Gloria
17	C_G1	Ceiba_30	542117,01	1070892,70	Ceiba	La Campera_Mi Salvacion_Las Margaritas
18	C_G1	Ceiba_31	542544,97	1070817,28	Ceiba	La Campera_Mi Salvacion_Las Margaritas

19	C_G1	Ceiba_34	545663,26	1095891,22	Ceiba	La Ceiba
20	C_G1	Ceiba_35	545554,02	1095881,76	Ceiba	La Ceiba
21	C_G1	Ceiba_48	538962,00	1138541,86	Ceiba	Las Pavas
22	C_G1	Ceiba_49	538994,13	1138552,11	Ceiba	Las Pavas
23	C_G1	Ceiba_50	538838,53	1136924,80	Ceiba	Las Pavas
24	C_G1	Ceiba_51	538820,38	1136875,90	Ceiba	Las Pavas
25	C_G1	Ceiba_52	537666,70	1136267,63	Ceiba	Las Pavas
26	C_G1	Ceiba_53	537593,95	1136208,05	Ceiba	Las Pavas
27	C_G2	Ceiba_14	540225,86	1116979,83	Ceiba	La Union
28	C_G2	Ceiba_16	538589,94	1122702,33	Ceiba	Chimborazo
29	C_G2	Ceiba_17	538510,49	1122813,85	Ceiba	Chimborazo
30	C_G2	Ceiba_18	538532,22	1122755,28	Ceiba	Chimborazo
31	C_G2	Ceiba_19	538759,80	1122936,80	Ceiba	Chimborazo
32	C_G2	Ceiba_20	539125,67	1125262,11	Ceiba	Chimborazo
33	C_G2	Ceiba_21	539199,26	1125090,38	Ceiba	Chimborazo
34	C_G2	Ceiba_23	534724,95	1125084,77	Ceiba	La Gloria
35	C_G2	Ceiba_24	534689,11	1124619,80	Ceiba	La Gloria
36	C_G2	Ceiba_29	556062,81	1090635,34	Ceiba	Ruby Teresa
37	E_G1	Eucalipto_6	537186,76	1127212,31	Eucalipto	La Gloria
38	E_G1	Eucalipto_N7	536501.58	1136555.94	Eucalipto	Las Pavas
39	E_G1	Eucalipto_143	537586,33	1137046,76	Eucalipto	Las Pavas
40	E_G1	Eucalipto_144	537568,63	1137161,98	Eucalipto	Las Pavas
41	E_G1	Eucalipto_152	536290,26	1136349,53	Eucalipto	Las Pavas
42	M_G1	Melina_R1	535220.14	1140485.90	Melina	Las Pavas
43	M_G1	Melina_R2	537089.52	1127066.13	Melina	La Gloria
44	M_G1	Melina_R3	537028.66	1127127.43	Melina	La Gloria
45	M_G1	Melina_R4	536815.68	1127065.85	Melina	La Gloria
46	M_G1	Melina_7	535910,37	1139093,73	Melina	Las Pavas
47	M_G1	Melina_8	535378,85	1140294,47	Melina	Las Pavas
48	M_G1	Melina_9	535216,01	1140561,71	Melina	Las Pavas
49	M_G1	Melina_10	535197,39	1140834,77	Melina	Las Pavas
50	M_G1	Melina_11	535463,28	1141219,50	Melina	Las Pavas
51	M_G1	Melina_18	536475,95	1125258,52	Melina	La Gloria
52	M_G1	Melina_19	536437,90	1129428,22	Melina	La Gloria
53	M_G1	Melina_20	536826,78	1129219,08	Melina	La Gloria
54	M_G1	Melina_N21	536762.22	1125809.52	Eucalipto	La Gloria
55	M_G1	Melina_22	537137,30	1127082,02	Melina	La Gloria
56	M_G1	Melina_23	536659,25	1125784,26	Melina	La Gloria
57	M_G1	Melina_24	536774,31	1124879,21	Melina	La Gloria
58	M_G1	Melina_25	536661,11	1125674,52	Melina	La Gloria
59	M_G1	Melina_26	537716,83	1126123,49	Melina	La Gloria
60	M_G1	Melina_27	537696,18	1126249,31	Melina	La Gloria
61	M_G1	Melina_30	538167,98	1123576,06	Melina	La Camachera
62	M_G1	Melina_31	537878,37	1124080,65	Melina	La Camachera
63	M_G1	Melina_32	538063,57	1124084,09	Melina	La Camachera
64	M_G1	Melina_33	537928,24	1123476,13	Melina	La Camachera
65	M_G1	Melina_43	539541,70	1090997,03	Melina	El Cerrejon

66	M_G1	Melina_44	561179.87	1095924.71	Melina	El Otoño
67	M_G1	Melina_48	546055,16	1096033,82	Melina	La Ceiba
68	M_G1	Melina_49	545774,77	1096271,27	Melina	La Ceiba
69	M_G1	Melina_50	545665,93	1096224,61	Melina	La Ceiba
70	M_G1	Melina_51	545662,64	1096030,00	Melina	La Ceiba
71	M_G1	Melina_N52	545435.34	1095889.44	Melina	La Ceiba
72	M_G1	Melina_54	547155,65	1099347,26	Melina	Puerto Adentro
73	M_G1	Melina_101	539463,96	1091020,51	Melina	El Cerrejon
74	M_G1	Melina_102	545706,69	1095422,28	Melina	La Ceiba
75	M_G1	Melina_103	546300,84	1095612,63	Melina	La Ceiba
76	M_G1	Melina_104	546072,73	1095774,69	Melina	La Ceiba
77	M_G1	Melina_109	540687,92	1115880,99	Melina	San Jose
78	M_G1	Melina_122	538749,76	1124900,42	Melina	La Camachera
79	M_G1	Melina_124	536910,96	1125878,00	Melina	La Gloria
80	M_G1	Melina_148	529872,30	1139224,29	Melina	La Esmeralda
81	M_G1	Melina_149	535382,39	1140342,00	Melina	Las Pavas
82	M_G1	Melina_150	535010,81	1140874,53	Melina	Las Pavas
83	M_G1	Melina_N44	561179.87	1095924.71	Melina	El Otoño
84	M_G1	Melina_N48	546074.61	1096148.19	Melina	La Ceiba
85	M_G2	Melina_N12	540570.18	1116535.23	Melina	La Pradera y san José
86	M_G2	Melina_13	540351,19	1116474,80	Melina	La Pradera y San José
87	M_G2	Melina_14	540732,92	1113921,12	Melina	La Pradera y San José
88	M_G2	Melina_15	540212,42	1113810,07	Melina	La Pradera y San José
89	M_G2	Melina_16	534690,93	1124797,10	Melina	La Gloria
90	M_G2	Melina_17	534726,08	1125320,71	Melina	La Gloria
91	M_G2	Melina_41	544571,43	1086637,13	Melina	Los Bagres y La Jar
92	M_G2	Melina_42	535036,60	1088233,00	Melina	La Floresta
93	M_G2	Melina_45	555896,91	1090623,88	Melina	Ruby Teresa
94	M_G2	Melina_105	559759,11	1098659,24	Melina	San Carlos de Rozo
95	M_G2	Melina_106	552242,66	1099687,64	Melina	La Virgen
96	M_G2	Melina_N107	540612.03	1114511.22	Melina	La Pradera y San José
97	M_G2	Melina_108	540161,03	1114514,46	Melina	La Pradera y San José
98	M_G2	Melina_110	540574,63	1116398,96	Melina	La Pradera y San José
99	M_G2	Melina_111	540145,55	1116924,07	Melina	La Unión
100	M_G2	Melina_120	536162,26	1124225,54	Melina	Cuatro esquinas
101	M_G2	Melina_155	539146,02	1123649,18	Melina	Chimborazo
102	M_G2	Melina_N106	552281.76	1099780.77	Melina	La Virgen
103	M_G3	Melina_112	535221,20	1118395,27	Melina	Alto Plano
104	M_G3	Melina_114	535657,73	1118978,18	Melina	Alto Plano
105	M_G3	Melina_117	534581,95	1123046,27	Melina	La Siberia
106	M_G3	Melina_118	540169,03	1123605,42	Melina	Santo Domingo
107	M_G3	Melina_119	539690,66	1123866,85	Melina	El Desvio

108	M_G3	Melina_132	535895,94	1129591,26	Melina	El Pensamiento
109	M_G3	Melina_133	535896,70	1129995,92	Melina	Madre Selva
110	M_G3	Melina_134	536007,51	1130309,42	Melina	Villa de la Mata
111	M_G3	Melina_135	546089,46	1132405,86	Melina	San Jose
112	M_G3	Melina_153	535335,53	1123303,69	Melina	La Siberia
113	M_G3	Melina_154	535475,99	1122992,26	Melina	La Siberia
114	M_G3	Melina_156	544935,04	1131682,59	Melina	Pajonal
115	M_G3	Melina_157	546291,05	1129652,23	Melina	San Antonio
116	M_G3	Melina_158	545442,61	1129977,30	Melina	El Milagro
117	M_G3	Melina_159	546301,64	1129439,56	Melina	San Antonio
118	M_G3	Melina_160	547815,98	1130596,83	Melina	Los Recuerdos
119	M_G3	Melina_161	547899,46	1130686,25	Melina	Los Recuerdos
120	M_G3	Melina_162	547360,84	1131250,82	Melina	Bariloche
121	M_G3	Melina_163	547179,97	1131199,49	Melina	El Recuerdo
122	M_G3	Melina_164	546728,54	1132027,40	Melina	Cambio Vida
123	M_G3	Melina_165	546726,33	1131676,36	Melina	Roble Claro
124	M_G3	Melina_166	546197,25	1131910,31	Melina	San Jose
125	M_G3	Melina_167	540111,70	1126099,81	Melina	Los Mangos
126	R_G1	Roble_138	535836,33	1135082,38	Roble	Las Pavas
127	R_G1	Roble_139	535368,64	1136079,51	Roble	El Recuerdo
128	R_G1	Roble_140	535656,77	1136191,75	Roble	El Recuerdo
129	R_G1	Roble_141	535458,24	1136426,18	Roble	El Recuerdo
130	R_G1	Roble_142	535548,03	1136431,78	Roble	El Recuerdo
131	R_G1	Roble_146	536513,75	1137890,82	Roble	El Recuerdo
132	R_G1	Roble_147	536026,40	1137971,57	Roble	El Recuerdo
133	R_G1	Roble_151	535689,56	1135199,35	Roble	Las Pavas
134	T_G1	Teca_N18	546831.92	1099235.87	Teca	Puerto Adentro
135	T_G1	Teca_22	531520,03	1120285,31	Teca	Caño Lindo
136	T_G1	Teca_23	531727,31	1120285,51	Teca	Caño Lindo
137	T_G1	Teca_24	531909,83	1120463,57	Teca	Caño Lindo
138	T_G1	Teca_N25	532154.18	1120534.74	Teca	Caño Lindo
139	T_G1	Teca_29	535186,45	1125375,15	Teca	La Gloria
140	T_G1	Teca_30	534984,06	1125424,27	Teca	La Gloria
141	T_G1	Teca_31	535873,22	1125623,67	Teca	La Gloria
142	T_G1	Teca_32	536004,56	1125551,48	Teca	La Gloria
143	T_G1	Teca_33	536334,41	1126379,22	Teca	La Gloria
144	T_G1	Teca_34	537348,68	1127242,18	Teca	La Gloria
145	T_G1	Teca_35	537214,96	1127284,58	Teca	La Gloria
146	T_G1	Teca_N36	536937.12	1127311.66	Teca	La Gloria
147	T_G1	Teca_37	536589,32	1127264,13	Teca	La Gloria
148	T_G1	Teca_R1	531290.73	1112686.81	Teca	Montevideo
149	T_G1	Teca_39	537144,84	1126933,13	Teca	La Gloria
150	T_G1	Teca_R2	531260.40	1112533.21	Teca	Montevideo
151	T_G1	Teca_R3	535570.37	1124883.85	Teca	La Gloria
152	T_G1	Teca_42	535515,80	1124992,63	Teca	La Gloria
153	T_G1	Teca_R4	535722.52	1124884.00	Teca	La Gloria
154	T_G1	Teca_R5	535783.24	1125068.38	Teca	La Gloria

155	T_G1	Teca_R6	536314.23	1126527.75	Teca	La Gloria
156	T_G1	Teca_R7	536277.59	1126580.01	Teca	La Gloria
157	T_G2	Teca_45	539274,58	1125232,32	Teca	Chimborazo
158	T_G2	Teca_27	534758,21	1125617,10	Teca	La Gloria
159	T_G2	Teca_28	534693,91	1125425,37	Teca	La Gloria
160	T_G2	Teca_44	539088,17	1123247,10	Teca	Chimborazo

Localization of simple plots in the field.

The establishment of the center points of the sample plots were performed using GPS Gramin eTREX 10 the process of location of the plots followed the proper protocol for such work (PRC_01). This activity was developed by two fieldwork teams who were trained for this.

The location of sample plots was basically the following steps for the two stages of sampling:

1. Identify the coordinates of the plot to be sampled, entering them into theGPS.
2. Define a route of accessible approach to the plantation, based on the maps of the project.
3. Identify the entrance of the stand to be sampled.
4. With the coordinates entered in the GPS, apply the function pathway to the defined point
5. Walk as directed by GPS until to reach the center point of the plot.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

As indicated in the PDD, the baseline net greenhouse gas removals by sinks are expected to be negative due to ongoing degradation of the project areas and due to phases of slash and burn in fallows. Then, the methodology conservatively assumes that baseline net greenhouse gas removals by sinks are zero.

E.2. Calculation of project emissions or actual net GHG removals by sinks

The actual net greenhouse gas removals by sinks is estimated according to section 5 of the applied methodology AR-AM0004 Version 04 and by using the tool CAMARA in order to systematize the procedures and calculation, therefore some steps and equations of the methodology were grouped in this tool, but without altering the results. These procedures and calculations are detailed below; equations are numbered as in the methodology and additional references indicating where equations are located into the tool CAMARA are given.

In accordance with the PDD, the actual net greenhouse gas removals by sinks represent the sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary, minus the increase in greenhouse emissions by sources measured in CO2 equivalents within the project boundary that are a result of the implementation of the A/R CDM project activity. Therefore it is estimated according to next equation of the methodology AR-AM0004 / Version 04:

$$C_{ACTUAL} = \_C_{P,LB} - GHG_E$$

where:

C_{ACTUAL}: Actual net greenhouse gas removals by sinks; t CO_2-e (worksheet: Removals 2, cell G62)
$\Delta C_{P,LB}$: Sum of the changes in living biomass carbon stocks (above- and below-ground); t CO_2-e

GHG_E: Sum of the increases in GHG emissions by sources within the project boundary as a result of the implementation of an A/R CDM project activity; t CO_2-e

Then,

$$\Delta C_{P,LB} = \Delta C_{P,BL_1} - E_{biomassloss}$$

where:

$\Delta C_{P,LB}$ Sum of the changes in living biomass carbon stocks (above- and below-ground); t CO2-e (Spreadsheet: Removals 2, cell G62)

$\Delta C_{P,LB\,T}$ Sum of the changes in living tree biomass carbon stocks (above- and below-ground); t CO_2-e

$E_{biomassloss}$ Decrease in the carbon stock in the living biomass carbon pools of non-tree vegetation in the year of site preparation, up to time *t**; t CO_2-e

E.3. Calculation of leakage

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$LK = LK_{ActivityDisplacement} = LK_{conversion} + LK_{fuel\text{-}wood}$

Where:

LK: Leakage
$LK_{ActivityDisplacement}$: Leakage due to activity displacement; t CO2-e
$LK_{conversion}$: Leakage due to conversion of forest to non-forest; t CO2-e

E.4. Summary of calculation of emission reductions or net GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	GHG emission reductions or net GHG removals by sinks (t CO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	0	1,033,342.4	0	0	1,033,342.4	1,033,342.4

E.5. Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	1,210,255	1,033,238.2

E.6. Remarks on difference from estimated value in registered PDD

It should be noted that all the established plots were used for the analyzes. These results did not identify the presence of atypical values that should be eliminated prior to the processing of the information. Furthermore, the distribution histograms points do not reflect extreme behavior of the mean values.

Current estimates were slightly lower than the 2011th year. As for the recent period (2011-2016) 453 ha. were harvested or thinning. In some lots, the thinning was close to 50%, are clearly influencing the forest carbon reduction.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Person/entity responsible for completing the CDM-MR-FORM
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