MONITORING REPORT FORM (CDM-MR) *
Version 01 - in effect as of: 28/09/2010

CONTENTS

MONITORING REPORT
Version 01. date 30/10/2011

Commercial reforestation on lands dedicated to extensive cattle grazing activities in the region of Magdalena Bajo Seco

Project CDM 4861

MONITORING PERIOD: 02 AUG 2000 – 30 OCT 2011
MONITORING PERIOD NUMBER: 1

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

>> The proposed A/R CDM project activity consists in the reforestation of 4,373 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 lost 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 activities, along with the natural increase of demography, have led to a worrying social situation with important risks for the region, falling 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.

[1] Becerra, 2004a. "Los múltiples servicios de los bosques y el desarrollo sostenible en Colombia", inn Peter Saile & María A. Torres (Eds.), International Conference on Forests, Colombia Country of Forests and life. Thesis, pp. 99-114. Bogotá:GTZ.

[2] Payen, 2003. Report of presentation of the Project FFEM Control of Erosion and Sedimentation of anthropic origin and its effects on river ecosystems and lakes of Magdalena and its influence area, including Caribbean coast. pp 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". Final report – August 2004. pag 117.

- The reforestation on private lands dedicated to extensive cattle grazing activities, of which 4,373 ha will be under A/R CDM project activities, implementing single plantations of *Gmelina arborea* (2447,08 ha), *Tectona grandis* (391,27 ha), *Bombacopsis quinata* (320,36 ha), *Tabebuia rosea* (166,68 ha) *and Eucalyptus tereticornis* (45,69 ha).
- The creation of a forest sector integrated to the regional wood sector.

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.

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, 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):

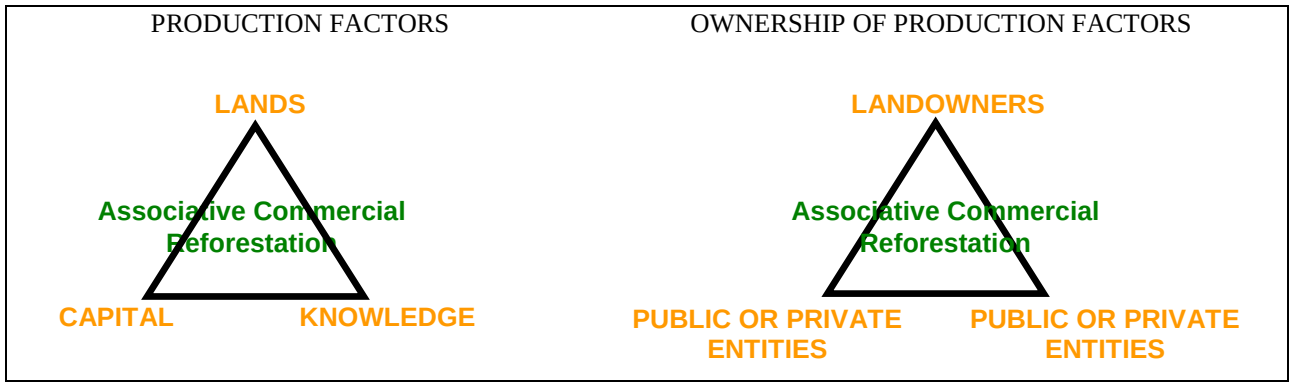

Figure 1: Associative Commercial Reforestation Model

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:

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

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

- 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], depending on the project phase. ONFI [9] has conducted the project 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.

A.1.1 Total of net anthropogenic GHG removals by sinks achieved in this monitoring period.

Tables 1 to 3, show the calculations developed for the amount of net removals obtained in the project.

[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.

- Table 1, refers to changes in carbon content for the period t ($\Delta C_{p,ikt}$).
- Table 2, 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 3, 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 removals by the project (C_{actual}.). For calculations of carbon removals by the project, it was used the information processing database CAMARA developed by ONFI[10].

Table 1: 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 (tCO_{2eq})
Ceiba_G1	*Bombacopsis quinata*_8- 11 years	75,2	260,76	19 609	71 899
Ceiba_G2	*Bombacopsis quinata*_5-7 years	36,0	59,60	2 148	7 876
Eucalipto_G1	*Eucalyptus tereticornis*_8-11 years	26,7	45,69	1 557	5 711
Melina_G1	*Gmelina arborea*_8-11 years	116,7	1 397,81	163 083	597 972
Melina_G2	*Gmelina arborea*_5-7 years	107,4	470,51	50 538	185 308
Melina_G3	*Gmelina arborea*_1-4 years	24,5	499,89	12 230	44 843
Roble_G1	*Tabebuia rosea*_8-11 years	117,6	165,68	19 485	71 444
Teca_G1	*Tectona grandis*_8-11 years	56,0	184,76	10 348	37 944
Teca_G2	*Tectona grandis*_5-7 years	51,1	40,83	2 087	7 651
				Total	***1.030.647***

Table 2: Carbon content in the baseline, which is removed to establish the project baseline stratum

ID stratum	Stratum	Mean biomass stock in AGB (t d.m.ha^{-1})	Total AGB and BGB mean carbon stock (tC.ha-1)	Mean carbon stock in stratum (tC)	Mean carbon stock in stratum (tCO_{2eq})
BLS1	Clean pastures	1.80	2.28	2 750	10 084
BLS2	Pastures with fallows	17.18	21,72	30 341	111 252
BLS3	Fallows	21.48	27.16	16 236	59 532
Total baseline carbon stock in ABG and BGB within project boundary.				***49 3281***	***180 868***

[10] Anexo 2. CAMARA_Core_v1.2_PRC.

Table 3: Final GHG removals in tonnes CO_2eq

Mean carbon stock in stratum of the project (tCO_{2eq})	Mean carbon stock in stratum in the base line (tCO_{2eq}).	Baseline net GHG removals by sinks (tCO_{2eq})	Leakage (tCO_{2eq})	Net anthropogenic GHG removals by sinks (tCO_{2eq})
1 030 647	***180 868***	***0***	***0***	***849 780***

A.2. Project Participants

Table 4lists the project participants and Party (ies) involved. Contact information is provided in sec. A.8.

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 10 years ago in Colombia in projects of sustainable management of ecosystems (especially related to forest) and climate change mitigation.

Table 4: Project participants

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

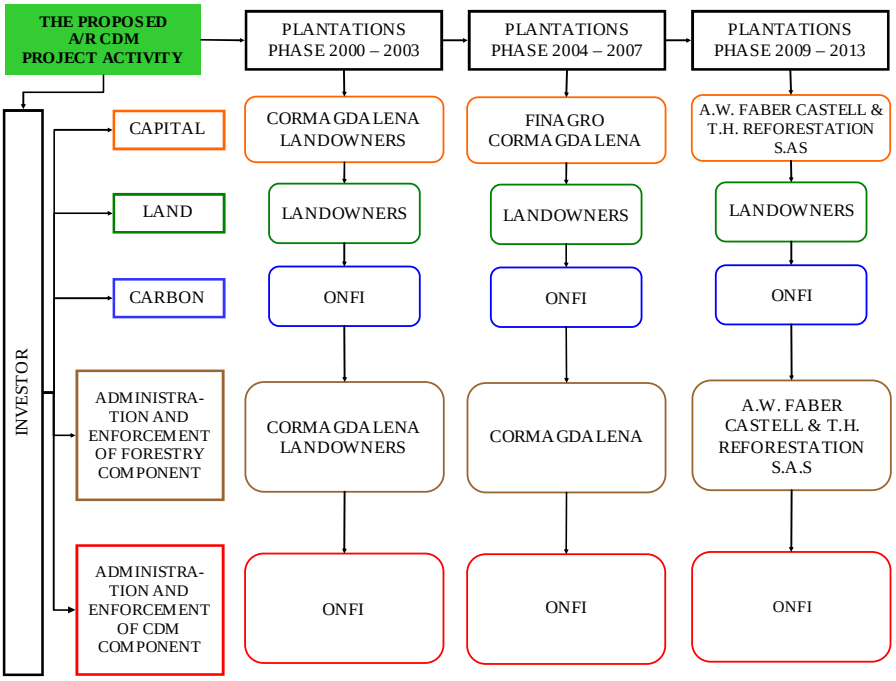

Figure 2: Project activity organization chart

A.3. Location of the project activity:

>> 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 and Magdalena, and covers an area of 917,165 ha, corresponding to 19.93% of the whole Magdalena watershed.

The proposed A/R CDM project activity are located in the Department of Magdalena. The area where the A/R CDM project activities will take place is named “Magdalena Bajo nucleus”. It is contiguous to the Magdalena River, on the occidental side of the department of Magdalena contiguous with the department of Bolivar, and in the south of the department of Atlántico.

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 shows the location of these municipalities and Figure 4-Figure 6, the site of the project boundary.

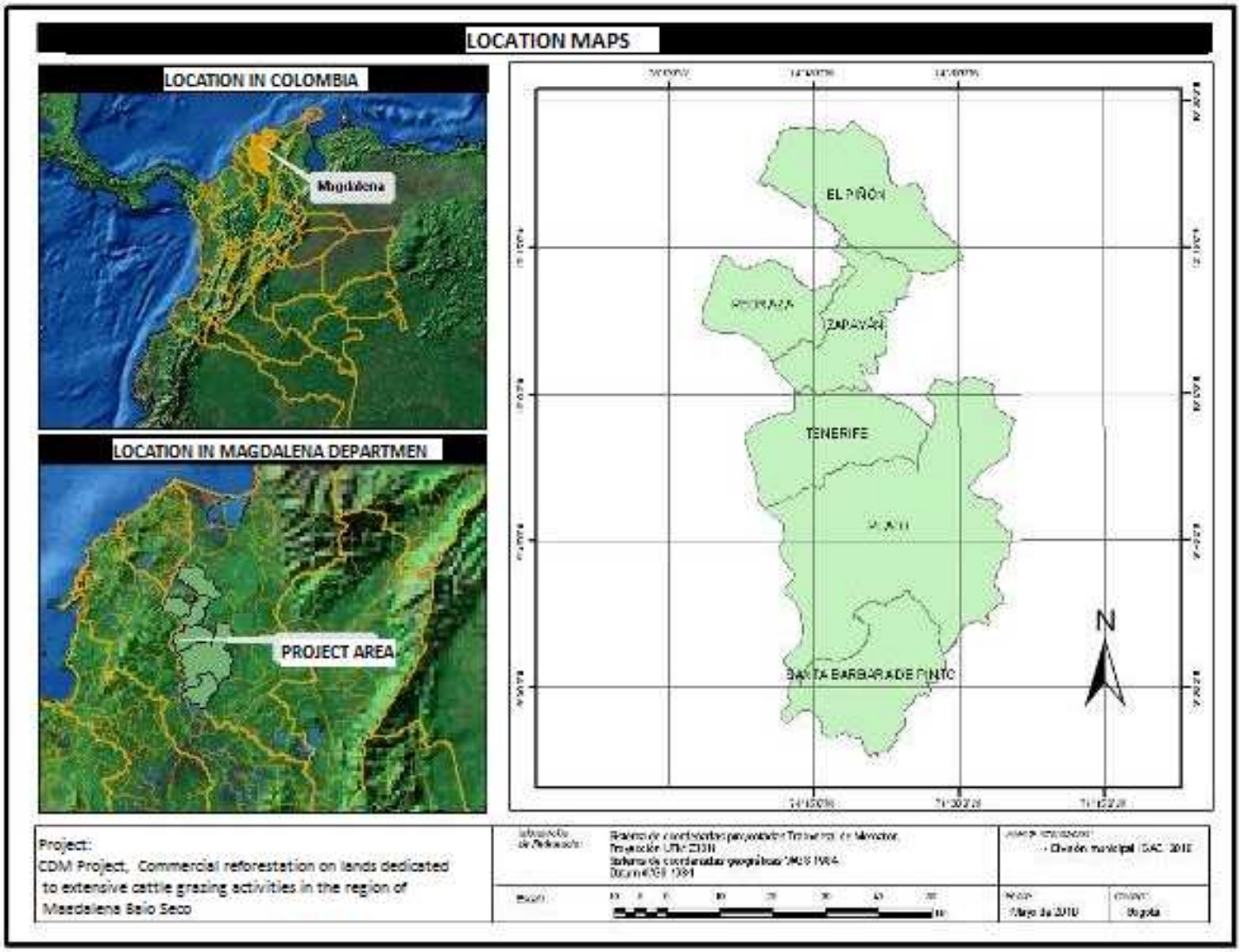

Figure 3: Compilation of maps locating the country, department and municipalities of the project

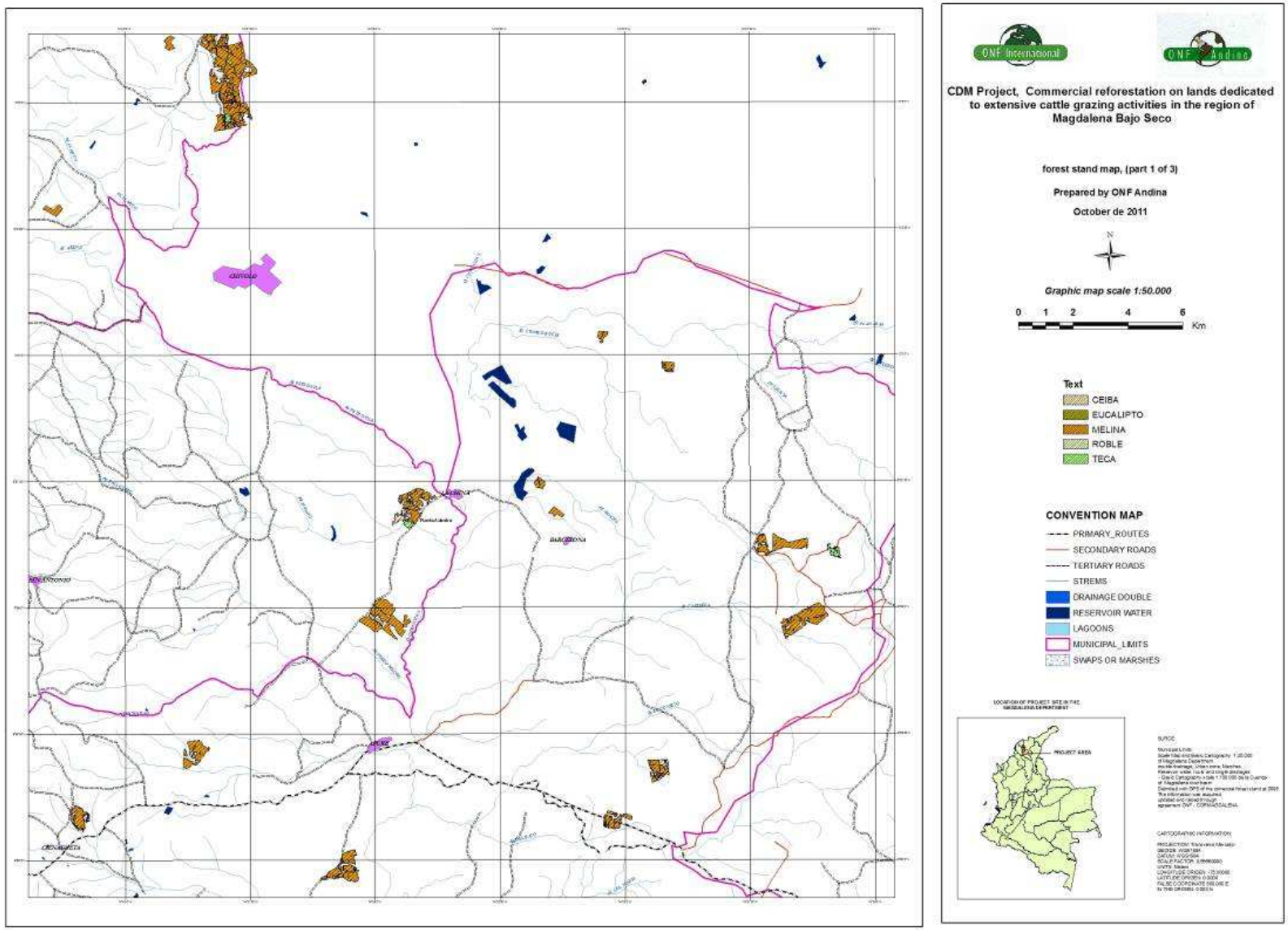

Figure 4: Location of the plantation project in the municipalities of El Piñón, Pedraza and Zapayan

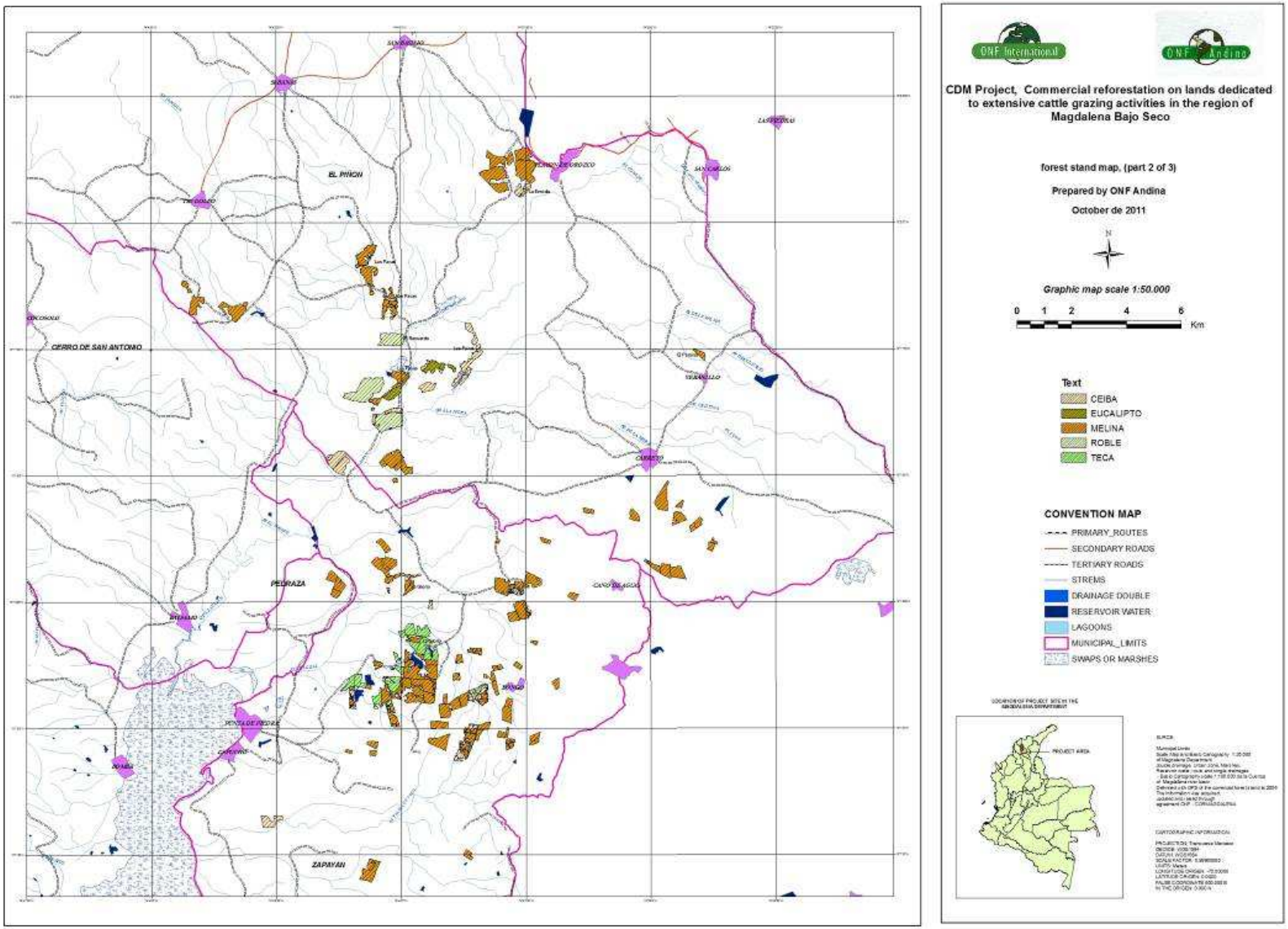

Figure 5: Location of the plantation project in the municipality of Chivolo

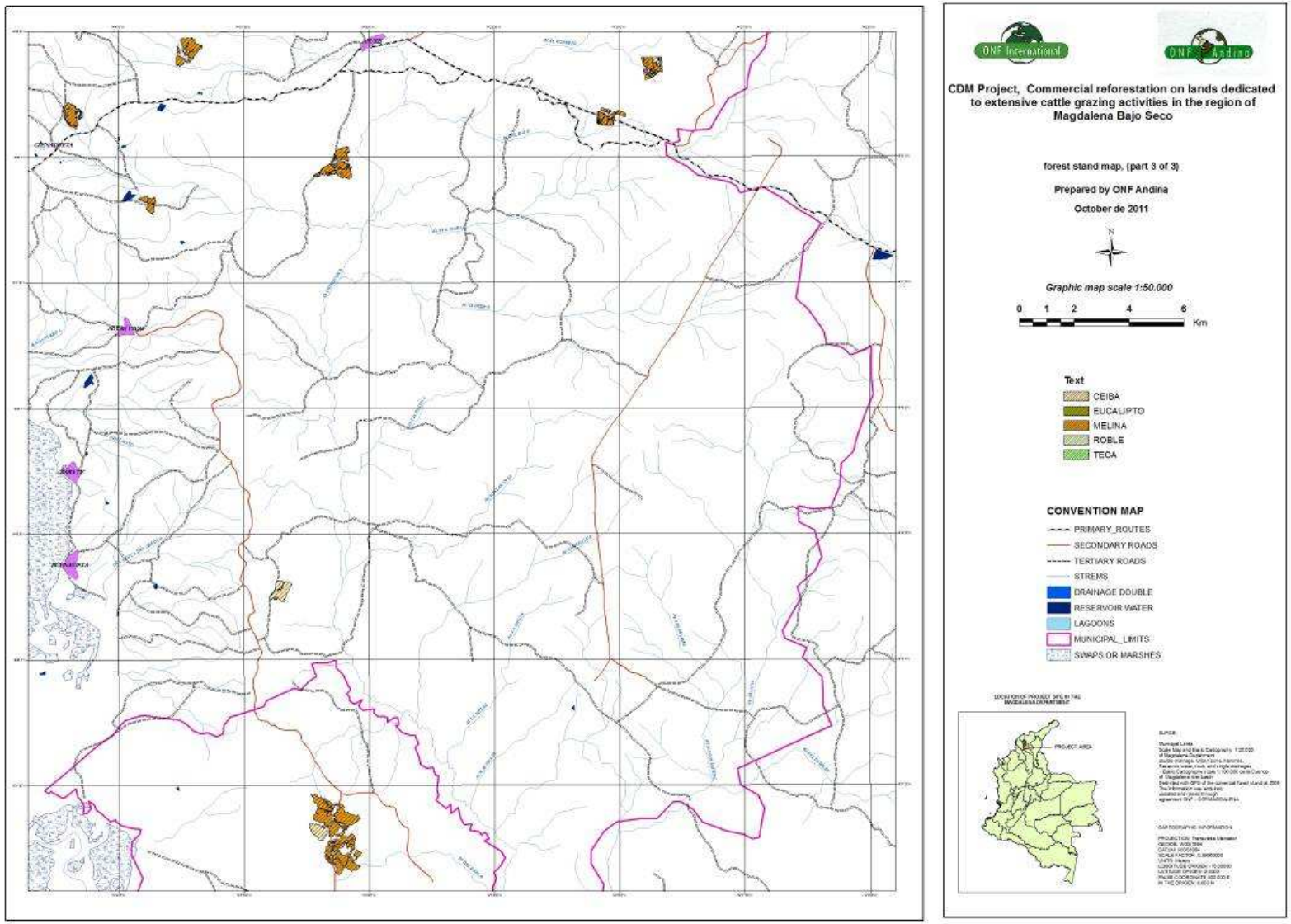

Figure 6: Location of the plantation project in the municipality of Chivolo Plato

The GIS database of the project is attached, including all geographical information taken in the field through the GPS *Trimble GeoExplorer CE*. Data was processed in ArcGIS and the information is subjected of coarse-scale visual verification using Landsat images[11].

A.4. Technical description of the project

Five species have been used for the A/R CMD project activities: *Bombacopsis quinata* (Red Ceiba) and *Tabebuia rosea* (Oak) as native species, and *Gmelina arborea* (Melina), *Tectona grandis* (Teak) and *Eucalyptus tereticornis* (Eucalyptus) as exotic species. These species were sselected based on 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.

InTable 5, the main characteristics of the selected species are summarized. Figure 7 shows current conditions of some stands.

[11] Annex. GIS files with relevant information to the areas under control and the areas effectively planting by lot, year and species *Shape_final_verificación.*

Table 5: 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[12] 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[13] 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[14] 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 pre-mountain 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[15] 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[16]	*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

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

Figure 7: Pictures of current conditions of some stands that are part of the project. *A*. Melina, *B*. Teak, *C*. Ceiba.

- **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 planting area, 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:

1) The first period during the years 2000-2003, planting Melina, Teak, Ceiba, Oak and Eucalyptus; with an initial density of 1,098 trees ha^{-1} for each species, with a planting distance of 3.5m x 2.6m in rectangular shape.
2) The second period covers 2004 to 2006, planting Melina, Teak and Ceiba; with an initial planting density of 833 trees was ha^{-1} (4m x3m) for each species.
3) In the last period, considered between 2009-2012, Melina was planted with an initial planting density of 1000 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 therefore 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.*

- **Final harvest:**

Final harvest will be done as follows (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.*

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

Title of the methodology: "Reforestation or afforestation of land currently under agricultural use" Reference of the methodology: AR-AM0004 / Version 04.
Methodological tools for A/R CDM project activity have also been used based on the requirement of the methodology applied:

- Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities, Version 01.

- Guidance on the application of the definition of project boundary to A/R CDM project activities, Version 01.

- Guidance on accounting GHG Emissions in A/R CDM Project Activities (EB 42, paragraph 35)

- Tool for the demonstration and assessment of additionality in A/R CDM project activities, Version 02.

- Guidance on conditions under which the change in carbon stocks in existing live woody vegetation are insignificant, Version 01 (EB46, Annex 16).

- Calculation of the number of sample plots for measurements within A/R CDM project activities, Version 02.

- Guidelines on conservative choice and application of default data in estimation of the Net.

- Anthropogenic GHG Removals by Sinks. Version 02 (EB 50, Annex 23).

- Guidelines for objective demonstration and assessment of barriers. Version 01, (EB 50, Annex 13).

A.6. Registration date of the project activity:

Date of registration: June 7th, 2011.
Date of registration action: 5th September 2011

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

The project set a fixed crediting period of 30 years. The crediting period began on August 2nd 2000.

This project qualifies with retroactive crediting in accordance with UNFCCC Executive Board guidance[17].

[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).

A.8. Name of responsible person(s)/entity(ies):

Organization:	ONF International (ONFI)
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URL:	www.onfinternational.org
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Persons responsible of the completion of the monitoring report:
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SECTION B. Implementation of the project activity

B.1. Implementation status of the 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].

During the period from 2000 to 2011, a total of 3 204.4 hectares have been planted, distributed as follows:

Table 6: Distribution of planting activities developed since 2000, in which the project activities began. It also shows the projection of the remaining seed in the areas under control by 2012*

Year	Ceiba (ha)	Eucalyptus (ha)	Melina (ha)	Oak (ha)	Teak (ha)	General Total (ha)
2000	0	0	161,148	0	0	161,148
2001	3,183	0,605	291,967	37,102	109,160	442,018
2002	195,665	0	462,135	0	38,832	696,631
2003	61,916	45,083	482,559	128,574	36,771	754,902
2004	51,163	0	216,759	0	25	293
2005	8,434	0	181,145	0	4	194
2006	0,000	0	62,039	0	12	74
2007	0,000	0	10,563	0	0	11
2009	0	0	116,921	0	0	116,921
2010	0	0	299,404	0	0	299,404
2011	0	0	83,565	0	0	83,565
2012*			11,80			11,80[19]
General Total	320,361	45,688	2 380,004	165,676	225,593	**3 137,322**

The project is implemented in three stages. The actors and hectares per stage are presented inTable 7.

[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] Projected areas for planting in 2012, which holds 100% of the project estimated for areas under control.

Table 7: Phases of the project in which the actors, species and intervenned areas are presented

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[20], ONFI[21] and landowners (20 farms of 16 landowners)	*Gmelina arborea, Tectona grandis, Bombacopsis quinata, Tabebuia rosea, Eucalyptus tereticornis*	2 055
2004 - 2006	Plantations phase 2004 – 2006	CORMAGDALENA, FINAGRO[22], ONFI and landowners (18 farms of 16 landowners)	*Gmelina arborea, Tectona grandis, Bombacopsis quinata*	584
2009 - 2013	Plantations phase 2009 – 2013	A.W. FABER CASTELL & T.H. REFORESTATION S.A.S[23], ONFI and landowners (43 farms of 42 landowners and 55 farm in area will be controlled)	*Gmelina arborea*	To date-2011- there are planted only ***577.88 ha.***

The technical activities of establishment and management have followed the procedures and guidelines described in the PDD. All these activities since 2000 have been under responsibility of CORMAGDALENA through partnerships with entities such as CONIF and ONFI. The related activities are supported by the attached documents and the Excel database list of activities[24] (see section C.5).

B.2. Revision of the monitoring plan

>>

The monitoring was not revised after project registration as the project was registered recently on 5th September 2011. Thus, the monitoring plan did not require a second review by the short time interval between validation and verification

[20] 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.

[21] 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.

[22] 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.

[23] 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

[24] This Excel database considers all activities planned in the management plan and the activities actually carried on. This was based on CORMAGDALENA checking activity databases obtained through an agreement with CONIF before 2004, then with ONFI from 2004 onward. Annex: *Base_datos_seguimiento_manejo.xls.*

B.3. Request for deviation applied to this monitoring period

The registration process of the project began on June 7th, 2011 (Date of registration action 05 Sep 11)-Section A.6. The verification process began in October 2011. This project qualifies with retroactive crediting in Accordance with UNFCCC Executive Board guidance.

During the validation is performed the review of the monitoring plan, which was adjusted to the activities carried out until 2011. Thus, the monitoring plan did not require a second review because of the short time interval between validation and verification.

B.4. Notification or request of approval of changes

No change occurred, so no request of approval of change is made.

SECTION C. Description of the 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 Figure 8 below.

The project monitoring system was based on the following aspects:

C.1. Monitoring of the boundary

The activity was developed following the methodological process described in the PDD. For this process, the perimeter of the areas that were incorporated gradually to the project and are under control was measured before starting and after planting. The basic information of this process is developed by CORMAGDALENA systematically, because payments for the establishment of activities of the first two project phases are done based on this result. For phase three, A.W. FABER CASTELL & T.H. Reforestation SAS and ONFI took car of this process. In this phase of the project, activities to assess the areas actually planted were carried out. This process was done by GPS survey of potential areas to be planted and a confirmation was done afterwards. All field information are brought to the office to be analysed by geographic information system (GIS) and so to determine areas effectively prepared and planted.

For the field work, it was developed and followed the *delimitation protocol of areas* (PRC_09), which was socialized with the field technician. This team is hired and coordinated by ONF Andina and has the proper training process for the activity.

During the process of GIS, developed by ONF Andina, areas effectively planted and under control, using, GPS, were subjected of visual check using Landsat 2011 images. This process consists of:

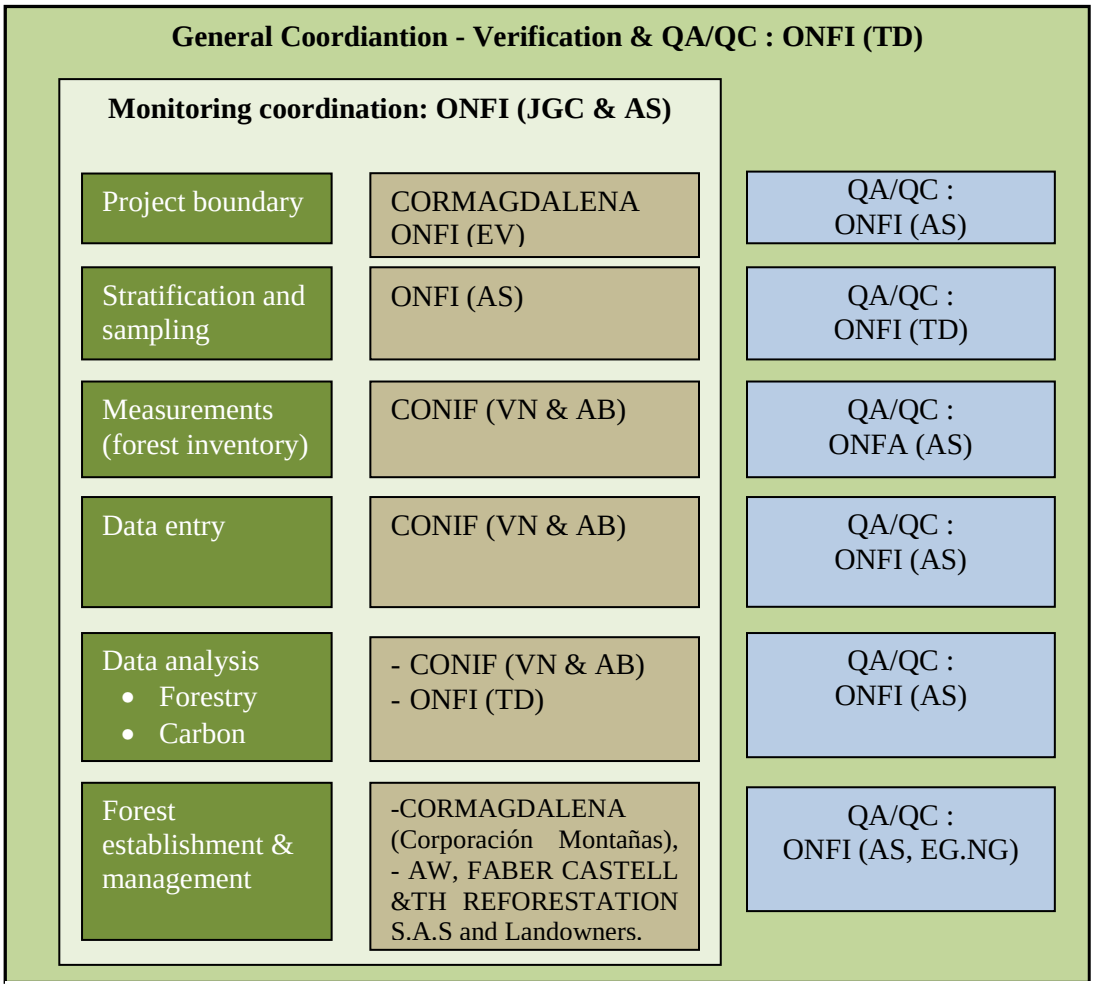


Figure 8: Structure of the CDM monitoring process of the project. JGC: Jean Guénolé CORNET, AS: Andrés Sierra, EV: Enrique Villamil, VN: Victor Nieto, AB: Adolfo Barrios, TD: Thomas DUFOUR, EG: Edison Gutiérrez, NG: Natalia González

Step 1:

With the latest version of the GIS database provided by ONFAndina, 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. It included the forest stands planted from 2000 to 2009,

Step 2:

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.

Step 3:
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 2011 the project area.

Step 4:
Synergism processing of the Landsat 2011.
This process allowed increasing the spatial resolution of the image to be analyzed and provides better clarity of the covers.

Synergism processing of Landsat 2011: 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.

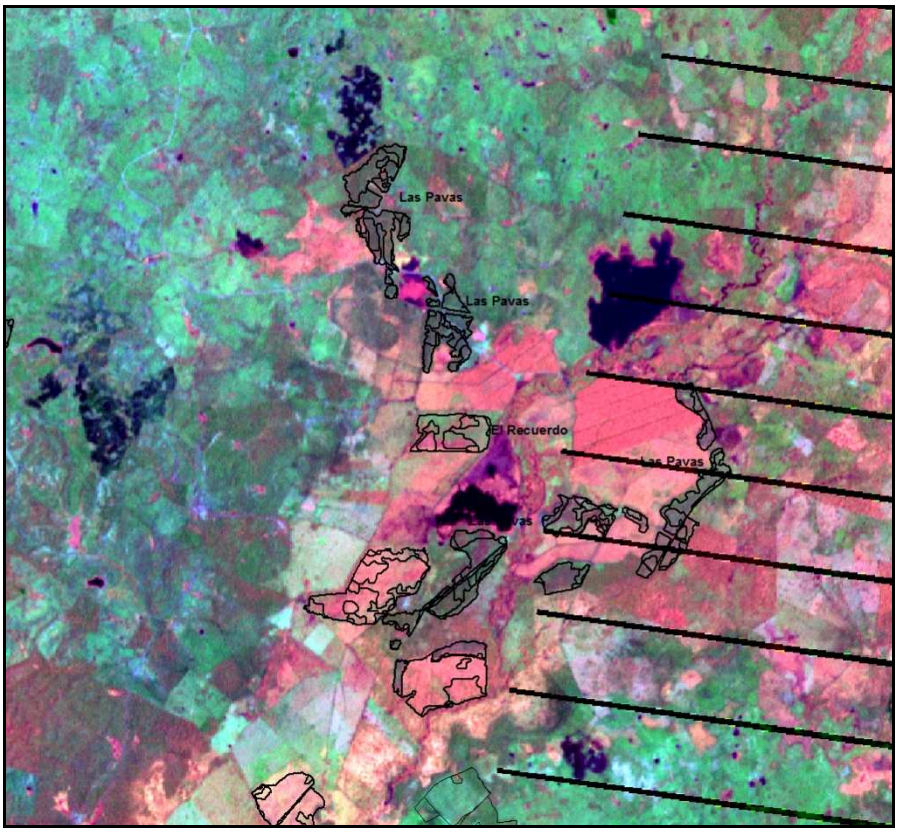


Figure 9: Overlapping of the areas planted by 2011 and surveyed in the field with GPS on the 2011 Landsat image

Step 5:
The GIS database in Excel by ONFA brings together relevant information from planted areas, owners, stratum code, species planted, among other information (Land dataset). As this GIS database was not updated the areas of the years 2010 and 2011, we proceeded to update the information of areas registered in field surveys using GPS during those years, for the reforestation project Magdalena Bajos seco.

This information contained only data from plots that were under control of project participants. Thus, it was filtered and eliminated the potential areas that could not be part of the project at the beginning of the verification, and these were removed from the final database (Land dataset). With this information it was updated a project Geodatabase, distinguishing the three phases of the project (2000-2003, 2004-2006, 2007-2012).

Step 6:
After having the three periods set, a topological adjustment was done. It establishes that there are no overlapping stands and that there are no gaps. This was done entirely by hand because those stands are polygons of small area.

Step 7:
Finally, the data were organized in Excel sheets by period for further analysis and measurement.

All this process is given in the SIG database attached to the present report.

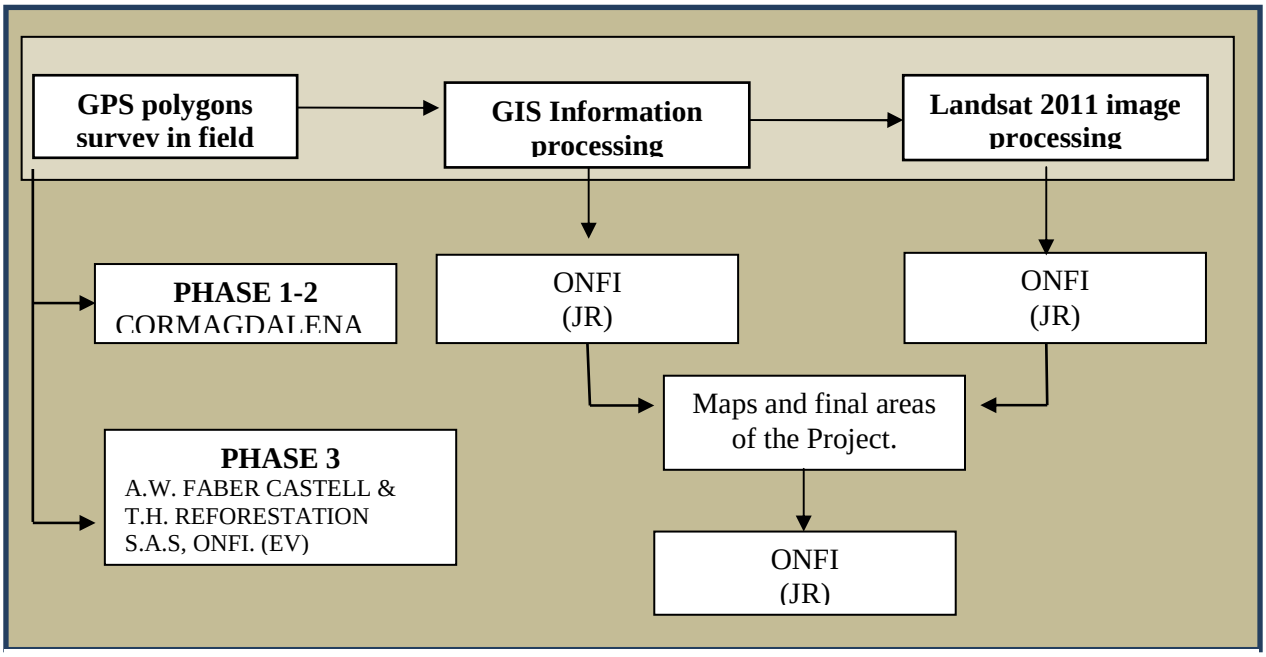


Figure 10: Monitoring structure of the areas under control of the Project. JR: Juan Rubiano, EV: Enrique Villamil

C.2. Stratification and sample size.

C.2.1.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 to be re-stratified in the first verification activity 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 2011 within all Project area.

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

Table 8: 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[25]). - **Oak:** Species of slow growth, medium wood density, crop shifts longer than 25 years (OFI-Catie, 2003[26]). - **Ceiba:**Species of slow growth, medium wood density. Crop rotation longer than 20years (OFI-Catie, 200327). - **Melina:** fast-growing species, medium to low wood density. Rotations less than 15 years (Ladrach, 2004[28]). -**Eucalyptus:** Species of slow growth, high – medium wood density in long-rotation conditions (Alvarado, C.R, *et al* s,f, a[29]).It is proposed for the project activity of short	Clearly differ in their growth behavior, characteristics of wood and crop shifts. Generating a first stratification by species

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

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

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

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

[29] 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

		rotations of 10 years.	
2.	Planting	Three phases of planting were developed .**Phase 1:** 2000 to 2004 with a planting density of 1098 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 2011 are between 8 to 11 years. - **Phase 2:** Teak, Melina, Ceiba. Ages between 5 to 7 years. - **Phase 3**: Melina. Young stands between 1 to 4 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.

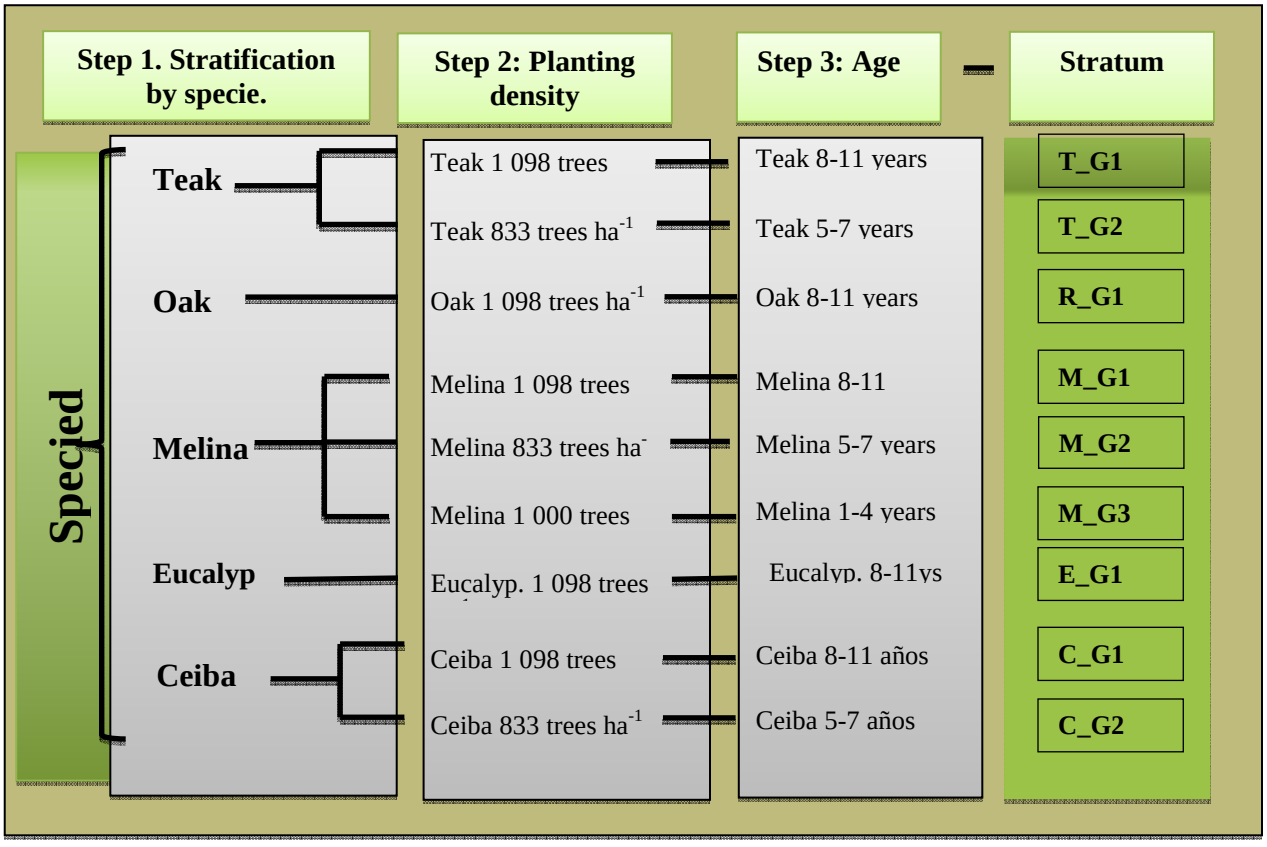


Figure 11: Scheme followed to determine the *ex-post* stratification of the project

Ex-post stratification clearly showed that there are important differences in the accumulation of carbon in contrast to the initial stratification (Table 9). The initial stratification considered only two stratums divided by the timing of the rotation of the species, short rotation stratum SM1 and half rotation SM2. The results demonstrate the need to increase the number of strata to make more accurate estimates, which is considered good practice (IPCC, 2003).

Table 9: Ex-post stratification by species and age range. Results generated by the monitoring of carbon stocks are presented per stratum.

Stratum ex-ante	Stratum ex-post	Specie	Group	Age Range (Years)	Average carbon stock ($tC.ha^{-1}$)
SM1	C_G1	Ceiba	1	8 - 11	75,20
	C_G2	Ceiba	2	5 - 7	36,04
SM2	E_G1	Eucalipto	1	8 - 11	26,68
	M_G1	Melina	1	8 - 11	116,67
	M_G2	Melina	2	5 - 7	107,41
	M_G3	Melina	3	1 - 4	24,46
SM1	R_G1	Roble	1	8 - 11	117,61
	T_G1	Teca	1	8 - 11	56,01
	T_G2	Teca	2	5 - 7	51,11

An advantage of increasing the number of strata, based on species criterion, is to apply stratum specific allometric models (Table 19).

C.2.2. 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[30].

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:

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

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

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:

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 $\alpha = 0.05$ (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.

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

Then the information estimates was obtained as follows:

1. Identify the number of stratums of the project (See section C.2.1).

2. Take the average volume per stratum, according to the information generated for the PDD during the validation process. (TARAM[31] and estimates of volumen validated 2011[32]).

3.Identify the final area of each stratum of the project

4.Calculate, using the CAMARA V.2 tool, the new sample size, entering the values of average volume per stratum, total area, area of each stratum, and assuming a standard deviation of 50% of the refering value (vol ha^{-1}), as recommended by the Guide of good practices by the IPCC.

The results of the new distribution by number of plots according to stratum can be seen inTable 10. The new distribution of random sample plots in the project area by stratum are presented in Table 13.

The sampling activities on the plantations, to assess their condition and carbon content, was developed by *Corporación Nacional de Investigación y Fomento Forestal* – CONIF, under direct supervision of ONFAndina as direct responsible of monitoring the project in its CDM component. This task is assigned to CONIF due to their expertise in forest inventories in Colombia, and because they have developed research activities for several years in the project area through the establishment and evaluation of permanent plots in commercial plantations

[31] TARAM V.1,3. Tool for afforestation and reforestation Approved methodologies. CATIE, BIOCARBON FOUND.

[32] Excel database that estimates volumes from secondary data, which feeds the information of TARAM in the *ex-ante* stage of the project.

Table 10: Results of calculation of the new sample size based on the ex-post stratification for the inventory of carbon stocks in the project, with the data *ex-ante*.

	Area	Expected amount	Number of sample plot per stratum
Stratum	**(ha)**	**m^3ha^{-1}**	***ni***
Ceiba_G1	260,8	103,00	7
Ceiba_G2	59,6	85,30	3
Eucalipto_G1	45,7	40,72	3
Melina_G1	1 397,8	129,90	28
Melina_G2	470,5	112,73	11
Melina_G3	499,9	123,43	11
Roble_G1	165,7	74,86	6
Teca_G1	184,8	150,22	4
Teca_G2	40,8	113,92	3
Total	3 125,52		***76***

According to ex-ante estimates of sample size, it was expected that 78 plots were managed to be within 10% error and confidence level of 95%. With the information taken in the field, it was calculated continuously sample size under the conditions of precision and error defined, based on real data from the plantation. 158 plots distributed in all strata were finally established for achieving the 10% of error.

This process involved two stages. The first one was essentially based on making use of information from re-measurements of 2011 of 108 plots in the network of permanent sample plots established by CONIF in the plantations of the project. These were remeasured between April and May 2011. It is important to highlight that these plots were established to identify the behavior of growth and develop annual estimates of volume of wood stocks. These plots share, with this project, procedures and objectives to evaluate the dynamics of increase of dendrometric variables, which are then converted to timber volume and carbon, hence the relevance to their use. (See monitoring protocol CONIF Anexe 7).

The second stage was to establish the necessary amount of additional parcels that met the assumptions of error and precision of sampling. At this stage 50 additional plots, already existent, were established between the months of August and September 2011.Table 11 relates the plots established at each stage.

Table 11: Number of sample plots established in each inventory stage by stratum

SPECIES	Stratum	Stage	
		CONIF	CONIF-ONFA
Ceiba	C_G1	26	-
Ceiba	C_G2	10	-
Eucalyptus	E_G1	3	2
Melina	M_G1	35	10
Melina	M_G2	9	8
Melina	M_G3	-	23

SPECIES	Stratum	Stage	
		CONIF	CONIF-ONFA
Oak	R_G1	1	7
Teak	T_G1	20	-
Teak	T_G2	4	-
TOTAL		**108**	**50**

Despite the development of the inventory, it resulted in a different growth than expected; thus, 155 plots had to be used, so to achieve the statistical adjustments (see Table 12), which are presented in Table 13.

Table 12: Applied statistical results of the inventory to estimate the amount of sample plots in each stratum of the project.

SPECIES	GROUP	PLOTS	AREA (ha)	P_j	S_{xj}	E_j	E_{st}
Ceiba	C_G1	26	240.36	0.0743	5.08673	9.9307	0.7378
Ceiba	C_G2	10	59.6	0.0184	6.86397	27.7513	0.5112
Eucalyptus	E_G1	5	45.69	0.0141	6.40712	19.5904	0.2767
Melina	M_G1	45	1 397.81	0.4321	6.59588	8.9972	3.8874
Melina	M_G2	17	472.62	0.1461	8.07903	11.3817	1.6627
Melina	M_G3	20	607.43	0.1878	0.92716	6.4338	1.2080
Oak	R_G1	8	165.68	0.0512	7.40819	17.0439	0.8728
Teak	T_G1	20	205.17	0.0634	5.56776	10.3244	0.6547
Teak	T_G2	4	40.83	0.0126	4.92492	15.5394	0.1961
TOTAL		155	3 235.19	1.0000			***10.0074***

For this analysis it was only taken data from 155 of the 158 plots established. P_j: participation of the stratum in the entire project area; S_{xj}: standard deviation of the estimate of stratum E_{st}:, $E_j$stratum error; E_{st}: stratum error weighted relative to the total area.

C.3. Allocation of permanent sample plots.

C.3.1 Distribution of plots.

The database of growth and development of forest plantation of the project , consisted of 108 permanent sample plots established by CONIF during the years 2009 to 2010 and remeasured in 2011. These plots were established randomly.

Then the database was complemented with infromation of the new 50 plots established in the contract ONFAndiana-CONIF.

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 n_i (Table 12)
3. Establish a plot size according to the monitoring plan (500m^2)
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 12, which served as inputs to the field teams for their initial location on the ground. Their correspondent coordinates are given in Table 13.

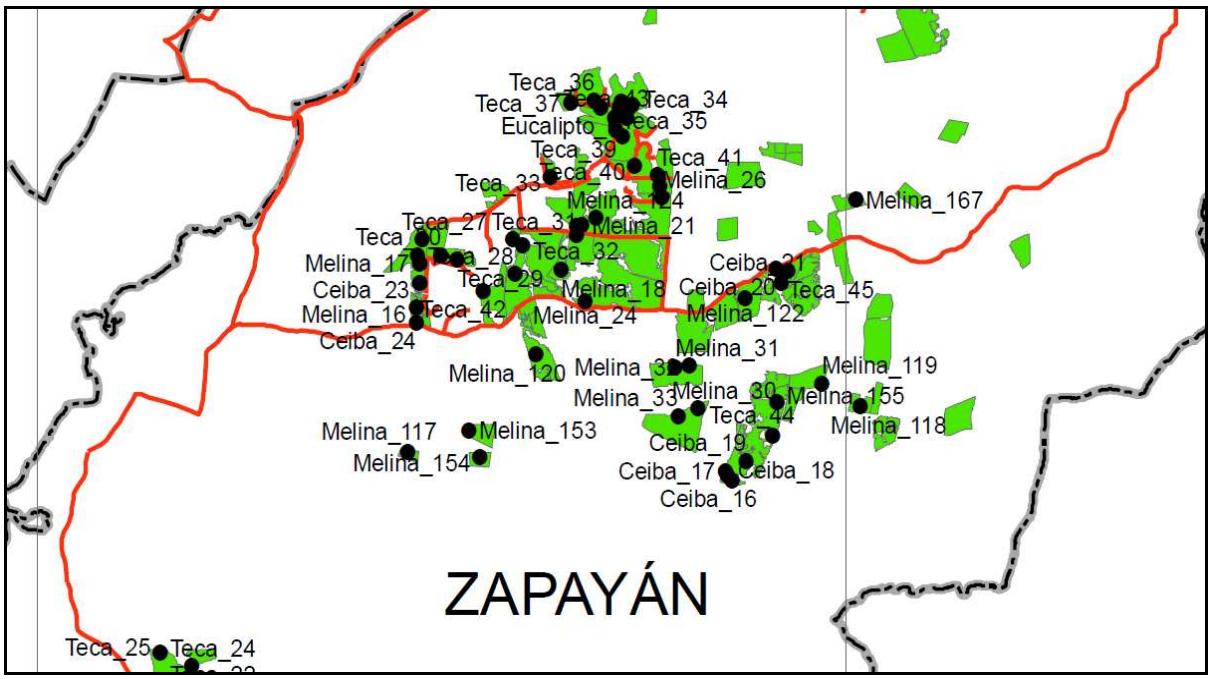


Figure 12: Example of the sampling points. Results of the stratified random distribution generated by the tool *Random point* of Argis.

Table 13: Distribution of sampling points according to the *ex-post* stratification. COD_Par: Plot Code, Coordinates: flat, COD_Lote, lot identification in MIS, St_Ex.ant: *ex-ante* stratification, Est.Expost: Strata *ex-post*.

Plot	COD_Par	Coordinates		SPECIE	FARM	COD_LOTE	St.ExAnt	St.Expst
		X	Y					
1	Ceiba_1	538640,28	1136739,68	Ceiba	Las Pavas	2002C0118	SM2	C_G1
2	Ceiba_2	539202,92	1137380,60	Ceiba	Las Pavas	2002C0116	SM2	C_G1
3	Ceiba_3	538798,67	1136896,54	Ceiba	Las Pavas	2002C0116	SM2	C_G1
4	Ceiba_4	538870,22	1136863,44	Ceiba	Las Pavas	2002C0119	SM2	C_G1
5	Ceiba_5	535971,24	1135398,40	Ceiba	Las Pavas	2003C0164	SM2	C_G1
6	Ceiba_6	535521,56	1134944,74	Ceiba	Las Pavas	2003C0163	SM2	C_G1
7	Ceiba_7	538945,12	1138582,68	Ceiba	Las Pavas	2002C0115	SM2	C_G1
8	Ceiba_8	537625,75	1136234,95	Ceiba	Las Pavas	2002C0120	SM2	C_G1
9	Ceiba_9	534160,22	1133210,39	Ceiba	La Floresta	2002C0105	SM2	C_G1
10	Ceiba_10	534367,09	1133281,40	Ceiba	La Floresta	2002C0105	SM2	C_G1
11	Ceiba_11	534064,10	1133559,46	Ceiba	La Floresta	2002C0106	SM2	C_G1
12	Ceiba_12	533893,18	1133533,65	Ceiba	La Floresta	2002C0106	SM2	C_G1
13	Ceiba_14	540225,86	1116979,83	Ceiba	La Union	2004C0224	SM2	C_G2
14	Ceiba_16	538589,94	1122702,33	Ceiba	Chimborazo	2004C0218	SM2	C_G2
15	Ceiba_17	538510,49	1122813,85	Ceiba	Chimborazo	2004C0218	SM2	C_G2
16	Ceiba_18	538532,22	1122755,28	Ceiba	Chimborazo	2004C0218	SM2	C_G2
17	Ceiba_19	538759,80	1122936,80	Ceiba	Chimborazo	2004C0218	SM2	C_G2
18	Ceiba_20	539125,67	1125262,11	Ceiba	Chimborazo	2004C0212	SM2	C_G2
19	Ceiba_21	539199,26	1125090,38	Ceiba	Chimborazo	2004C0212	SM2	C_G2
20	Ceiba_22	536687,27	1129266,98	Ceiba	La Gloria	2002C0110	SM2	C_G1
21	Ceiba_23	534724,95	1125084,77	Ceiba	La Gloria	2004C0221	SM2	C_G2
22	Ceiba_24	534689,11	1124619,80	Ceiba	La Gloria	2004C0222	SM2	C_G2
23	Ceiba_25	536963,22	1127202,71	Ceiba	La Gloria	2001C0053	SM2	C_G1
24	Ceiba_26	537216,94	1127140,81	Ceiba	La Gloria	2001C0053	SM2	C_G1
25	Ceiba_27	536581,11	1129453,23	Ceiba	La Gloria	2002C0113	SM2	C_G1
26	Ceiba_29	556062,81	1090635,34	Ceiba	Ruby Teresa	2005C0256	SM2	C_G2
27	Ceiba_30	542117,01	1070892,70	Ceiba	La Campera_Mi Salvacion_Las Margaritas	2003C0158	SM2	C_G1
28	Ceiba_31	542544,97	1070817,28	Ceiba	La Campera_Mi Salvacion_Las Margaritas	2003C0158	SM2	C_G1
29	Ceiba_34	545663,26	1095891,22	Ceiba	La Ceiba	2003C0157	SM2	C_G1
30	Ceiba_35	545554,02	1095881,76	Ceiba	La Ceiba	2003C0159	SM2	C_G1
31	Ceiba_48	538962,00	1138541,86	Ceiba	Las Pavas	2002C0115	SM2	C_G1
32	Ceiba_49	538994,13	1138552,11	Ceiba	Las Pavas	2002C0115	SM2	C_G1
33	Ceiba_50	538838,53	1136924,80	Ceiba	Las Pavas	2002C0116	SM2	C_G1
34	Ceiba_51	538820,38	1136875,90	Ceiba	Las Pavas	2002C0116	SM2	C_G1
35	Ceiba_52	537666,70	1136267,63	Ceiba	Las Pavas	2002C0120	SM2	C_G1
36	Ceiba_53	537593,95	1136208,05	Ceiba	Las Pavas	2002C0120	SM2	C_G1
37	Eucalipto_6	537186,76	1127212,31	Eucalipto	La Gloria	2001E0054	SM1	E_G1
38	Eucalipto_7	536500,51	1136508,38	Eucalipto	Las Pavas	2003E0169	SM1	E_G1
39	Eucalipto_143	537586,33	1137046,76	Eucalipto	Las Pavas	2003E0168	SM1	E_G1
40	Eucalipto_144	537568,63	1137161,98	Eucalipto	Las Pavas	2003E0168	SM1	E_G1
41	Eucalipto_152	536290,26	1136349,53	Eucalipto	Las Pavas	2003E0169	SM1	E_G1
42	Melina_1	530243,89	1139175,36	Melina	La Esmeralda	2001M0017	SM1	M_G1
43	Melina_2	530371,58	1138860,82	Melina	La Esmeralda	2001M0017	SM1	M_G1
44	Melina_3	529293,66	1139476,37	Melina	La Esmeralda	2001M0016	SM1	M_G1
45	Melina_4	528707,20	1140016,12	Melina	La Esmeralda	2001M0015	SM1	M_G1
46	Melina_5	536292,00	1139060,69	Melina	Las Pavas	2001M0035	SM1	M_G1
47	Melina_6	536080,90	1139582,91	Melina	Las Pavas	2001M0038	SM1	M_G1
48	Melina_7	535910,37	1139093,73	Melina	Las Pavas	2001M0035	SM1	M_G1
49	Melina_8	535378,85	1140294,47	Melina	Las Pavas	2002M0095	SM1	M_G1
50	Melina_9	535216,01	1140561,71	Melina	Las Pavas	2002M0095	SM1	M_G1
51	Melina_10	535197,39	1140834,77	Melina	Las Pavas	2002M0093	SM1	M_G1
52	Melina_11	535463,28	1141219,50	Melina	Las Pavas	2002M0093	SM1	M_G1
53	Melina_12	540580,58	1116495,04	Melina	La Pradera y San	2004M0201	SM1	M_G2

Plot	COD_Par	Coordinates		SPECIE	FARM	COD_LOTE	St.ExAnt	St.Expst
					Jose			
54	Melina_13	540351,19	1116474,80	Melina	La Pradera y San Jose	2004M0201	SM1	M_G2
55	Melina_14	540732,92	1113921,12	Melina	La Pradera y San Jose	2004M0189	SM1	M_G2
56	Melina_15	540212,42	1113810,07	Melina	La Pradera y San Jose	2004M0187	SM1	M_G2
57	Melina_16	534690,93	1124797,10	Melina	La Gloria	2004M0178	SM1	M_G2
58	Melina_17	534726,08	1125320,71	Melina	La Gloria	2004M0177	SM1	M_G2
59	Melina_18	536475,95	1125258,52	Melina	La Gloria	2002M0096	SM1	M_G1
60	Melina_19	536437,90	1129428,22	Melina	La Gloria	2002M0083	SM1	M_G1
61	Melina_20	536826,78	1129219,08	Melina	La Gloria	2002M0079	SM1	M_G1
62	Melina_21	536735,73	1125790,03	Melina	La Gloria	2000M0011	SM1	M_G1
63	Melina_22	537137,30	1127082,02	Melina	La Gloria	2001M0028	SM1	M_G1
64	Melina_23	536659,25	1125784,26	Melina	La Gloria	2000M0011	SM1	M_G1
65	Melina_24	536774,31	1124879,21	Melina	La Gloria	2000M0006	SM1	M_G1
66	Melina_25	536661,11	1125674,52	Melina	La Gloria	2000M0002	SM1	M_G1
67	Melina_26	537716,83	1126123,49	Melina	La Gloria	2000M0011	SM1	M_G1
68	Melina_27	537696,18	1126249,31	Melina	La Gloria	2000M0010	SM1	M_G1
69	Melina_28	535905,22	1125201,76	Melina	La Gloria	2000M0001	SM1	M_G1
70	Melina_29	531607,63	1112843,66	Melina	Montevideo	2002M0060	SM1	M_G1
71	Melina_30	538167,98	1123576,06	Melina	La Camachera	2003M0133	SM1	M_G1
72	Melina_31	537878,37	1124080,65	Melina	La Camachera	2003M0134	SM1	M_G1
73	Melina_32	538063,57	1124084,09	Melina	La Camachera	2003M0134	SM1	M_G1
74	Melina_33	537928,24	1123476,13	Melina	La Camachera	2003M0133	SM1	M_G1
75	Melina_41	544571,43	1086637,13	Melina	Los Bagres y La Jar	2005M0236	SM1	M_G2
76	Melina_42	535036,60	1088233,00	Melina	La Floresta	2006M0261	SM1	M_G2
77	Melina_43	539541,70	1090997,03	Melina	El Cerrejon	2001M0013	SM1	M_G1
78	Melina_44	561339,28	1095831,71	Melina	El Otono	2003M0136	SM1	M_G1
79	Melina_45	555896,91	1090623,88	Melina	Ruby Teresa	2005M0245	SM1	M_G2
80	Melina_48	546055,16	1096033,82	Melina	La Ceiba	2002M0070	SM1	M_G1
81	Melina_49	545774,77	1096271,27	Melina	La Ceiba	2002M0070	SM1	M_G1
82	Melina_50	545665,93	1096224,61	Melina	La Ceiba	2003M0132	SM1	M_G1
83	Melina_51	545662,64	1096030,00	Melina	La Ceiba	2003M0132	SM1	M_G1
84	Melina_52	545430,12	1095881,42	Melina	La Ceiba	2003M0137	SM1	M_G1
85	Melina_54	547155,65	1099347,26	Melina	Puerto Adentro	2001M0027	SM1	M_G1
86	Melina_101	539463,96	1091020,51	Melina	El Cerrejon	2001M0013	SM1	M_G1
87	Melina_102	545706,69	1095422,28	Melina	La Ceiba	2003M0137	SM1	M_G1
88	Melina_103	546300,84	1095612,63	Melina	La Ceiba	2001M0021	SM1	M_G1
89	Melina_104	546072,73	1095774,69	Melina	La Ceiba	2003M0132	SM1	M_G1
90	Melina_105	559759,11	1098659,24	Melina	San Carlos de Rozo	2005M0231	SM1	M_G2
91	Melina_106	552242,66	1099687,64	Melina	La Virgen	2006M0264	SM1	M_G2
92	Melina_107	540580,75	1114490,81	Melina	La Pradera y San Jose	2004M0196	SM1	M_G2
93	Melina_108	540161,03	1114514,46	Melina	La Pradera y San Jose	2004M0198	SM1	M_G2
94	Melina_109	540687,92	1115880,99	Melina	San Jose	2003M0145	SM1	M_G1
95	Melina_110	540574,63	1116398,96	Melina	La Pradera y San Jose	2004M0201	SM1	M_G2
96	Melina_111	540145,55	1116924,07	Melina	La Union	2004M0176	SM1	M_G2
97	Melina_112	535221,20	1118395,27	Melina	Alto Plano	2009M0270	SM1	M_G3
98	Melina_114	535657,73	1118978,18	Melina	Alto Plano	2009M0270	SM1	M_G3
99	Melina_117	534581,95	1123046,27	Melina	La Siberia	2009M0312	SM1	M_G3
100	Melina_118	540169,03	1123605,42	Melina	Santo Domingo	2009M0280	SM1	M_G3
101	Melina_119	539690,66	1123866,85	Melina	El Desvio	2009M0275	SM1	M_G3
102	Melina_120	536162,26	1124225,54	Melina	Cuatro esquinas	2005M0230	SM1	M_G2
103	Melina_122	538749,76	1124900,42	Melina	La Camachera	2003M0140	SM1	M_G1
104	Melina_124	536910,96	1125878,00	Melina	La Gloria	2000M0011	SM1	M_G1
105	Melina_132	535895,94	1129591,26	Melina	El Pensamiento	2009M0277	SM1	M_G3
106	Melina_133	535896,70	1129995,92	Melina	Madre Selva	2009M0319	SM1	M_G3
107	Melina_134	536007,51	1130309,42	Melina	Villa de la Mata	2009M0326	SM1	M_G3
108	Melina_135	546089,46	1132405,86	Melina	San Jose	2009M0324	SM1	M_G3
109	Melina_148	529872,30	1139224,29	Melina	La Esmeralda	2001M0017	SM1	M_G1
110	Melina_149	535382,39	1140342,00	Melina	Las Pavas	2002M0095	SM1	M_G1

Plot	COD_Par	Coordinates		SPECIE	FARM	COD_LOTE	St.ExAnt	St.Expst
111	Melina_150	535010,81	1140874,53	Melina	Las Pavas	2002M0093	SM1	M_G1
112	Melina_153	535335,53	1123303,69	Melina	La Siberia	2009M0313	SM1	M_G3
113	Melina_154	535475,99	1122992,26	Melina	La Siberia	2009M0314	SM1	M_G3
114	Melina_155	539146,02	1123649,18	Melina	Chimborazo	2004M0171	SM1	M_G2
115	Melina_156	544935,04	1131682,59	Melina	Pajonal	2009M0321	SM1	M_G3
116	Melina_157	546291,05	1129652,23	Melina	San Antonio	2009M0323	SM1	M_G3
117	Melina_158	545442,61	1129977,30	Melina	El Milagro	2009M0301	SM1	M_G3
118	Melina_159	546301,64	1129439,56	Melina	San Antonio	2009M0323	SM1	M_G3
119	Melina_160	547815,98	1130596,83	Melina	Los Recuerdos	2009M0328	SM1	M_G3
120	Melina_161	547899,46	1130686,25	Melina	Los Recuerdos	2009M0329	SM1	M_G3
121	Melina_162	547360,84	1131250,82	Melina	Bariloche	2009M0283	SM1	M_G3
122	Melina_163	547179,97	1131199,49	Melina	El Recuerdo	2009M0307	SM1	M_G3
123	Melina_164	546728,54	1132027,40	Melina	Cambio Vida	2009M0288	SM1	M_G3
124	Melina_165	546726,33	1131676,36	Melina	Roble Claro	2009M0322	SM1	M_G3
125	Melina_166	546197,25	1131910,31	Melina	San Jose	2009M0324	SM1	M_G3
126	Melina_167	540111,70	1126099,81	Melina	Los Mangos	2009M0279	SM1	M_G3
127	Roble_138	535836,33	1135082,38	Roble	Las Pavas	2003R0166	SM2	R_G1
128	Roble_139	535368,64	1136079,51	Roble	El Recuerdo	2003R0165	SM2	R_G1
129	Roble_140	535656,77	1136191,75	Roble	El Recuerdo	2003R0165	SM2	R_G1
130	Roble_141	535458,24	1136426,18	Roble	El Recuerdo	2003R0165	SM2	R_G1
131	Roble_142	535548,03	1136431,78	Roble	El Recuerdo	2003R0165	SM2	R_G1
132	Roble_146	536513,75	1137890,82	Roble	El Recuerdo	2001R0054	SM2	R_G1
133	Roble_147	536026,40	1137971,57	Roble	El Recuerdo	2001R0054	SM2	R_G1
134	Roble_151	535689,56	1135199,35	Roble	Las Pavas	2003R0166	SM2	R_G1
135	Teca_18	546871,25	1099285,11	Teca	Puerto Adentro	2001T0040	SM2	T_G1
136	Teca_22	531520,03	1120285,31	Teca	Cano Lindo	2002T0122	SM2	T_G1
137	Teca_23	531727,31	1120285,51	Teca	Cano Lindo	2002T0122	SM2	T_G1
138	Teca_24	531909,83	1120463,57	Teca	Cano Lindo	2002T0122	SM2	T_G1
139	Teca_25	531522,05	1120615,01	Teca	Cano Lindo	2002T0122	SM2	T_G1
140	Teca_27	534758,21	1125617,10	Teca	La Gloria	2004T0210	SM2	T_G2
141	Teca_28	534693,91	1125425,37	Teca	La Gloria	2004T0210	SM2	T_G2
142	Teca_29	535186,45	1125375,15	Teca	La Gloria	2002T0099	SM2	T_G1
143	Teca_30	534984,06	1125424,27	Teca	La Gloria	2002T0099	SM2	T_G1
144	Teca_31	535873,22	1125623,67	Teca	La Gloria	2002T0098	SM2	T_G1
145	Teca_32	536004,56	1125551,48	Teca	La Gloria	2002T0101	SM2	T_G1
146	Teca_33	536334,41	1126379,22	Teca	La Gloria	2001T0045	SM2	T_G1
147	Teca_34	537348,68	1127242,18	Teca	La Gloria	2001T0043	SM2	T_G1
148	Teca_35	537214,96	1127284,58	Teca	La Gloria	2001T0043	SM2	T_G1
149	Teca_36	536874,18	1127294,03	Teca	La Gloria	2001T0043	SM2	T_G1
150	Teca_37	536589,32	1127264,13	Teca	La Gloria	2001T0044	SM2	T_G1
151	Teca_38	537236,60	1126865,07	Teca	La Gloria	2001T0041	SM2	T_G1
152	Teca_39	537144,84	1126933,13	Teca	La Gloria	2001T0050	SM2	T_G1
153	Teca_40	537386,51	1126515,09	Teca	La Gloria	2001T0051	SM2	T_G1
154	Teca_41	537664,00	1126392,98	Teca	La Gloria	2001T0052	SM2	T_G1
155	Teca_42	535515,80	1124992,63	Teca	La Gloria	2001T0049	SM2	T_G1
156	Teca_43	537285,55	1127077,64	Teca	La Gloria	2001T0041	SM2	T_G1
157	Teca_44	539088,17	1123247,10	Teca	Chimborazo	2004T0209	SM2	T_G2
158	Teca_45	539274,58	1125232,32	Teca	Chimborazo	2004T0208	SM2	T_G2

C.3.2. Localization of simple plots in the field.

The establishment of the center points of the sample plots were performed using submeter GPS Ashtech ™ Mobile Mapper ™ CX supplied by FORESTRY SUPPLIERS INC, which allows to locate the centers of sample plots with errors less than 2m (Figure 13). 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.

Figure 13: Submeter GPS Ashtech ™ Mobile Mapper ™ CX for georeferencing center puntos, with sampling accuracy of 2m.

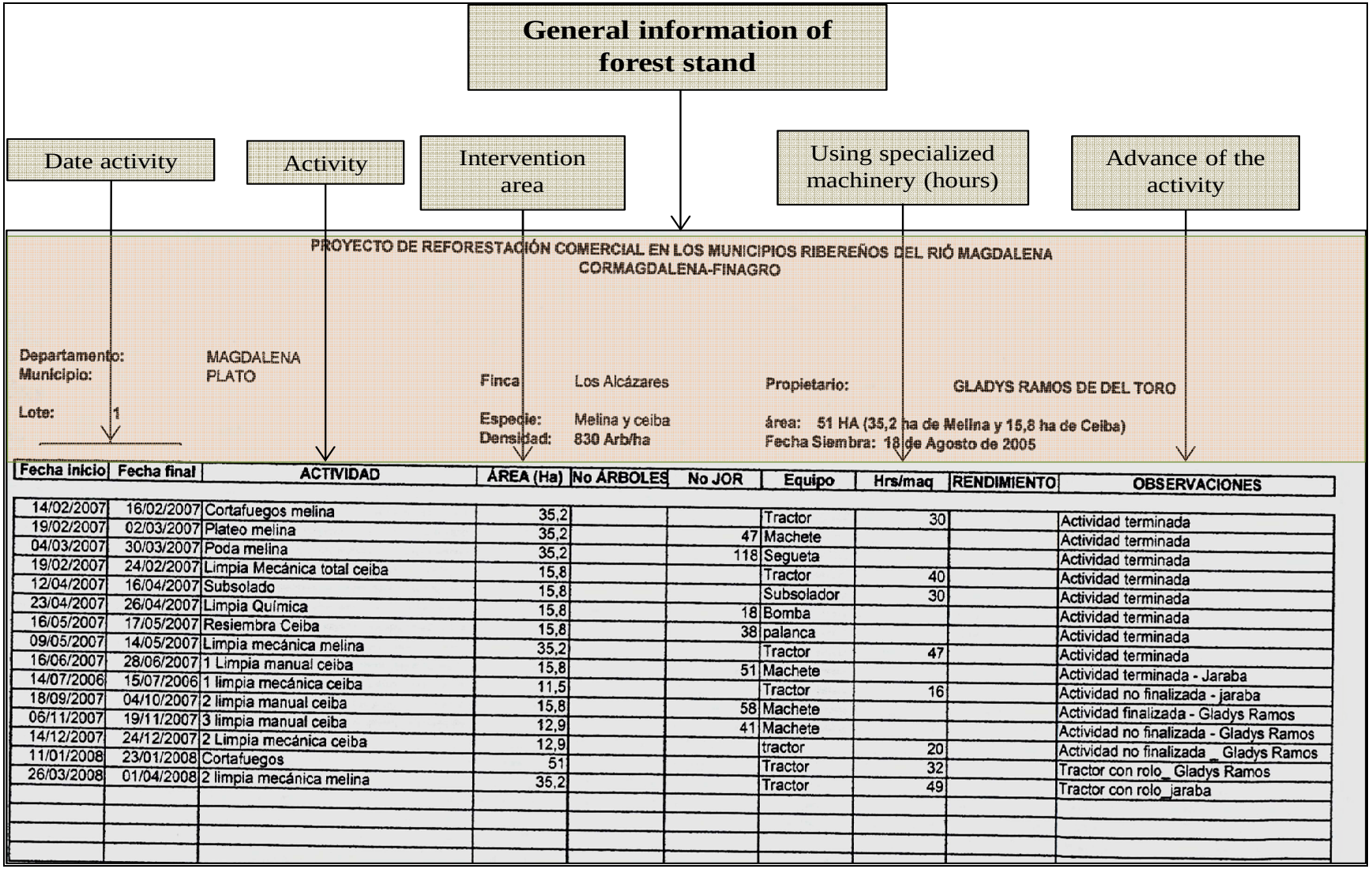
The location of sample plots was basically the following steps for the two stages of sampling:

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.

C.4. Monitoring of forest establishment.

This was developed in its first and second phase by CORMAGDALENA and checked by ONFI and ONFAndina assistance. The follow-up of the forest establishment activities was carried out by trained technical staff. This staff also provided technical assistance to landowners about how activities should be run according to the plans for Forest Establishment and Management. The guarantee of quality of the process was developed by CORMAGDALENA, which consisted of verification of any contracted activities for the establishment of the plantations for each plot. Based on these, a report was written for monitoring the work; it also included management activities. Annex 3 presents an example of the recording books developed by field technicians to ensure the establishment and management activities at each plot.

The information of the forest establishment activities, that have been properly confirmed by CORMAGDALENA, served to issue payments to each landowner for the activities effectively performed. Figure 14 below shows an example of the format of recod books for activities checked by field technicians during the previous years to the validation of the project, under CDM, and to the creation of the CDM standard protocols.



Fecha inicio	Fecha final	ACTIVIDAD	ÁREA (Ha)	No ÁRBOLES	No JOR	Equipo	Hrs/maq	RENDIMIENTO	OBSERVACIONES
14/02/2007	16/02/2007	Cortafuegos melina	35,2			Tractor	30		Actividad terminada
19/02/2007	02/03/2007	Plateo melina	35,2		47	Machete			Actividad terminada
04/03/2007	30/03/2007	Poda melina	35,2		118	Segueta			Actividad terminada
19/02/2007	24/02/2007	Limpia Mecánica total ceiba	15,8			Tractor	40		Actividad terminada
12/04/2007	16/04/2007	Subsolado	15,8			Subsolador	30		Actividad terminada
23/04/2007	26/04/2007	Limpia Química	15,8		18	Bomba			Actividad terminada
16/05/2007	17/05/2007	Resiembra Ceiba	15,8		38	palanca			Actividad terminada
09/05/2007	14/05/2007	Limpia mecánica melina	35,2			Tractor	47		Actividad terminada
16/06/2007	28/06/2007	1 Limpia manual ceiba	15,8		51	Machete			Actividad terminada - Jaraba
14/07/2006	15/07/2006	1 limpia mecánica ceiba	11,5			Tractor	16		Actividad no finalizada - jaraba
18/09/2007	04/10/2007	2 limpia manual ceiba	15,8		58	Machete			Actividad finalizada - Gladys Ramos
06/11/2007	19/11/2007	3 limpia manual ceiba	12,9		41	Machete			Actividad no finalizada - Gladys Ramos
14/12/2007	24/12/2007	2 Limpia mecánica ceiba	12,9			tractor	20		Actividad no finalizada _ Gladys Ramos
11/01/2008	23/01/2008	Cortafuegos	51			Tractor	32		Tractor con rolo_ Gladys Ramos
26/03/2008	01/04/2008	2 limpia mecánica melina	35,2			Tractor	49		Tractor con rolo_jaraba

Figure 14: Form filled out log to check activities of establishment and management of reforested land, these reports are supported with images of each activity evaluated (Figure 15,Figure **16** and Figure **17**).These forms are filled out for each property in the first two phases of the project and have been modified for phase three. The information generated is adjusted to the process of monitoring forest establishment and management of CDM validated. For the second check will be implemented protocols developed in the manual QA / QC of the project.

For phase three (3) A.W. FABER CASTELL & T.H. Reforestation SAS was in charge of coordinating with landowners the establishment activities, and provided the respective assistance for technical forestry work. Likewise in phase 1 and 2, the corroboration of the activities served as a guarantee to make payments to each landowner. This is why forest establishment activity check and the guarantee of these activities was essential.

During this process it was monitored:

- Areas effectively prepared for planting.
- Species.
- Planting Spacing.
- Areas effectively planted.
- Replanting.

All information was recorded in a record book of field activities in phases 1 and 2, and by activities execution in each plot at phase 3. Aspects such as the amount of biomass removed during site preparation were not possible to monitor because the activities began in 2000. At that time there were no CDM methodologies or procedures. Thus, biomass by baseline stratum had to be estimated for the whole project area using the values reported in the PDD (see section A of this report).

Main activities checked during the establishment of plantations:

Figure 15 and Figure 16 show the activities of plantation establishment, according to the guidelines of the management plan.

Figure 15: Pictures of temporary nurseries within the project areas established under the technical guidance and advice of Cormagdalena, Conif.

C.5. Monitoring of forest management

This process was carried out as for the establishment process. It was controlled and monitored by CORMAGDALENA in phases 1 and 2, and by AW FABER CASTELL & T.H. Reforestation S.A.S in phase 3. Information of all forest management activities was corroborated by ONFAndina through a detailed analysis of the information registered in the record book of field activities in each stand forest (la información de actividades de manejo se encuentra archivada en format Excel). (The information of management activities is on file in Excel format). This information was strictly monitored, because it is the basis of payment to each landowner for the activities performed under the agreement established between the entities that are part of the project .

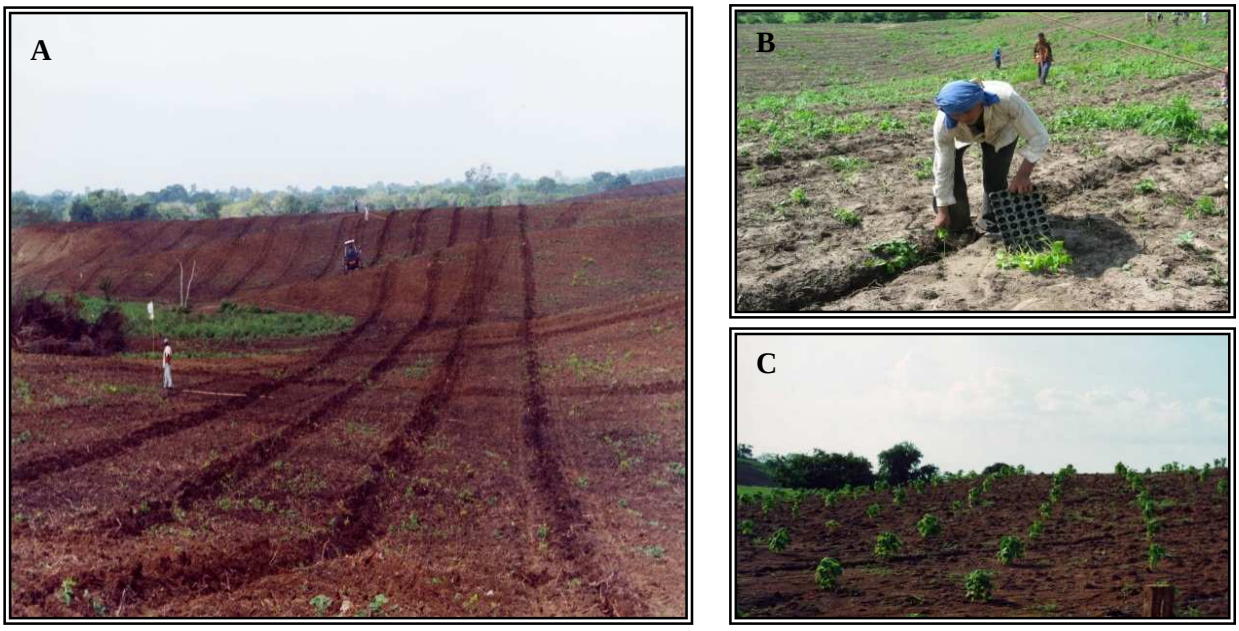


Figure 16: Pictures of activities for the establishment of plantations in the early stages of the project (2000 to 2004) A. Adecuacion of soils through the creation of grooves for the establishment of seedlings. B. Planting of seedlings.C. Lot set.

The Excel sheets including these activities are attached to the report.

The project entails the following stages and activities during the process of establishment and forest management:

- **Forest management activities:**

Figure 17: Pictures of fire control activities in forest plantations of the project. A. Creation of firebreaks corridors and maintenance of these (B). C and D, Training owners and workers of the project in control of forest fires.

Figure 18: Pictures of maintenance activities of the stands. A and B. Early pruning process, C Application of healing at the point of pruning, D, application of supplemental irrigation during times of drought.

Plantation management program:

For the forestry project proposal of the Bajo Magdalena seco through the CDM, forest management and interventions were established according to the ecological conditions of the species and the environmental conditions in the region. Section A.5.4 of the PDD present the activities that would be implemented during the program of forest plantation management. To identify the type of activities that had been developed since 2000 until today, it was organized and evaluated the based of existing reports of technical visits of the project. These include a series of papers in a physical format for each of the plots and for each of the phases.

Annex 4 presents the activities defined in management plans for each phase, each lot, and which ones were duly carried out. It also shows if it was done in accordance with the foreseen schedule. These activities are the same considered in the PDD. Table 8 gives an example of how the monitoring of these activities was conducted, based on the record books which detail the effective implementation of activities.

Table 14: Example of how track is done on the activities for establishing and managing the plantation per each lot part of the project. PM: planned activity in the Management Plan. BIT, activity duly followed in a Record Book Activities P, S, F, R, and others are explained in Table 15.

Cod_lot	Planting_date	year 2000																					
		P		S		F		R		Cm		Po		Cf		Cp		E		C		Rp	
		PM	BIT	PM	BIT	PM	BIT	PM	BIT	PM	BIT	PM	BIT	PM	BIT	PM	BIT	PM	BIT	PM	BIT	PM	BIT
Melina_G1																							
2000M0001	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0002	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0003	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0005	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0006	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0007	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0008	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0009	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0010	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
2000M0011	ago-00	1	1	1	1	1	0	1	0	7	7	2	2	1	1	1	1	-	-	-	-	-	-
Cod_lot	**Planting_date**	**year 2001**																					
2001M0012	jun-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0013	jun-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0015	may-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0016	may-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0017	may-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0018	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1	-	-	-	-	-	-
2001M0019	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1	-	-	-	-	-	-
2001M0020	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1	-	-	-	-	-	-
2001M0021	sep-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0022	jun-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0024	jun-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0027	sep-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0028	may-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0029	may-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0030	may-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0031	may-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0032	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0033	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0034	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0035	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0036	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0037	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0038	jul-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						
2001M0039	may-01	1	1	1	1	1	0	1	0	7	13	2	2	1	1	1	1						

* The values 0 (cero) and 1 (one) in the column, define whether the activity was actually carried out. 0= not 1= ok. (–) = Activity not planned for that time. Values different to cero and one, activity was actually carried out and that amount.

Table 15: Activities developed within the management plan of the project.

Activity	
Site Preparation	**P**
Removal	
Distribution of plant debris	
Collection of plant debris	
Plowing	
Raking,	
Subsoiling,	
Building roads and firebreaks	
Isolation and fencing	
Planting	**S**
Internal transport of plant material	
External transport of plant material	
Distribution of trees in the seed lot	
Layout	
Planting	
Straightening trees	
Planting control	
Replanting	
Weeding	**Cm**
Manual clean	
mechanical clean	
chemical clean	
Pruning	**Po**
Low pruning	
high pruning	
Phytosanitary Control	**Cp**
Plant control.	
Firebreaks control.	
Firebreaks	**Cf**
Cut weeds	
Raking	
Plowing	
Thininng	
Forest Inventor and mark thinning tree Harvest Lower transport Tie packages	**E**

The analysis of the monitoring activities since 2000 to date, based on the technical recording books, report in high percentage that the establishment and management activities were carried out according to management plans.

- In relation to fertilization and thinning activities there is not enough information to prove in detail how it was executed; however, the final reports indicate that fertilization was carried out but without specifying the amount applied and the plot .(See Anexe 8). Consequently, it is not supported in a concrete way that the activities were duly executed (See Table 16).

- The thinnings have not been developed at the indicated times as set by management plans, or in some cases, not in all plots that should have been intervened.

- Weed control (Cm) was developed in some strata over 100% of expected (See Table 17). It was due to high prescence of these during the first three years of the plantations, so this activity had to be intensified.

- The harvest (C) of Eucalyptus species planted in 2001 and which is the only stratum that has satisfied the first period of rotation, has not yet been executed in this period of verification. Table 16 presents a comparison between the number of activities planned in the establishment and management plan (MP), and the ones effectively done and reported in the record books by field technicians (BT). Table 17 shows the results of effective implementation in percentage terms up to 2011 between PM and BT.

Table 16: Comparison among activities planned by the management plans (PM) and the activities reported in the recorded books (BT)

	P		S		F		R		Cm		Po		Cf		Cp		E		C		Rp	
	PM	BT	PM	BT	PM	BT	PM	BT	PM	BT	PM	BT	PM	BT	PM	BT	PM	BT	PM	BT	PM	BT
Melina_G1	102	102	102	102	204	0	102	0	3162	2530	408	306	1033	204	1033	204	204	57	0	0	0	0
Melina_G2	63	63	63	63	63	1	63	59	1108	1336	152	267	473	363	473	363	100	0	0	0	0	0
Melina_G3	92	60	92	60	2	0	2	0	738	36	238	4	126	7	126	7	15	0	0	0	0	0
Ceiba_G1	25	25	25	25	75	0	25	1	925	634	101	76	243	50	243	50	25	0	0	0	0	0
Ceiba_G2	21	21	21	21	21	0	21	21	381	441	63	81	160	123	160	123	21	0	0	0	0	0
Teca_G1	19	19	19	19	57	2	19	0	545	500	219	38	200	38	200	33	19	0	0	0	0	0
Teca_G2	7	7	7	7	7	0	7	7	122	147	28	38	53	40	53	40	7	0	0	0	0	0
Roble_G1	3	3	3	3	9	2	3	0	69	66	15	9	29	6	29	6	3	0	0	0	0	0
Eucalipto_G1	4	4	4	4	4	0	4	0	146	26	4	1	33	2	33	2	8	0	1	0	0	0

In the record books there is not special emphasis of fertilization activities, which reflects its low application.

Table 17: Percentage of execution of forest establishment and monitoring activities. It is based on the relationship between the planned forest establishment plans and activities implemented that are supported by record books or reports of activities execution.

Stratum	Execution (%)											Percentage by stratum (%)
	P	S	F	R	Cm	Po	Cf	Cp	E	C	Rp	
Melina_G1	100	100	0	0	80	75	20	20	28	-	-	46,9
Melina_G2	100	100	2	94	121	176	77	77	0	-	-	82,8
Melina_G3	65	65	0	0	5	2	6	6	0	-	-	16,4
Ceiba_G1	100	100	0	4	69	75	21	21	0	-	-	43,2
Ceiba_G2	100	100	0	100	116	129	77	77	0	-	-	77,6
Teak_G1	100	100	4	0	92	17	19	17	0	-	-	38,7
Teak_G2	100	100	0	100	120	136	75	75	0	-	-	78,6
Oak_G1	100	100	22	0	96	60	21	21	0	-	-	46,6
Eucalyptus_G1	100	100	0	0	18	25	6	6	0	**0**	-	28,3
Percentage by activity (%)	96,1	96,1	3,0	33,1	79,4	77,1	35,7	35,3	3,1	0,0	-	

The total sum of the percentages of implementation of an activity among all species must be equal to 100%. Therefore, based on Table 16, it is concluded that the actitivies with higher percentage of excecution were soil preparation(P), planting (S), then followed by pruning. Fertilization was not fully carried out because of the good conditions of the soils demostraed in soil studies.

In terms of stratum, the establishment and management of Melina_G2 has been the one with the most closely following of the plans, represented in 82.2% of performance. It is then followed by Teak_G2 with 78.6%.Moreover, in relation to thinning reports (E) thinning has been only done in the stratum of Melina_G1 with a 28% of excecution.

Summarizing, the activities have been developed partially according to management plans. However it is emphasized that the above values describe the activities that have been developed over the 10 years of the project, confirming,with supports of execution, that some activities have been developed as required, even though there is no a detailed support of some of these activities

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 19.

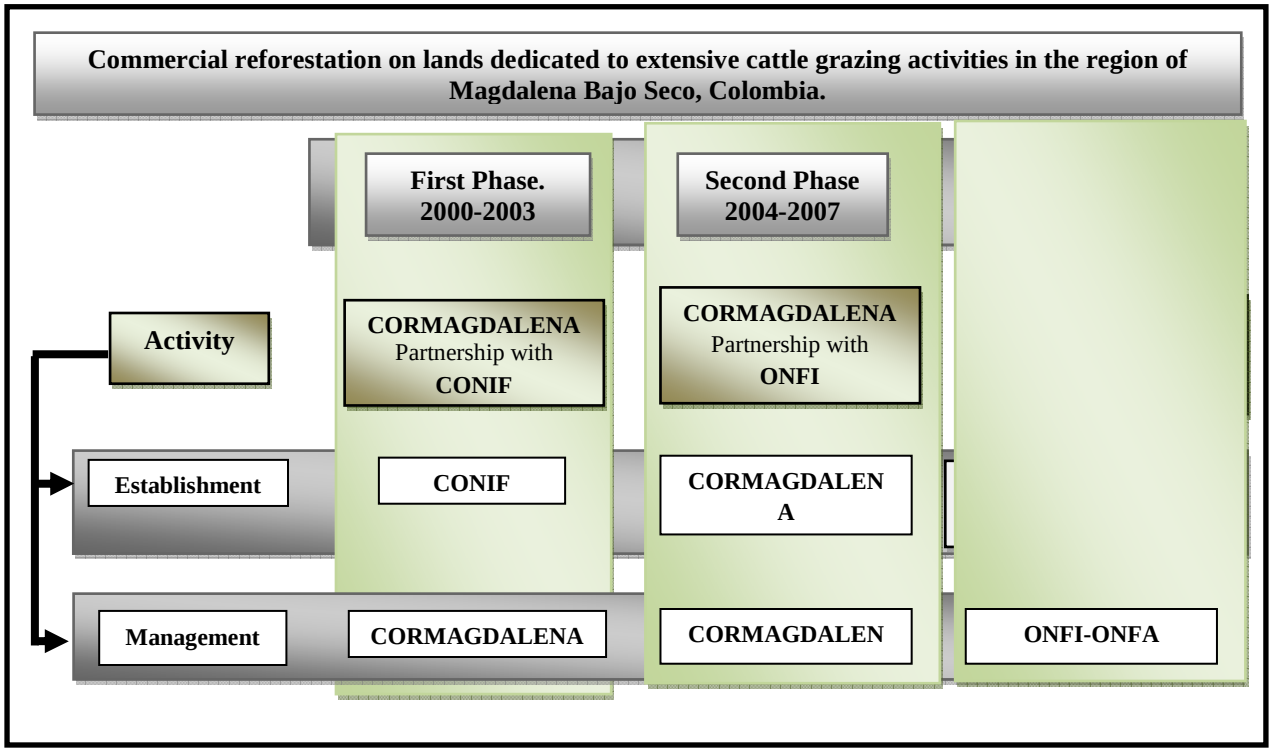


Figure 19: Participation Scheme of the entities involved in the activities of forest establishment and management of the project. These entities are responsible for documenting and responding to the management of information that is supplied to the ONFAndina for CDM processes. Plantation phase 3 A.W. Faber Castell & TH Reforestation SAS, is responsible for developing establishement and management

C.6. 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 measurements were taken with digital equipment such as Vertex Laser and Laser hypsometer Forestry 550 with tilt sensor, giving an accuracy of 0.1 m in height measurement (Figure 20).

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

Table 18: Description of the groups for field inventories CONIF, 2011

FUNCTION	GROUP 1	GROUP 2
Leader of the group	Iván Darío González	Manuel Guillermo Yaya
Measurement Assistant	Omar Quiroga	Cristobal Castillo
Field assistance	Local worker	Local worker

Figure 20: Equipment used during the forest inventory. Digital hypsometers used for measuring heights. A: Vertex Laser hypsometer, B: Forestry 550 Laser hypsometer. Equipment for measuring diameters: C: Diameter tape, D: Caliper.

Estimates of forest stocks in terms of volume (m^3ha^{-1}).

As shown in Table 10, the forest inventory included 158 permanent plots established according to the stratification proposed. Therefore, the analysis was developed with information from 155 permanent plots. The volume estimates were developed using the equations in Table 19. 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 19: Volume models used by species.

SPECIES	MATHEMATICAL EXPRESSION	Source
Melina	$Age \leq 4\ year$ $V = \left[\sum_{i=1}^{n} v_i\right].F_e$ *where* $v_i = 0.022894 + 0.0000149 .d^{2.163941} .h^{1.0327856}$ $F_e = \frac{10000}{Size\ \ plot}$	López *et al.* (2011)
	$Age \geq 5\ años$ $V = 0.6661 .H^{0.8995} .G^{0.9518}$	CIRAD-Forêt (2003)
Teak	$V = \left[\sum_{i=1}^{n} v_i\right].F_e$ *where* $v_i = \left(\frac{\pi}{4}\right).\left(\frac{d}{100}\right)^2 .h.0.48$ $F_e = \frac{10000}{Tamaño \quad parcela}$	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.

For Gmelina arborea two allometric models were used depending on plantation age, less than 4 years López *et al*. (2011) or 4 years and more (CIRAD Forêt, 2003), in order to minimize uncertainties.

The statistical results of field sampling are presented in Table 20. It can be seen that increasing the sample size it was possible to achieve the total error adjustment (10%), based on the proportional share of each stratum in the whole project.

Table 20: 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.

ESPECIES	GROUP	PLOTS ni	AREA (ha)	P_j	S_{xj}	E_j	E_{st}
Ceiba	C_G1	26	240.36	0.0743	5.08673	9.9307	0.7378
Ceiba	C_G2	10	59.6	0.0184	6.86397	27.7513	0.5112
Eucalyptus	E_G1	5	45.69	0.0141	6.40712	19.5904	0.2767
Melina	M_G1	45	1 397.81	0.4321	6.59588	8.9972	3.8874
Melina	M_G2	17	472.62	0.1461	8.07903	11.3817	1.6627
Melina	M_G2	20	607.43	0.1878	0.92716	6.4338	1.2080
Oak	R_G1	8	165.68	0.0512	7.40819	17.0439	0.8728
Teak	T_G1	20	205.17	0.0634	5.56776	10.3244	0.6547
Teak	T_G2	4	40.83	0.0126	4.92492	15.5394	0.1961
TOTALS		**155**	3 235.19	1.0000			***10.0074***

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

Average results obtained for the monitored variables such as diameter, height and density per ha^{-1} are presented in Table 21, as well as the volume estimates per ha, with the respective standard deviation values. These results are part of the forest inventory developed by CONIF (2011),Anexe 7.

Table 21: Results of the volume estimates for each stratum according to the inventory results and mean values for the height, diameter and density per ha^{-1} variables.

SPECIES	GROUP	DIÁMETER (cm)		HEIGHT (m)		DENSTY (Tree ha^{-1})		ÁREA BASAL (m^2 ha^{-1})		VOLUMEN (m^3 ha^{-1})	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Ceiba	C_G1	19.67	2.47	13.95	1.49	779.33	156.24	24.45	5.36	105.50	25.94
Ceiba	C_G2	17.66	2.10	10.34	2.45	572.25	99.02	14.87	4.51	55.96	21.70
Eucalyptus	E_G1	15.74	0.62	19.16	1.15	577.00	79.18	11.82	1.40	90.80	14.35
Melina	M_G1	20.21	1.88	18.37	1.86	552.39	175.22	17.76	4.72	147.75	44.24
Melina	M_G2	18.96	1.62	17.36	2.15	652.35	141.69	18.83	3.45	150.48	33.30
Melina	M_G2	8.97	0.85	6.61	0.80	824.00	59.33	5.46	1.08	30.17	4.15
Oak	R_G1	16.46	1.11	12.38	1.24	650.00	117.59	14.39	2.93	102.78	20.94
Teak	T_G1	17.54	1.37	14.49	1.17	656.50	116.86	16.08	2.94	112.88	24.89
Teak	T_G2	16.43	0.90	13.68	0.75	697.50	32.79	15.15	1.03	100.88	9.84

Information processing and estimates of the removal of CO_2e.

Field data were digitized and archived by CONIF in Excel format. 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. CONIF durante el proceso de remedición de sus parcelas 2011, empleó procedimiento de digitalización directa de las variables de campo en medios como el GPS Ashtech™ Mobile Mapper CX, por lo que cerca del 66% de la información en campo no se presenta en archivos físicos. CONIF, during the remeasurement of the plots by 2011, used the process of direct digitalization of field variables measured with GPS Mobile Mapper CX AshtechTM; therefore, about 66% of the field information is not present in physical files.The other 33% of the information obtained in the field was archived in physical formats (format field F_PRC_01) and then processed digitally in Excel spreadsheets. The remaining information was digitized directly in the field with the help of digital pocket.

C.7.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.

The follow up of forest establishment and management activities was under the responsibility of CORMAGDALENA during the initial phases, then under the responsibility of A.W. Faber Castell in the final phase. Currently the follow-up was pursued by each entity. The reports of follow-up are saved in format known as “technical visit record books”, as a result of the agreements established between project participants (CORMAGDALENA, landowners, ONF Andina).

Then, ONF Andina have access to follow-up reports in order to manage monitoring activities under the CDM.

Regarding the audit process of the forest inventory, ONF Andina was in charge of controlling the quality of the field work realized by CONIF, who was responsible of developing the field work, collecting the data in permanent sample plots. Annexe 9 refers to the audit report, highlighting deviations observed in the inventory process developed by CONIF, also pointing out how these variations did not affect the results and final objectives

Based on this scheme, 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: CONIF, as a National Corporation for Forestry Research and Enhancement (Corporación Nacional de Investigación y Fomento Forestal in Spanish), has conducted forest inventory activities in a permanent pool of farms during several years. These activities were related to follow-up forest establishment and management, sampling procedures and forest inventories *sensu stricto*. Hence CONIF counts with qualified staff for developing forest inventories. This was corroborated by the ONF Andina's auditor.

3. Control of measurement equipment quality: CONIF counts with high-tech equipments for the measurement of dendrometric variables as mentioned above. This fact guarantees the quality of data gathered in the field. Moreover, CONIF realizes periodic quality control of the measurement equipments (see certificate of equipment calibration in the annex 7).

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. Table 22 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 two auditing teams of ONF Andina, each team including two people. The auditing teams took new measurements of the dendrometric variables previously measured by CONIF teams. This was done for cross checking the measurements. Afterwards, the ONFAndina results were compared to the values reported by the CONIF inventory teams.

Table 22: Plots selected for the audit of field measurement and data entry. The sampling developed in 158 growing permanent sample plots; hence the 16 plots audited correspond to a bit more than the 10% of the sample plots something that is in line with the procedure of quality control.

Plot	Plot ID	Stratum	Coordinates	
			X	Y
1	101	T_G.1	X:74°40´04,93"	Y:10°11´2,84"
2	102	M_G.1	X:74°38'21,70"	Y:9°52'09,92"
3	20	C_G.1	X:74°38´34,01"	Y:10°10´45,74"
4	49	M_G.1	X:74°34´55,86"	Y:9°55´01,56"
5	50	M_G.1	X74:°35´00,47"	Y:9°55´00,14"
6	167	M_G.3	X:74°38´01,60"	Y:10°11´2,78"
7	118	M_G.1	X:74°37´59,74"	Y:10°09´51,70"
8	155	M_G.2	X:74°38´33,30"	Y:10°09´52,99"
9	119	M_G.3	X:74°38´15,45"	Y:10°10´00,20"

10	120	M_G.2	X74°40´11,48"	Y:10°10´20,01"
11	124	M_G.1	X:74°39´46,82"	Y:10°11´05,77"
12	24	M-G1	74°40'59,93"	10°10'24,85"
13	32	T_G.1	X:74°40´16,67"	Y:10°10´55,2"
14	33	T_G.1	X:74°40´05,64"	Y:10°11´22,18"
15	31	T_G.1	X:74°40´20,9"	Y:10°10´57,7"
16	21	T_G.1	X:74°40´04,93"	Y:10°11´2,84"

6. *Control of data entry*:. For this process, the data recorded in the field forms, (15% of the total farms) generated by CONIF's teams, were controlled and compared to the data presented in the digital files. The percentage error according to the formula is:

$$Mesurement\ error(\%) = \frac{Number\ of\ errors\ checked\ sample}{Total\ number\ checked}\ x\ 100$$

For the audit process, 23 plots out of 158 were controlled. Thus, 1211 input records were assessed. Relevant information to the error estimate is presented in Table 23.

Table 23: Sample selected for identifying data entry errors. The process followed the steps mentioned in the monitroing plan and in the verification data entry protocols. DBH: Diameter at breast height, H: height.

#	Plot No.	Variables Analyzed		Data entry Errors
		DBH	H	
1	57	41	16	5
2	58	41	16	0
3	52	30	16	4
4	1	15	15	0
5	7	47	18	0
6	8	27	16	0
7	9	38	16	1
8	10	37	16	0
9	11	33	17	0
10	12	42	16	0
11	17	36	17	0
12	18	40	16	0
13	19	36	16	0
14	120	38	16	0
15	32	43	17	3
16	33	42	15	0
17	34	42	17	0
18	35	49	16	0
19	47	25	16	0
20	38	41	16	0
21	39	37	16	1

22	41	29	16	0
23	42	30	16	0
Total Analyzed		**1211**		**14**

Analysis		**Sample Percentage**
Total plots	158	100,00%
Plots analyzed for error	23	14,56%
Data analyzed	1211	
Identified error	14	
Estimation of digitizing errors	***1,16%***	

The results of data entry errors are within the permissible values. It means, these are below the 10% allowed (1.16%).

7. Error estimation on biomass was calculated for inconsistent values between the field average values like the DBH and the values obtained by the auditing teams. The formula applied was:

$$Measurement\ error\% = \frac{Biomass_{Before\ corrections} - Biomass_{after\ corections}}{Biomass_{after\ corrections}}\ x\ 100$$

Biomass Before correction (data CONIF), Biomass after corrections (data audit CONIF).

An error of 2.68% was obtained. This result is below the 5% of maximum error admissible. The analysis is presented in the Excel file (Datos_auditoria_PRC_2011).

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

9. ONF Andina auditing team:

- Andrés Sierra B. Forest Engineer
- Edisón Gutierrez M. Forest Engineer
- Enrique Villamil. Zootechnitian

SECTION D. Data and parameters

This section include:

- Parameters used to calculate project and leakage GHG emissions.
- Relevant parameters required by the approved methodology and the monitoring plan.
- Specific information on how data and parameters have been monitored during the monitoring period.

Data that are determined only once for the crediting period but are used after registration of the project activity are included here under section D.1.

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors	
Data / Parameter:	**DLP**
Data unit:	**%**
Description:	Desired level of precision .
Source of data used:	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003.
Value(s) :	10 %
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Setting value considered for inventory estimates of forest stocks
Additional comment:	

Data / Parameter:	PL_i
Data unit:	**Dimensionless**
Description:	ID simple plot
Source of data used:	Defined by the Project.
Value(s) :	N.A
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	To identify specifically permanent sample plots.
Additional comment:	

Data / Parameter:	***Confidence level***
Data unit:	**%**
Description:	
Source of data used:	Defined by the Project Developer in accordance with the applied methodology.

Value(s) :	90 %
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Setting value considered for estimates of carbon stocks
Additional comment:	To develop an accurate inventory of timber volume and carbon stocks

Data / Parameter:	***E***
Data unit:	**%**
Description:	Allowable error. Defined by the project developer in accordance with the applied methodology.
Source of data used:	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003.
Value(s) :	10 %.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Setting value considered for estimates of carbon stocks
Additional comment:	To develop an accurate inventory of timber volume and carbon stocks

Data / Parameter:	BEF_{2j}
Data 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 used:	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003.
Value(s) :	3.4
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	GHG removals by each species in the project activity.
Additional comment:	It was applied to each stand model.

Data / Parameter:	***Root:shoot ratio, R***
Data unit:	**Dimensionless**
Description:	relationship between root biomass and shoot biomass
Source of data used:	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003.
Value(s) :	0.27
Indicate what the data are	GHG removals by each species in the project activity.

used for (Baseline/ Project/ Leakage emission calculations)	
Additional comment:	It was applied to each stand model.

Data / Parameter:	***Carbon fraction***
Data unit:	**Dimensionless**
Description:	Carbon fraction content in the biomass
Source of data used:	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003.
Value(s) :	0.5
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	GHG removals by each species in the project activity.
Additional comment:	It was applied to each stand model.

Data / Parameter:	**Ratio of the molecular weight of carbon dioxide to molecular weight of carbon. (44/12).**
Data unit:	**Dimensionless**
Description:	Ratio of molecular weights of CO_2-e and carbon.
Source of data used:	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003.
Value(s) :	3.67
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	GHG removals by each species in the project activity.
Additional comment:	It was applied to each stand model.

Data / Parameter:	$\boldsymbol{D_j}$
Data unit:	**t d.m. $\mathbf{m^{-3}}$**
Description:	Basic wood density for species *Bombacopsis quinata.*
Source of data used:	Cordero y Boshier (2003)[33], El semillero[34]
Value(s) :	0.45
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	GHG removals by *Bombacopsis quinata* in the project activity.
Additional comment:	

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

[34] http://elsemillero.net/nuevo/index.php?option=com_wrapper&view=wrapper&Itemid=212

Data / Parameter:	D_j
Data unit:	**t d.m. m^{-3}**
Description:	Basic wood density for species *Eucalyptus tereticornis*
Source of data used:	Refocosta[35].
Value(s) :	0.69
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	GHG removals by *Eucalyptus tereticornis* in the project activity.
Additional comment:	

Data / Parameter:	D_j
Data unit:	**t d.m. m^{-3}**
Description:	Basic wood density for species *Gmelina arborea.*
Source of data used:	Obregon (2006)[36].
Value(s) :	0.53
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	GHG removals by *Gmelina arborea* in the project activity
Additional comment:	

Data / Parameter:	D_j
Data unit:	**t d.m. m^{-3}**
Description:	Basic wood density for species *Tabebuia rosea.*
Source of data used:	IPCC (2006)[37], Refocosta[38].
Value(s) :	0.54
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	GHG removals by *Tabebuia rosea* in the project activity.
Additional comment:	

Data / Parameter:	ID_{ikt}
Data unit:	**Alpha numeric**

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

[36] 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.revista-mm.com/ediciones/rev50/especie.pdf.

- Roble-Flor morado. http://www.unalmed.edu.co/~lpforest/PDF/Roble,%20flor%20morado.pdf.

[37] IPCCC. 2006. Guidelines for National Greenhouse Gas Inventories. Complementary tool for default parameter.

[38] Oak - Purple Flower. http://www.refocosta.com/en_refocosta_03especies04.html

Description:	*Ex-post* stratum 1, 2, 3, …
Source of data used:	Determined by project developer
Value(s) :	N.A
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Required for the stratification of the project during the estimations of carbon sequestration.
Additional comment:	Associated with each stand model, basically defined by the species.

Data / Parameter:	***XF***
Data unit:	**Numeric**
Description:	Plot expansion factor from per plot values to per hectare values)
Source of data used:	By mathematic analysis.
Value(s) :	**20** (by plot with 500 m^2) and **12,5** (by plots with 800 m^2).
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Calculation of GHG removal is based on the results of the inventory of carbon pools in sample plots.
Additional comment:	The plots vary in size according to planting density.

D.2. Variables that were monitored for estimates of carbon sequestration in the project according to the PDD and the project monitoring plan.

The variables that were monitored and fed the databases to estimate the net GHG removals by project activities are described in this section. It included only those that required the use of equipment for their measurement.

D.2. Data and parameters monitored used to calculated net removals.	
(Copy this table for each data and parameter. To report multiple values, a table may be used)	
Data / Parameter:	***A***
Data unit:	**ha.**
Description:	Total area of project, 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.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project carbon capture.

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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:	Continuously, during the beginning of site preparation activities and final establishment.
Calculation method (if applicable):	
QA/QC procedures applied:	- Protocol for project boundary delimitation. - Protocol of project boundary control with the addition of new areas under control.

Data / Parameter:	***Ai***
Data 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. Polygons are distributed according to stratum and planted areas by 2011.
Value(s) of monitored parameter:	Ceiba_G1 260,8 Ceiba_G2 59,6 Eucalipto_G1 45,7 Melina_G1 1 397,8 Melina_G2 470,5 Melina_G3 499,9 Roble_G1 165,7 Teca_G1 184,8 Teca_G2 40,8 **Total 3 125,52**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project carbon capture.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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:	Continuously, during the beginning of site preparation activities and final establishment. According to the planted species by 2011.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	- Protocol for project boundary delimitation.

Data / Parameter:	A_{ikt}
Data 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:	3 1235,52 ha
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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:	Analysis of the final results of monitoring the project boundary via *Ai*.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	- Protocol for project boundary delimitation.

Data / Parameter:	***AP***
Data 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.
Indicate what the data are used for (Baseline/ Project/	Project carbon capture.

Leakage emission calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Metric tape of 30 m. Precision of 2 mm.
Measuring/ Reading/ Recording frequency:	Monitoring and measurement plots in the field.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	- Protocol for project boundary delimitation.

Data / Parameter:	***DBH***
Data 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.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project carbon capture.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Metric tape of 30 m. Precision of 2 mm.
Measuring/ Reading/ Recording frequency:	Monitoring and measurement plots in the field.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	- Protocol for taking dendrometric measurement variables

Data / Parameter:	***H***
Data unit:	**m**
Description:	Merchantable height of trees
Measured /Calculated /Default:	Measured
Source of data:	Field measurement
Value(s) of monitored	At least 14 trees were taken in each plot to measure its height.

parameter:	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project carbon capture.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	- Haglöf Laser Vertex Hypsometer Resolution: Angle Range, -55° to 85°; Resolution, 0.1°; Accuracy, ±0.1°. - Nikon Forestry 550 Laser Rangefinder/Hypsometer. Resolution: 0.5m
Measuring/ Reading/ Recording frequency:	Monitoring and measurement plots in the field.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	- Protocol for taking dendrometric measurement variables

Data / Parameter:	***lat/long***
Data unit:	**Plot location**
Description:	Localization each sampling plots
Measured /Calculated /Default:	Measured
Source of data:	Data field sampling
Value(s) of monitored parameter:	See CAMARA.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project carbon capture.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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:	Field sampling.
Calculation method (if applicable):	See Table 15.
QA/QC procedures applied:	- Protocol for establishing plots

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

>> N.A

E.2. Project emissions calculation

>> In the framework of the proposed AR CDM project activities, project emissions are generated by the decrease of the carbon stocks in carbon pools of the living biomass of non-tree vegetation during site preparation at project start. The calculation of project emissions was made based on average biomass content in each baseline stratum.

$$E_{biomasslos} = A_{ik} \cdot B_{pre,ik} \cdot CF_{pre} \cdot \frac{44}{12}$$

Where:

$B_{pre,ik}$ Average pre-existing stock of non-tree pre-project biomass on land to be planted before the start of the proposed A/R CDM project activity for baseline stratum i and stand model k, t d.m. ha^{-1}

CF Carbon fraction of biomass.

44/12 Ratio of molecular weights of carbon and CO_2

A_{ik} Area of stratum in base line.

Sources of information were taken from Dufour (2005), who measured the contents of non-tree biomass in the baseline strata.

Table 24: Estimation of emissions from suitability of areas for planting.

ID stratum	Stratum	Mean biomass stock in AGB (t d.m.ha^{-1})	Total AGB and BGB mean carbon stock (tC.ha^{-1})	Area (ha)	Mean carbon stock in stratum (tC)	carbon stock in stratum (tCO_2eq)
BLS1	Clean pastures	1,80	2,28	1 208,6	2 750	10 084
BLS2	Pastures with fallows	17,18	21,72	1 397,0	30 341	111 252
BLS3	Fallows	21,48	27,16	597,9	16 236	59 532
Total baseline carbon stock in ABG and BGB within project boundary, in tons of carbon (tCO2eq)						***180 868***

E.3. Leakage calculation

According to the demonstration made in the PDD leakage is estimated at zero.

Therefore:

$$LK = LK_{ActivityDisplacement} = LK_{conversion} + LK\ fuel\text{-}wood = 0$$

See section D.2. in the PDD, estimate of the ex ante leakage.

E.4. Emission reductions calculation / table

>>

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 CO_2 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 equation (13) of the methodology AR-AM0004 / Version 04:

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

where:

C_{ACTUAL}: Actual net greenhouse gas removals by sinks; t CO_2-e
$\Delta C_{P,LB}$: 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

The changes in living biomass carbon stocks were estimated using the stock change method as proposed in the applied methodology AR-AM0004 / Version 04. Thus, the equations (9) to (11) of the methodology were used:

$$C_{ikt} = C_{AB,ijt} + C_{BB,ijt}$$

$$C_{AB,ijt} = A_{ijt} \cdot V_{ijt} \cdot D_j \cdot BEF_{2,j}$$

$$C_{BB,ijt} = C_{AB,ijt} \cdot R_j$$

Where:

C_{ikt} Carbon stock in living biomass for stratum *i*, stand model *k*, time *t*; t C
C_{ABijt} Carbon stock in above-ground biomass for stratum *i*, species *j*, at time *t*; t C
C_{ABijt} Carbon stock in below-ground biomass for stratum *i*, species *j*, at time *t*; t C
V_{ijt} Average volume of stratum *i*, species *j*, at time *t*; $m^3.ha^{-1}$
D_j Basic wood density of species *j*; t d.m. m^{-3} merchantable volume
BEF_{2j} Biomass expansion factor for conversion of merchantable volume to above-ground tree biomass for species *j*; dimensionless
Rj Root-shoot ratio for species *j*; dimensionless

Values of D_j, have been updated through existing scientific literature. BEF_{2j} and Rj used for final estimations are the same recommanded by IPCC GPG LULUC.

Table 25: Actual net GHG removals by sinks in carbon pools by stratum, based on *ex-post* stratification.

ID stratum	Stratum	Mean carbon stock ($tC.ha^{-1}$)	Area (ha)	Mean carbon stock in stratum (tC)
Ceiba_G1	*Bombacopsis quinata_8- 11 years*	75,20	260,76	19 609
Ceiba_G2	*Bombacopsis quinata_5-7 years*	36,04	59,60	2 148
Eucalipto_G1	*Eucalyptus tereticornis_8-11 years*	29,64	45,69	1 557
Melina_G1	*Gmelina arborea_8-11 years*	116,67	1 397,81	163 083
Melina_G2	*Gmelina arborea_5-7 years*	107,41	470,51	50 538
Melina_G3	*Gmelina arborea_1-4 years*	24,46	499,89	12 230
Roble_G1	*Tabebuia rosea*	119,83	165,68	19 485
Teca_G1	*Tectona grandis_8-11 year*	56,01	184,76	10 348
Teca_G2	*Tectona grandis_5-7 years*	51,11	40,83	2 087
				281 086
Total actual carbon stock in ABG and BGB within project boundary, in tons of carbon ($tCO_2eq.$)				***1 030 647***

Uncertainties were estimated and expressed as half the 95% confidence interval width divided by the estimated value,

$$U_s(\%) = \frac{\frac{1}{2}(95\%ConfidenceIntervalWith)}{\mu} \cdot 100$$
$$= \frac{\frac{1}{2}(4\sigma)}{\mu} \cdot 100$$

Where:
Us = percentage uncertainty of each species within sub-stratum, %
μ = mean value
σ = standard deviation

The percentage uncertainties on quantities that are the product of several terms were then estimated using the following equation:

$$U_s = \sqrt{U_1^2 + U_2^2 + \cdots U_n^2}$$

Where:
US percentage uncertainty of product (emission by sources or removal by sinks);
Ui percentage uncertainties associated with each term of the product (parameters and activity data),*i* = 1,2,…,*n*

The percentage uncertainty on quantities that are the sum or difference of several terms was estimated using following simple error propagation equation

$$U_c = \frac{\sqrt{(U_{s1} \cdot C_{s1})^2 + (U_{s2} \cdot C_{s2})^2 + \cdots + (U_{sn} \cdot C_{sn})^2}}{\left|C_{s1} + C_{s2} + \cdots + C_{sn}\right|}$$

Where:
Uc = combined percentage uncertainty of sub-stratum, %
Usi = percentage uncertainty of species *i* in the sub-stratum, %
Csi = mean carbon stock of species *i* in the sub-stratum

The percentage of uncertainty was calculated through CAMARA.

The final value of $\boldsymbol{U_c = 5,44\%}$

Total project emissions:

GHG_E represent the GHG emissions resulting from site preparation. See Table 21.

GHG_E= ***180.868*** **tCO_2eq**

The actual net GHG removals by sinks are presented in Table 26.

Table 26: Results of net anthropogenic GHG removals by sinks.

Total project emissions Only from site preparation GHG_E (tCO_2eq).	**Total leakage: *LK***	***Biomass carbon stocks*** $C_{P,LB}$ **(tCO_2eq)**	***Actual net greenhouse gas removals by sinks t CO_2-e***
180 868	**0**	***1 030 647***	***849 780***

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

>>

In accordance with Table 9 of the PDD and TARAM[39], the actual net GHG removals estimated *ex-ante* for the first period of verification is ***763 017*** **tCO_2eq**

[39] TARAM. Tool for Afforestation and Reforestation Approved Methodologies V1.4. Applied in 2011 for validation PRC project A/R. Anexx 10.

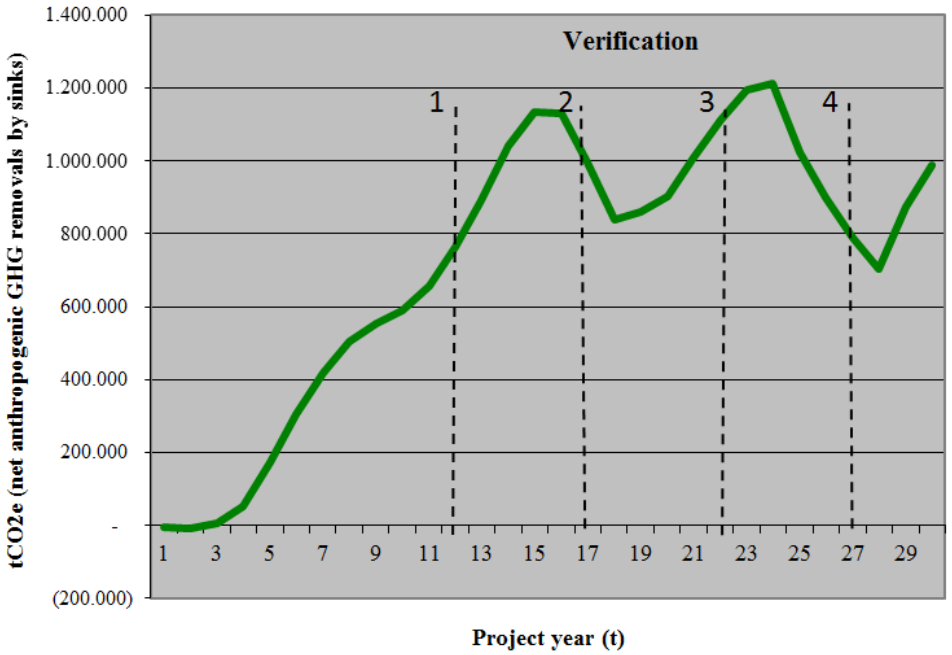


Figure 21: Projection of CO_2eq accumulation, in the phase exante of the project. Source: TARAM of the PDD.

Table 27: Comparison of *ex-ante* and *ex-post* estimation of actual net GHG removals by sinks by carbon pools within project boundaries.

Item	Values applied in *ex-ante* calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	***763 017***	***849 780***

The difference between *ex-ante* estimation of actual net GHG removals by sinks and *ex-post* estimation of actual net GHG removals by sinks is **86 763 *(*tCO_2eq),** the *ex-post* estimation being 11,37% above the ex-ante estimation.

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

>>

As described in section C, and *ex-post* stratification was made based on two principal stratification criteria: species and plantation year. Initially, two strata were identified depending on one stratification criteria: behavior of species in terms of growth (Table 28). With stratification criteria determined *ex-post*, nine strata were identified (Table 25).

Table 28: *Ex-ante* stratification of the project scenario, see PDD.

ID stratum (*i*)	**Stand model (*k*)** Stratification criteria **Management plan/rotation (*j*)**	**Species**
SM1	*Short-term rotation (1)*	*Gmelina arborea* *Eucalyptus tereticornis*
		Sub total SM1
SM2	*Mid-term rotation (2)*	*Bombacopsis quinata* *Tabebuia rosea* *Tectona grandis*
		Sub total SM2

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History of the document

Version	**Date**	**Nature of revision**
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		