Monitoring report form

(Version 05.1)

MONITORING REPORT		
Title of the project activity	CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia	
UNFCCC reference number of the project activity	9199	
Version number of the monitoring report	Version 01	
Completion date of the monitoring report	Date 12/12/2016	
Monitoring period number and duration of this monitoring period	First monitoring period Monitoring period: 02 June 2005 – 16 Feb 2016	
Project participant(s)	Bosques de la Primavera S.A.	
Host Party	Colombia	
Sectoral scope(s)	Afforestation and Reforestation (14)	
Selected methodology(ies)	Reforestation or afforestation of land currently under agricultural use, ARAM0004, Version 04	
Selected standardized baseline(s)	NA	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	***1,618,206*** tCO2eq.	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	0	***1,186,468*** tCO2eq.

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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

The *CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia* has as its objective to employ the international carbon market as a key incentive for investments in new commercial forest plantations and restoration of natural forests in the remote High Orinoco region of Colombia.

- The project is based on changing the use of land from extensive cattle ranching to sustainable forest production systems, restoring natural forest cover, and creating a landscape of biological and productive corridors that produce financial, social and environmental services for the region. These include the mitigation of climate change, regulation of water flows, expansion of habitat and conservation of the flora and fauna of the Orinoco region, among others.
- Locally, the social benefits of the project include the direct and indirect creation of employment, the technification of manual labor, the development of social and productive infrastructure, and the demonstration of how the CDM and carbon markets may support the sustainable development of the region. The project is drawing labor force away from the illegal crops which have plagued the region.

The project was originated in 2005, when the Ministry of Agriculture and Rural Development began a program to promote the CDM as a means to financially bolster and promote reforestation and afforestation activity in the region

The project is a private initiative composed of 6 groups: Organización La Primavera S.A., Bosques de la Orinoquía S.A., Bosques de La Primavera S.A., the María Padres Monfortianos Company, the Reforestadora Guacamayas S.A. and the Reforestadora Los Cambulos S.A.S.

The total area of the project is 29,019 hectares' eligibility. An extensive cattle ranching based on regular anthropogenic burning of grasslands has been the dominant model of land-use for over a century. As a result of the remoteness, lack of infrastructure and high transportation costs, this system has dominated land-use: 90% of the productive land of the Municipality of La Primavera is devoted to livestock grazing (Land Management Plan - EOT 2000).

21,527.0 Hectares have been established in commercial stand models and in natural regeneration systems for the current monitoring period. The project achieved the replacement of activities that historically have been developed in the project area. Instead of those activities that used to lead soil degradation, today are covered by commercial forest systems and recovery of native forests with natural regeneration. These new systems have allowed the connectivity between *gallery forests*, plantations and area in recovery for the mobility of species of fauna and improving the flow gene between relicts of forests.

Among the aspects to be highlighted during the current period are the ability to recover degraded soils, due to the unsustainable use of land to livestock production and the continuous burnings to which they were subjected historically. Nowadays by the implementation of the project, soils have horizons with organic compounds that were not distinguishable at the beginning of the process. Therefore, the assessment of this additional sink is included to validation process to those already submitted, as a significant contribution in the soil recovery.

The organizational structure observed permits the implementation of monitoring actions on silvicultural, social and environmental activities (Diagram 1), and have a special emphasis on components related to the CDM (Diagram 2).

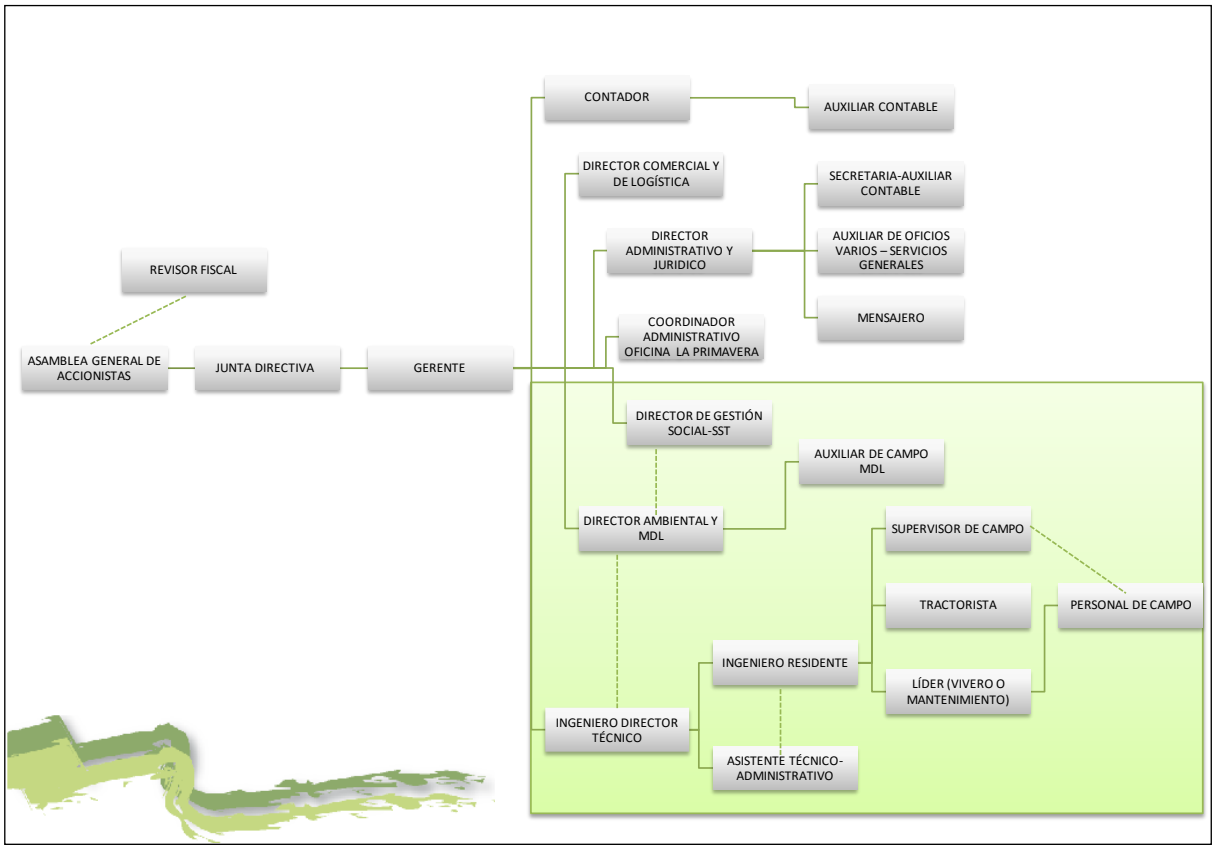

Diagram 1. Organization chart Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia.

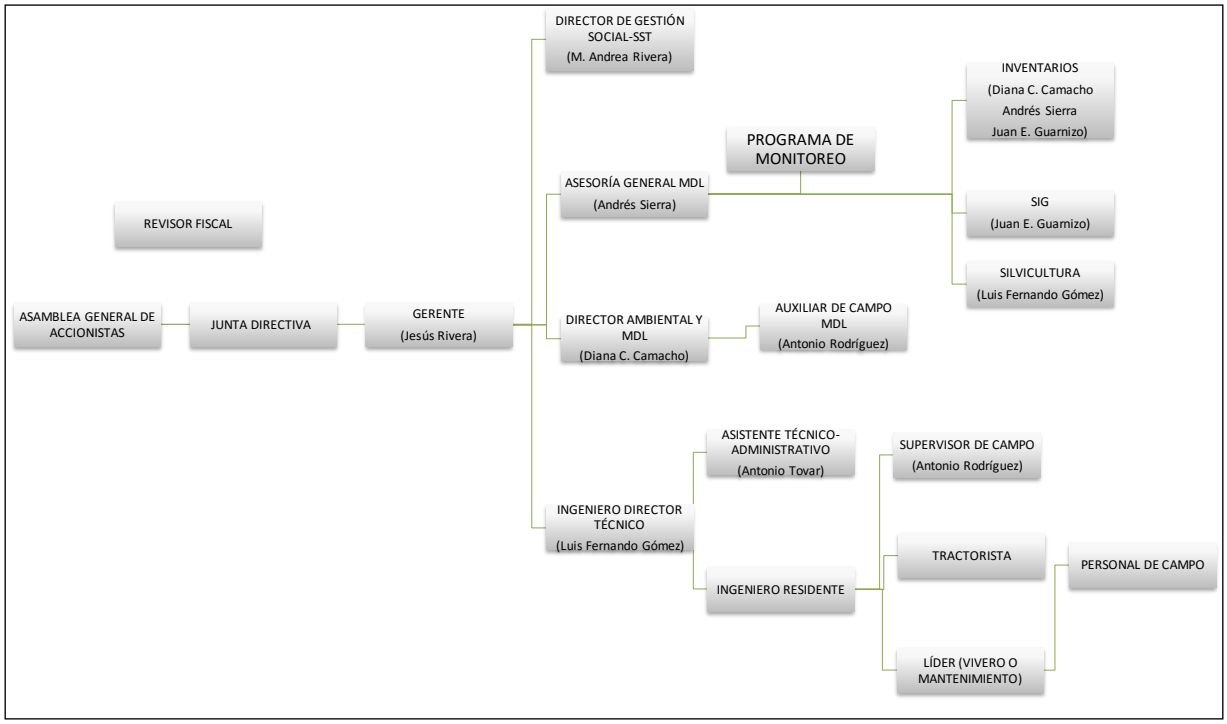

Diagram 2. Organization chart monitoring CDM.

Total removals estimations of atmospheric carbon by the project implementation are 1,531,236 tCO2 eq. This includes contributions from aboveground and belowground sink.

b) Installed technology and equipment.

In general, the project has developed to 2015 two models for stands: commercial and natural regeneration. The commercial model is based on the establishment of the species: *P. caribaea*, and a few tests with *P. oocarpa*; representing 88% of total area of the commercial stand. The rest of commercial areas were established with species such as *Tectona grandis*, *Acacia mangium* and *Eucalyptus pellita*, and some test with native species such as "congrio" (*Acostimions nitens*) were developed under the same commercial establishment plans, but these last will be areas for trials to natural regeneration[1]. Total of the commercial stand consists of 18,304.5 ha that have been established since 2005.

For the development of natural regeneration, the project released the pressure that cattle used to make on the soil, and eliminated the burning in that area by leaving a spontaneous recovery of the land covers. To 2015 have been identified land recovery in 32,22.5 h, which are in early successional processes (Photo 1).

Photo 1. A y B, Early Development of Natural Regeneration.

The activities of establishment and forest management of the commercial stands began since 2005. In the same year, the actions started for encouraging the regeneration of the natural forest. The project has maintained and supported actions to enforce the care and positive contribution to the environment, for which it conforms to the regulations of the regional environmental entity CORPORINOQUIA. Commercially-oriented stands keep the forest management activities, such as pruning, weed-release, and replanting among others. Areas with planting trials with native species strictly follow the technical recommendations of the environmental corporation, thus, only weed-release interventions are used for fertilization and replanting, but they are not pruned nor thinning or harvested foreseen, as they are areas of natural recovery. Natural regeneration in transition areas of gallery forests and plantations has been essential for structuring the biological corridors in the project.

Activities such as establishment of the areas to cultivate, planting, weed control, fertilizing and pruning procedures are similar in the commercial plantations of the four species and in the model of assisted natural regeneration. However, the specific procedures for each of the species involved are detailed in the *Plan for Establishment and Forest Management*. A brief description of the activities is presented below.

Nursery: The seedlings are produced in a transitional nursery, which for this purpose was installed on each farm with a capacity of 500,000 to 1,000,000 seedlings. The best quality seeds will be

[1] Accorded activity with the regional environmental entity CORPORINOQUIA.

used and the seedlings are produced in tubular bags (bottomless) of 7 cm in diameter and 13 cm in height, with good resistance and root formation. Seeds for commercial species are available from certified suppliers; seeds for the ANR are gathered by hand from the local natural forests and seedlings are produced in a central nursery dedicated only to native species.

Photo 2. The tree nursery. *Pinus caribaea*

Establishing the plantation:

Planting will take place between the months of May, June, July and August, which are the months of most precipitation in the region.

***Planting density*:** planting density will be 1,001 trees per ha. Spaced at 3.16 x 3.16 m in a square.

Plantation layout: will be in stands according to the high land areas that do not flood. The low land areas that flood will not be planted.

Field preparation: Previous to the preparation of the terrain for planting, the team carries out basic activities including the elimination of minor vegetation, removal of rocks, and staking out the 50-meter buffer area to protect the adjacent natural forests. The preparation for planting is mechanized, with tractors.

Photo 3. Field preparation.

***Planting*:** is carried out manually, by removing the bag without crumbling the loaf of soil and slightly pruning the root. The area around the tree should be pressed by the feet of the worker, preventing air pockets from remaining in the hole.

Photo 4. Hand-Planting the tree.

***Fertilization*:** 8 days before the seedlings are taken to the field, fertilizer is applied to the leaves in dosages of 100 grams per each 20 liters of water, in order to improve the resistance and the vigor of the plant for transplanting in the field and adaptation to the new habitat in which it is develop. In the field, fertilization will be carried out after 25 – 30 days after planting, by irrigation with a mix that includes mycorhizae. The project will carry out regular nutritional evaluation (visual observations and plant leaf tissue analysis) of the plantation, and provide any additionally required nutrients.

***Plant sanitation*:** controls will be carried out when necessary (manual, chemical and cultural) to prevent infestations by Attar ants. These practices will be carried out within a program of integrated pest and disease management (IMP), which includes monitoring and timely reporting and an internal training plan for technicians and operators led by the Organization's head technician (Bosques de La Primavera S.A.).

Photo 5. Forest pest control in the project.

***Fire control and prevention**:* although firebreaks will be cleaned during the dry seasons, it will be necessary to train staff to monitor and control during periods of high risk with the equipment and instruments suitable for these tasks, such as beat-fire pumps, back-hoes, shovels, machinery and other alternatives. To this end a Control Pump was purchased for the project. In addition, it will emphasize the Prevention and Attention to Forest Fires Program, which includes training by Forest Brigadiers and preventive forestry techniques.

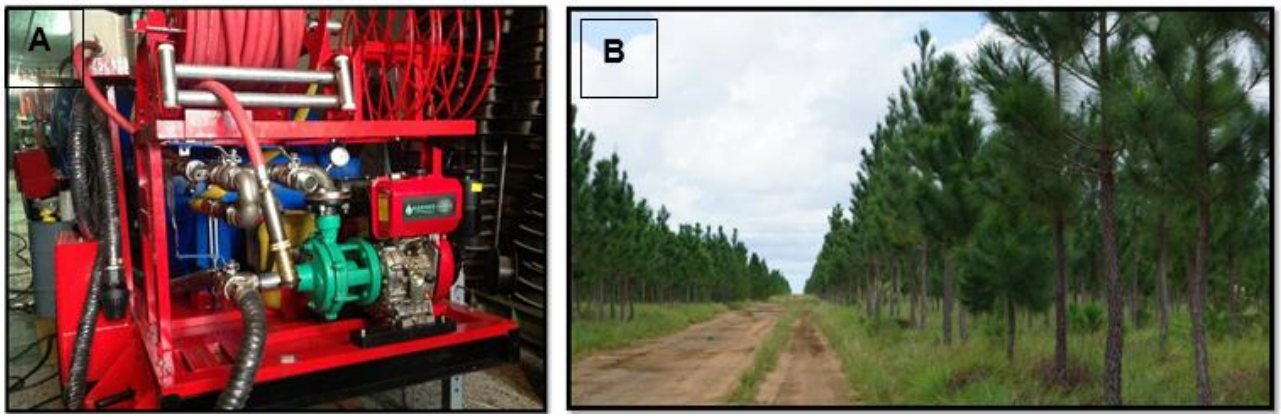

Photo 6. Fire control. A, fire control equipped. B, Firebreaks. Bulldozers and special plows are used to clear fire lanes or firebreaks.

Forest management

Weed Control: During the first year after planting, the plate (80cm) surrounding the planted seedling is maintained completely free of weeds in order to permit the development of the plants and avoid attacks from pests and diseases. For the species, *Pinus caribaea* and *Eucalyptus pellita*, the plates are cleaned of weeds three times per year during the first three years in order to prevent the highly aggressive Gramineous species of the region from crowding out the planted tree.

Pruning: is done to the extent that the development of trees requires it, in order to obtain the best quality of wood. It is believed necessary to perform this activity from the second or third year. The basic criterion for pruning is to eliminate the side branches of trees up to 50% of their total height. This activity is done in order to prevent the formation of knots in the wood.

Photo 7. First tree pruning.

Thinning: all malformed trees (twisted, forked and defective) will be felled to avoid inefficient competition for space and nutrients with well developed trees. This operation is done from the fifth year of the project. The procedure begins with the selection of individuals to be cut based on the intensity established (Table A.7).

For the *Pinus sp.* thinning, will be done in year 5, 9 and 12. One objective of the first thinning is to eliminate poorly formed individuals and branches, and those trees that present physiological deficiencies. The maximum allowed elimination is 30%, in order to leave 700 trees per hectare. The first thinning does not generate commercial products. The second thinning also focuses on eliminating poorly formed individuals and those that present physiological deficiencies. Again, the maximum allowed elimination is 30%, in order to leave 490 trees per hectare. The third thinning, in year 12, will again eliminate 30% of the stand.

For the *A. mangium*, thinning will be done in year 5 (20%), and the last harvest will be done in year 10. For the *T. grandis*, the first thinning will be at 10 years, removing 20% of the volume at 15 and, 20, years, 30% of the total inventory at the time of the thinning to perform the final harvest at year 25, considering plantation turn. For the *E. pellita* a thinning is planned for year 5 to eliminate 30%

of the stand, and another at year 9 that extracts 40%. . A mortality rate of 5% is expected for every species.

The first thinning, does not develop in its entirety followed, due to the natural mortality and regulations in the pinus and other species in the commercial stand.

In order to maintain forest management monitoring activities, work contracts are carried out. These are recorded and located in physical papers at the main offices, and from there the information is taken for the balance of activities, an example of this monitoring is presented in the Table 1.

Table 1. Example of the monitoring exercise to record the activities of maintenance and forest management. The logs that feed the database are executed by Works contracts.

COMPANY	ACTIVITY	CONTRACTOR								
		2005	2006	2007	2008	2009	2010	2011	2012	2013
Organización La Primavera SA	NURSERY	Román Jaramillo	Román Jaramillo	Álvaro Rodríguez	Álvaro Rodríguez	-	Osvaldo Torres Usme	Henry Mendoza-Ricardo Reyes	Cristian Pérez	Alex Pérez
	MAINTENANCE	-	Jesús Fernández	Jesús Fernández	Jesús Fernández-Omar Rodríguez	Jesús Fernández	Jesús Fernández	Jesús Fernández	Jesús Fernández	Jesús Fernández
Bosques de la Orinoquia SA	NURSERY			Osvaldo Torres Usme	Osvaldo Torres Usme	Osvaldo Torres Usme	Henry Mendoza	-	Omar Rodríguez	Omar Rodríguez
	MAINTENANCE			-	-		Wilson Martínez	Wilson Martínez	Jose Luciano Neiva	Omar Rodríguez
Bosques de la Primavera SA	NURSERY				Mauren Dila Chavez	Mauren Dila Chavez	Alberto Rodríguez	Alberto Rodríguez	Alberto Rodríguez	Marelbi Hernández
					Alvaro Carvajal	Alvaro Carvajal	Alvaro Carvajal	Alvaro Carvajal	José Hidalgo Niño	José Hidalgo Niño
						Omar Méndez	José Hidalgo Niño	José Hidalgo Niño	Carlos Márquez	Cristian Leonardo Pérez-Alberto Rodríguez
	MAINTENANCE				-	Elvia Maria Camacho	Elvia Maria Camacho	Elvia Maria Camacho	Elvia Maria Camacho	Elvia Maria Camacho
					-	Gilbert Quintero	Nelson Mora	Nelson Mora	Nelson Mora	Nelson Mora
Compañía de María Padres Montfortianos	NURSERY				Eliecer Guzmán	Eliecer Guzmán	Eliecer Guzmán	Eliecer Guzmán	Eliecer Guzmán	Héctor Coronado
	MAINTENANCE				-	-	Marisela Santa	Wilson Márquez	Héctor Coronado	Héctor Coronado
Reforestadora Guacamayas SA	NURSERY					Sergio Méndez	Sergio Méndez-Miguel Rojas	Luis Octavio Castaño-Miguel Rojas	Uberney Castaño-Francisco Navarro	Uberney Castaño-Hugo Salazar
	MAINTENANCE					-	-	Libardo Castaño	Libardo Castaño	Libardo Castaño
Reforestadora Los Cambulos SA	NURSERY						Osvaldo Torres Usme	Marisela Santa	Luis Octavio Castaño	Luis Octavio Castaño
	MAINTENANCE						-	-	Albert Pinzon-Jerson Pérez	Luis Octavio Castaño
Fundación Obra Social Redentorista Señor de los Milagros	NURSERY							Osvaldo Torres Usme	Osvaldo Torres Usme	Durley de Jesús Castaño
	MAINTENANCE							-	Elmer Jose Arias	Jerson Pérez Silva

Harvest plan

The harvests of the species are to be held in the year of the period established for each, as follows: *P. caribaea* 18 years, *A. mangium* 12 years, *T. grandis* 25 years and *E. pellita* 15 years, unless the wood market conditions are unfavorable. In that case the owners may choose to leave the trees in the ground and continue to sequester carbon. This may occur if paved roads, bridges

and related transport infrastructure are not built by the government. The harvesting activities have been displaced, due to low developed the commercial stand (Table 2).

Table 2. General thinning schedule for species, which make up the commercial stand model.

Species	Tree ha^{-1}	Thinning 1			Thinning 2			Thinning 3			Final turn	
		t (yrs)	% Ext.	% Mort.	t (yrs)	% Ext.	% Mort.	t (yrs)	% Ext.	% Mort.	t (yrs)	N_f
P. caribaea	1040	12	25	5	14	40	5	16	50	5	20	197
A. mangium	1040	12	20	5	15	50	5	-	-	-	12	371
T. grandis	1040	10	20	5	15	30	5	20	30	5	35	153
E. pellita	1040	-	-	-	-	-	-	-	-	-	15	1040

Tree ha^{-1}: initial tree density.

% Ext.: thinning percentage (removal).

% Mort.: considered mortality percentage.

N_f: final tree density corresponds to the quantity of trees harvested during the turn of the species.

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

Plantation began in June 2005 by gradually incorporating suitable areas for the establishment of commercial stands. These activities were most intense in the years 2009 to 2013 (Table 3). The plantations were completed in 2014 and the new activities have focused on maintenance and restoration. Maintenance activities have been carried out every year, according to the age of the lots and the stands in general. The records of these activities are supported by the work contracts developed by technicians and field workers[2].

Table 3. Distribution of plantations and regeneration areas over time.

t	*year*	*Area (ha)*	*Cumulated area (ha)*
0	2005	441,00	441,00
1	2006	568,00	1.009,00
2	2007	885,00	1.894,00
3	2008	1.557,00	3.451,00
4	2009	3.547,00	6.998,00
5	2010	3.338,00	10.336,00
6	2011	3.518,60	13.854,60
7	2012	2.683,90	16.538,50
8	2013	3.503,70	20.042,20
9	2014	1.400,83	21.443,03
10	2015	84,00	21.527,03
11	2016	***21.527,03***	***21.527,03***

Planting will take place between the months of May, June, July and August, which are the months of most precipitation in the region.

[2] Records of these activities are in the logs of contracted and executed work. The records shall be made available in physical form to the auditor.

The forest inventory processes were carried out between December 2015 and February 2016.

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

The vegetation covers in the project activity sites are pasture grasses, burned grasses and scrublands in the base line. The predominant economic activity of the project area is based on extensive cattle ranching. This activity usually lacks appropriate technological packages, generating high pressure on the grasslands and the only food and energy sources available for livestock. The combination of natural wildfires during periods of intense summer and regular anthropogenic grassland burning for cattle grazing degrade the soil, as minerals are lost and the physical conditions such as porosity, among others, are altered.

According to the methodology applied and the validated PDD[3], carbon contents in base line are assumed to be zero $C_{bsl}= 0.$

Leakeage by activity displacement were shown to be zero. $L.K_{conversión}= 0.$

The total values of reduced emissions are estimated to be 1,186,468 tCO2eq. These are distributed in five strata defined for the present verification period (Table 3). Anthropogenic net removals estimations are presented in the tool: Carbon_capture_AR_primavera_v01 (it is appended to the report as a confidentiality document to the auditor).

Table 4. Ratio of reduced emissions per stratum for the present verification period.

Estratum	Area ratio	Average CO_2 stock (ton).	Total	
			Area (ha)	*tCO2 total*
LOW	*11%*	*6.58*	*2,400.9*	*15,800*
REGULAR (STEADY)	*32%*	*29.73*	*6,936.2*	*206,186*
MEDIUM (MIDDLE)	*29%*	*68.87*	*6,136.1*	*422,576*
HIGH	*13%*	*176.90*	*2,831.3*	*500,862*
***N_R* (Natural Regenerations)**	*15%*	*12.74*	*3,222.5*	*41,044*
Total			***21,527,0***	***1,186,468***

Table 5. Final removals in tonnes CO2eq.

$\Delta C_{P,LB}$ Sum of the changes in living biomass carbon stocks (above- and below-ground); t CO2-e	C_{BSL} Baseline net GHG remvals by sinks (t CO2-e)	GHG_E Emissions (t CO2-e)	LK Leakage (t CO2-e)	tCERs
1,186,468	0	0	0	***1,186,468***

A.2. Location of project activity

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[3] See validated PDD.

(a) Host Party

Colombia

(b) Region/ State/ Province

Department of Vichada

(c) City/ Town/ Community

Municipality of La Primavera

(d) Physical/ Geographical location

The *CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia* is located in the Municipality of La Primavera in the Department of Vichada (6º19'34'' y º53'58'' N y 67º25'1'' y 71º7'10'' W) in the extreme eastern plains of the Colombian High Orinoquia region (CORPORINOQUIA, 2008[4]). The Municipality of La Primavera is located approximately 400 km from Puerto Carreño, the capital of the department, and limits to the North with the Departments of Casanare and Arauca and the border of Venezuela. To the South, it limits with the Municipality of Cumaribo, to the East with the Municipality of Puerto Carreño and to the West with the Municipality of Santa Rosalía. The Municipality of La Primavera has an area of 21,420 km^2 which represents 22% of the total land area of Vichada (Figure 1) (CORPOORINOQUIA 2008).

The Meta River is the main means of transportation during the rainy season, and dirt roads become more used in the dry seasons; municipal access from the project site is by unpaved roads. The Municipality has a large but untapped potential for tourism thanks to its scenic richness and unique, abundant biodiversity (CORPORINOQUIA, 2008).

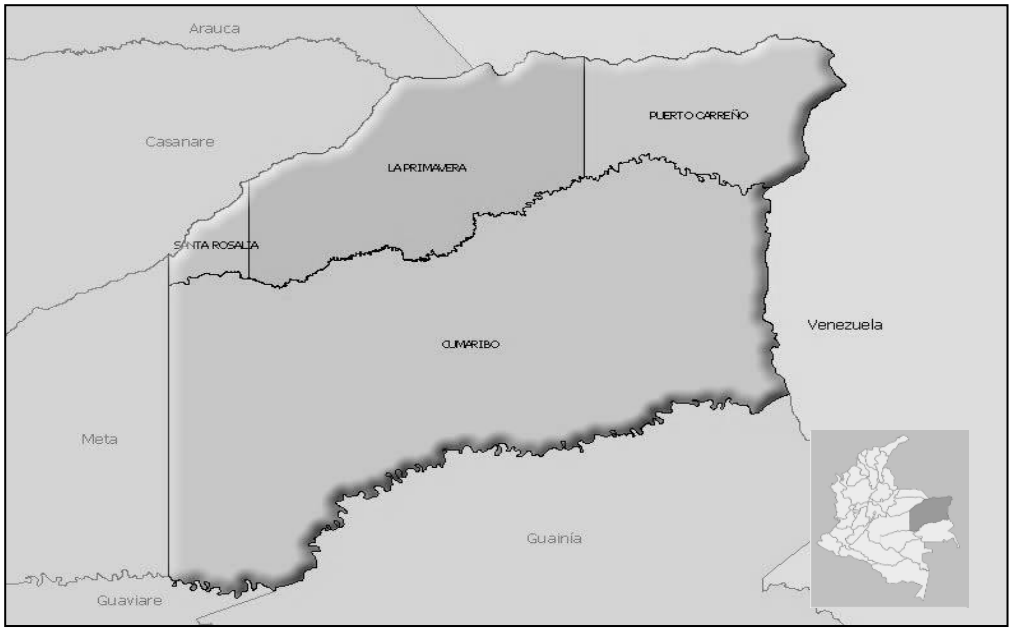

Figure 1. Location of the Municipality of La Primavera, department of Vichada.

Location of the forest project nuclei that make up the Project

[4] Corporación autónoma regional de la Orinoquia - CORPORINOQUIA. 2008. Agenda Ambiental municipal de La Primavera, Departamento del Vichada.

The CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia is divided into six forest nuclei (Figure 2). The main features of each are presented below.

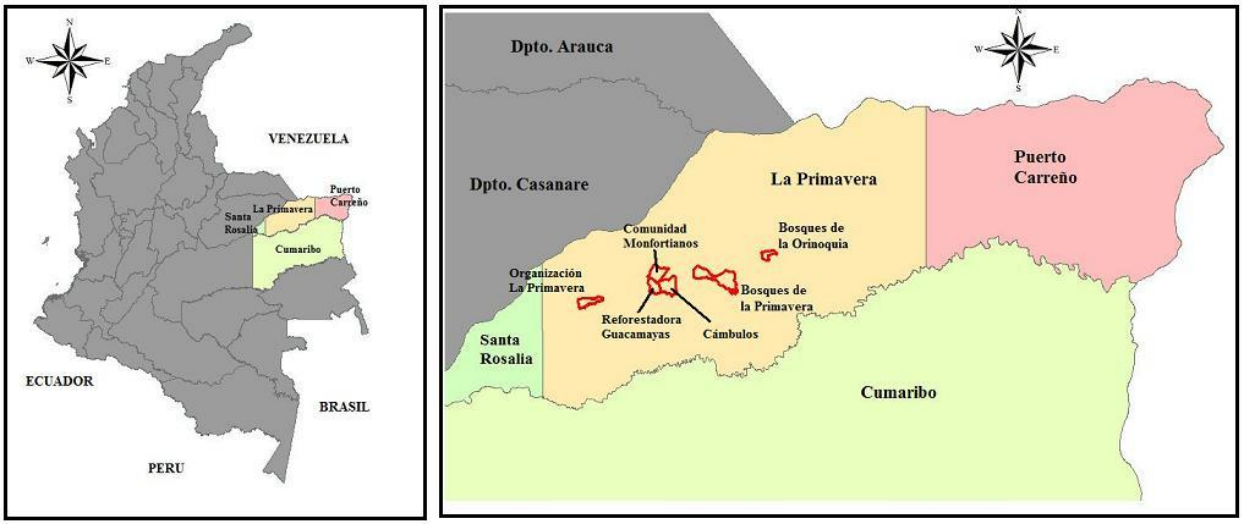

Figure 2. Location of the six forest nuclei in Municipality of La Primavera, Department of Vichada.

Table 6. Location of each nucleus (center point).

Nucleus	Geographic coordinates		Plane coordinates	
Bosques de la Orinoquía S.A.	69º33'19,84'' W	5º26'52,65'' N	836.177, 17 X	1'094.386,64 Y
Compañía de María, Padres Monfortianos	70º4'1,33'' W	5º21'39,52'' N	779.425,36 X	1'084.935,22 Y
Reforestadora Guacamayas S.A.	70º0'52,58'' W	5º17'55,22'' N	785.215,93 X	1'078.011,80 Y
Bosques de La Primavera S.A.	69º47'1,75'' W	5º20'15,71'' N	810.816,12 X	1'082.266,35 Y
Organización La Primavera S.A.	70º23'36,54'' W	5º13'42,98'' N	743.164,61 X	1'070.409,16 Y
Reforestadora Los Cámbulos S.A.S.	70º4'42,40'' W	5º17'59,31'' N	778.135,26 X	1'078.171,20 Y

Bosques de la Orinoquia S.A.: this nucleus is located in the hamlet of La Soledad, 120 kilometers from the municipal capital on the road which leads towards Marandua between the Terecay Stream and the Bita River. It includes the properties of Tranquilandia and La Pista.

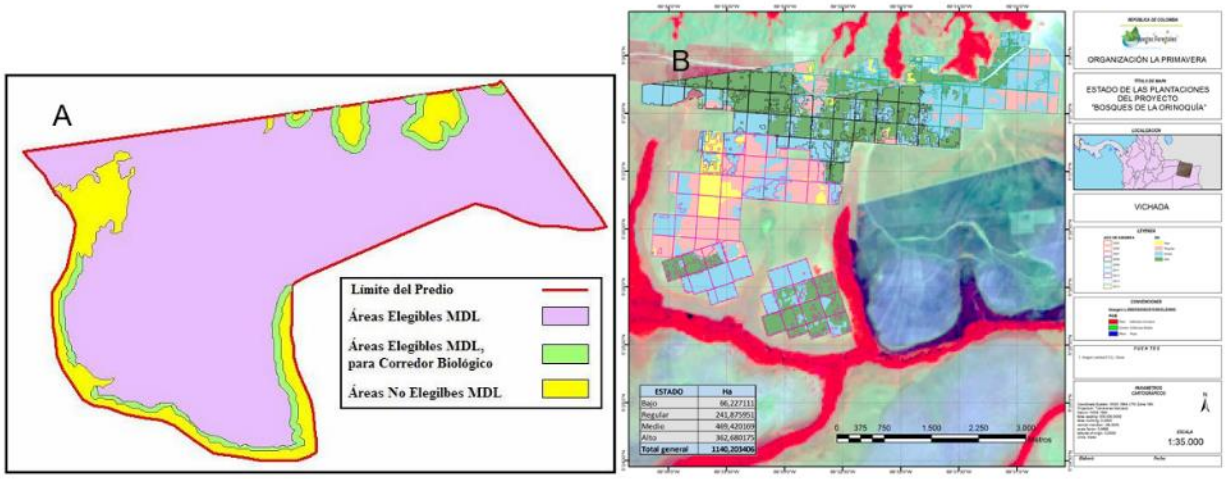

Figure 3. Project boundary for Bosques de la Orinoquia. A, Project boundary; B, Planted area at 2015 year.

Compañía de María Padres Monfortianos*:* this nucleus includes the rural properties of Chaparrito and El Clavo. It is located in the hamlet of Matiyure, 50 km from the municipal capital.

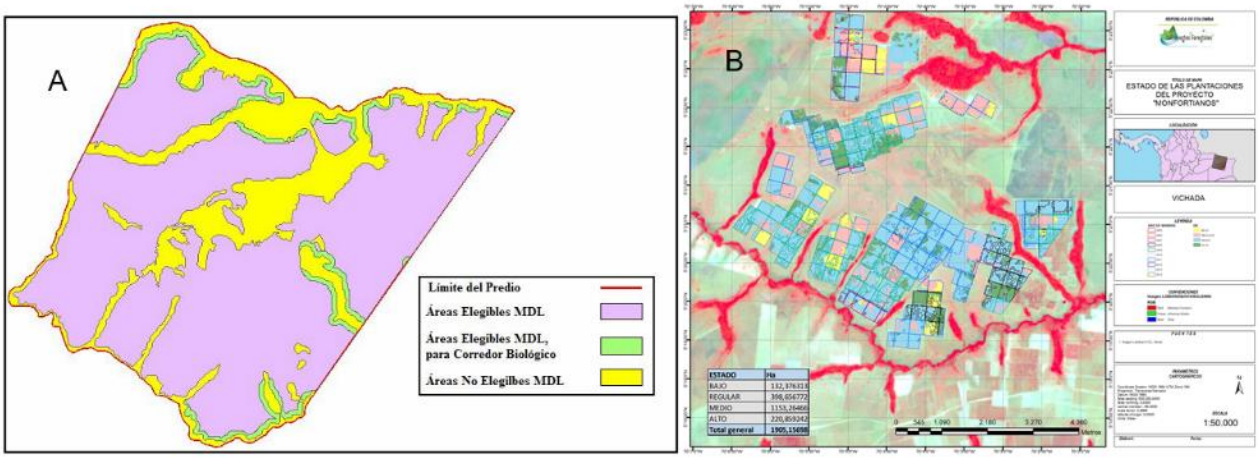

Figure 4. Project boundary for Compañia de María Padres Monfortianos. A, Project boundary; B, Planted area at 2015 year.

Reforestadora Guacamayas S.A*.:* the properties of Guacamayas, Los Leones and El Cafuche make up this nucleus, located near the hamlet of La Jaula.

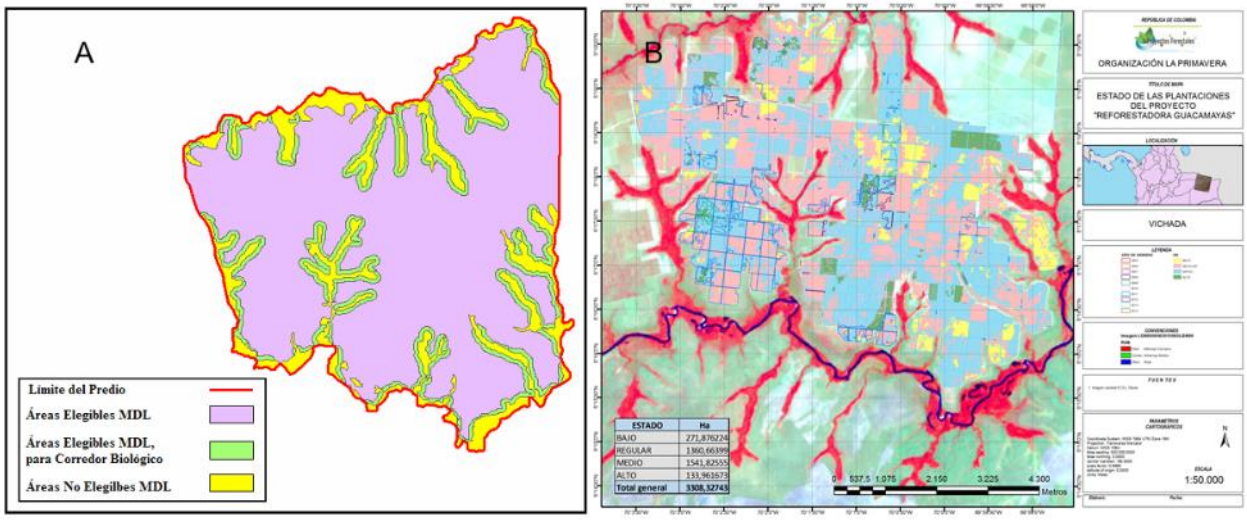

Figure 5. Project boundary for Reforestadora Guacamayas. A, Project boundary; B, Planted area at 2015 year.

Bosques de La Primavera S.A.: this nucleus is located near the hamlet of Matiyure. It includes the properties of Rincón Hondo, Caudimare, Araucaima, Araguaney, Paz Verde, Tibu, La Piraña, Manaos and El Suevo.

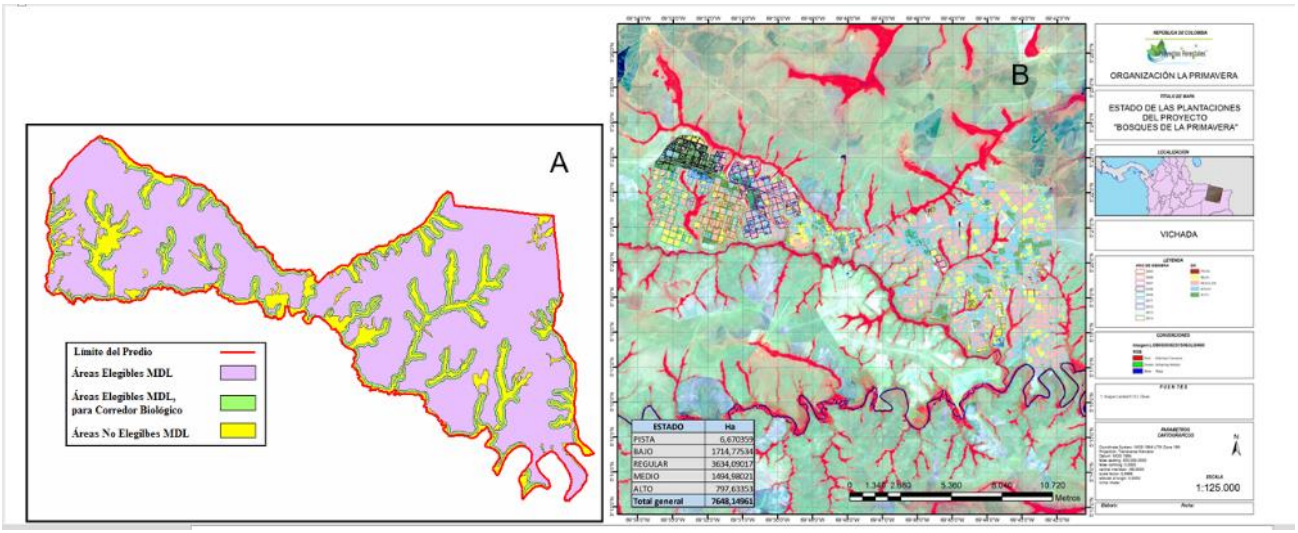

Figure 6. Project boundary for Reforestadora Guacamayas. A, Project boundary; B, Planted area at 2015 year.

Organización La Primavera S.A*.:* this nucleus is located near the Altos de Meiva hamlet, 40 km from the municipal capital, bordering the El Lobo and Guacharacas streams and the junction with the La Evita River, a direct affluent of the Tomo River. It includes the properties of El Limonar, Mykonos II, Bosques de Vermont, Syros, Pasatiempo and El Deseo.

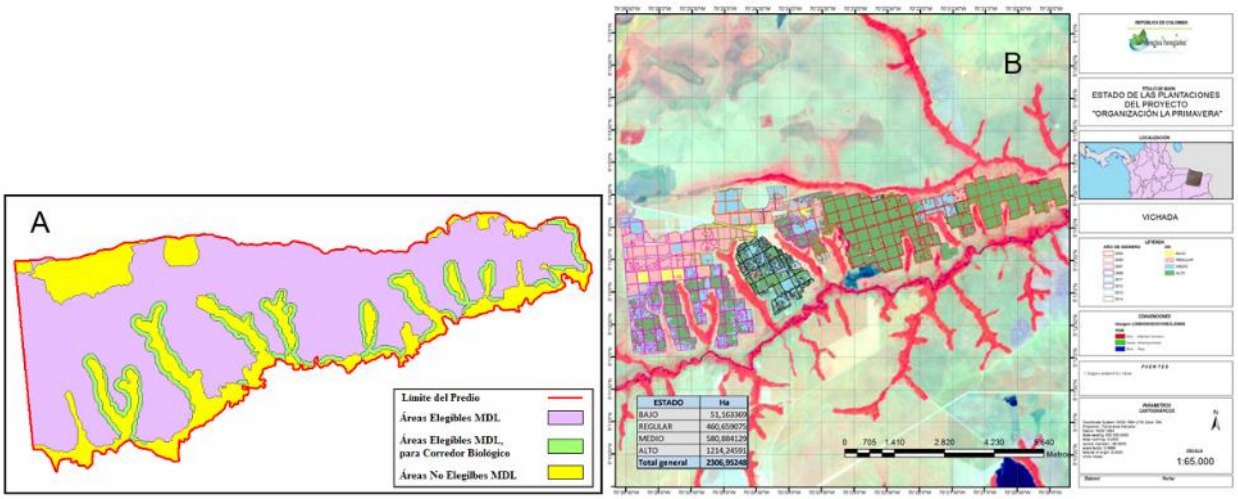

Figure 7. Project boundary for Organización La Primavera. A, Project boundary; B, Planted area at 2015 year.

Reforestadora Los Cambulos S.A.S*:* This nucleus includes the properties Los Venados, Cámbulos and Chile. It is located on the road which leads from the Municipality of La Primavera to the city of Villavicencio (department of Meta) deviating at kilometer 19 and continuing 38 km East. The properties of this nucleus border to the North with the Veraditas stream, to the East with properties owned by the Reforestadora Guacamayas S.A, to the South with the Gavilán River, and to the East with the lands of Mr. Víctor Porto.

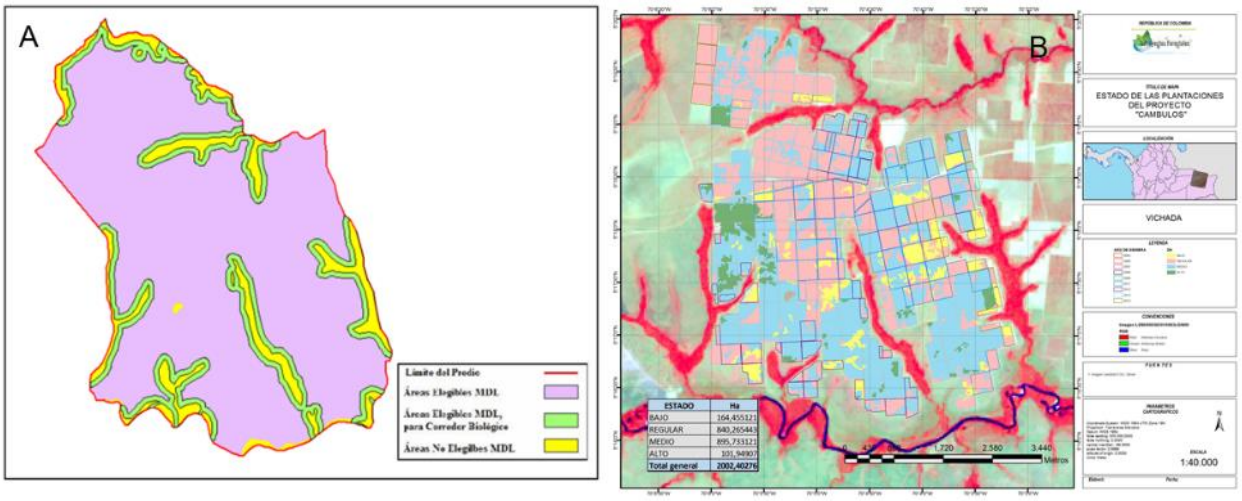

Figure 8. Project boundary Reforestadora Los Cambulos. A, Project boundary; B, Planted area at 2015 year.

The *CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia* consists of 29,018 ha, of which 25,628 are devoted to commercial reforestation, 390 ha devoted to assisted natural regeneration (ANR), and the protection of deforested areas for natural regeneration (PNR) comprises 3,000 ha. The boundaries for each project nucleus are presented in the next figure. The **¡Error! No se encuentra el origen de la referencia.** details the stand model areas of each forest nucleus.

Some of the areas evaluated with a potential for a commercial forestry that were within the eligible areas lists were not established due to a weak soil quality conditions, such as periodic flooding that impede good seedling development. These areas have been left for natural regeneration, to increase the estimated areas for this component in the project.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
Colombia (host)	**Bosques de la Primavera S.A.**	**No**

A.4. Reference of applied methodology and standardized baseline

Methodology:

Approved Methodology for Afforestation and Reforestation Activities AR-AM0004: ***"Reforestation or afforestation of land currently under agricultural use"- Version 04[5].***

The following methodological tools were used in the construction the PDD and the first verification:

[5] https://cdm.unfccc.int/methodologies/DB/S2OMSUTOWYOMLW75MPR0CG6SAKNG4Y

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

A.5. Crediting period of project activity

>>

Length of the crediting period: 20 years, 0 months, 0 days, from 2 June 2005 to 1 June 2025; with two equal renewal periods for a total crediting period of 60 year.

The actual monitoring period: 02 June 2005 – 16 Feb 2016

A.6. Contact information of responsible persons/entities

>>

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SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The Project began in June 02, 2005. As shown in the registered PDD; retroactivity is recognized since this date.

At present, 21,527.03 hectares have been established in commercial stand and natural regeneration systems. Total area for the project eligible areas is 29,019 ha, of which the majority of the species is *Pinus caribaea* (88%), a species with good development in acid, mineralized and degraded soils of the region.

The commercial model will be established in areas that are currently in pastures where extensive livestock activities have traditionally been carried out. The commercial plantations will include the following species:

- *Pinus caribaea*
- *Acacia mangium*
- *Tectona grandis*
- *Eucalyptus pellita*

The commercial species were re-stratified according to their biomass content, as presented in Table 7.

Table 7. Distribution of strata in the eligible area.

Strata	*Area (ha)*
Low growth	2,400.87
Steady growth	6,936.21
Middle growth	6,136.11
High growth	2,831.33
R_N (Natural Regenerations)	3,222.50
Total	***21,527.03***

The actions of establishment, management and monitoring were followed according to the development plan for this purpose. These actions have been monitored within FINAGRO's audit scheme as part of the support received from the Forest Incentive Certificate (CIF). All of the above projections for the forest management plan, including planting, maintenance, thinning, and harvesting among others, were modified during the period of implementation and growth of the project activity. The availability of resources, soil quality, the weather, and other factors, they affected the development of the stands and therefore the silvicultural activities.

At present, the project has established the next stands:

- Commercial
- Protection of deforested areas adjacent to gallery forests[6] to allow protected natural regeneration (PNR) of forest cover

The system of Protected Areas for Natural Regeneration (PNR), areas will be focused on deforested areas adjacent to the gallery forests, which until the beginning of the project were used

[6] Gallery forests are remnants of natural forests that remain in place protecting waterways and .

to cattle ranching and anthropogenic burning. The PNR's main anthropogenic activities are the physical isolation for the protection of deforested areas and the elimination of livestock, fires and hunting. The Table 8, present the area in the project by nucleus and strata.

Table 8. Distribution of forest establishments by nucleus and stratum.

Stratum	Bosques de la Orinoquia (ha)	Bosques de la Primavera (ha)	R. Cambulos (ha)	Guacamayas (ha)	P. Monfortianos (ha)	Organización La Primavera. (ha)	TOTAL (ha)
Low growth	66.23	1,714.78	164.46	271.88	132.38	51.16	***2,400.87***
Steady growth	241.88	3,634.09	840.27	1,360.66	398.66	460.66	***6,936.21***
Middle growth	469.42	1,494.98	895.73	1,541.83	1,153.26	580.88	***6,136.11***
High growth	362.68	797.63	101.95	133.96	220.86	1,214.25	***2,831.33***
R_N (Natural Regenerations)	172.95	770.87	547.42	481.96	640.30	609.00	***3,222.50***
Sub-totals	***1,313.15***	***8,412,35***	***2,549.82***	***3,790.29***	***2,545.46***	***2,915.96***	***21,527.03***

The records of the activities developed in the period of the present monitoring session are kept in physical documents in the installations of the project. Figure 9, shows the structure for the development of establishment and implementation of forestry and environmental technology.

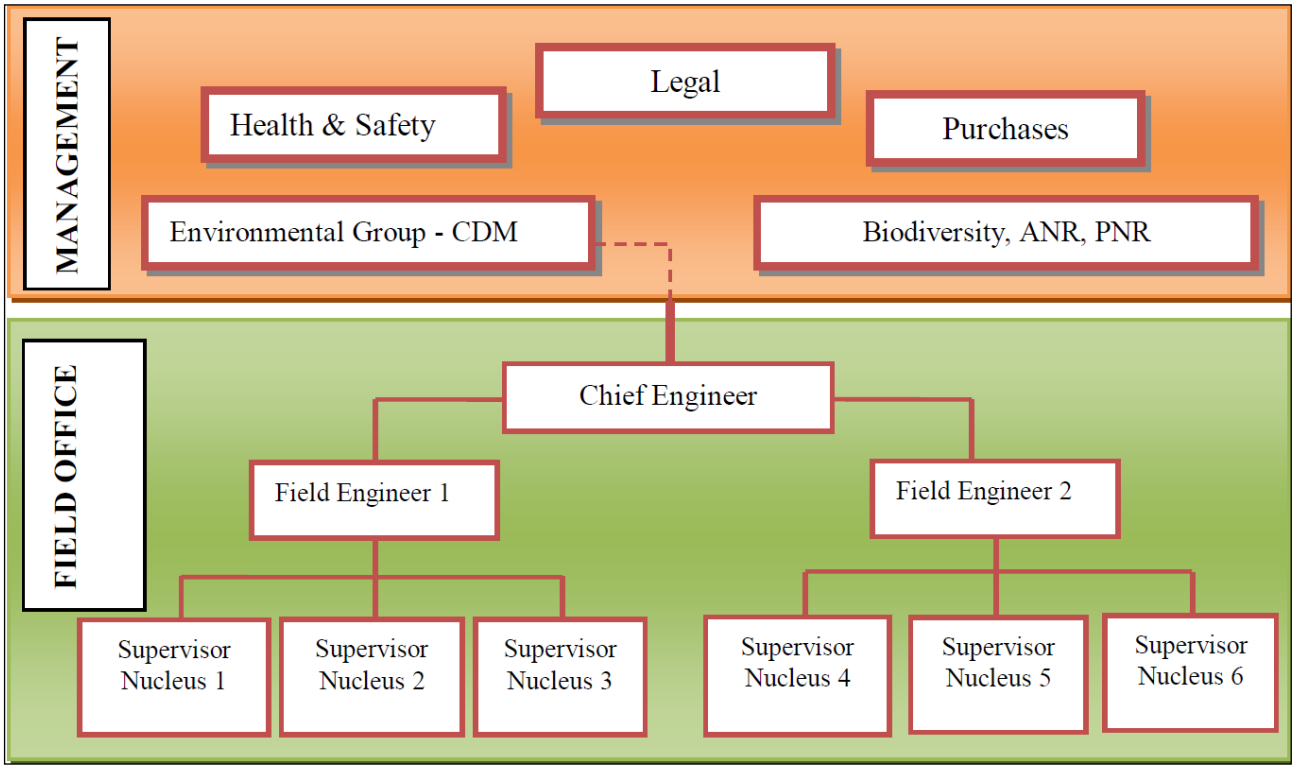

Figure 9. Operational and Management Structure of the Project Activity

The central operational and management structure of the project is organized under the Office of the General Manager. This office runs operations and oversees the offices of Legal, Purchases, Health and Safety, the Environmental Group which coordinates CDM, biodiversity and the Biodiversity team which coordinates Assisted Natural Regeneration of Natural Forests.

The Field office manages forestry operations and technical direction, which is composed of the supervisors, resident forestry engineers and the chief forestry engineer. These operatives manage all the silvicultural activities of the project activity. Each one of the six nuclei that conform the

project activity is under the direction of a field supervisor, who report to the chief forestry engineer. The chief forestry engineer is responsible for gathering and recording all the relevant information on the management of the project activity in each of the six nuclei. Each nucleus has a resident forestry engineer that files regular reports to the chief engineer, who then reports to and interfaces with the general manager of the project.

Monitoring of the CDM related parameters and data is the responsibility of the Environmental Group Director. The archives shall include:

• Registers and logbooks of activities, including soil preparation, planting, application of soil correctives, fertilizers, weeding, pruning, thinning, and harvests among others.

• Copies of all original field measurement data, data analyses and spreadsheets.

• Estimates of the carbon stock changes in all aboveground and belowground biomass and corresponding calculation spreadsheets.

• GIS products;

• Copies of the measuring and monitoring reports.

For the development of the actions and fulfillment of the objectives of the project, about 942 trainings have been developed since 2011, in which 8,674 people have participated (Table 9). In this way, the project contributes to the development of the region and the country, by forming skilled labor for the forestry activities in the territory.

Table 9. List of trainings and number of participants of the activities developed from 2011 to 2016.

Training	Total, Training	PERSONAL Trained
Occupational accident and illnesses	46	385
Ophidian accidents	39	376
Check list application	1	2
Personal and camp cleanliness	1	7
Self-care	9	115
Project benefits	4	56
Climate Change	39	367
Waste classification	7	103
Basic concepts of Biodiversity	12	72
Conservation	12	72
Fire controls	1	24
Control of Entrance/Exit of Personnel Staff	1	9
Care of flora and fauna	39	367
Care of environment	3	56
Waste disposal	39	367
Ecology	9	47
Hunting effects in natural ecosystem and the project	9	129
EPP	53	425
Establishment of forest plantations	3	41
Management strategies for biodiversity in the project	3	25
Geographical information structure	2	6
Identification of hazards and prevention of risk at work	1	12
Environmental Impacts	19	247
Environmental impacts on the project	20	120
Biodiversity importance	12	72
Instruction in change of pins	1	2
Water management	39	367
Use of extinguishers	11	150
Use of safety MSDS	53	430
Forest plantation maintenance	3	41

CMD	39	367
Basic safety and coexistence Standards	51	490
Safety Standards for maintenance of agriculture machinery	1	2
Safety Standards for operation of agricultural machinery	1	2
Standards for handling and storage of crop protection products	50	483
Standards for tool handling	30	363
Standards for transfers	42	380
Reforestation objectives	4	56
Workplace hazards	50	393
Environmental management plan	1	6
Prevention of forest fires	22	260
Project processes	39	367
Environmental management program	20	120
Trophic networks (concepts, composition, levels, importance)	9	129
Responsibilities in matters of SO	1	2
Occupational health	28	250
Social security	34	258
Signaling	1	14
Waste management system	8	103
Field techniques for wildlife inventory and monitoring	1	1
Transportation of personnel	1	9
Use of first aid kit	17	120
Tree nursery	1	7
Total	***942***	***8,674***

Nearly 400 thousand labor wages have been generated (Table 10) and a total of 1,666 jobs during the current monitoring period. This is highlighted in a region where job opportunities are scarce.

Table 10. Days wage and employment generated (2005-2015).

Año	Day's wage year	Employment
2005	6278	26,16
2006	2123	8,85
2007	14447	60,2
2008	32079	134
2009	83832	350
2010	54036	225
2011	50335	210
2012	44222	184
2013	57979	242
2014	35395	147
2015	19160	80
Total	399,885	1,666

Most of the jobs and labor works were performed between 2009 and 2013, where the largest establishments were presented and coincided with the maintenance of the plantations established in previous years.

Finally, there has not been any request for prior approval.

B.2. Post-registration changes

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

Not apply

B.2.2. Corrections

Not apply

B.2.3. Changes to start date of crediting period

Not apply

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

Not apply

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

Not apply

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

Not apply

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

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As per the document, *"Guidelines on accounting of specified types of changes in A/R CDM project activities from the description in registered project design documents"* (version 02.0) (Annex 24, EB 66), the types of changes presented in the project are minimal that does not require CDM EB approval.

The changes in the planted area, species composition and planting time, have not impacted the baseline scenario and the additionality of the project.

Types of changes with respect to the description in the registered PDD were made as outlined in the guidelines (Annex 24, EB66):

a) Planted densities for commercial stands during the years 2005-2010 were in line with the planning chart (Table 10); however, the relationship of ages in many lots varied due to restocking (re-planting activities in the same period). For the years 2011-2014, the remaining lots were established to complete an area of 18304.5 ha with commercial species. It was expected to have a final target of 25,629 ha (Table 11) but in many places soil quality conditions have limited its establishment. Currently, there is 29% less area planted in commercial stands than projected. For the models of assisted natural regeneration, the actions have concentrated on releasing spaces with livestock presence to allow a natural regeneration as expected for the areas of the model for protected areas for natural regeneration (PNR) of the PDD.

Table 11. Distribution over time of planting activity (ha) projected in PDD, per species, for the commercial stand model (PDD).

Nucleus	Species	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total projected (ha)	Total actual (ha)
Bosques de la Orinoquía S.A.	*Pinus caribaea*	-	-	251	366	727	-	-	-	-	-	1,344	
	Acacia mangium	-	-	67	173	178	-	-	-	-	-	418	
	Tectona grandis	-	-	-	2	2	-	-	-	-	-	5	
	Subtotal	**-**	**-**	**318**	**541**	**908**	**-**	**-**	**-**	**-**	**-**	***1,767***	**1,140.2**
Organización La Primavera S.A.	*Pinus caribaea*	284	547	677	392	-	30	300	154	-	-	2,524	
	Acacia mangium	67	-	-	43	-	-	7	-	-	-	117	
	Tectona grandis	-	28	22	16	-	-	-	-	-	-	65	
	Eucalyptus pellita	32	4	11	34	-	-	-	-	-	-	80	
	Subtotal	**523**	**578**	**709**	**485**	**-**	**30**	**307**	**154**	**-**	**-**	***2,786***	**2,306.9**
Compañía de María Padres Monfortianos	*Pinus caribaea*	-	-	-	450	786	83	600	700	488	-	3,107	
	Acacia mangium	-	-	-	25	35	157	100	100	100	-	517	
	Tectona grandis	-	-	-	-	12	-	-	20	20	-	52	
	Eucalyptus pellita	-	-	-	-	-	100	50	50	-	-	200	
	Subtotal	**-**	**-**	**-**	**475**	**833**	**340**	**750**	**870**	**608**	**-**	**3,875**	**1,905.2**
Bosques de La Primavera S.A.	*Pinus caribaea*	-	-	-	648	2,190	1,085	950	900	900	-	6,673	
	Acacia mangium	-	-	-	-	240	84	80	70	283	-	757	
	Tectona grandis	-	-	-	-	240	125	128	100	313	-	906	
	Eucalyptus pellita	-	-	-	-	6	401	300	300	300	-	1,307	
	Subtotal	**-**	**-**	**-**	**648**	**2,676**	**1,694**	**1,458**	**1,370**	**1,796**	**-**	***9,643***	***7,641.5***
Reforestadora Guacamayas S.A.	*Pinus caribaea*	-	-	-	-	1,066	958	760	750	645	-	4,178	
	Acacia mangium	-	-	-	-	56	152	70	60	60	-	399	
	Tectona grandis	-	-	-	-	-	70	39	20	20	-	149	
	Subtotal	**-**	**-**	**-**	**-**	**1,122**	**1,180**	**869**	**830**	**725**	**-**	***4,726***	***3,308.33***
Reforestadora Los Cámbulos S.A.S.	*Pinus caribaea*	-	-	-	-	-	714	650	500	170	-	2,034	
	Acacia mangium	-	-	-	-	-	24	30	20	20	-	94	
	Tectona grandis	-	-	-	-	-	244	200	150	110	-	704	
	Subtotal	**-**	**-**	**-**	**-**	**-**	**982**	**880**	**670**	**300**	**-**	***2,832***	***2,002.40***
Total (ha)		**523**	**523**	**578**	**1,027**	**2,149**	**5,539**	**4,225**	**4,264**	**3,894**	**-**		
Area accumulated total (ha)		**523**	**1,102**	**2,129**	**4,278**	**9,817**	**14,042**	**18,306**	**22,200**	**25,629**		***25,629***	***18,304.5***

b) Changes in species composition:

P. oocarpa was included, which is linked to the commercial stand model. This species presents similar conditions of adaptation to the soils of the region and the environmental conditions that the *P. caribaea.* The species is included as research actions in the project.
The stand Eucalipto pellita trials of *E. urophilla*. were added.

c) Changes in stratification for sampling. The stratification is previously adapted for each monitoring event; according to the applied A/R baseline methodology. For this monitoring the stratification was adapted according to the biomass accumulation, specifically commercial stand. The re-stratification processes, are presented in Annex I.

SECTION C. Description of monitoring system

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The structure for the monitoring process in the CDM project is presented in Figure 10.

Total coordination was developed by the entity *Proyectos Forestales* and was supported by a team of forestry, administrative, social and CDM experts.

The project activity applies the monitoring system as prescribed in the approved methodology AR-AM0004/Version 04 and the registered PDD V.06.

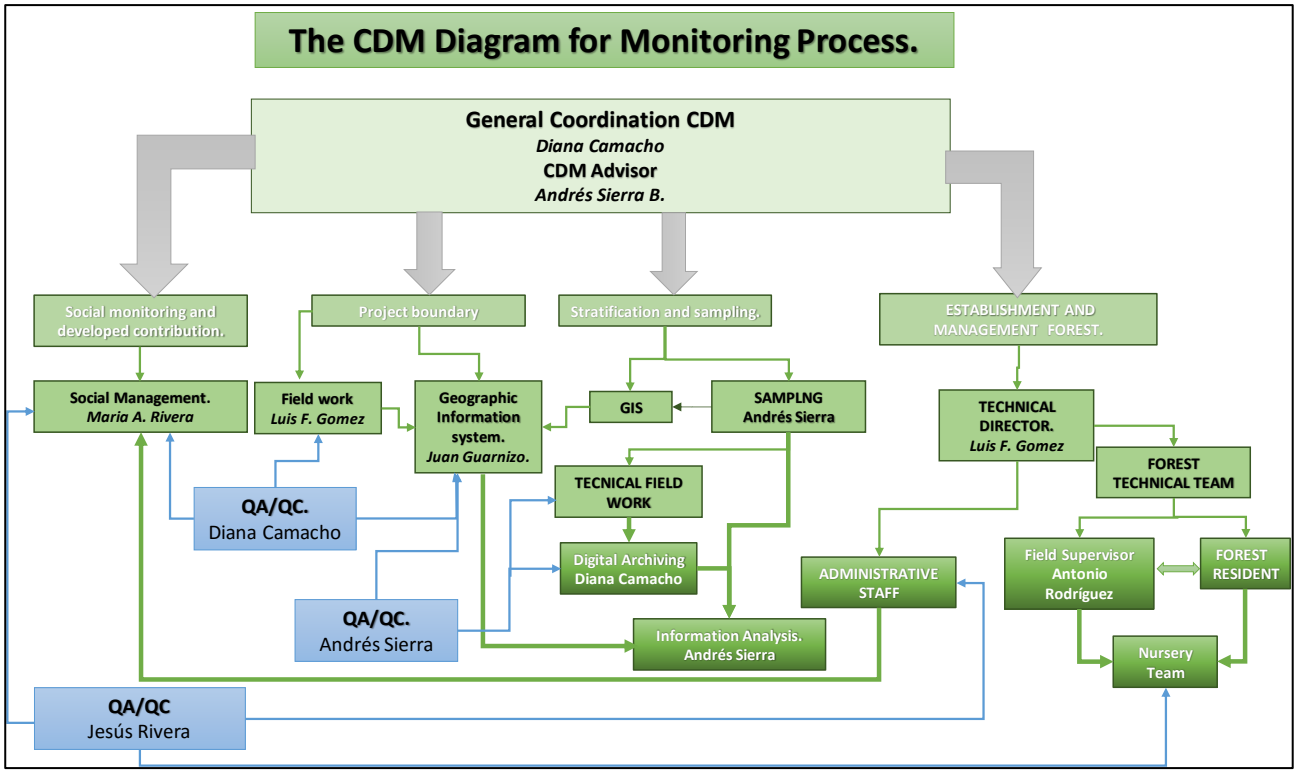

Figure 10. Monitoring structure for A/R CDM project.

The project monitoring system was based on the following aspects:

1. **Monitoring project boundary and project implementation:**

Each lot was measured with the help of GPS during the execution of the Project, through field trips. The lots were drawn following its contour and were related in the database of activities tracking with the date of planting and other silvicultural management activities developed.

Through geographic information processes, and with the help of satellite images *Landsat 8* of the year 2016 an effort was made to determine areas effectively established, and areas included in the eligible areas and described in the PDD.

The project has digital files of the contours of each lot collected with GPS; and Annex I, shows the verification process of the areas established within the eligible areas also by using GIS.

The areas under natural regeneration were identified with satellite image information; and, by means of spectral responses was possible to describe developed areas (with early successions of secondary forest) and biomass contents greater than those identified in the baseline (pastures), qualifying therefore those areas which have been in recovery processes.

Re-stratification was developed due to the different degrees of development between and within each lot, due to the clear differences in site quality, mortalities and re-plantings. This re-evaluation was made based on the biomass contents obtained trough satellite imagery processes. Therefore, plots with similar dates of planting, species and management had to be unified in strata of similar biomass conditions. This process is in line with the stratification proposed in the PDD, sect B.8.2.

2 Monitoring of forest management.

Forest management practices are important drivers of the GHG balance of the project, and thus must be monitored. The activities monitored included

• **Cleaning and site preparation measures:** date, location, area, biomass removed and other measures undertaken;

• **Planting:** date, location, area, tree species (establishment of the stand models);

• **Thinning:** date, location, area, tree species, thinning intensity, volumes or biomass removed;

• **Harvesting:** date, location, area, tree species, volumes or biomass removed;

• **Coppicing:** date, location, area, tree species, volumes or biomass removed;

• Checking and confirming that harvested lands are re-planted, re-sowed or coppiced

as planned and/or as required by forest law;

• Checking and ensuring that good conditions exist for natural regeneration if harvested lands are allowed to regenerate naturally;

• Monitoring of disturbances: date, location, area (GPS coordinates and remote sensing, as applicable), tree species, type of disturbance, biomass lost, implemented corrective measures, change in the boundary of strata and stands.

Monitoring of these activities is related to work contracts executed by the contractors and reports are archived in digital format at the project headquarters in Bogota.

Monitoring of GHG removals have been performed by sampling procedures based on ex-post stratification (see PDD). Baseline net GHG removals by sinks, GHG emissions and leakage have not been monitored following section B.7 of the PDD.

3 Measurement of carbon pools

Monitoring of GHG removals have been performed by sampling procedures based on ex-post stratification (see previous paragraphs) The Baseline net GHG removals by sinks, GHG emissions and leakage have not been monitored, following what is defined in the PDD.

Sampling for ex post calculations.

For the present verification period, five strata were defined to be monitored, and on which inventories were implemented to determine net removals of anthropogenic carbon. The statistical results for each stratum are presented in Table 12.

Table 12. Areas of each identified stratum in the Project area.

Stratum	Area (ha)	% Project	Plots	Mean Biomass	Standard Deviation
LOW	2400,9	11%	54	3,82	2,55
STEADY	6936,2	32%	77	17,25	6,64
MIDDLE	6136,1	29%	34	39,96	8,86
HIGH	2831,3	13%	33	102,65	30,25
***N_R* (Natural Regenerations)**	3222,50	15%	30	7,39	2,43
Total	***21.527,03***	***100%***	***228***		

4. Quality assurance/ quality control.

Verification of methods used to collect field data: to verify the correct measurements of sample plots 10% of them, randomly selected, have been re-measured. Three parameters have been re-measured (plot location, DBH and height of each tree).

During the first quarter of 2015, a first sampling procedure was held, which was audited to assess the quality of the procedure. Preliminary results of this audit showed some procedural errors in sampling activities and lack of accuracy in the equipments for dasometric measurements. At the same time, the redefinition of the strata had to be developed due to the wide variations found between the dates of sowing, the species and the forest management. Therefore, during the months of November and December of 2015, and January and February of the 2016, the new sampling was successfully completed with a significant reduction of procedure errors of measurement and fingering.

The audited actions for quality control were:

- Training of personnel and expertise in the inventory processes: Training was held on the implementation of sampling, and how field activities are developed. The training was in line with the monitoring plan developed and presented in the PDD. The team featured: forestry engineers, crew leaders, and field staff support.

- Equipment: Verification of the proper functioning of the equipment used and its calibration. Diameters were taken with Lufkin W606PM diametric tape, and for diameters smaller than 5 cm, calibrator was used (Image 1A and B).

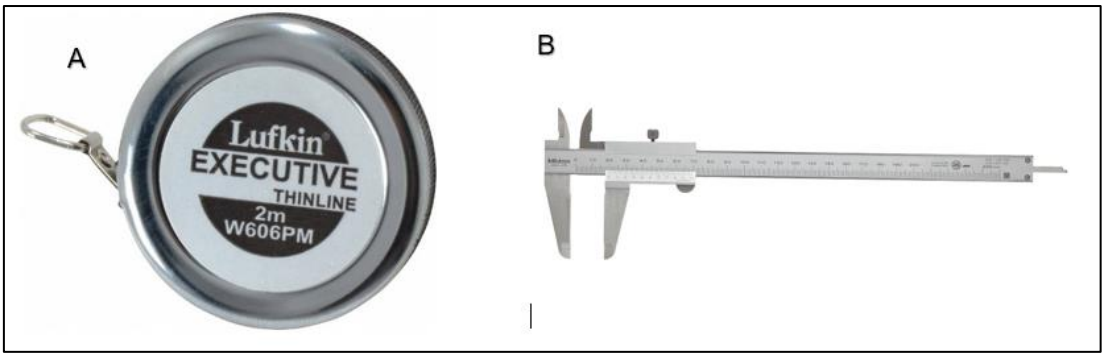

Image 1. DBH measurement equipment (cm): A, diametric tape, B. calibrator.

To take the height to those trees that exceeded 4 m, indirect measurement was held with the use of TRUPULSE ™ 200 / 200B instrument (Figure 2-3). In all other cases, it was performed with a rod and a metric tape.

Image 2. Indirect Height Measurement Unit TRUPULSE™ 200 / 200B.

The equipment was purchased before the sampling started with factory calibration.

- **Verification of methods used to collect field data:** to verify the correct measurements of sample plots 10% of them, randomly selected, have been re-measured. Three parameters have been re-measured (plot location, DBH and height of each tree).

  Due to the adjustments developed within the quality control processes, and to the improvement of the equipment use, the measurement errors were not significant. Variations in the diameters (greater in the audit) were identified as a result of the normal growth of the trees and normal detachment of barks in the species of *Pinus sp.* It is suggested within the monitoring plan to measure the heights only to a portion of the trees of each plot, and to develop adjustments of allometric equations to determine the other heights. During the sampling, all tree heights were taken in each plot, reducing the associated uncertainty when heights are estimated with allometric equations.

- **Verification of data entry and analysis techniques:** All field data collected have been reviewed by an expert. Some necessary corrections, based basically on the transcript of data form field forms to the spreadsheet, have been done in coordination between the field team and the expert. Typing errors were associated to decimals entered. These, within the analyzed database did not exceed 1% error (five data found and corrected).

- **Custody of the information collected in the field and digitized**: Archiving performance was verified of the information generated in field; all the forms were collected and ordered in books that rest in the central offices in Bogota. As a backup of the information obtained, all forms were recorded into digital media by scanning. The digital field survey files with GPS and GIS processes are digitally backed by the CDM coordinating computer at the headquarters of *Proyectos Forestales Company*, and have digital backups in the cloud (Dropbox, google drive) and in hard disks. All project information is available to DOE in its original formats and in digital media.

SECTION D. Data and parameters

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

The parameters measured and monitored were aligned with those settled in the monitoring plan. The constant values suggested by the IPCC 2003 as presented in the PDD were maintained and some equations for determining biomass contents were adjusted to the requirements of the methodological tools, especially using information that is used in official national reports for determination of emission factors for Land Use Change and Forestry sector.

Data/parameter:	BEF_{2j}
Unit	Dimensionless

Description	Biomass expansion factor for conversion of stem biomass to above-ground tree biomass for tree species j
Source of data	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003. Table 3A.1.10
Value(s) applied)	*Pinus sp:* *1.3* *Broadleaf:* *3.4* *- Eucaliptus sp.* *- A. mangium.*
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of actual net GHG removals by sinks Applied in the eq. 67 of the methodology AR-AM0004 v.04.
Additional comments	The only used BEF in this first monitoring has been for *Pinus sp*. For other species Allometric equation method has been used.

Data/parameter:	***Carbon fraction, CF_j***
Unit	Dimensionless
Description	Carbon fraction content in the biomass
Source of data	AR-Tool 14 Version 04.2
Value(s) applied)	0.47
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by each species in the project activity. Applied in the eq. 68 of the methodology AR-AM0004 v.04
Additional comments	It was applied to each stand model.

Data/parameter:	***D_j***
Unit	t d.m. m^{-3}
Description	Basic wood density for species *P. caribaea*
Source of data	Trujillo N. 2013. Guía de Reforestación. 3º edición. Bogotá 254 p.
Value(s) applied)	0.56
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by *P. caribaea* in the project activity. Applied in the eq. 67 of the methodology AR-AM0004 v.04
Additional comments	Data from national reference.

Data/parameter:	D_j
Unit	t d.m. m^{-3}
Description	Basic wood density for species *P. oocarpa*
Source of data	Trujillo N. 2013. Guía de Reforestación. 3º ed. Bogotá 254 p.
Value(s) applied)	0.51
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by *P. caribaea* in the project activity. Applied in the eq. 67 of the methodology AR-AM0004 v.04
Additional comments	Data from national reference.

Data/parameter:	***Root-shoot ratio, R_j***
Unit	Dimensionless
Description	Root-shoot ratio for species *j.*
Source of data	Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC, 2003. Table 3A.1.8
Value(s) applied)	Pinus sp: 0.32 Broadleaf: 0,24 - *Eucaliptus sp* - *A. mangium.*
Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by each species in the project activity. Applied in the eq. 68 of the methodology AR-AM0004 v.04 for Pinus sp. and allometric method for broadleaf.
Additional comments	It was applied to Pinus sp, commercial stand model. Pinus tropical/sub-tropical moist forest.

Data/parameter:	***Root-shoot ratio, R_j***
Unit	Dimensionless
Description	Relationship between root biomass and shoot biomass.
Source of data	MA Cairns, S Brown, EH Helmer, GA Baumgardner. 1997. Root biomass allocation in the world's upland forest. Oecologia 111: 1 – 11.
Value(s) applied)	$BRG = exp^{(-1{,}085+0{,}9256*\ln(biomass\ aerea)}$ Applied only natural regenerations stratum.

Choice of data or measurement methods and procedures	
Purpose of data	Actual net GHG removals by each species in the project activity. Applied in the eq. 68 of the methodology AR-AM0004 v.04 for Pinus sp. and allometric method for broadleaf.
Additional comments	It was applied to Pinus sp, commercial stand model. Pinus tropical/sub-tropical moist forest.

Data/parameter:	***DLP***
Unit	%
Description	Desired level of precision.
Source of data	Value suggested by the methodology applied (AR-AM0004 v.04)
Value(s) applied)	10 %
Choice of data or measurement methods and procedures	N.A
Purpose of data	Calculation of project emissions or actual net GHG removals by sinks
Additional comments	Applied for adjustment of the statistical sampling. Applied in the eq. 57 of the methodology AR-AM0004 v.04

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

D.2. Data and parameters monitored

This list considering only data and parameters obtained from field measurement in accordance with monitoring plan (see PDD).

Data/parameter:	***A***
Unit	ha
Description	All area under control that have been established up to 2015 in the commercial stand and natural regeneration stand.
Measured/calculated/default	Measured
Source of data	Measured in field with GPS and verified with GIS.
Value(s) of monitored parameter	21.527,03 ha
Monitoring equipment	Global Position System (GPS). GARMIN ETREX 30. And GIS
Measuring/reading/recording frequency:	Yearly and verified for the monitoring period.
Calculation method (if applicable):	NA
QA/QC procedures:	Areas/lots/plots are measured with GPS, before establishment, and re-measured after plantation. This is required for payment procedures to contractors who carry out the activities, and is subjected to a second verification by national entities that promote the development of the forestry sector (FINAGRO[7]). The whole process of area measuring in the field is carried out by professionals of the forestry and the environmental sector in charge of the project. These staff have been trained to use and manage GPS. As a control of the actual presence of the established stands, verification is done with satellite images and geographic information processes. This work is developed by an expert in image processing. The areas of natural regeneration are measured according to the image processing identification development of the areas under control and released for their natural forest development.
Purpose of data:	Calculation of project emissions or actual net GHG removals by Sinks.
Additional comments:	The total project area is calculated as de the sum of areas of the biomass estimation strata: $A=\sum A_i$

Data/parameter:	A_i
Unit	ha
Description	All area under control that have been established up to 2015.
Measured/calculated/default	Measured
Source of data	Measured in field with GPS and verified with GIS.

[7] https://www.finagro.com.co/productos-y-servicios/CIF

Value(s) of monitored parameter	**Stratum** / **Area (ha)** ***LOW*** 2400,9 ***STEADY*** 6936,2 ***MIDDLE*** 6136,1 ***HIGH*** 2831,3 ***N_R* (Natural Regenerations)** 3222,50 ***Total*** ***21.527,03***
Monitoring equipment	Global Position System (GPS). GARMIN ETREX 30.
Measuring/reading/recording frequency:	Yearly and verified for the monitoring period.
Calculation method (if applicable):	NA
QA/QC procedures:	Areas/lots/plots are measured with GPS, before establishment, and re-measured after plantation. This is required for payment procedures to contractors who carry out the activities, and is subjected to a second verification by national entities that promote the development of the forestry sector (FINAGRO). The whole process of area measuring in the field is carried out by professionals of the forestry and the environmental sector in charge of the project. These staff have been trained to use and manage GPS. As a control of the actual presence of the established stands, verification is done with satellite images and geographic information processes. This work is developed by an expert in image processing. The areas of natural regeneration are measured according to the image processing identification development of the areas under control and released for their natural forest development.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comments:	For the present monitoring, the stratification has been performed based on biomass contend for the commercial stand.

Data/parameter:	***AP***
Unit	m^2
Description	Sample plot area
Measured/calculated/default	Measured
Source of data	Field measurement
Value(s) of monitored parameter	0.05 ha for the commercial stand and 0.001 ha in the sample for natural regeneration.
Monitoring equipment	Metric tape of 30 m. Precision of 2 mm.
Measuring/reading/recording frequency:	5 years
Calculation method (if applicable):	NA

QA/QC procedures:	Sampling protocol.
Purpose of data:	Calculation of the changes in carbon stocks.
Additional comments:	The field-team received additional training for the correct establishment of the plots, this included team management, reading and care. To evaluate the biomass in the natural regeneration, a specific protocol was developed with defined steps, which was socialized to the field team. Given rectangular plots developed in commercial models, the right angles in the corners had to be verified with metallic stakes that have right angles in their upper part. See startup report. In order to verify that the parcels presented the correct areas, 10% of the established parcels were re-measured.

Data/parameter:	***DBH***
Unit	cm
Description	Diameter at breast height
Measured/calculated/default	Measured
Source of data	Field measurement in sample plots
Value(s) of monitored parameter	All trees within simple plots.
Monitoring equipment	Diametric tape and Caliper. Precision of 1 mm.
Measuring/reading/recording frequency:	Five years
Calculation method (if applicable):	NA
QA/QC procedures:	Data cross checking is done in the sample plots. New diametric tapes were used during the inventory development. Staff was trained in the correct way to measure and make use of the equipment. An audit process was held, and under cross-checking verification was corroborated data in a sample greater than 10% of the established plots.
Purpose of data:	Applied in the allometric or volume equations, for each species.
Additional comments:	Prior to fieldwork, the staffs were trained in the development of sampling.

Data/parameter:	***H***
Unit	m
Description	Tree height
Measured/calculated/default	Measured
Source of data	Field measurement

Value(s) of monitored parameter	NA
Monitoring equipment	TRUPULSE™ 200 / 200B. And metric tape.
Measuring/reading/recording frequency:	5 years
Calculation method (if applicable):	N.A
QA/QC procedures:	-Protocol for taking dendrometric measurement variables. A random sampling was developed in more than 10% of the established plots. With the same equipment and processes were used to corroborate the proper height measurement.
Purpose of data:	Applied in the allometric or volume equations, for each species.
Additional comments:	Height measurements were taken in all plots of commercial stands, and in all trees into the plots. This process was adjusted to the recommended in the monitoring plan and in the PDD, since it was suggested only to sample a portion and to develop allometric equations for estimates the heights of the unmeasured trees.

D.3. Implementation of sampling plan

For the implementation of the sampling plan, a re-stratification was held according to the definition in the PDD in section B.8.2. This was based on the biomass contents identified through image processing and field work (see Annex I).

The samples were randomly distributed within the strata by following the sampling plan.

The sample size was calculated following the methodological tool "Calculation of the number of sample plots for measurements within A / R CDM project activities" V.02.1.0. And, the Winrock's CDM A / R Sample Plot Calculator Spreadsheet Tool version 2014 tool was applied to estimate the sample size from the field survey. Samples for the commercial and natural regeneration strata were estimated separately; this is due the variation in the sampling process and the different plot size (0.05 ha for commercial and 0.001 ha for NRA).

Equations to determine aerial biomass

The plots randomly distributed were located in the four strata defined in the re-stratification. These included species *Acacia mangium*, *Pinus caribaea* y *Eucalipto pellita*. The species *P. caribea* dominates more than 70% of the commercial crop in the project. The equations used in general were allometric that related a dasometric variable with the total biomass of the tree; in cases where this equation was not available, volume equations were applied and the basic density method of the wood was taken to total biomass. To select the equations, we followed the recommendations of the tools *"Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A / R CDM project activities"* and *"Demonstrating appropriateness of allometric equations for estimation of aboveground biomass in A / R CDM project Activities"*[8].

Equations per species and their application according to the tools are:

[8] http://cdm.unfccc.int/Reference/tools/index.html

Table 13. Equations of volume and biomass applied for included species in work-field survey.

ESPECIE	ECUACIÓN	OBSERVACIÓN.	FUENTE
P. caribaea	$\text{Vol}=-9.66+1.834*\ln(\text{DAP})+1{,}007h_t$	✓ DBH≥ 11-28 cm ✓ Temperature: 21.7 °C ✓ Soil: Ultisols, clay, acid and red. ✓ Very humid, tropical premotane forest. ✓ R^2= 0.97 ✓ N=45	Salazar, 1985.
	$BA = 0{,}887 + \left(\frac{1048 * DAP^{2,84}}{(DAP^{2.84}) + 376907}\right)$	✓ DBH 0,6-56 cm. ✓ Pines of temperate and tropical zones. ✓ R^2= 0,98. ✓ N= 137	IPCC 2003.
A. mangium	$BA = 0{,}204 * DAP^{2,2801}$	✓ Humid tropical forest ✓ Temperature: 26 °C – 28 °C ✓ Alluvial plane. ✓ Acid soils, low fertility ✓ Slope 0-3% ✓ N=52 ✓ R^2= 0.94 ✓ DAP> 5cm	Recommended in the national carbon protocol of Colombia, Yepes et al, IDEAM, 2011.
E. pellita	$BA = 1{,}22 * DAP^2 * h_t * 0{,}01$	✓ R^2= 097. ✓ N= 130.	Recommended in the national carbon protocol of Colombia, Yepes et al, IDEAM, 2011, Surce IPCC 2003.

Selected equations applied conform to the requirements of the methodological tools *"Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A / R CDM project activities",* and *"Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A / R CDM project activities*", specifically in the sample size needed for achieve the equation, the adjustment level, and similar environmental conditions.

For the areas where the development of natural regeneration occurred, as mentioned, a biomass harvest protocol was applied in circular plots of 10 m^2 in which the whole of the aerial biomass was harvested. Fresh Biomass value per parcel unit was achieved. Afterwards samples were taken to determine in the laboratory the moisture content, which by applying *equation 2* the average dry biomass per plot was obtained. This process was necessary given the randomness of the development of the arboreal individuals and their mixing in the regeneration process.

Underground biomass.

This was estimated from the aerial biomass, applying the conversion factor of aerial biomass to underground *Root:Shoot ratio*, which value is 0.24 (IPCC, 2003). This process is considered a good practice within the IPCC guidelines for land use change.

Statistic for the five strata identified is presented in Table 14.

Table 14. Statistics for strata sampled in the project within the current monitoring period.

Stratum	Area (ha)	% Project	Plots	Mean Biomass	Standard Deviation
LOW	2400,9	11%	54	3,82	2,55
STEADY	6936,2	32%	77	17,25	6,64
MIDDLE	6136,1	29%	34	39,96	8,86
HIGH	2831,3	13%	33	102,65	30,25
***N_R* (Natural Regenerations)**	3222,50	15%	30	7,39	2,43
Total	***21.527,03***	***100%***	***228***		

To determine if the sampling was sufficient and that fulfils the 10% error level criteria and 90% of reliability level, the *Winrock's CDM A/R Sample Plot Calculator Spreadsheet Tool Version 2014*[9] tool was used. This tool applies the methodological tool AR_AM_03_v2 (*Calculation of the number of sample plots for measurements within A/R CDM project Activities*[10]).

For the sampling process in each stratum, the steps described in the applied methodology and in the methodological tools for determination of sample size were followed.

After stratifying the project, the equation for the calculation of the sample per stratum was applied.

Equation 1 $$n = \frac{N * t_{val}^2 * (\sum_i w_i * s_i)}{N * E^2 + t_{val}^2 * \sum_i w_i * s_i^2}$$

Where:

n: Number of required plots:

N: Total number of possible plots in the area of the project.

t_{val}: Students t (two-tailed) value for infinite degrees of freedom, and according to the defined reliability level.

w_i: Relative weight of stratum area i (divides the stratum size by the total size of the project).

s_i: Estimated standard deviation for biomass content (t dry matter ha-1).

E: Acceptable error margin defined for biomass estimation.

i: 1,2,3,… Project stratum.

The size of the plots and their shape were consistent with the approaches developed in the monitoring plan (Anexx_2). Adjustments were made to the Natural regenerations model because they present developments of early successional states and a methodology of biomass harvest plots was used to have more adjusted data of the evolution of this stratum.

In total for commercial stands, 198 plots were established and 30 plots for biomass harvest in natural regeneration areas (see Table 14).

Statistical analysis applied to the results for the plots in each stratum determines significant differences between commercial strata (see Table 15 and Figure 11). The natural regeneration stratum was not included in this analysis due to its clear differences in management, thus, it does not apply a comparison with commercially managed stands.

[9] http://www.winrock.org/resources/winrock-sample-plot-calculator

[10] http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-03-v2.1.0.pdf

Table 15. Results of multiple ranges for the values of the commercial strata sampled.

Contrast	*Significanse*	*Diference*	*+/- Límits*
Low - Steady	*	-13,4312	4,7408
Low - Middle	*	-36,1436	5,84741
Low - High	*	-98,8318	5,90153
Steady - Middle	*	-22,7124	5,49965
Steady - High	*	-85,4006	5,55716
Middle - High	*	-62,6883	6,52679

* Shows a significant difference.

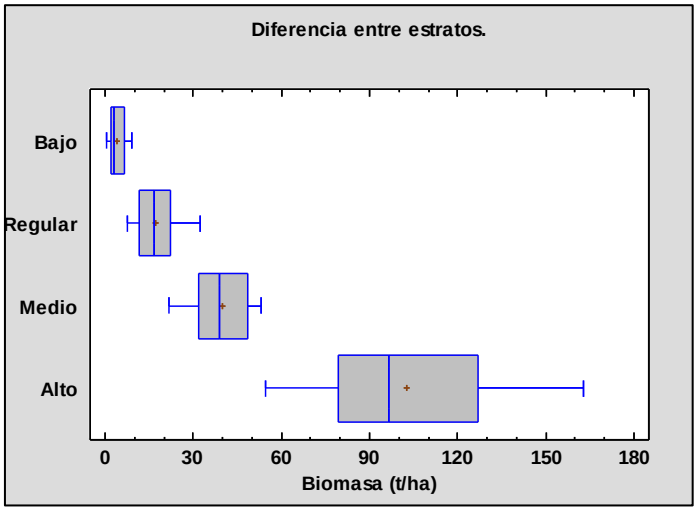

Figure 11. Analysis of statistical differences of the total biomass (t / ha) between strata of commercial species from the monitoring developed.

Estimation of simple size.

To determine whether sampling was sufficient and meets the 10% error level criteria and 90% confidentiality level, we followed the *Winrock's CDM A / R Sample Plot Calculator Tool Spreadsheet Tool Version 2014*[11]. This format is adjusted by the methodological tool *AR_AM_03_v2 (Calculation of the number of sample plots for measurements within A / R CDM project Activities*[12]*).*

The results of the calculation tool for the sample size are presented in Table 16. This shows that the number of established plots compared to the required plots was exceeded, so it is assumed that the sampling was sufficient and complies with the Statistical adjustments of error of 10% and level of confidence of 90%.

Table 16. Sample plot in the present monitoring period.

Stratum	*Plot calculated*	*Samplet Plot*
Low	1	54

[11] http://www.winrock.org/resources/winrock-sample-plot-calculator

[12] http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-03-v2.1.0.pdf

Steady	6	77
Middle	7	34
High	11	33
R.N	32	30

Results of CO_2e contents by sink and for all strata.

In order to estimate the final emission reduction values generated by the project during the analysis period, the uncertainty associated to estimations was evaluated in order to make discounts according to their level.

The accumulated uncertainty was less than 3% as shown inTable 17. Since the uncertainty associated with the total estimates was <10%, no adjustments are required to the final estimates.

Table 17. Results of the assessment of the uncertainty of the reduced carbon estimations in the project area by the implementation of the CDM.

Area relation	***100%***	***Uncertainty calculation***	
Total plots	***228***	t student (90%)	***1,65***
Standard Error (average)	***10,15***	Uncertainty	***2,00***
Weighted standard error (ES)	***1,21***	Average content of CO2 (ton ha)	***55,12***
		Total uncertainty	***3,63%***

According to previous analyzes and in line with the assumptions explained in the PDD that explains no emissions generated by implementation of the project activities, and there are no leaks, the anthropogenic net removals for the 2005-2015 analysis periods are:

Table 18. Results of carbon removals for each stratum within the Project.

Stratum	Proportion of participation in area	Average content of CO_2	Totals	
			ha	***tCO2 total***
LOW	***11%***	***6,58***	***2,400.9***	***15,800***
STEADY	***32%***	***29,73***	***6,936.2***	***206,186***
MEDIUM	***29%***	***68,87***	***6,136.1***	***422,576***
HIGH	***13%***	***176,90***	***2,831.3***	***500,862***
R_N	***15%***	***12,74***	***3,222.5***	***41,044***
Total.			***21,527.0***	***1,186,468***

For more details see Anexx_3 Carbon_balance

The databases, analyzes and statistical processes are presented to the DOE confidentially for its verification.

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

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

>>

N/A.

The baseline is determined ex ante and remains fixed during the first crediting period. Thus the baseline is not monitored. (See section B.7. of the PDD) Following equation in section B.7. of the PDD, ex ante baseline net greenhouse gas removals by sinks is zero:

Equation 2. *CBSL = 0 for all t* ≤ tcp* (Equation number 2 of the PDD)

CBSL = baseline net greenhouse gas removals by sinks; t CO_2-e
ΔCB,LB= baseline sum of the changes in living biomass carbon stocks (above- and below-ground); t CO_2-e.
*t** = Number of years elapsed since the start of the A/R project activity; yr
tcp = Year at which the first crediting period ends; yr.

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

>>

According to the AR-AM0004/Version 04 its applicability conditions, only emissions from burning of biomass activities are considered. In the proposed A/R CDM project activity there will be no biomass burning for site preparation or for forest management. Therefore, emissions within the project boundary are not taken into account; GHG = 0.

E.3. Calculation of leakage

According to the PDD, leakages are not considered due to displacement of activities as a product of project implementation. See section B.7.3 of the PDD.

Therefore, *Lk= 0*

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

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	GHG emission reductions or net GHG removals by sinks (t CO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	0	0	0	0	***1,186,468***	***1,186,468***

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

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	***1,618,206***	***1,186,468***

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

The values of removals of the present period are associated to the fact that the totality of the areas to establish for the present period was not obtained. In the PDD, it was proposed to have, by 2014, 25,629 ha of established commercial stand, and 3,390 ha in natural regeneration models for a total of 29,019 ha. In the present period, only 18,304 ha of commercial models and 3,222.5 ha were established under natural regeneration models, as a consequence of the above, the anthropogenic net removals are smaller than those estimated within the PDD.

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

Project participant and/or responsible person/ entity	[X] Project participant [ ] Person/entity responsible for completing the CDM-MR-FORM
Organization name	Bosques de la Primavera S.A.
Street/P.O. Box	Street/P.O.Box: Cra. 14 No 78-30, pisos 3 y 4
Building	
City	Bogotá
State/region	Bogotá D.C
Postcode	
Country	Colombia
Telephone	(571) 257 9528 – 257 9679 – 257 9757 – 616 4380
Fax	
E-mail	proyectosforestales@proyectosforestales.com
Website	http://www.proyectosforestales.com
Contact person	jesusrivera@proyectosforestales.com
Title	General Manager
Salutation	Mr
Last name	Rivera
Middle name	
First name	Jesús
Department	
Mobile	
Direct fax	
Direct tel.	(571) 257 9528
Personal e-mail	
Project participant and/or responsible person/ entity	[X] Project participant [ ] Person/entity responsible for completing the CDM-MR-FORM
Organization name	Bosques de la Primavera S.A.
Street/P.O. Box	Street/P.O.Box: Cra. 14 No 78-30, pisos 3 y 4
Building	

City	Bogotá
State/region	Bogotá D.C
Postcode	
Country	Colombia
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E-mail	mdl@proyectosforestales.com
Website	http://www.proyectosforestales.com
Contact person	mdl@proyectosforestales.com
Title	Environmental engineer and leader CDM project.
Salutation	Mrs
Last name	Camacho
Middle name	
First name	Diana
Department	
Mobile	
Direct fax	
Direct tel.	(571) 257 9528
Personal e-mail	

Project participant and/or responsible person/ entity	☐ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	Bosques de la Primavera S.A.
Street/P.O. Box	Street/P.O.Box: Cra. 14 No 78-30, pisos 3 y 4
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Personal e-mail	

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Document information

Version	*Date*	*Description*
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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Keywords: monitoring report		