Definición de estilo: Descripción

Monitoring report form for CDM project activity

(Version 09.0)

MONITORING REPORT			
Title of the project activity	**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 PDD applicable to this monitoring report	Version 04.0		
Version number of this monitoring report	Version 02.0		
Completion date of this monitoring report	01/09/2023		
Monitoring period number	Third monitoring period		
Duration of this monitoring period	02/10/2020 – 29/01/2023		
Monitoring report number for this monitoring period	032		
Project participants	Bosques de la Primavera S.A.		
Host Party	Colombia		
Applied methodologies and standardized baselines	AR-ACM003 Version 02.0		
Sectoral scopes	Afforestation and Reforestation (14)		
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
	0	**108.312**	**1.081.759,1**
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex-ante for this monitoring period in the PDD	**1.762.034 tCO_2eq**		

SECTION A. Description of project activity

A.1. 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 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.
b)
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 project and carbon markets may support the sustainable development of the region. The project is drawing the labor force away from the illegal crops that have plagued the region.

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

The project is a private initiative composed of seven 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. the Reforestadora Los Cambulos S.A.S. and Incomser LTDA.

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).

At the present verification, only 22,040.77 hectares were established in the different stand models (commercial stand models and natural regeneration systems) of the 29,019 hectares' eligibility.
The project achieved the replacement of activities that historically have been developed in the project area. Instead of those activities that used to lead to 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 areas in recovery for the mobility of species of fauna and improving the flow of genes between relicts of forests.

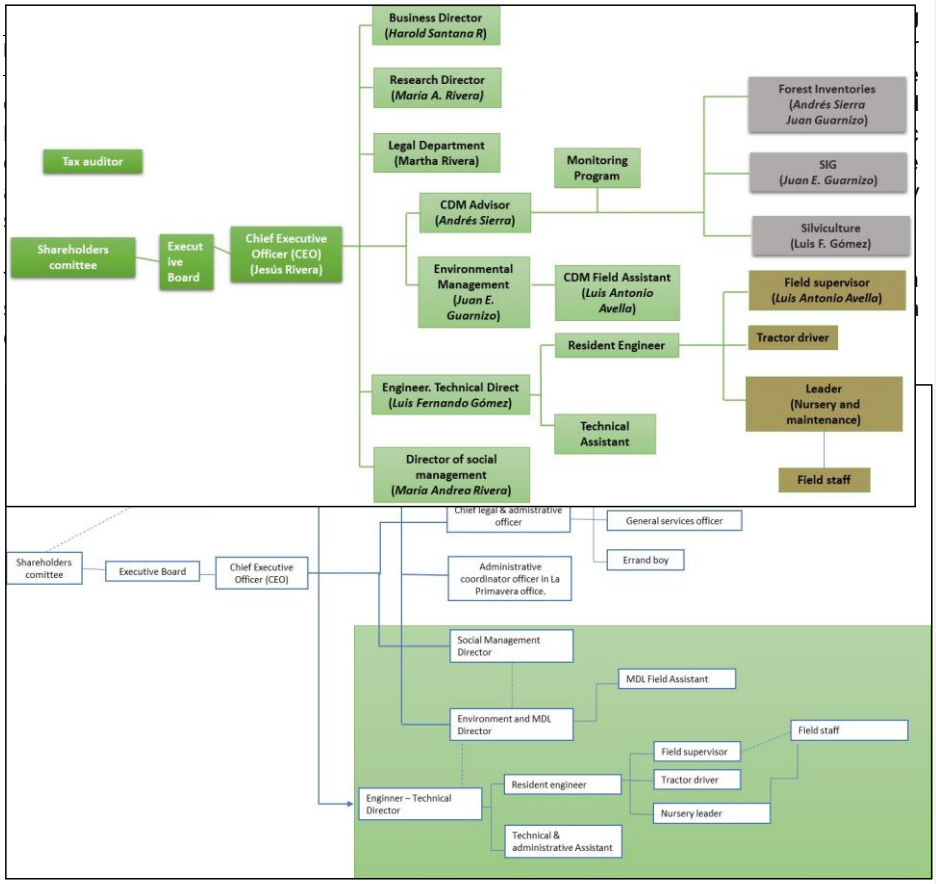


Diagram 1. Organization chart Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia.

Total removals estimations of atmospheric carbon by the project implementation accumulated 2005-2023 are 5,559,630, of which ***1.190.071*** tCO_2 eq correspond to the present monitoring period (2021-2023). This includes contributions from aboveground, belowground, shrubs, litter, dead wood, and carbon organic soil sink.

c) Installed technology and equipment.

In general, the project has developed 29/01/2023 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 the total area of the commercial stand. The rest of the commercial areas were established with species such as *Tectona*

grandis, *Acacia mangium,* and *Eucalyptus pellita*. Total of the commercial stand consists of 18,940.3 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 19 of January of 2023, have been identified land recovery in 3,100.5 ha, which are in early successional processes (**¡Error! No se encuentra el origen de la referencia.**).

Photo 1. Early Development of Natural Regeneration

The activities of establishment and forest management of the commercial stands began in 2005. In the same year, the actions started to encourage 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 the 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 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. Tree nursery. *Pinus caribaea*

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

***Planting density*:** The 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: Before 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

The chiseling of soils in the Orinoquia.

The solution to make more productive and sustainable soils was to develop an arable layer in them through vertical tillage (with chisels) to correct certain physical conditions. To add lime and fertilizers to amend their chemical conditions and sow in them, as components of the pasture, forage species, and improved cultivated species that adapt to soil conditions.

The use of the fertilizer and added amendments promote vigorous growth of the roots of the grasses in the pasture. Also, it allows for increasing the fixation of atmospheric carbon (by 'sequestration') in the deep layers of the soil. Moreover, it reduces the nitrification and emission of nitrous oxides from the soil, boosts the biological activity of the soil, and stabilizes its physical structure.

Suppose farmers develop the idea of establishing topsoil and combine this soil management technology, either with cultivars of forage species and crops adapted to acidic soils in agropastoral systems or already with arboreal components in silvopastoral systems. In that case, they will have the instruments and technology to transform the Colombian savannas, increasing agricultural productivity and mitigating climate change.

Source: Sistemas agropastoriles: Un enfoque integrado para el manejo sostenible de Oxisoles de los Llanos Orientales de Colombia Amezquita et al (2013).

***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 every 20 liters of water, 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 developed. In the field, fertilization will be carried out after 25 – 30 days after planting, by irrigation with a mix that includes *mycorrhizae.* The project will carry out regular nutritional

evaluation (visual observations and plant leaf tissue analysis) of the plantation and provide any additional 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. Fire control equipped. 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 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 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, 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 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.

The *Pinus sp.* thinning will be done in years 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%, 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%, to leave 490 trees per hectare. The third thinning, in year 12, will again eliminate 30% of the stand.

Photo 8. Thinning.

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.

To thin has been gradually developed for some of the lots, as a self-regulation of the stands has been identified with the initial mortality, so the lots remain in the expected densities for the final shift.

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 **¡Error! No se encuentra el origen de la referencia.**.

For this verification period, no new plantations were established, only maintenance and monitoring of already established plantations was carried out, as demonstrated in the contracting documents.

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 (2020-2023).

Project	Activity	Total Contracts
BOSQUES DE LA ORINOQUIA	**Maintenance**	46
BOSQUES DE LA PRIMAVERA		284
INCOMSER		191
MONTFORTIANOS		205
ORGANIZACIÓN LA PRIMAVERA		318
REFORESTADORA CAMBULOS		193
REFORESTADORA GUACAMAYAS		79
TOTAL		***1,316***

All the supports of the activities by nucleus are archived in physical and digital formats for their follow-up, accounting control, and silvicultural execution.

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 the low development of the commercial stand (**¡Error! No se encuentra el origen de la referencia.**)

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

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
P. oocarpa	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 number of trees harvested during the turn of the species.

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

The establishment of commercial stands at the plantation began in June 2005, and the plantation was completed in 2014. The focus has since shifted to maintenance and restoration, and activities have been carried out every year based on the age of the lots and stands in general. Technicians and field workers have developed work contracts to support the records of these activities.

The most intense activities occurred between 2009 and 2013, according to Table 3.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(**¡Error! No se encuentra el origen de la referencia.**~~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[1].

The sowings were carried out in May, June, July and August, which are the months of most precipitation in the region.

The forest inventory processes were carried out between February and April 2023.

[1] 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.

Table 3. Distribution of commercial stand and natural regeneration areas (ha) over time.

t	*year*	*Area (ha)*	*Cumulated area (ha)*
0	2005	835,88	835,88
1	2006	489,92	1.325,80
2	2007	1.005,77	2.331,58
3	2008	2.582,01	4.913,58
4	2009	2.902,05	7.815,63
5	2010	3.595,05	11.410,68
6	2011	2.894,00	14.304,68
7	2012	2.405,30	16.709,98
8	2013	3.953,15	20.663,13
9	2014	1.377,63	22.040,76
10	2015	0,00	22.040,76
11	2016	0,00	22.040,76
12	2017	0,00	22.040,76
13	2018	0,00	22.040,76
14	2019	0,00	22.040,76
15	2020	0,00	22.040,76
16	2021	0,00	22.040,76
17	2022	0,00	22.040,76
	Total	***22,040.7***	***22,040.7***

d) **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 mostly, 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[2], carbon contents in base line are assumed to be zero $C_{bsl} = 0$.

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

The total values of reduced emissions accumulated to 29/01/2023 are estimated to be 5.559.630 tCO2eq.

These are distributed in six strata defined for the present verification period (period. Table 4).

[2] See validated PDD.

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

Balance								
Strata	Area (ha)	%		*Pools* (tCO2)				
			Above and below biomass (tCO2)	Biomass Shrubs (tCO2)	Litter	Dead Wood (tCO2)	Carbon Organic Soil (tCO2)	Total (tCO2)
Low	***2.154,6***	9,8%	***90.918***	60.222	5.455	14.547	752.802	
Steady	***3.016,1***	13,7%	***342.385***	84.302	20.543	54.782		
Middle	***2.185,2***	9,9%	***341.104***	61.079	20.466	54.577		
High	***6.222,4***	28,2%	***1.262.938***	173.920	75.776	202.070		
Upper	***5.362,0***	24,3%	***1.397.714***	149.872	83.863	223.634		
Natural Regeneration	***3.100,5***	14,1%	***86.660***	0	0	0		
	22.040,7	*100,0%*	***3.521.719***	***529.396***	***206.104***	***549.609***	***752.802***	***5.559.630***

Table 5. Final removals accumulated in tons (2005-2023) CO2eq.

∆CP,LB Sum of the changes in living biomass carbon stocks (above- and below-ground); t CO2-e	CBSL Baseline net GHG removals by sinks (t CO2-e)	GHGE Emissions (t CO2-e)	LK Leakage (t CO2-e)	*CERs*
5.559.630	0	0	0	***5.559.630***

The carbon for the current monitoring period is calculated according to:

$$\Delta C_{ARB} = C_{ARB,t1} - C_{ARB,t2}$$

For the current period, the net removals are:

$$\Delta C_{ARB} = 4{,}369{,}559 - 5{,}59{,}630$$

$$\Delta C_{ARB\ (2020-2023)} = \mathbf{1,190,071\ tCO_2}$$

A.2. Location of project activity

a) Host Party
Colombia

b) Region/ State/ Province
Department of Vichada

c) City/ Town/ Community
La Primavera Municipality

d) Physical/ Geographical location

The *Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia* is 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[3]). 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 is limited 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 (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).

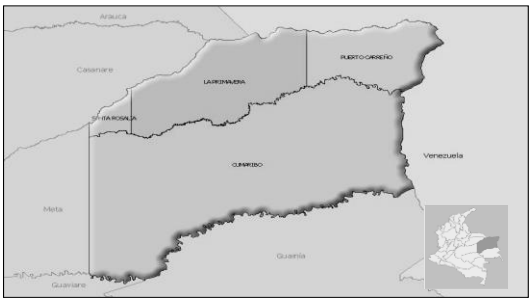


Figure 1. Location of the Municipality of La Primavera, department of Vichada.

Location of the forest project nuclei that make up the Project

The Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia is divided into seven forest nuclei (**¡Error! No se encuentra el origen de la referencia.**). The main features of each are presented below.

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

	Projected Coordinate system coordinates (Magna Colombia East)		Geographic coordinates	
Project	**X**	**Y**	**N**	**E**
Bosques de la Orinoquia	1168687	1094402	5° 26' 52,650" N	69° 33' 19,840" W
Compañía de María Padres Montfortianos	1112002	1084663	5° 21' 39,507" N	70° 4' 1,336" W
Bosques de la Primavera	1143404	1082147	5° 20' 15,701" N	69° 47' 1,765" W
Organización de la Primavera	1075832	1069974	5° 13' 42,975" N	70° 23' 36,550" W
Reforestadora los Cámbulos	1110748	1077895	5° 17' 59,279" N	70° 4' 42,417" W
Incomser	1120319	1081091	5° 19' 42,781" N	69° 59' 31,446" W

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

Reforestadora Guacamayas	1117826	1077782	5° 17' 55,218" N	70° 0' 52,586" W

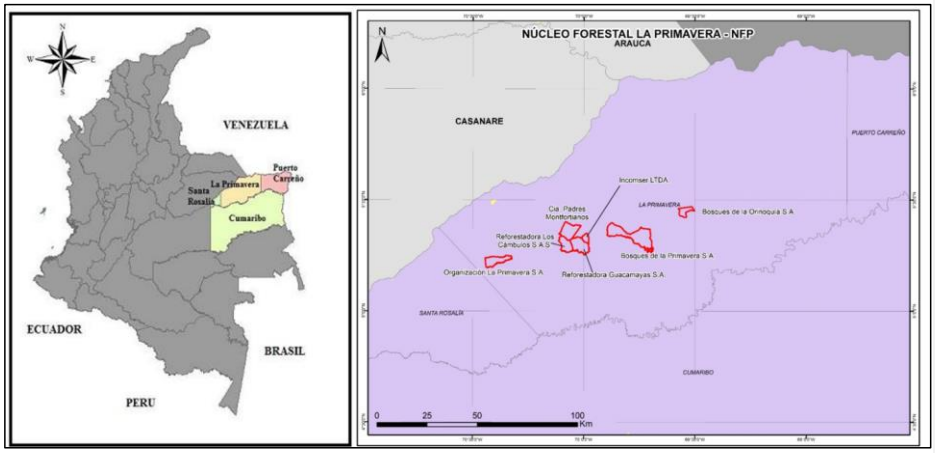
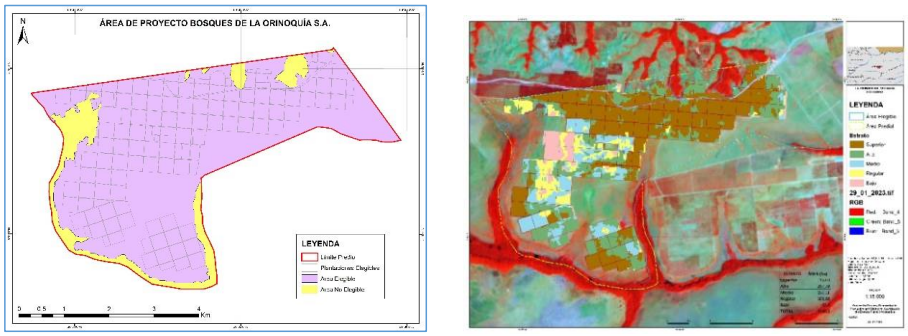


Figure 2. Location of the seven forest nuclei in Municipality of La Primavera, Department of Vichada.

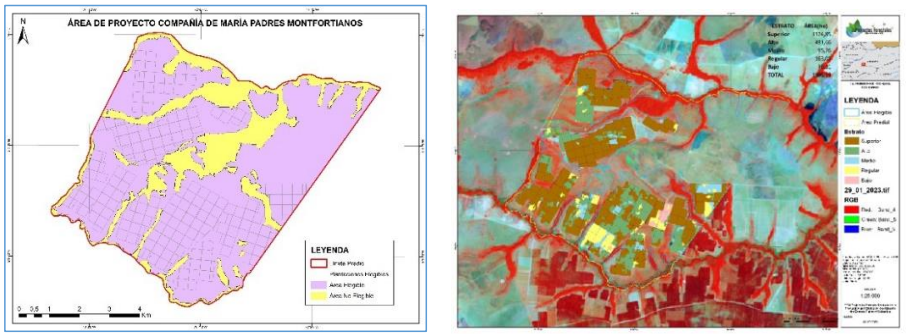
Bosques de la Orinoquia S.A.: This nucleus is in the village of Soledad, 120 kilometers from the municipal capital on the road that leads towards Marandua between the Terecay Stream and the Bita River. It includes the properties of Tranquilandia and La Pista.



A **B**

Figure 3. Project boundary for Bosques de la Orinoquia. A, Project boundary; B, Planted area at 2023 year.

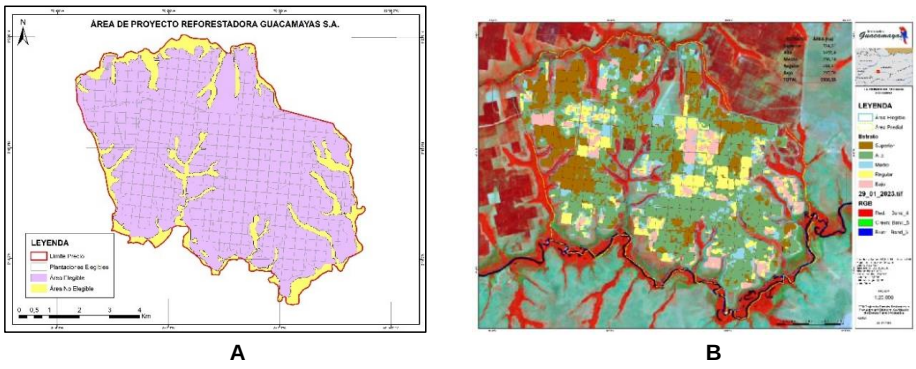
Compañía de María Padres Monfortianos*:* this nucleus includes the rural properties of Chaparrito and El Clavo. It is located in the hamlet of Matiyure, 50 km from the municipal capital.



A B

Figure 4. Project boundary for Compañia de María Padres Monfortinos. A, Project boundary; B, Planted area at 2023 year.

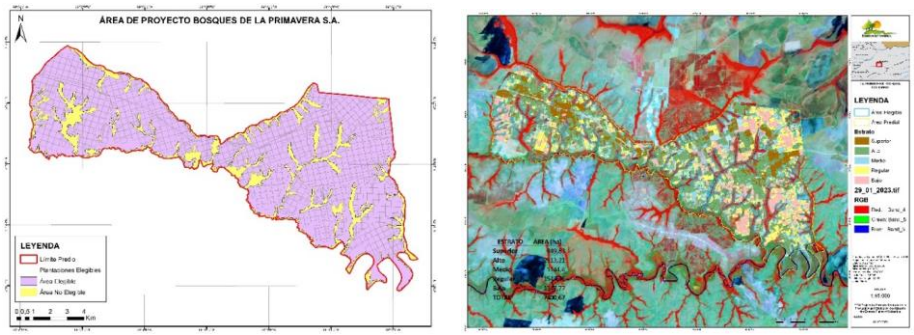
Reforestadora Guacamayas S.A*.:* the properties of Guacamayas, Los Leones, and El Cafuche make up this nucleus, located near the hamlet of La Jaula.



A B

Figure 5. Project boundary for Reforestadora Guacamayas. A, Project boundary; B, Planted area at 2023 year.

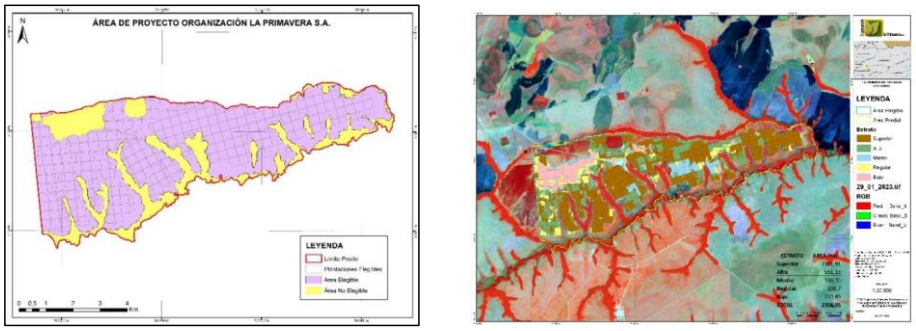
Bosques de La Primavera S.A.: this nucleus is located near the hamlet of Matiyure. It includes the properties of Rincón Hondo, Caudimare, Araucaima, Araguaney, Paz Verde, Tibu, La Piraña, Manaos, Los Ponches and El Suevo.



A B

Figure 6. Project boundary for Reforestadora Bosques de la Primavera. A, Project boundary; B, Planted area at 2023 year.

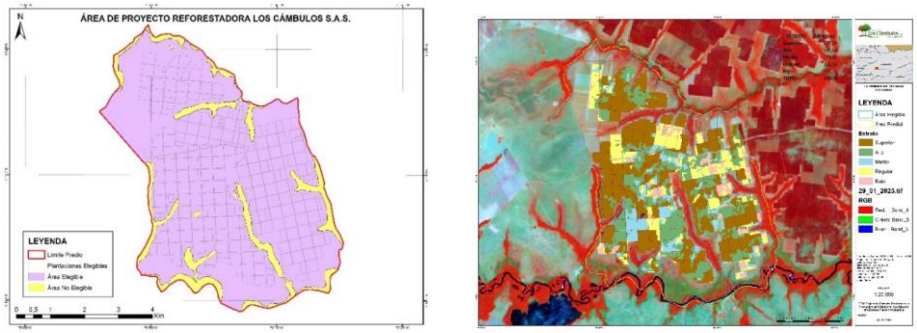
Organización La Primavera S.A*.:* this nucleus is located near the Altos de Meiva hamlet, 40 km from the municipal capital, bordering the El Lobo and Guacharacas streams and the junction with the La Evita River, a direct affluent of the Tomo River. It includes the properties of El Limonar, Mykonos II,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



A B

Figure 7. Project boundary for Organización La Primavera. A, Project boundary; B, Planted area at 2023 year.

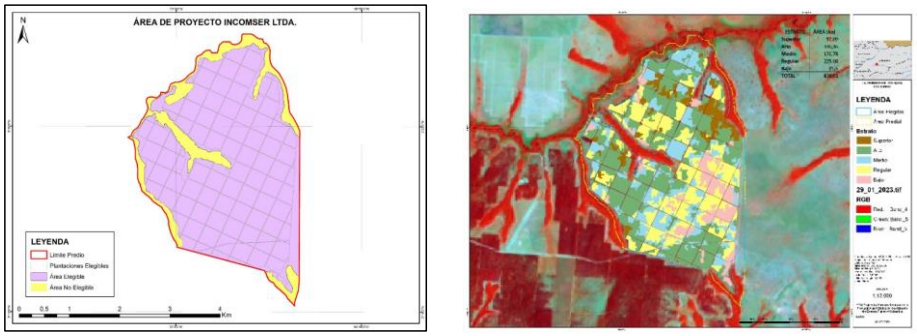
Reforestadora Los Cambulos S.A.S*:* This nucleus includes the properties Los Venados, Cámbulos and Chile. It is located on the road which leads from the Municipality of La Primavera to the city of Villavicencio (department of Meta) deviating at kilometer 19 and continuing 38 km East. The properties of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



A B

Figure 8. Project boundary Reforestadora Los Cambulos. A, Project boundary; B, Planted area at 2023 year.

Incomser LTDA: This nucleus is adjacent to the Guacamayas project, on the northeastern side. At present it is owned by INCOMSER LTDA, a company specializing in forestry and engineering services, the property is known as La Lapa[4].



A B

Figure 9. Project boundary Incomser. A, Project boundary; B, Planted area at 2023 year.

The *Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia,* will consist of 29,019 ha, of which 20,573.1 will be devoted to commercial reforestation. The areas devoted to assisted natural regeneration (**ANR**) will total 390 ha, and the protection of deforested areas for natural regeneration (**PNR**) will comprise 8,056 ha. This distribution of areas is presented in **¡Error! No se encuentra el origen de la referencia.**.

[4] Referred to in the certificate of freedom as La Papa II.

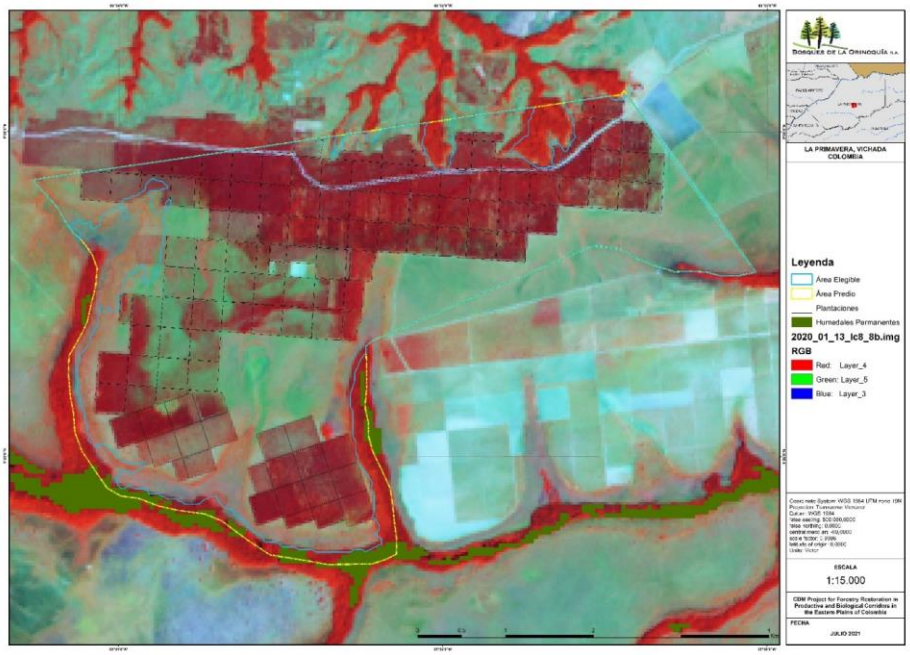
Table 7. Stand model distribution (ha)

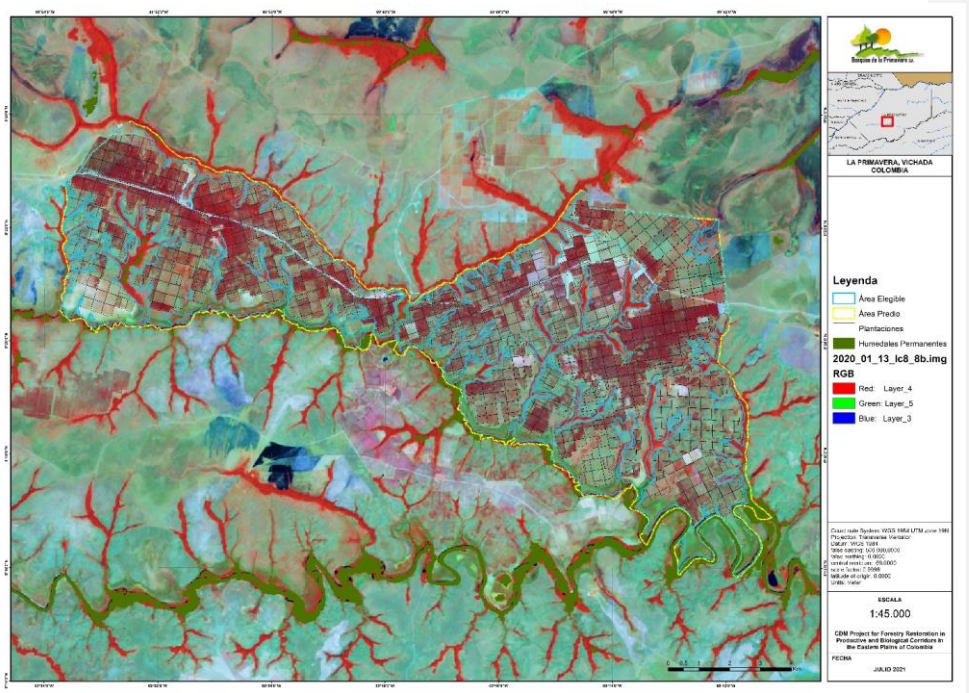
Stand Model	Area (ha)
Commercial	20,573.1
Assisted natural regeneration	390
Natural regeneration (Passive)	8,056
Total	**29,019**

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

Assessment of the establishment of stands outside wetland areas.
According to requirement AR-ACM0003 methodology, the actions of the project should not be in certain areas such as wetlands. Next, an analysis was developed, based on the national layers of permanent wetland zones for the region, where it is shown that the plantations were not established in those areas, complying with the requirement of the methodology.

In the following series of maps, the wetlands areas are presented in green polygons, the eligible areas in blue, the property area in yellow, and the establishment of the commercial model in solid black points (see wetlands_annex).




LA PRIMAVERA, VICHADA
COLOMBIA
Leyenda
Área Elegible
Área Predio
Plantaciones
Humedales Permanentes
2020_01_13_lc8_8b.img
RGB
Red: Layer_4
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CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia
FECHA
JULIO 2021


LA PRIMAVERA, VICHADA
COLOMBIA
Leyenda
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Plantaciones
Humedales Permanentes
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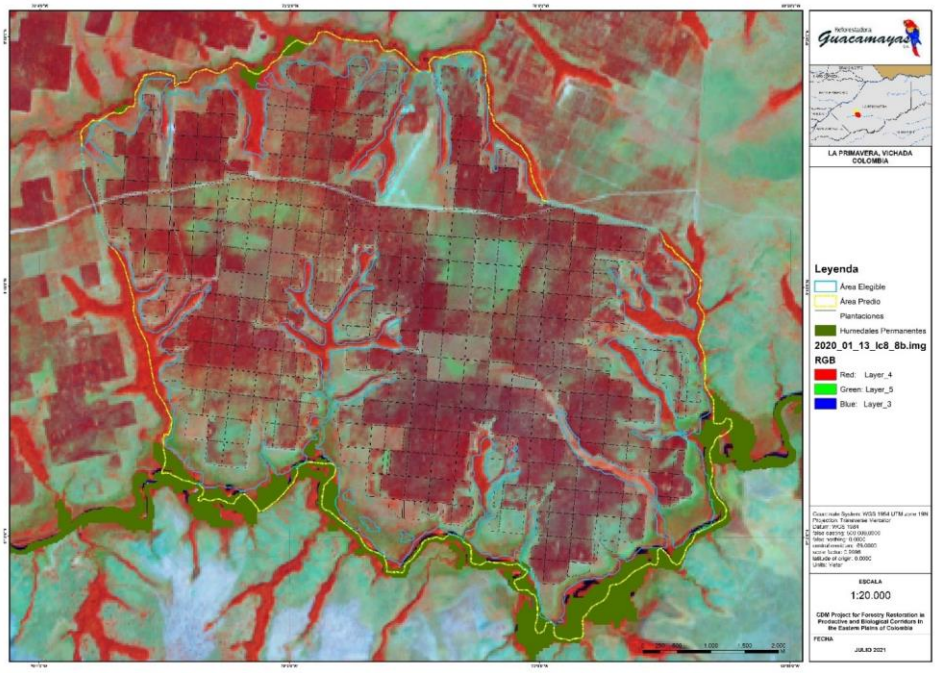
CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia
FECHA
AGOSTO 2021


Reforestadora Guacamayas
LA PRIMAVERA, VICHADA COLOMBIA
Leyenda
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Área Predio
Plantaciones
Humedales Permanentes
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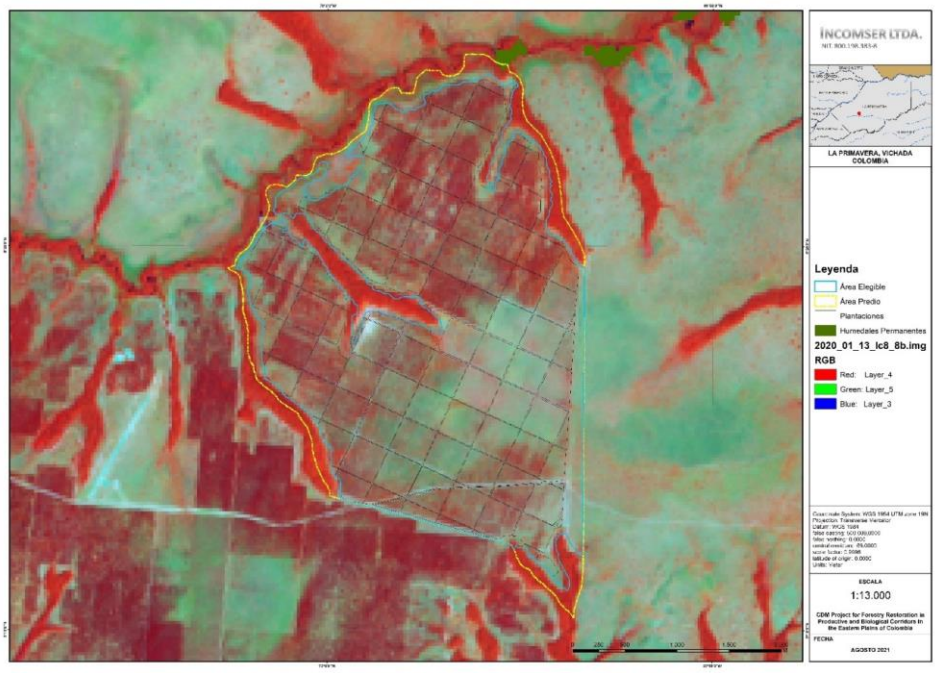
JULIO 2021


INCOMSER LTDA.
LA PRIMAVERA, VICHADA COLOMBIA
Leyenda
Área Elegible
Área Predio
Plantaciones
Humedales Permanentes
2020_01_13_lc8_8b.img
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CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia
FECHA
AGOSTO 2021


LA PRIMAVERA, VICHADA
COLOMBIA
Leyenda
Área Elegible
Área Predio
Plantaciones
Humedales Permanentes
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ESCALA
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AGOSTO 2021


LA PRIMAVERA, VICHADA
COLOMBIA
Leyenda
Área Elegible
Área Predio
Plantaciones
Humedales Permanentes
2020_01_13_lc8_8b.img
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~~A.5.~~A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (host Party)	**Bosques de la Primavera S.A.**	No

~~A.6.~~A.4. References to applied methodologies and standardized baselines

Afforestation and reforestation of lands except wetlands, Version 1. AR-ACM003V02.0[5]

The following methodological tools are implemented in the current verification and validation processes.

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

- 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 02.1. 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
- Methodological tool. Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R. CDM project activities. AR-TOOL14. Version 04.2 https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v4.2.pdf
- Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities".

https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v3.1.pdf

e) Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities.

https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-16-v1.1.0.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

Código de campo cambiado

[5] https://cdm.unfccc.int/UserManagement/FileStorage/THNRJC15IW4K89UBE6DFZYX23OVP0Q

- 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.7.A.5. Crediting period type and duration

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 years.

The actual monitoring period: 02/10/2020 – 29/01/2023.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

At present, 22,040.77 hectares have been established in commercial stand and natural regeneration systems. The total area for the project eligible areas is 29,019 ha, of which most of the species is Pinus caribaea, 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*
- *Pinus oocarpa*
- *Acacia mangium*
- *Tectona grandis*
- *Eucalyptus pellita*

The commercial species were re-stratified according to their biomass content, as presented in Table 8. The re-stratification was developed following the PDD (see PDD Appendix 5 section 3), where strata were unified with similarity in biomass contents and statistical analysis revealed the difference between strata (see section D.3 below).

Table 8. Distribution of commercial strata in the eligible area.

Strata	*Area (ha)*
Low	2,154.6
Steady	3,016.1
Middle	2,185.2
High	6,222.4
Upper	5,362.0
Natural Regeneration	3,100.5
Total	***22,040.77***

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 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, 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 for cattle ranching and anthropogenic burning. The PNR's main anthropogenic activities are physical isolation for the protection of deforested areas and the elimination of livestock, fires, and hunting.
Table 9, presents the area in the project by nucleus and strata (2020-2023).

Table 9. 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)	Incomser (ha)	TOTAL (ha)
Low growth	62,400	1.347,77	101,16	297,76	30,31	233,86	81,300	**2.154,6**
Steady growth	106,880	1.545,45	310,52	464,41	163,08	200,70	225,080	**3.016,1**
Middle growth	157,110	1.144,40	174,09	298,24	95,26	139,36	176,780	**2.185,2**
High growth	297,790	2.513,21	538,84	1.493,40	491,66	551,13	336,360	**6.222,4**
Upper	516,030	849,83	877,79	754,51	1.124,85	1.181,91	57,090	**5.362,0**
Protected Natural regeneration	229,540	653,35	479,47	379,46	863,97	479,76	14,900	**3.100,5**
Sub-totals	**1.369,8**	8.054,0	**2.481,9**	3.687,8	2.769,1	**2.786,7**	891,5	**22.040,8**

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 10~~**Figure 10**~~), shows the structure for the development of the establishment and implementation of forestry and environmental technology.

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

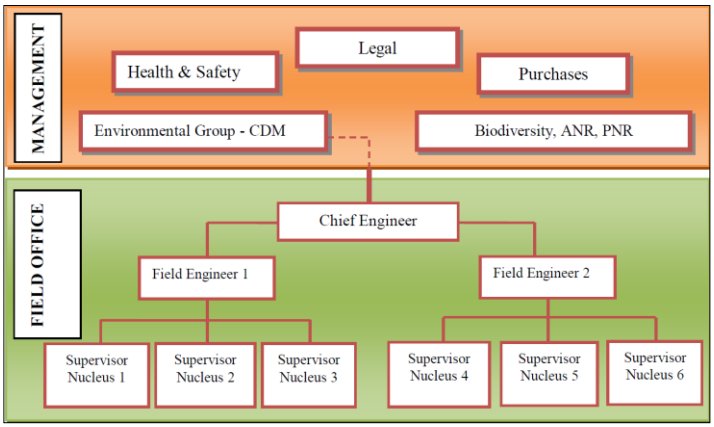


Figure 10. Operational and Management Structure of the Project Activity

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 projects, 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 seven nuclei that conform to the project activity is under the direction of a field supervisor, who reports 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 seven nuclei. Each nucleus has a resident forestry engineer who files regular reports to the chief engineer, who then reports to and interfaces with the general manager of the project.

Monitoring of the PROJECT-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 project objectives, around 20 trainings have been developed during the verification period (10/02/2020 – 01/29/2023). In this way, the project contributes to the development of the region and the country, by training qualified labor

for forestry activities in the territory. For 2023, training related to preventive management of fuel spills and preventive management of burning was developed (see annex Training records).

Photo 9. Personal capacitation.

1,316 jobs have been created, through a monthly renewed employment contract, linking women (94) and men (1,222) to project activities, during the current monitoring period. This labor dynamic is important for the area, since in this region job opportunities and stable employment relationships are low. See table 10

Table 10. Day's wage and employment generated (2020-2023)[7]. See social component annex

Project	Year						
	2020		2021		2022		TOTAL
	Men	Women	Men	Women	Men	Women	
BOSQUES DE LA ORINOQUIA	0	0	22	0	24	0	46
BOSQUES DE LA PRIMAVERA	41	3	104	13	111	12	284
INCOMSER	12	5	42	12	83	37	191
MONTFORTIANOS	9	0	119	0	77	0	205
ORGANIZACIÓN LA PRIMAVERA	24	0	112	0	170	12	318
REFORESTADORA CAMBULOS	36	0	85	0	72	0	193
REFORESTADORA GUACAMAYAS	6	0	24	0	49	0	79
TOTAL	128	8	508	25	586	61	1316
Total Women	**94**						
Total Men	**1222**						

Con formato: Justificado

[7] All activities carried out between 2020 to December of 2022 are delimited. The employment relationship described was carried out through monthly contracts for employment

B.3.B.2. Post-registration changes

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

N.A

B.2.2. Corrections

N.A

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

Not Apply

B.2.4. Inclusion of monitoring plan

N.A

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

For the current verification period, no changes to the project have been determined since verification 02 (period 2016 - 2020) of the project.

The following describes the changes that the project presented in the previous verification.

It supported the application of the AR-ACM003 methodology, which replaces the AR-AM0004.

The change refers explicitly to the adoption of carbon sink accounting. For this and subsequent verification, and because AR-ACM003 replaced the AR-AM0004 methodology, all the carbon sinks provided by AR-ACM003 V02.0 are adopted. Litter, deadwood on the ground, and soil organic carbon are included in the carbon balances for the component shrubs within the plantations.

These sinks, in contrast to the baseline where they are grasslands subjected to annual burns, this sink is considered to be zero (this condition is based on the assumptions established in the methodological tool Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, as they are degraded soils with the presence of saline and acid soils, and especially as described in point 5, line 12: *"Changes in carbon stocks in trees and shrubs in the baseline may be accounted as zero for those lands for which the project participants can demonstrate, through documentary evidence or participatory rural appraisal (PRA), that one or more of the following indicators apply: (f) Land is subjected to periodic cycles (eg slash-and-burn, or clearing -regrowing cycles) so that the biomass oscillates between a minimum and a maximum value in the baseline."*

Therefore, the aboveground biomass is considered zero, and it is additional to the accumulation made by trees, shrubs, litter, and deadwood present in the stand models.

Also, soil conditions according to the study of Vichada soils and land zoning elaborated by the Agustín Codazzi Geographical Institute, 36% of the department (3.6 million hectares) has areas suitable for agricultural, livestock, and forestry production. It is possible to take advantage of this potential if appropriate agronomic practices are carried out. Those practices must improve soil conditions and restore them from the damage of severe chemicals derived from continuous burning in the region for more than 50 years. Because of these historical processes, soils present low organic matter content, high acidity, and in some sectors, aluminum toxicities (Vichada, 2020).

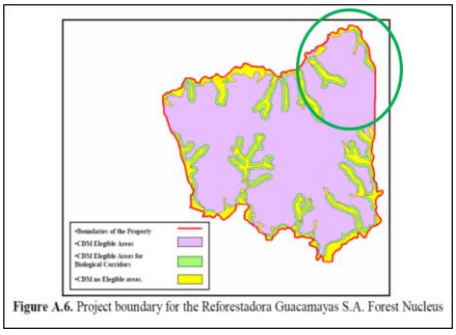
Considering the characteristics described before, soil organic carbon component is fundamental in the accounting for the project. This sink was not considered in AR-AM0004, and it is incorporated in the current verification and the following.

The changes related to this monitoring period are following option c (Section B.2.5) of the instructions of the monitoring report template:

"Changes that are being submitted with this monitoring report as part of the request for issuance (post-registration change - issuance track) as applicable from this monitoring period".

f) The company Incomser LTD is included in the project because it is the owner of the La Papa II plot. It is an area that had the eligibility and applicability conditions, and it was attached to the Guacamayas property.

The maps and areas of the properties were readjusted. Also, under Act No. February 11, 2020, the board of directors of the project participation account contract "Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia" accepted to include the company Incomser LTDA to the project as an owner of a portion of the areas eligible and registered for the project. (See certificate of tradition and freedom Incomser real estate registration 540-908 office of public records of Puerto Carreño Vichada).



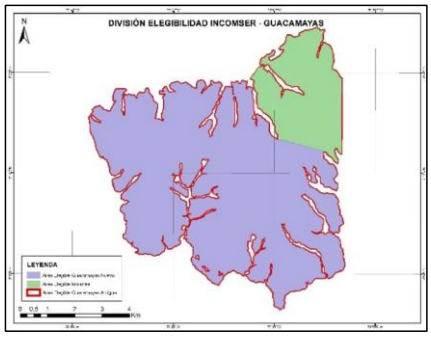


Figure 11. In the right is the eligibility map of the Guacamayas property taken directly from the registered PDD, and the left in green is the Incomser property, which already made part of the eligibility in the validation, so the eligibility is not modified with the adjustment of said area the property of Guacamayas to Incomser.

The above changes do not affect:

- **Not affect the additionality:** They remain the same stand models and project proposal registered.

- **Not affect the scale project.** The annual net removals remain high, so it does not change the scale of the project.

Concerning the Root-shoot ratio values, they are adjusted appropriately to the values reported by the guideline of the IPCC 2003, since this guide discriminates by species and range of tons accumulated in the biomass area.

The value related in the PDD and the monitoring report of the first verification assumed an R: S value of 0.27 for all species and refers to the IPCC 2003 table 3A.1.8. However, the IPCC value corresponds to:

Table 11. Root-Shoot Ratio

ROOT-SHOOT RATIO	Date	Source
Pino sp	0.46 (<50 t/ha Above biomass) 0.32 (50-150 t/ha Above biomass) 0.23 (>150 t/ha Above biomass)	IPCC 2003 Table 3A.1.8
Eucalipto sp	0.45 (<50 t/ha Above biomass) 0.34 (50-150 t/ha Above biomass) 0.2 (50-150 t/ha Above biomass)	IPCC 2003 Table 3A.1.8
A. mangium	0.24 (NE t/ha Above biomass)	IPCC 2003 Table 3A.1.8

Finally, the Carbon Factor, according to tool ar-am-tool-14-v4.2, and national normative the Carbon content in biomass is **0.47**, This value changes the 0.49 the first PDD

B.2.6. Changes to project design

The project has made some changes to the validated document. These changes were made during the second verification of the project in 2020.

These changes were audited, reviewed, and approved during the second verification process. The changes and modifications are described below, to maintain the consistency and follow-up of the document. For the current monitoring period, no modifications or additional changes are presented.

For verification 02 (2016-2020) the Project presented changes in terms of distribution of areas among participants. The changes generated at that time are following option c (Section B.2.6) of the instructions of the monitoring report template:

"Changes that are being submitted with this monitoring report as part of the request for issuance (post-registration change - issuance track) as applicable from this monitoring period".

- **Distribution area**.

The changes in the Project Design are related to the distribution of the areas of each company that is part of the Project. This last part refers to when Incomser joined as part of the project participation account contract. The same approved, valid, and registered area is as follows:

Table 12. Companies linked to the project.

Property	AREA (ha)	%
Incomser	1,021	4%
Organización La Primavera	3,279	11%
Comunidad Monfortiana	4,236	15%
Cambulos	3,265	11%
Bosques de la Primavera	10,750	37%
Bosques de la Orinoquia	1,921	7%
Guacamayas	4,548	16%
TOTAL	***29,019***	***100%***

Changes in stratification.

-

In the present verification was a re-stratification, modifying the strata proposed in the registered project. The procedure was developed in line with the proposed in section B.7.2. *Sampling plan* of the PDD. The re-stratification was developed because of the differences identified in the developed pre-sampling process assessments with information systems and geographic. These lots with the same species, age, and handling, showed important differences in their development, due to the difference in the quality of the site, causing wide in its development and hence variations in the content of biomass.

Con formato: Con viñetas + Nivel: 1 + Alineación: 0 cm + Sangría: 0,63 cm

This re-stratification makes precision on the phases of development and established conservative biomass assessments, differentiate within the same plot, areas with variations in their growth and therefore on contents of biomass. The new stratum of the project is presented below.

Table 13. Stand model Re-stratification see PDD.

Strata	Sub-strata	Area (ha)
Commercial	***LOW***	20,573.1
	STEADY	
	MIDDLE	
	HIGH	
	UPPER	
Assisted Natural regeneration		390
Protected Natural regeneration		8,056
Total		**29,019**

This in line with the procedures proposed in the PDD register.

a. Not affect the applicability condition of the methodology and Base line

b. The re-stratification is consistent with the registered PDD, see B.8.2 section.
c. Maintains the accuracy requirements in the estimates and reduces uncertainty.
d. Not affect the additionally.
e. Not affect the scale project. Since the project area is not reduced and the annual average removals remain high.

The changes made at the time are in accordance with Annex 24, EB 66, is presented below.

~~**Types of changes from the description in the registered PDD as outlined in the guidelines (Annex 24, EB66) and their applicability to the implemented project.**~~

~~No.~~	~~Types of changes from the project description in the PDD of an A/R project activity~~	~~Applicability to the project~~

~~a)~~	~~Changes in year-wise areas planted, possibly resulting in a part of the project area not being planted;~~	~~No~~

~~b)~~	~~Changes in species composition, if the changes are demonstrated at verification to be consistent with the baseline identification and additionality demonstration made at the validation stage;~~	~~No~~

~~c)~~	~~Changes in stocking density, if the changes are demonstrated at verification to be consistent with the baseline identification and additionality demonstration made at the validation stage~~	~~Yes.~~ ~~By incorporating new sinks into the Project, the estimates are higher than estimates calculated in formulation and adjustment before PDD~~ ~~This does not affect the contents achieved until the first verification, conversely has a positive effect reflected on carbon build-up by project activities~~ ~~-Not affect the applicability condition of the methodology and Base line~~ ~~- Not affect the additionality.~~ ~~- Not affect the scale project. The project continues to meet the conditions of large scale, according to CDM small-scale projects are those that Net anthropogenic GHG removals by sinks must be less than 16,000 tons of CO2 per year (CDM Methodology Booklet December 2020, section 4.1). The ex-ante and verified averages exceed this value.~~ ~~The baseline remains unaffected because the assumptions indicate a value of zero in the carbon content in the baseline~~

~~d)~~	~~Changes in timing and choice of silvicultural operations;~~	~~No, there are no changes in the timing of harvest anticipated before the third verification.~~

~~e)~~	~~Changes in the timing of harvest occurring before the third verification;~~	~~No~~

~~f)~~	~~Changes related to the collection of non-timber forest products;~~	~~No~~

~~g)~~	~~Changes in tree/shrub propagation method;~~	~~No~~

~~h)~~	~~Changes in post-harvest replanting/regeneration methods;~~	~~No~~

~~i)~~	~~Changes in the technology employed;~~	~~No~~

~~j)~~	~~Changes in inputs (e.g., fertilizers, certified seeds, watering);~~	~~No~~

~~K)~~	~~Changes in stratification for sampling;~~	~~Yes, ex-post stratification has been implemented considering site conditions that influence the development of stands.~~ ~~This in line with the procedures proposed in the PDD register.~~ ~~-Not affect the applicability condition the methodology and Base line~~ ~~-The re-stratification is consistent with the registered PDD, see B.7.2 section.~~ ~~- Maintains the accuracy requirements in the estimates and reduces uncertainty.~~ ~~- Not affect the additionality.~~ ~~- Not affect the scale project. Since the project area is not reduced and the annual average removals remain high.~~

l)	Changes in type of sample plots (e.g. temporary, permanent, point sampling);	No
m)	Changes in number of sample plots and their allocation to strata;	Yes. The strata are modified (see above) and of sample plots and their allocation to strata is developed The strata have been adjusted following the considerations and recommendations defined in section B.7.2 of the PDD. According to this, the sample size and its allocation are redefined according to the number of strata identified in the current verification. The number of plots changed to 230 plots, distributed in five strata for the current verification.
n)	Changes in the project boundary (limited to reduction in project area), if the changes are demonstrated at verification to be consistent with the baseline identification and additionally demonstration made at the validation stage;	No, changes in project boundaries have not occurred. The project boundary at the verification is consistent with that at the baseline identification and additionality demonstration at the validation stage.
o)	Changes in quality assurance/quality control (QA/QC) procedures, where it can be demonstrated that the changed QA/QC procedures are used by the National Forest Inventory or were applied in another registered A/R CDM project activity;	No.
p)	Changes in parameters, equations, or methods used in tree biomass estimation, if the applicability of the changed parameters, equations, or methods is demonstrated at verification using the *"Tool for demonstration of the applicability of allometric equations and volume equations in A/R CDM project activities"* when available, or if the changed parameters, equations, or methods do not result in a decrease in precision of the estimate of tree biomass.	*Yes, according to tool ar-am-tool-14-v4.2, and national normative Carbon content in biomass is 0,47. This value changes the 0.49 for the first PDD.*
q)	Changes from provisions regarding shifting of pre-project activities, if the related emissions are estimated at verification using the tool "Estimation of the increase in greenhouse gas (GHG) emissions attributable to the displacement of pre-project agricultural activities in A/R CDM project activity", and are accounted for as leakage	Not Applicable.
r)	Changes in the use of fire in site preparation, if the related emissions are estimated at verification using the tool "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" and are accounted for as project emissions;	Not Applicable.
s)	Changes in the extent of soil disturbance in site preparation, if the related emissions are estimated at verification using Equation (2) of the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" and are accounted for as project emissions;	No
t)	Changes in methods of estimation of changes in any carbon pool, if the method applied at verification uses the latest version of the relevant approved tool and the applicability conditions of the methodology applied are consistent with the applicability conditions of the tool.	Yes, *The estimation of the carbon contents for the Shrub sinks within the plantations, litter, dead Wood and Carbon Organic Soils (COS), is incorporated.* The R:S ratio values are adjusted according to those reported by the IPCC 2003 Table 3A.1.18, for the species of *Pino sp* and *E. pellita*. According to the accumulation of aerial biomass obtained from the forest monitoring.

Types of changes from the description in the registered PDD as outlined in the guidelines (Annex 24, EB66) and their applicability to the implemented project.		
No.	***Types of changes from the project description in the PDD of an A/R project activity***	***Applicability to the project***
a)	Changes in year-wise areas planted, possibly resulting in a part of the project area not being planted;	No
b)	Changes in species composition, if the changes are demonstrated at verification to be consistent with the baseline identification and additionality demonstration made at the validation stage;	No
c)	Changes in stocking density, if the changes are demonstrated at verification to be consistent with the baseline identification and additionality demonstration made at the validation stage	Yes. By incorporating new sinks into the Project, the estimates are higher than estimates calculated in formulation and adjustment before PDD This does not affect the contents achieved until the first verification, conversely has a positive effect reflected on carbon build-up by project activities -Not affect the applicability condition of the methodology and Base line - Not affect the additionality. - Not affect the scale project. The project continues to meet the conditions of large scale, according to CDM small-scale projects are those that Net anthropogenic GHG removals by sinks must be less than 16,000 tons of CO2 per year (CDM Methodology Booklet December 2020, section 4.1). The ex-ante and verified averages exceed this value. The baseline remains unaffected because the assumptions indicate a value of zero in the carbon content in the baseline
d)	Changes in timing and choice of silvicultural operations;	No, there are no changes in the timing of harvest anticipated before the third verification.
e)	Changes in the timing of harvest occurring before the third verification;	No
f)	Changes related to the collection of non-timber forest products;	No
g)	Changes in tree/shrub propagation method;	No
h)	Changes in post-harvest replanting/regeneration methods;	No
i)	Changes in the technology employed;	No
j)	Changes in inputs (e.g., fertilizers, certified seeds, watering);	No
K)	Changes in stratification for sampling;	Yes, ex-post stratification has been implemented considering site conditions that influence the development of stands. This in line with the procedures proposed in the PDD register. -Not affect the applicability condition the methodology and Base line -The re-stratification is consistent with the registered PDD, see B.7.2 section. - Maintains the accuracy requirements in the estimates and reduces uncertainty. - Not affect the additionality. - Not affect the scale project. Since the project area is not reduced and the annual average removals remain high.
l)	Changes in type of sample plots (e.g. temporary, permanent, point sampling);	No

m)	Changes in number of sample plots and their allocation to strata;	Yes. The strata are modified (see above) and of sample plots and their allocation to strata is developed The strata have been adjusted following the considerations and recommendations defined in section B.7.2 of the PDD. According to this, the sample size and its allocation are redefined according to the number of strata identified in the current verification. The number of plots changed to 230 plots, distributed in five strata for the current verification.
n)	Changes in the project boundary (limited to reduction in project area), if the changes are demonstrated at verification to be consistent with the baseline identification and additionally demonstration made at the validation stage;	No, changes in project boundaries have not occurred. The project boundary at the verification is consistent with that at the baseline identification and additionality demonstration at the validation stage.
o)	Changes in quality assurance/quality control (QA/QC) procedures, where it can be demonstrated that the changed QA/QC procedures are used by the National Forest Inventory or were applied in another registered A/R CDM project activity;	No.
p)	Changes in parameters, equations, or methods used in tree biomass estimation, if the applicability of the changed parameters, equations, or methods is demonstrated at verification using the *"Tool for demonstration of the applicability of allometric equations and volume equations in A/R CDM project activities"* when available, or if the changed parameters, equations, or methods do not result in a decrease in precision of the estimate of tree biomass.	*Yes, according to tool ar-am-tool-14-v4.2, and national normative Carbon content in biomass is 0,47. This value changes the 0.49 for the first PDD.*
q)	Changes from provisions regarding shifting of pre-project activities, if the related emissions are estimated at verification using the tool "Estimation of the increase in greenhouse gas (GHG) emissions attributable to the displacement of pre-project agricultural activities in A/R CDM project activity". and are accounted for as leakage	Not Applicable.
r)	Changes in the use of fire in site preparation, if the related emissions are estimated at verification using the tool "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" and are accounted for as project emissions;	Not Applicable.
s)	Changes in the extent of soil disturbance in site preparation, if the related emissions are estimated at verification using Equation (2) of the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" and are accounted for as project emissions;	No
t)	Changes in methods of estimation of changes in any carbon pool, if the method applied at verification uses the latest version of the relevant approved tool and the applicability conditions of the methodology applied are consistent with the applicability conditions of the tool.	Yes. *The estimation of the carbon contents for the Shrub sinks within the plantations, litter, dead Wood and Carbon Organic Soils (COS), is incorporated.* The R:S ratio values are adjusted according to those reported by the IPCC 2003 Table 3A.1.18, for the species of *Pino sp* and *E. pellita*. According to the accumulation of aerial biomass obtained from the forest monitoring.

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Analysis on the applicability conditions between the methodologies AR-AM0004 y la AR-ACM003.

Then a parallel shown concerning the conditions of applicability of the above methodology and AR-ACM0003 v02.0 to define its due applicability. Shows that the AR-AM004 has greater applicability conditions AR-ACM0003 vV02.0. When verifying the conditions of the two methodologies, the project complies with all of them and there is no restriction for updating to the AR-ACM003.

AR-AM0004	Justification	AR-ACM003 v02.0	Justification
Scope			
Reforestation or afforestation of land currently under agricultural use. "Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary."	The baseline represents the continuation of the economic activities that have taken place historically, at present, and are unlikely to change in the absence of the project activity. *The project meets this condition as seen in section B.2 of the PDD.*	This methodology excludes from its scope the land that falls into the category of wetlands.	*Lands to be afforested or reforested are severely degraded and the lands are still degrading or remain in a low carbon steady state.* The areas are considered low in carbon content and are not organic soils and are instead degraded soils, derived from oxisols.
Applicability			
Afforestation or reforestation of degraded land, which is subject to further degradation or remains in a low carbon steady state, through assisted natural regeneration, tree planting, or control of pre-project grazing and fuel-wood collection activities (including in-site charcoal production).	As demonstrated in the eligibility analysis (see PDD Section A.7), the vegetation covers in the project activity sites are pasture grasses, burned grasses and scrublands. The predominant economic activity of the project area is based on extensive cattle ranching (90% of productive land in the Municipality of La Primavera is devoted to livestock). See PDD section B.2, for more details. The Project activities are defined as afforestation on historically degraded land, which exceeds the carbon content compared to those identified in the baseline.	This methodology is applicable under the following conditions:	*Lands to be afforested or reforested are severely degraded and the lands are still degrading or remain in a low carbon steady state.* According to the zoning of permanent wetlands for the Region of the Colombian Orinoquia, developed by the Directions of Forests, Biodiversity and Ecosystem Services - DBBSE, Ministry of Environment of Colombia[8], it can be determined that the areas eligible for the project are outside said zoning, as can be seen in **¡Error! No se encuentra el origen de la referencia.**~~Image 1~~. A more detailed analysis of this condition is presented and annexed to the monitoring report, with GIS files and shape files. (wetlands_Anexx_Orinoquia).
The project activity can lead to a shift of pre-project activities outside the project boundary, e.g. a displacement of agriculture, grazing and/or fuel-wood collection activities, including charcoal production.	The A / R project activities did not lead to the ex-ante activity displacement, since the baseline activities were determined as extensive cattle ranching, and in section B.6.1.3 of the PDD there is a demonstration of how the treatment of the ex-ante activity, in which not even leaks are generated by the implementation of the project. Meets the condition	(a) The land subject to the project activity does not fall in the wetland category.	*Lands to be afforested or reforested are severely degraded and the lands are still degrading or remain in a low carbon steady state.* The areas are considered low in carbon content and are not organic soils and are instead degraded soils, derived from oxisols See above

[8] https://www.arcgis.com/home/item.html?id=a499da66b2814db48888343283b57cdb

Lands to be afforested or reforested are degraded and the lands are still degrading or remain in a low carbon steady state;	See the paragraphs above.	(b) Soil disturbance attributable to the project activity does not cover more than 10 percent of the area in each of the following types of land when these lands are included within the project boundary: (i) Land containing organic soils. (ii) Land which, in the baseline, is subjected to land-use and management practices and receives inputs listed in appendices 1 and 2 to this methodology.	(b) (i) As can be seen in the PDD and in the applicability conditions of AR-AM004, the soils in the project areas are not organic soils, nor do they correspond to the category of wetlands (see previous paragraphs), hence this condition does not apply to the project area. On the other hand, in the work of soil preparation, when chiseling, the alteration will be less than 10%, in soils derived from oxisols. (ii) The baseline represents the continuation of the economic activities that have taken place historically, at present, and are unlikely to change in the absence of the project activity (grassland). Lands to be afforested or reforested are severely degraded and the lands are still degrading or remain in a low carbon steady state. The areas are considered low in carbon content and are not organic soils and are instead degraded soils, derived from oxisols. Soils were never or were considered improved practices of their management in baseline actions. The soil is dedicated to grasslands (Anexx 2 Methodology) but they are degraded soils and without management or improvement in their conditions, therefore they do not present restrictions for the implementation of the methodology in the project. As demonstrated in the eligibility analysis (see PDD Section A.7), the vegetation covers in the project activity sites are pasture grasses, burned grasses and scrublands. The predominant economic activity of the project area is based on extensive cattle ranching (90% of productive land in the Municipality of La Primavera is devoted to livestock). Meets the condition
Site preparation does not cause significant longer-term net decreases in soil carbon stocks or increases in non-CO2 emissions from soil	The Colombian *llanos orientales* (eastern plains) cover approximately 17 million hectares. As has been widely documented, the conditions of their soils are not highly suitable for agricultural activities, as they possess high acidity and high levels of aluminum (Rippstein et. al. 2001), and low organic matter content. Plowing the land becomes necessary to achieve better physical, biological, and chemical soil conditions. As a result of its low content of organic matter, emissions from tilling are low and otherwise promote the inclusion and increased organic matter and increase soil carbon.		
Carbon stocks in soil organic carbon, litter and dead wood can be expected to further decrease due to soil erosion and human intervention or increase less in the absence of the project activity, relative to the project scenario	In this case, carbon stocks in soil organic carbon, litter and dead wood can be expected to further decrease due to continued cattle ranching based on regular grassland burnings and continual soil erosion from overgrazing and constant tropical rains or increase less in the absence of the project activity, relative to the project scenario. Given these activities and the type of coverage present in the baseline setting, the presence of debris and litter is practically zero, as well as the content of organic matter in the soil. By implementing the project activity, carbon stocks will be increased directly and very significantly due to the increase of biomass in the tree stand models established and the cycling of nutrients and carbon from forestry. The carbon stocks will increase indirectly due to the elimination of the fire management cycle, the movement of cattle grazing activities to other areas on the farms for intensive management, and the restoration of natural forests by the implementation of the Assisted Natural Regeneration and Protected Natural Regeneration models		
Flooding irrigation is not permitted	The species proposed in the stand models do not support flood conditions, therefore such activity is not considered in the project.		

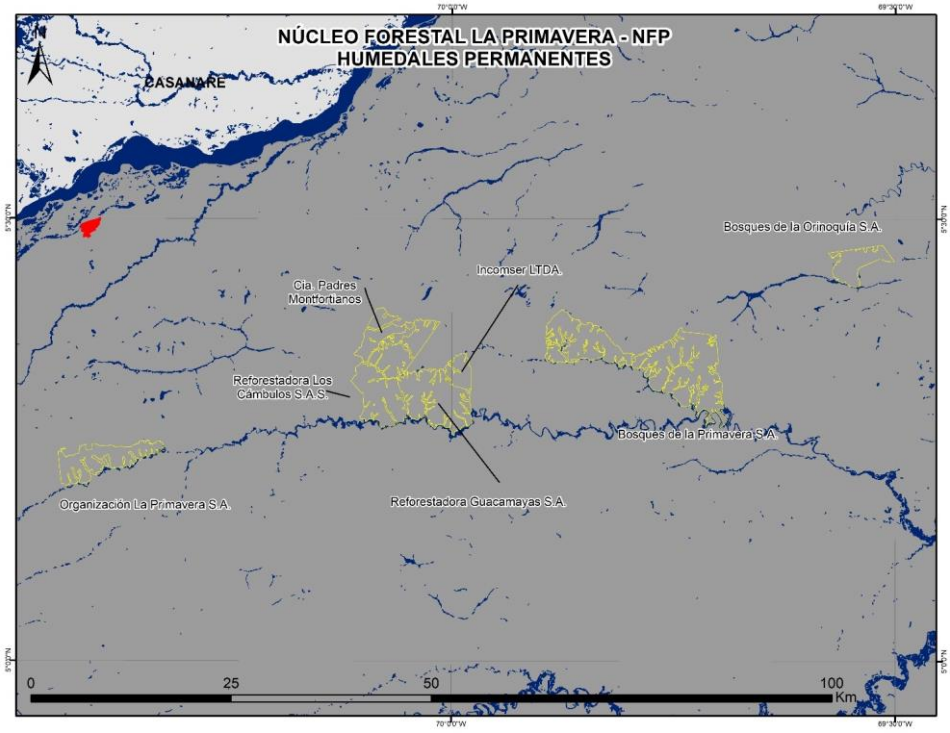

Figure 12. In blue, is the category of wetland in the region project, and the yellow line eligibility area. The eligibility area is outside of the areas determined as permanent wetlands identified for the region, complying with the requirement of applicability of the methodology AR-ACM0003 V02.0.

B.2.7. Changes specific to afforestation or reforestation project activity

Not Apply

SECTION C. Description of monitoring system

The structure for the monitoring process in the project is presented in Figure 12. This diagram is slightly different from that presented in the PDD, but it is in line with what was developed in the project until the present verification. The changes are in line, with the processes of continuous improvement in QA/QC.

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

The project activity applies the monitoring system as prescribed in the approved methodology AR-ACM003 V02.0.

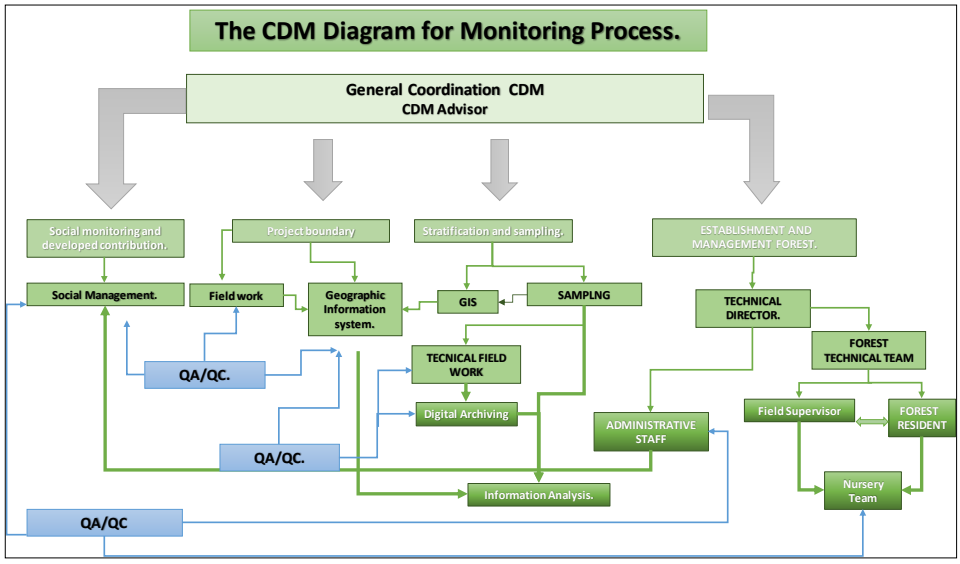

Figure 13. Monitoring structure for A/R project. The structure is continuously adjusted to improve the quality and control information.

The project monitoring system was based on the following aspects:

a) 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* dated January 2023, 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[9], 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, using 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 through 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 and Appendix 5.

[9] They are not annexed to the monitoring report, supports delivered only to the DOE.

b) 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 are 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 can 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 has 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.

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 inventories were implemented to determine net removals of anthropogenic carbon. The statistical results for each stratum are presented in **¡Error! No se encuentra el origen de la referencia.**.

Table 14. Areas of each identified stratum in the Project area.

Stratum	Area (ha)	% Project	Plots	Above Biomass (tonCO2/ha)
LOW	2,154.6	9.8%	52	17,257
STEADY	3,016.1	13.7%	65	47,3
MIDDLE	2,185.2	9.9%	45	68,619
HIGH	6,222.4	28.2%	32	89,224
UPPER	5,362.0	24.3%	25	114,590
P_N_R **(Protected Natural Regenerations)**	3,100.5	14.1%	N.A	11.585
Total	**22,040.77**	**100.0%**	***222***	

The natural regeneration in the current verification was not provided with arboreal species on which there could be implemented processes of measurement of diameters and heights in permanent plots, given to that are still in a process successional early, characterized mostly by shrubs of average and high size, which crown cover the totality of the areas that corresponds to natural regeneration. For the previous thing, the biomass in was calculated according to AR-Tool 14, section 11 (only shrubs). Its estimation way does not imply any plot assembly in the land:

$$C_{SHRUB,t} = \frac{44}{12} \times CF_s \times (1 + R_s) \times \sum_i A_{SHURUB,i} \times b_{SHRUB,i}$$

Where:

$C_{SHRUB,t}$ = Carbon stock in shrubs within the project boundary at a given point of time in year *t*; tCO2-e

CF_s = Carbon fraction of shrub biomass; t C (t.d.m.)$^{-1}$
A default value of ***0.47*** is used unless transparent and verifiable information can be provided to justify a different value.

R_s = Root-shoot ratio for shrubs; dimensionless.
The default value of 0.40 is used unless transparent and verifiable information can be provided to justify a different value.

$A_{SHRUB,I}$ = Area of shrub biomass estimation stratum *i*; ha

$B_{SHRUB,\ i}$ = Shrub biomass per hectare in shrub biomass estimation stratum *i*; t d.m. ha^{-1}

BDR_{sf} = Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 (i.e. 100 percent) and the default above-ground biomass content per hectare in the forest in the region/country where the A/R project activity is located; dimensionless. A default value of 0.10 should be used unless transparent and verifiable information can be provided to justify a different value.

b_{FOREST} = Default above-ground biomass content in the forest in the region/country where the A/R project activity is located; t d.m. ha^{-1}.

$CC_{SHRUB,I}$ = Crown cover of shrubs in shrub biomass estimation stratum *i* at the time of estimation, expressed as a fraction (e.g. 10 percent crown cover implies $CC_{SHRUB,i}$ = 0.5; dimensionless.

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).

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, a calibrator was used (Image 1A and B).

For measurement process, totally new equipment was acquired, guaranteeing its good function and calibration. The equipment was presented to the audit team and the purchase records are presented in annex _7.

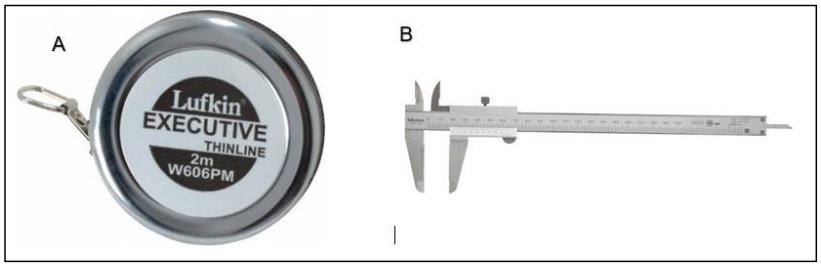

Image 1. DBH measurement equipment (cm): A, diametric tape, B. calibrator.

For measuring the height to those trees that exceeded 4 m, indirect measurement was held with the use of TRUPULSE ™ 200 / 200B instrument (**¡Error! No se encuentra el origen de la referencia.¡Error! No se encuentra el origen de la referencia.**). In all other cases, it was performed with a rod and metric tape.

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

Image 2. Verification of equipment before the start of field sampling

The hypsometer equipment was the reference Nikon Forestry Pro II Laser Rangefinder/Hypsometer. These were acquired new for the present monitoring, so they do not require calibration.

Image 3. Verification in the measurement of geographic coordinates from the two equipment to be used in the field. A new GPS is used as a reference.

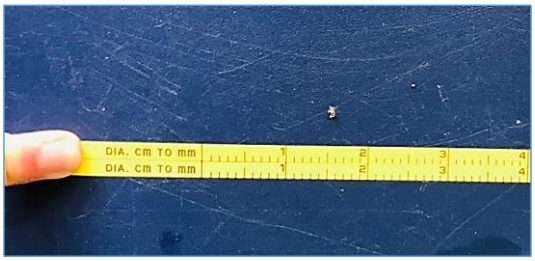

Image 4. New diameter tapes (cm values) are used in each field monitoring process, and both are verified to have equal calibration and no measurement-altering defects.

Sample Data.

Process description

The data collection quality process begins as soon as the plot measure ends. The process follows the same data collection protocol. It is recorded in the same formats as primary data, using custody equipment. This information will be used to be compared later with the primary data. For the digitalized data, once this process ends, digitalized information is compared with the physical formats. When an-error was detected, then it was corrected (see annex, QA_QC).

(1) Quality of data collection

Of 222 permanent plots sampled for the process, 12,1% were verified for quality measurement. This percentage represents 27 plots. This sample size complies with those stipulated in the PDD (it must be between 10-20%). The plots were randomly selected and distributed among all the nuclei that the project gathered. This review was carried out on 100% of the DBH and 100% of the heights present in the 27 selected plots, for a total of 647 data reviewed.

(2) *Digitalization quality*

The team reviewed 100% of the records to verify and guarantee the quality of the digitization process. It means that team checked 11,028 data. When there was a difference between field formats and excel records, it was corrected following field data. This process guarantees the quality of 100% of the data recorded in the formats compared to the digital ones used for the calculations.

Results

1. Results regarding the quality of data collection.

The team identified 11 errors for the DBH taking. These errors are described as a difference equal to or greater than twice the precision of the measuring instrument, in the case of 2 mm of the diameter tape. This represents a total error of **1.8%** of the revised DBH data.

During the fieldwork, the quality control team carried out a review process as the data was collected in the field, finding only 4 errors in the height measurement. These errors are described as a difference equal to or greater than twice the precision of the measuring instrument, in this case, 1 meter in the digital hypsometer. This represents a total error of **0.7%** of the HT data reviewed

Data that does not meet the quality criteria is identified in red in the digital spreadsheets attached to this chapter.

In total, **15** errors were identified in the **1294 (647 DBH y 647 H)** data that were performed in quality control. As identified in the following tables, an error of **1.16%** is within the allowed percentage (less than 5%) in the sampling that accounts for carbon biomass for the project.

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 because of the normal growth of the trees and normal detachment of barks in the species of *Pinus sp*.

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 from field forms to the spreadsheet, have been made in coordination between the field team and the expert. Typing errors were associated with decimals entered. These, within the analyzed database, did not exceed **0.03%** error (3 data found and corrected).

- Custody of the information collected in the field and digitized: Archiving performance was verified of the information generated in the 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 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.

In subsequent monitoring processes to ensure accuracy in measuring equipment, an evaluation of the status and assessment of the level of accuracy will be carried out with equipment of the same references that have been properly safeguarded, to make comparisons quality control for accuracy, This applies especially to those of mechanical operation (Example: metric and diametric tape, calibrator). Digital equipment, such as GPS or digital hypsometer, will be taken to laboratories recommended by the manufacturers for their verification.

Monitoring of disturbances.

For this component, the project has implemented a monitoring scheme using remote sensing of the affected areas. This monitoring mechanism, in addition to complementing silvicultural control actions, is aligned with the requirements established by the Environmental Corporation in the Environmental Management Measures (MMA in spanish).

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During this monitoring period there was only one disturbance caused by fire in one of the core areas that are part of the project. The fire occurred in the Company of Mary Monfortian Fathers Nucleus and the data are as follows:

- Type of Disturbances: Fire.
- Date: 31/12/2020.
- Time: 12:00 pm
- Affected area: 157.47 ha.
- Causes: Naturals. Rain and thunderstorms occurred and a lightning strike started the fire in the plantation.

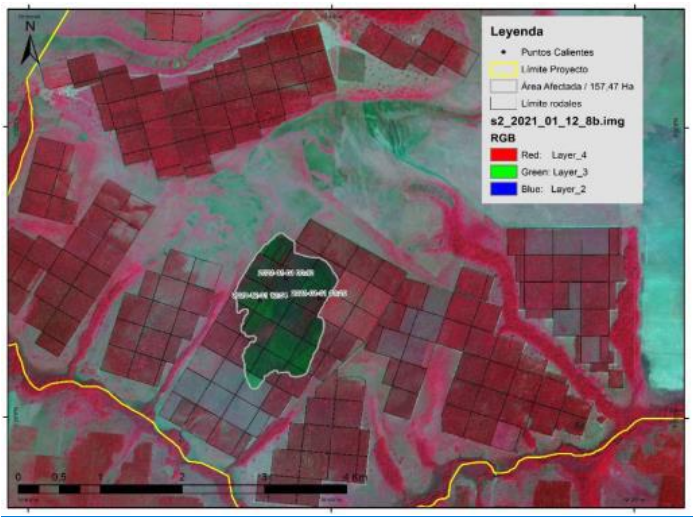

Image 5. Identification of the area affected by the fire in the nucleus of the Company of Mary Fathers Montfortianos, a sector known as Módulo 4.

Con formato: Inglés (Estados Unidos)

As a result of the fire, the lower parts of the tree stems are burned, but there is no tree mortality (see the following image).

Image 6. Degree of damage caused by the fire. Impact only in the lower parts of the tree trunk.

This affectation was reported to the corporation and is evidenced in the annex 9 Maintenance.

Con formato: Inglés (Estados Unidos)

SECTION E.SECTION D. Data and parameters

E.1.D.1. Data and parameters fixed ex-ante

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 the 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*
Choice of data or measurement methods and procedures	Default Value
Purpose of data/parameter	Calculation of actual net GHG removals by sinks
Additional comments	The equations used in *pinus sp* (except DAP<0.6cm) relate the DBH to the stem volume, and the *BEF 2* should be applied for branches, leaf biomass, etc. For other species, Allometric equation method has been used.

Data/Parameter	**Carbon fraction, *CFj***
Unit	Dimensionless
Description	Carbon fraction content in the tree biomass
Source of data	IPCC (2003), PDD REF 9199. AR-Tool 14 Version 04.2

Value(s) applied	*0.47 for all specie and models.*
Choice of data or measurement methods and procedures	Default Value
Purpose of data/parameter	Actual net GHG removals by each species in the project activity. AR-Tool 0014 V.04.2 in section 11 for the biomass and carbon shrubs.
Additional comments	It was applied to each stand model.

Data/Parameter	**Carbon fraction, *CFs***
Unit	t C
Description	Carbon fraction of shrub biomass
Source of data	AR-Tool 14 Version 04.2
Value(s) applied	0.47
Choice of data or measurement methods and procedures	Default Value
Purpose of data/parameter	Actual net GHG removals by each species in the project activity. Applied in the AR-Tool 14 V 04.2, in section 11 for the biomass and carbon shrubs.
Additional comments	It was applied to ANR and PNR models

Data/Parameter	*Dj*
Unit	t d.m. m-3
Description	Basic wood density for species *P. caribaea and P. oocarpa*
Source of data	USDA 2006[a] Trujillo N. 2007. Guía de Reforestación.
Value(s) applied	0.55
Choice of data or measurement methods and procedures	Data from national reference.
Purpose of data/parameter	Actual net GHG removals by *P. caribaea and P oocarpa* in the project activity.
Additional comments	Data from national reference. Is applied only with volume equations to lead to biomass. For *A. mangium,* and *E. pellita*, biomass equations were used, and Basic wood density for this species it was not necessary.

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	*Pino sp*: 0.46 (<50 t.ha above biomass); 0.32 (50-150 t.ha above biomass); 0.23 (>150 t.ha above biomass) *Eucalipto sp*: 0.45 (<50 t.ha above biomass); 0.34 (50-150 t.ha above biomass); 0.2 (50-150 t.ha above biomass) *A. mangium*: 0.20 (<125 t.ha above biomass) *Several species (ANR and PNR stand models): 0.27*
Choice of data or measurement methods and procedures	Default Value
Purpose of data/parameter	Actual net GHG removals by each species in the project activity.
Additional comments	It was applied to *Pinus sp,* commercial stand model. *Pinus* tropical/sub-tropical moist forest.

Data/Parameter	**Root-shoot ratio, *Rs***
Unit	Dimensionless
Description	Root-shoot ratio for shrubs
Source of data	UNFCCC AR Tool 14.
Value(s) applied	*0.4*
Choice of data or measurement methods and procedures	N.A
Purpose of data/parameter	Actual net GHG removals in the early successional states ANR and PNR.
Additional comments	This process is applied to the early successional states in natural regeneration.

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/parameter	Calculation of project emissions or actual net GHG removals by sinks
Additional comments	Applied for adjustment of the statistical sampling.

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	*Excel program*
Value(s) applied	*1.97*

Choice of data or measurement methods and procedures	
Purpose of data/parameter	Calculation of project emissions or actual net GHG removals by sinks
Additional comments	To develop an accurate inventory of timber volume and carbon and apply for adjustment of the statistical sampling.

Data/Parameter	BDR_{sf}
Unit	Dimensionless
Description	The ratio of shrub biomass per hectare in land having a shrub crown cover
Source of data	AR Tool 14 V 04.2
Value(s) applied	0.10
Choice of data or measurement methods and procedures	Default Value
Purpose of data/parameter	Actual net GHG removals in the early successional states ANR and PNR
Additional comments	This process is applied for the early successional states in the natural regeneration and PNR.

Data/Parameter	$\boldsymbol{DF_{DW}}$
Unit	Percent (%)
Description	Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass
Source of data	National source, national forest inventory, IPCC, or UNFCCC.
Value(s) applied	*6%*
Choice of data or measurement methods and procedures	D The values recommended by AR-Tool 12 tropical biome with elevation below 2000m and precipitation >1600 mm yr^{-1}.
Purpose of data/parameter	Applied in the carbon dead wood
Additional comments	AR-Tool 12

Data/Parameter	$\boldsymbol{CC_{SHRUBS.i}}$
Unit	Dimensionless
Description	Crown cover of shrubs in shrub biomass stratum i
Source of data	National source, national forest inventory, IPCC, UNFCCC OR Field measurement
Value(s) applied	*0.5*
Choice of data or measurement methods and procedures	Considering that the biomass in shrubs is smaller than the biomass in trees, a simplified method of measurement may be used for estimating shrub crown cover. Ocular estimation of crown cover may be carried out or any other method such as the line transect method or the relascope method may be applied

Purpose of data/parameter	Applied in the carbon shrub biomass stratum *i*
Additional comments	AR-Tool 14. When land is subjected to periodic cycles (e.g. slash-and-burn, or clearing-regrowing cycles) so that the shrub crown cover oscillates between minimum and maximum values in the baseline, an average shrub crown cover equal to ***0.5*** is used unless transparent and verifiable information can be provided to justify a different value.

Data/Parameter	DF_{li}
Unit	Percent (%)
Description	Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass.
Source of data	National source, national forest inventory, IPCC or UNFCCC.
Value(s) applied	*16%*
Choice of data or measurement methods and procedures	The values recommended by AR-Tool 12 tropical biome with elevation below 2000m and precipitation >1600 mm yr^{-1}.
Purpose of data/parameter	Applied in the carbon dead wood
Additional comments	AR-Tool 12. The value of the conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass (DF_{LI}) is selected according to the guidance provided in the relevant table in Section 8 unless transparent and verifiable information can be provided to justify a different value. *For the present Project, litter biomass studies were analyzed for Pinus sp plantations under similar conditions to that project area. From this analysis (see attached analysis delivered to the auditor team) was demonstrated that an average value of 16% is adequate for tropical forest plantations and is important to highlight that tool-recommended values is for natural forest not to plantations. This value is not appropriate to be applied to these AR project conditions*. A literature analysis was developed to identify the reported values of litter biomass in *Pinus sp* plantations, which is presented to the auditor as an **annex to this report.**

Data/Parameter	f_{MG}
Unit	Dimensionless
Description	Relative stock change factor for baseline land-use in stratum *i* of the areas of Land.
Source of data	IPCC 2003. Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities.
Value(s) applied	*0.7*
Choice of data or measurement methods and procedures	The values recommended by Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities. The baseline identifies grassland as land use.
Purpose of data/parameter	Applied for estimation of change in soil organic carbon stocks
Additional comments	

Data/Parameter	$f_{lu,i}$
Unit	Dimensionless
Description	Relative stock change factor for baseline land use in stratum *i* of the areas of land
Source of data	IPCC 2003. Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities.
Value(s) applied	*1*
Choice of data or measurement methods and procedures	The values recommended by Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities. For Grassland in *Tropical, wet.*
Purpose of data/parameter	Applied for estimation of change in soil organic carbon stocks.
Additional comments	

Data/Parameter	$F_{IN,i}$
Unit	Dimensionless
Description	Relative stock change factor for baseline management regime in stratum *i* of the areas of land
Source of data	IPCC 2003. Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities.
Value(s) applied	*1*
Choice of data or measurement methods and procedures	The values recommended by Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities. For Severely degraded soil.
Purpose of data/parameter	Applied for estimation of change in soil organic carbon stocks
Additional comments	

Data/Parameter	B_{Forest}
Unit	t.d.m ha^{-1}
Description	Default above-ground biomass content in forest in the region/country where the A/R project activity is located
Source of data	IPCC 2003 and Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities.
Value(s) applied	*231.7*
Choice of data or measurement methods and procedures	For tropical rainforest in Colombia. Phillips et al, IDEAM, 2014[10].
Purpose of data/parameter	Applied for estimation of change in *shrub* carbon stocks
Additional comments	

[10] Phillips, J.F., Duque, A.J., Scott, C., Peña, M.A., Franco, C.A., Galindo, G., Cabrera, E., Álvarez, E. & Cárdenas, D. 2014. Aportes técnicos del Sistema de Monitoreo de Bosques y Carbono a la propuesta de preparación de Colombia para REDD+: datos de actividad y factores de emisión. Memoria técnica. Instituto de Hidrología, Meteorología, y Estudios Ambientales (IDEAM). Bogotá D.C., Colombia. 45 pp.

E.2.D.2. Data and parameters monitored

Data/Parameter	A
Unit	ha
Description	Total project area
Measured/calculated/ default	Measured
Source of data	Measured and verified with GIS.
Value(s) of monitored parameter	29,019 ha
Monitoring equipment	GIS (Geographic Information System) and remote sensing.
Measuring/reading/recording frequency	Annual
Calculation method (if applicable)	N.A
QA/QC procedures	As a control of the actual presence of the established stands, verification is done with satellite images and geographic information processes. This work was 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/parameter	Calculation of project emissions or actual net GHG removals by Sinks.
Additional comments	

Data/Parameter	A_{ikt}
Unit	ha
Description	All areas under control that have been established up to 2005 in the stratum *i.*
Measured/calculated/ default	Measured
Source of data	Measured in the field with GPS and verified with GIS.
Value(s) of monitored parameter	**Stratum** / **Area (ha)** **LOW** 2,154.6 **STEADY** 3,016.01 **MIDDLE** 2,185.2 **HIGH** 6,222.4 **UPPER** 5,362.0 **P_N_R (Protected_Natural Regenerations)** 3,100.5 **Total** ***22,040.77***
Monitoring equipment	Global Position System (GPS). Remote sensing.
Measuring/reading/recording frequency	Yearly and verified for the monitoring period.
Calculation method (if applicable)	N.A

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[11]). 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 was 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. The equipment's GPS (GLOBAL POSITIONING SYSTEMS) with which measurements are made of the areas of the strata, will be checked in his calibration before the fieldwork.
Purpose of data/parameter	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: $A_{i,k,t}=\sum A_i$

Data/Parameter	$A_{SHRUB,i}$
Unit	ha
Description	Area of shrub biomass estimation stratum i; ha
Measured/calculated/ default	Measured
Source of data	Measured in the field with GPS and verified with GIS.
Value(s) of monitored parameter	N_R (Natural Regenerations) ***3,100.5*** ha
Monitoring equipment	Remote sensing and geographic information system (GIS). The land verification with Global Position System (GPS).
Measuring/reading/recording frequency	Yearly and verified for the monitoring period.
Calculation method (if applicable)	N.A
QA/QC procedures	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. The equipment's GPS (GLOBAL POSITIONING SYSTEMS) with which measurements are made of the areas of the strata, will be checked in his calibration before the fieldwork.
Purpose of data/parameter	Calculation of project emissions or actual net GHG removals by sinks
Additional comments	It is also valued for areas (ha) in the commercial stand model, which allows carbon estimation by shrubs within the plantation.

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

Data/Parameter	***AP***
Unit	m^2
Description	Sample plot area
Measured/calculated/ default	Measurement
Source of data	Field measurement
Value(s) of monitored parameter	0.05 ha for the commercial stand.
Monitoring equipment	Metric tape of 30 m. Precision of 2 mm.
Measuring/reading/recording frequency	5 years
Calculation method (if applicable)	N.A
QA/QC procedures	The sampling protocol was applied, and the training of field staff was developed. Then the developed procedure and the obtained information are evaluated. Development of error control according to PDD. In each verification process, new metric tapes will be available to ensure proper operation and accuracy of measurements.
Purpose of data/parameter	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 the startup report. To verify that the parcels presented the correct areas, 12% 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	Each monitoring
Calculation method (if applicable)	N.A

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. This process was realized with metallic diametrical Tapes, which show fewer variations in precision. The monitoring staff, keeps a tape in perfect condition, to calibrate the tapes used in the field. This tape is not used in field measurements and is stored in the central offices. Tapes that have problems with calibration are replaced with new tapes of the same conditions (metallic tape).
Purpose of data/parameter	Applied in the allometric or volume equations, for each species.
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.

Data/Parameter	***H***
Unit	m
Description	Tree height
Measured/calculated/ default	Measured
Source of data	Field measurement
Value(s) of monitored parameter	N.A
Monitoring equipment	NIKON Forestry Pro II Laser Rangefinder™ And metric tape.
Measuring/reading/recording frequency	Each monitoring
Calculation method (if applicable)	N.A

QA/QC procedures	-Protocol for taking dasometric measurement variables. Random sampling was developed in more than 10% of the established plots. The same equipment and processes were used to corroborate the proper height measurement. The trees with heights less than 5 meters, can be taken with the help of tape measure. The staff keeps a tape in perfect condition, to calibrate the tapes used in the field. This tape is not used in field measurements and is stored in the central offices. Tapes that have problems of calibration are replaced with new tapes of the same conditions (metallic tape). Trees with heights greater than 5 meters, will be measured with digital hypsometers. The equipment with which measurements, will be checked in his calibration before the fieldwork. These checks are developed in a laboratory specialized and recognized by the manufacturers. When an equipment present problem is demonstrated by the calibration laboratory and verified by monitoring staff, will be strictly replaced by a new one.
Purpose of data/parameter	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 the PDD since it was suggested only to sample a portion and to develop allometric equations for estimating the heights of the unmeasured trees. 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. To verify that the parcels presented the correct areas, more than 10% of the established parcels were re-measured.

Data/Parameter	$CC_{SHRUB,I}$
Unit	dimensionless
Description	Crown cover of shrubs in shrub biomass stratum i
Measured/calculated/ default	Calculated
Source of data	Field measurement
Value(s) of monitored parameter	0.5
Monitoring equipment	N.A
Measuring/reading/recording frequency	At every verification
Calculation method (if applicable)	Considering that the biomass in shrubs is smaller than the biomass in trees, a simplified method of measurement may be used for estimating shrub crown cover. Ocular estimation of crown cover may be carried out.

QA/QC procedures	A default value of 0.5 should be used unless transparent and verifiable information can be provided to justify a different value. Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or the IPCC GPG LULUCF 2003, is applied.
Purpose of data/parameter	Applied in the biomass and carbon shrubs in the regeneration stratum (ANR and PNR) and shrubs commercial stand.
Additional comments	When land is subjected to periodic cycles (e.g., slash-and-burn, or clearing-regrowing cycles) so that the shrub crown cover oscillates between minimum and maximum values in the baseline, an average shrub crown cover equal to ***0.5*** is used unless transparent and verifiable information can be provided to justify a different value. This process appeared in the **natural regeneration**[12] and in the shrubs present within the commercial stand.

~~E.3.~~D.3. Implementation of sampling plan

To implement 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 fieldwork (see Annex).

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., Winrock's CDM A / R Sample Plot Calculator Spreadsheet Tool version 2014 tool was applied to estimate the sample size from the field survey.

Equations to determine the above biomass.

The plots randomly distributed were in the five strata defined in the re-stratification. These included species *Acacia mangium*, *Pinus caribaea*, *and Eucalipto pellita*. The species *P. caribea* dominates more than 70% of the commercial crop in the project.

The equations used in general were allometric and 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*". It should be noted that for the region there are no equations for the project species, but there are equations from official national sources. For pine species, equations developed in regions with similar conditions and management were sought

[12] This approach is considered conservative, until destructive sampling can be performed for greater precision in the accumulation of biomass in the successional processes of the natural forest.

as the tools requested. The sources of information for the equations used are provided to the auditor in annex[13].

Equations per species and their application according to the tools are in **¡Error! No se encuentra el origen de la referencia.**:

Table 15. Equations of volume and above biomass applied for included species in work-field survey.

Specie	Equations	*Observation /applied*	Source
P. caribaea	$\text{Ln(Vol)}=-9.66+1.834*\ln(\text{DAP})+1.007\text{Ln}(h_t)$	**Edafo climatic conditions:** Temperature: 21.7 °C Soils: Ultisols, red clay soils and acidic. Very humid, tropical premontane forest **Statistics:** ✓ R^2= 0.97 ✓ N=45 **Application range:** DAP≥ 10-28 cm	Salazar, 1985[14].
	$BA = 0.887 + \left(\frac{10486 * DAP^{2.84}}{(DAP^{2.84}) + 376907}\right)$	**Edafo climatic conditions:** Pines of temperate and tropical zones **Statistics:** R^2= 0,98 N= 137 **Application range:** DAP 0,6 - 56 cm.	IPCC 2003[15].
P. oocarpa	$V(m^3) = \left((0.442123) \times \left(\frac{DAP}{100}\right)^2 \times H_t\right) + 0.000178$	**Edafo climatic conditions:** Temperature: 18-24 °C. Very humid, tropical premontane forest **Statistics:** R^2: 0.991 N: 105 **Application range:** Not defined.	INDERENA, 1989[16] OIMT-CONIF-MINAMBIENTE, 1999[17].
A. mangium	$BA = 0.204 * DAP^{2.2801}$	**Edafo climatic conditions:** Humid tropical forest Temperature: 26 °C – 28 °C Alluvial plane. Acid soils, low fertility Slope 0-3% **Statistics:** N=52 R^2= 0.94 **Application range:** *DAP> 5cm*	Recommended in the national carbon protocol of Colombia, Yepes et al, IDEAM, 2011[18].

[13] They are not annexed to the monitoring report, supports delivered only to the DOE.

[14] Salazar, R. 1985. Productividad del *Pinus caribaea var. hondurensis Barr.* Y Golf. En Turrialba, COSTA RICA. IPEF. N.29 p.19-24

[15] IPCC 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Penman, J. Gytarsky, M., Hiraishi, T., Krug, T., Kruger, D., Pipatti, R., Buendia, L., Miwa, K., Ngara, T., Tanabe K., and Wagner F Editors. Intergovernmental Panel on Climate Change.

[16] Posada F, 1989. Compilación de tablas de volumen para árboles en pie. Instituto Nacional de los Recursos Naturales Renovables y del Ambiente -INDERENA. 128 pg.

[17] Vélez, F., Ortiz R. 1999. Estimador del crecimiento Forestal V.1. Organización Internacional de las Maderas Tropicales –OIMT, Corporación Nacional de Investigación y Fomento Forestal –CONIF, Ministerio del Medio Ambiente de Colombia –MINAMBIENTE. 70 pg.

[18] Yepes A.P., Navarrete D.A., Duque A.J., Phillips J.F., Cabrera K.R., Álvarez, E., García, M.C., Ordoñez, M.F. 2011. Protocolo para la estimación nacional y subnacional de biomasa - carbono en Colombia. Instituto de Hidrología, Meteorología, y Estudios Ambientales-IDEAM-. Bogotá D.C., Colombia. 162 p.

E. pellita	$BA = 1.22 * DAP^2 * h_t * 0.01$	**Edafo climatic conditions:** *Subtropical zone.* Temperature: 17.3 °C. **Statistics:** R^2= 0.97. N= 130. **Application range:** *DBH:1-31 cm*	*Recommended in the national carbon protocol of Colombia, Yepes et al, IDEAM, 2011, Surce IPCC 2003.*

Below ground biomass.

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

The statistic for the six strata identified is presented in **¡Error! No se encuentra el origen de la referencia.**~~Table 16~~.

Table 16. Statistics for strata sampled in the project within the current monitoring period.

Stratum	Area (ha)	% Project	Plots	Above Biomass (tonCO2/ha)
LOW	2,154.6	9.8%	52	17,257
STEADY	3,016.1	13.7%	65	47,3
MIDDLE	2,185.2	9.9%	45	68,619
HIGH	6,222.4	28.2%	32	89,224
UPPER	5,362.0	24.3%	25	114,590
***P_N_R* (Protected Natural Regenerations)**	3,100.5	14.1%	N.A	11.585
Total	**22,040.77**	**100.0%**	***222***	

To determine if the sampling was sufficient and that fulfills the 10% error level criteria and 90% of reliability level, the *Winrock's CDM A/R Sample Plot Calculator Spreadsheet Tool Version 2014*[19] tool was used. This tool applies the methodological tool AR_AM_03_v2.1 (*Calculation of the number of sample plots for measurements within A/R CDM project Activities*[20]).

For the sampling process in each stratum, the steps described in the applied methodology and in the methodological tools for the 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.

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

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

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.

In total for commercial stands, 222 plots were established (see: *anexx_ analisis_estadisticos_muestreo).*

The plots sampled by stratum were as follows.

Table 17. Measured plots per stratum for the monitoring period 2020-2023.

No	*Low*		*Steady*		*Middle*		*Higth*		*Upper*	
	Plot	$b_{tree,p,i\ (t)}$	Parcela	$b_{tree,p,i\ (t)}$	Parcela	$b_{tree,p,i\ (t)}$	Parcela	$b_{tree,p,i\ (t)}$	Parcela	$b_{tree,p,i\ (t)}$
1	**BO_2_8**	30,633	**BO_1_1**	57,091	**BO_2_2**	74,021	**BO_2_1**	96,213	**BO_2_5**	109,095
2	**BOP_1_10**	20,837	**BO_1_10**	48,231	**BO_2_3**	66,945	**BO_2_6**	91,747	**BO_2_7**	126,797
3	**BOP_1_13**	5,884	**BO_1_2**	33,771	**BO_2_9**	69,728	**BOP_1_26**	94,854	**BOP_1_1**	137,672
4	**BOP_1_15**	3,326	**BO_2_4**	40,949	**BOP_1_17**	61,847	**BOP_1_39**	84,698	**BOP_1_16**	109,638
5	**BOP_1_19**	2,215	**BOP_1_11**	58,973	**BOP_1_4**	59,698	**BOP_1_49**	83,989	**BOP_1_21**	104,659
6	**BOP_1_2**	10,575	**BOP_1_12**	37,702	**BOP_1_41**	66,474	**BOP_1_53**	87,654	**BOP_1_38**	101,969
7	**BOP_1_20**	30,859	**BOP_1_14**	47,855	**BOP_1_48**	68,202	**BOP_1_57**	82,386	**BOP_2_3**	104,481
8	**BOP_1_22**	5,274	**BOP_1_18**	56,507	**BOP_1_54**	71,538	**BOP_1_7**	88,966	**CAM_1_14**	102,192
9	**BOP_1_23**	30,710	**BOP_1_24**	37,531	**BOP_2_7**	62,752	**BOP_2_4**	83,255	**GUA_1_26**	129,149
10	**BOP_1_25**	20,746	**BOP_1_29**	41,348	**CAM_1_10**	72,903	**BOP_2_6**	90,922	**GUA_1_28**	105,521
11	**BOP_1_27**	9,365	**BOP_1_30**	49,943	**CAM_1_11**	73,398	**CAM_1_12**	89,702	**MON_1_12**	105,455
12	**BOP_1_28**	9,929	**BOP_1_42**	33,480	**CAM_1_17**	73,886	**CAM_1_2**	85,383	**MON_1_18**	103,594
13	**BOP_1_3**	30,299	**BOP_1_44**	50,464	**CAM_1_6**	74,869	**GUA_1_16**	87,736	**MON_1_8**	106,626
14	**BOP_1_31**	13,823	**BOP_1_45**	41,260	**CAM_1_8**	62,693	**GUA_1_17**	84,532	**MON_1_9**	112,346
15	**BOP_1_32**	24,785	**BOP_1_47**	37,886	**GUA_1_1**	68,889	**GUA_1_29**	89,656	**MON_2_4**	118,188
16	**BOP_1_33**	3,435	**BOP_1_52**	33,921	**GUA_1_10**	69,147	**GUA_1_30**	84,301	**MON_2_6**	114,335
17	**BOP_1_34**	30,456	**BOP_1_55**	56,756	**GUA_1_18**	75,979	**GUA_1_6**	82,083	**OLP_1_11**	126,409
18	**BOP_1_36**	30,499	**BOP_1_6**	54,901	**GUA_1_19**	74,865	**GUA_2_4**	91,332	**OLP_2_10**	143,280
19	**BOP_1_37**	9,190	**BOP_1_9**	43,539	**GUA_1_4**	65,827	**INC_1_19**	94,051	**OLP_2_11**	109,915
20	**BOP_1_40**	1,897	**BOP_2_1**	43,641	**INC_1_11**	70,849	**MON_1_22**	87,425	**OLP_2_13**	147,200
21	**BOP_1_43**	15,191	**BOP_2_2**	57,920	**INC_1_13**	70,623	**MON_1_23**	94,913	**OLP_2_16**	127,725
22	**BOP_1_46**	28,344	**BOP_2_5**	58,305	**INC_1_14**	66,430	**OLP_1_1**	96,468	**OLP_2_18**	103,193
23	**BOP_1_5**	30,579	**CAM_1_16**	38,952	**INC_1_15**	75,023	**OLP_1_18**	89,606	**OLP_2_5**	105,228
24	**BOP_1_56**	2,725	**CAM_1_3**	43,624	**INC_1_16**	69,157	**OLP_1_5**	90,693	**OLP_2_8**	108,174
25	**BOP_1_59**	15,647	**CAM_1_4**	54,761	**INC_1_17**	67,307	**OLP_2_14**	90,700	**OLP_2_9**	101,915
26	**BOP_1_8**	0,654	**CAM_1_7**	33,670	**INC_1_18**	65,362	**OLP_2_15**	98,450		
27	**CAM_1_1**	5,933	**CAM_2_3**	52,893	**INC_1_21**	66,016	**OLP_2_20**	81,068		
28	**CAM_1_13**	4,195	**GUA_1_12**	55,803	**INC_1_29**	70,546	**OLP_2_22**	86,436		
29	**CAM_1_15**	21,989	**GUA_1_13**	57,683	**MON_1_2**	67,287	**OLP_2_23**	86,466		
30	**CAM_1_5**	29,634	**GUA_1_15**	54,296	**MON_1_24**	61,359	**OLP_2_27**	96,229		
31	**CAM_1_9**	12,921	**GUA_1_2**	48,287	**MON_1_3**	62,307	**OLP_2_4**	90,822		
32	**CAM_2_1**	22,126	**GUA_1_20**	54,304	**MON_1_5**	62,433	**OLP_2_6**	92,432		
33	**GUA_1_11**	25,962	**GUA_1_21**	57,057	**MON_2_1**	64,306				
34	**GUA_1_14**	29,182	**GUA_1_23**	43,669	**OLP_1_12**	66,448				
35	**GUA_1_24**	28,224	**GUA_1_5**	53,186	**OLP_1_16**	77,808				
36	**GUA_1_25**	20,613	**GUA_1_8**	58,880	**OLP_1_20**	66,962				
37	**GUA_1_27**	28,958	**GUA_1_9**	47,534	**OLP_1_3**	61,303				
38	**INC_1_1**	8,793	**GUA_2_1**	34,225	**OLP_1_4**	65,511				
39	**INC_1_2**	3,913	**INC_1_10**	59,633	**OLP_1_6**	74,415				

40	**INC_1_4**	15,599	**INC_1_12**	58,003	**OLP_1_9**	62,736				
41	**INC_1_5**	7,300	**INC_1_20**	34,344	**OLP_2_12**	75,546				
42	**INC_1_6**	26,037	**INC_1_22**	50,893	**OLP_2_19**	77,628				
43	**INC_1_7**	21,240	**INC_1_23**	33,819	**OLP_2_2**	71,334				
44	**INC_1_8**	7,798	**INC_1_24**	60,007	**OLP_2_26**	61,863				
45	**INC_1_9**	29,486	**INC_1_25**	57,132	**OLP_2_28**	73,628				
46	**MON_1_1**	18,505	**INC_1_26**	40,799	**BO_2_2**	74,021				
47	**OLP_1_14**	26,964	**INC_1_27**	43,489	**BO_2_3**	66,945				
48	**OLP_1_19**	30,219	**INC_1_28**	42,139	**BO_2_9**	69,728				
49	**OLP_1_7**	20,132	**INC_1_30**	46,754	**BOP_1_17**	61,847				
50	**OLP_2_17**	31,277	**MON_1_10**	35,868	**BOP_1_4**	59,698				
51	**OLP_2_30**	9,872	**MON_1_11**	59,837	**BOP_1_41**	66,474				
52	**OLP_2_31**	24,083	**MON_1_14**	41,444	**BOP_1_48**	68,202				
53			**MON_1_15**	34,419	**BOP_1_54**	71,538				
54			**MON_1_17**	34,272	**BOP_2_7**	62,752				
55			**MON_1_19**	52,805	**CAM_1_10**	72,903				
56			**MON_1_20**	58,809	**CAM_1_11**	73,398				
57			**MON_1_21**	49,737	**CAM_1_17**	73,886				
58			**MON_1_4**	48,597	**CAM_1_6**	74,869				
59			**MON_2_2**	55,185	**CAM_1_8**	62,693				
60			**MON_2_3**	35,631	**GUA_1_1**	68,889				
61			**MON_2_5**	39,542	**GUA_1_10**	69,147				
62			**OLP_1_10**	56,677	**GUA_1_18**	75,979				
63			**OLP_1_13**	53,418	**GUA_1_19**	74,865				
64			**OLP_1_15**	34,063						
65			**OLP_1_8**	56,826						
66			**OLP_2_1**	49,022						
67			**OLP_2_24**	43,130						
68			**OLP_2_3**	39,314						

Statistical analysis applied to the results for the plots in each stratum determines significant differences between commercial strata (see **¡Error! No se encuentra el origen de la referencia.**~~Table 17~~ and **¡Error! No se encuentra el origen de la referencia.**~~Figure 13~~). 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.

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Table 18. Results of multiple ranges for the values of the commercial strata sampled.

Contrast	*Significance*	*Difference*	*+/- Limits*
Low - Steady	*	-29,4379	3,22357
Low - Middle	*	-50,7567	3,56271
Low - High	*	-71,3618	3,93156
Low -Upper	*	-96,7281	4,25869
Steady - Middle	*	-21,3188	3,36264
Steady - High	*	-41,9239	3,75122
Steady - Upper	*	-67,2902	4,09279
Middle - High	*	-20,6052	4,04638
Middle – Upper	*	-45,9714	4,36491
High - Upper	*	-25,3662	4,67084

* Shows a significant difference.

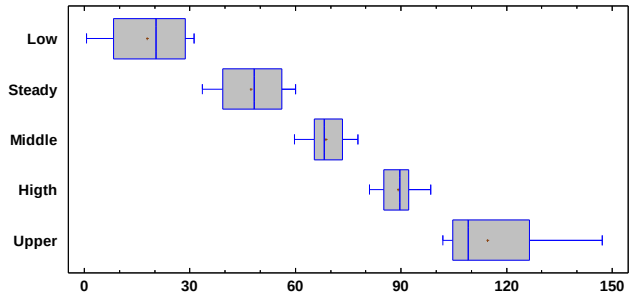

Figure 14. Analysis of statistical differences of the total biomass (t / ha) between strata of commercial species from the monitoring developed.

Estimation of sample size.

To determine whether sampling was sufficient and met 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*[21] *(Annex).* 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*[22]*).*

The results of the calculation tool for the sample size are presented **¡Error! No se encuentra el origen de la referencia.**. 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 19. Sample plot in the present monitoring period.

Stratum	*Plot calculated*	*Sample Plot*
Low	3	52
Steady	3	68
Middle	3	45
High	3	32
Upper	3	25
	15	**222**

Shrubs

According to AR_Tool 14 tool, Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, this sink is considered positive when the biomass shrubs values are above those identified values in the baseline. Hence, they are accounted for in the anthropogenic net carbon balance.

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

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

On the other hand, this component in AR activities within the definition of forest considers shrubs as an integral part of the Colombian context. Therefore, as they have significant changes compared to the baseline values, they are accounted for in the anthropogenic net carbon balance.

As indicated in previous paragraphs, due to frequent burn activities, the eligible zones just consider clean grasslands without tree presence or shrubs, this zones to be influenced by periodic burns, restrict the presence of this component in the baseline conditions. Therefore, his value is assumed as zero.

Now the estimation of this component for project conditions is carried out, following recommendations from literal 11 of AR-Tool 14 tool. Its application is made in strata where the dominance in the coverage of the tops of the shrubs is above 5%.

- $\Delta C_{SHRUB,t} = \frac{44}{12} \times CF_s \times (1 + R_s) \times \sum_i A_{SHRUBS,i} \times b_{SHRUBS,i}$ Equation 26 Tool.
- $b_{SHRUBS,i} = BDR_{SF} \times b_{FOREST} \times CC_{SHRUBS,I}$ Equation 27 Tool.

Where:

$\Delta C_{SHRUB,t}$	=	Change in carbon stock in shrubs within the project boundary in year t between times t_1 and t_2. tCO_2-e
CF_s	=	Carbon fraction of shrub biomass C (t.d.m.)$^{-1}$. default value of 0.47
R_s	=	Root-shoot ratio for shrubs; dimensionless. Default value of 0.40
$A_{SHRUB,t}$	=	Area of shrub biomass estimation stratum *i*; ha
$b_{SHRUB,t}$	=	Shrub biomass per hectare in shrub biomass estimation stratum *i, td.m.ha*$^{-1}$
BDR_{SF}		Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 (i.e. 100 per cent) and the default above-ground biomass content per hectare in forest in the region/country where the A/R project activity is located; dimensionless. A default value of 0.10
b_{FOREST}	=	Default above-ground biomass content in forest in the region/country where the A/R project activity is located *td.m.ha*$^{-1}$
$CC_{SHRUBS,i}$	=	Crown cover of shrubs in shrub biomass estimation stratum i at the time of estimation, expressed as a fraction.

Carbon stock in dead wood and Litter.

To estimation of this component follows the methodological tool, AR-TOOL12 "Estimation of carbon stocks and change in carbon stocks in and litter in A / R CDM project activities."

The baseline is based on the same concept: the absence or accumulation of litter due to the periodic burning processes. Instead, project activities promote the formation of a litter layer that remains for long periods on the ground. Some studies have shown contributions of up to 29% of the biomass in the general balance of carbon sinks. Compared with the accumulation of zero in the baseline, this value shows the importance of this deposit in the general carbon balances for the Project.

The methodological tool recommends two ways to estimate the carbon content in the litter and deadwood components. For the current calculation, the conservative method of default factors will be used.

This methodological process assumes that deadwood is not removed and remains on the plantation soil. This assumption is what happens in the project activities; the organic matter derived by pruning or self-pruning (eucalyptus) and by natural mortality of some individuals is not removed. This matter is left inside the plantations during the rotation cycle. Your way of calculating for dead wood is defined by:

$\Delta C_{DW,i,t} = C_{TREE,i,t} \times DF_{DW}$ Equation 9 Tool.

Where:

$C_{DW,t}$	=	Carbon stock in dead wood within the project boundary at a given point of time in year t, t CO_2-e
$C_{TREE,i,t}$	=	Carbon stock in trees biomass in stratum i at a point of time in year t, as calculated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities. tCO_2-e
DF_{DW}	=	Conservative default factor expressing carbon stock in dead Wood as a percentage of carbon stock in tree biomass, %.
i	=	1,2,3,… biomass estimation strata within the project boundary
t	=	1,2,3,… years elapsed since the start of the A/R project activity

Carbon Litter.

It is conservatively estimated with default factors for estimating the carbon content of this pool.

- $C_{LI,i,t} = C_{TREE,i,t} \times DF_{LI}$ Equation 15 of tool.

Where:

$C_{LI,i,t}$	=	Carbon stock in litter in stratum i at a given point of time in year, *t* CO_2-e
$C_{TREE,i,t}$	=	Carbon stock in trees biomass in stratum *i* at a point of time in year t, as calculated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities". *t*CO_2-e
DF_{LI}	=	Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass; percent, %.
i	=	1,2,3,… biomass estimation strata within the project boundary
t	=	1,2,3,… years elapsed since the start of the A/R CDM project activity

Soil Organic Carbon stocks

Under baseline conditions (see paragraphs of generalities), because of the characteristics of the soils and their management, have led to significantly low organic carbon content of the soil.
To develop carbon balances and their changes in the soil component, the methodological tool will be applied *"Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities".*

Changes in organic carbon content are defined by:

$\Delta SOC_{AL,i}$ Change in SOC stock in areas of land meeting the above applicability conditions, in year t tCO_2-*e*

$$SOC_{INITIAL,i} = SOC_{REF,i} \times f_{LU,i} \times f_{MG,i} \times f_{IN,i}$$ Equation 1 of tool.

Where:

$SOC_{INITIAL,i}$	=	SOC stock at the beginning of the A/R project activity in stratum i of the areas of land, *t*C ha^{-1}
$SOC_{REF,i}$	=	Reference SOC stock corresponding to the reference condition in native lands (i.e. non-non-degraded, unimproved lands under native vegetation - normally forest) by climate region and soil type applicable to stratum i of the areas of land *t*C ha^{-1}
$f_{LU,i}$	=	Relative stock change factor for baseline land-use in stratum *i* of the areas of land; dimensionless.
$f_{MG,i}$	=	Relative stock change factor for baseline management regime in stratum *i* of the areas of land; dimensionless.
$f_{IN,i}$	=	Relative stock change factor for baseline input regime (e.g. crop residue returns, manure) in stratum i of the areas of land; dimensionless
i	=	*1, 2, 3, …..* strata of areas of land; dimensionless.

For the estimation of this component, making use of default factors and following methodological recommendations of conservative values, and maintaining the transparency of the results, the tool is used ARWG SOC tool Multizone format *Excel "The approved spreadsheet to facilitate the calculation of changes in soil organic carbon stocks"*[23].

Results of CO_2e contents by sink and for all strata.

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

The equations applied were (equation 6, Tool AR_AM00014):

Equation 2

$$u_{\Delta C} = \frac{t_{val} \times \sqrt{\sum_{i=1}^{M} w_i^2 \times \frac{S_{\Delta i}^2}{n_i}}}{|\Delta b_{TREE}|}$$

Where:

ΔC_{TREE} = Change in carbon stock in trees between two successive measurements; t CO_2e.

$u_{\Delta C}$ = Uncertainty in $\Delta C_{TREE.}$

Δb_{TREE} = Mean change in tree biomass per hectare within the biomass estimation strata; t d.m. h^{-1}.

t_{val} = Two-sided Student's t-value for a confidence level of 90 percent and degrees of freedom equal to n – M, where n is the total number of sample plots within the tree biomass estimation strata, and M is the total number of tree biomass estimation strata

[23] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-16-v1.1.0.pdf/history_view

w_i = Ratio of the area of stratum *i* to the sum of areas of biomass estimation strata (i.e.A_i/A); dimensionless.

$S^2_{\Delta,i}$ =*Variance of mean change in tree biomass per hectare in stratum i;* (t d.m. $ha^{-1})^2$

n_i = Number of sample plots, in stratum *i*, in which tree biomass was re-measured.

The accumulated uncertainty was less than 5% and by strata less than 10% as shown in **¡Error! No se encuentra el origen de la referencia.**. Since the uncertainty associated with the total estimates was <10%, no adjustments are required to the final estimates.

Table 20. Results of the assessment of the uncertainty (only commercial area above and below carbon biomass) of the reduced carbon estimations in the project area by the implementation of the project.

Strata	Area of Stratum (ha)	Mean carbon of Stratum (t/ha)	Ratio of stratum *i* area to project area (wi)	wi* Mean carbon of Stratum	Number of sample plots	Variance of mean change in carbon per ha	t-value 10%, sample plots *i* - 4 strata	Error	Margin of Error (%)
Low	2.154,6	42,2	0,10	4,1	52,0	0,1	**1,68**	**0,6**	**13,97%**
Steady	3.016,1	113,5	0,14	15,5	68,0	0,1	**1,67**	**0,6**	**4,02%**
Middle	2.185,2	156,1	0,10	15,5	45,0	0,0	**1,68**	**0,3**	**1,83%**
High	6.222,4	203,0	0,28	57,3	32,0	0,3	**1,70**	**0,9**	**1,58%**
Upper	5.362,0	260,7	0,24	63,4	25,0	2,3	**1,71**	**2,6**	**4,08%**
Total	***18,904.3***			***155,9***	***222***	***2,9***	***1.65***	***2.8***	***1.79%***

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 02/10/2020-02/01/2023 analysis periods are:

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Table 21. Results of accumulated net (tCO_2) removals until the period of 2023.

Strata	*Pools*						Total *($tCO_2e.$)*
	Area (ha)	***CO_2 total tree biomass***	***Shrubs***	**Cli,t**	**CDW**	**COS**	
Low	***2.154,6***	***90.918***	60.222	5.455	14.547	752,802	
Steady	***3.016,1***	***342.385***	84.302	20.543	54.782		
Middle	***2.185,2***	***341.104***	61.079	20.466	54.577		
High	***6.222,4***	***1.262.938***	173.920	75.776	202.070		
Upper	***5.362,0***	***1.397.714***	149.872	83.863	223.634		
RN	***3.100,5***	***86.660***	0	0	0		
	22.040,77	***3.521.719***	***529.396***	***206.104***	***549.609***	***752,802***	***5,559,630***

For more details see Annex: Monitoring_03_Carbon_Balance_Monitoreo_2020-2023_V03

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

SECTION F.SECTION E. Calculation of emission reductions or net anthropogenic removals

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

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 the equation in section B.7 of the PDD, ex-ante baseline net greenhouse gas removals by sinks are zero.

$$CBSL = 0 \text{ for all } t^* \leq tcp \quad \text{(Equation number 2 of the PDD)}$$

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.

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

The net GHG removals by carbon sinks (actual net GHG removals) represents the sum of the changes in the carbon content in the project activity scenario, after deducting non-woody biomass removed to establish the models (*Ebiomassloss*), minus the increase in GHG emissions due to project implementation (GHG emissions) under Section 7.1 of the AR-AM0004/Version 04 Methodology.

The actual net GHG removals by sinks within the project scope (C_{ACTUAL}) were determined using Equation 3 and Equation 4 of methodology AR-AM0004/Version 04.

Equation 3 $C_{Actual} = \Delta C_{P,LBt} - GHG_e$

$\Delta CP_{,LB}$ = changes in carbon stored in the living tree biomass compartments in the project activity scenario; $tCO_{2\text{-}e}$

GHG_E = sum of the increments in GHG emissions within the project scope attributable to the project implementation; t CO_2-e

Equation 4 $\Delta C_{P,LB} = \Delta C_{P,LB_T} - E_{biomassloss}$

Equation 5 $\Delta C_{P,LB_T} = \sum_{t=1}^{t} \sum_{i=1}^{m_{BL}} \sum_{k=1}^{K_p} \Delta C_{P,LB,ikt}$

Where:

$\Delta C_{P,LBt}$. = sum of changes in the carbon stock of the project scenario
$\Delta C_{LB,ikt}$ = change in the annual carbon stock for stratum i, tree stand model *k*, time *t*
i = 1, 2, 3,…m_{BL}
k = 1, 2, 3,…*K* tree stand model in the project scenario
t = 1, 2, 3,…*t** years from the start of the project.

$E_{biomasslos}$ = Decrease in the carbon stock of the living biomass

According to the AR-ACM0003 that replaces the AR-AM004 with its applicability conditions, only emissions from burning of biomass activities are considered. In the proposed A/R project activity there will be no biomass burning for site preparation or forest management. Therefore, emissions within the project boundary are not considered; GHG = 0.

Changes in biomass content in the project activity models ($\Delta C_{P,LBikt}$)
The procedure and implemented equations to estimate the aboveground and belowground biomass is described in section D.3 (see above).

Removed biomass ($E_{biomassloss}$)

The biomass removed as part of site preparation before planting corresponds to herbaceous vegetation. Following the methodology AR-AM0004/Version 04 and guidance contained in paragraph 35 in the report of the EB 42 meeting, the living biomass does not contain the biomass of herbaceous vegetation; therefore, loss of living biomass ($E_{biomassloss}$) is *0*.

Burning for the preparation of soils has not been developed nor is it expected to develop in the project proposal, on the other hand, this is an activity that is controlled by the environmental corporation (CORPORINOQUIA) and that it conforms to resolution 0187 the 2007 year, of the ministries of Agriculture and environment of Colombia regarding the prohibition of burning for soil adequacy in Colombian territory (CORPORINOQUIA[24]).

The above mentioned, is in line with what was proposed in the PDD section B.6.1.

Increase in GHG emissions of the project activity ($GHG_{Emissions}$)

According to the AR-ACM0003 that replaces the AR-AM004, its applicability conditions its applicability conditions, only emissions from burning of biomass activities are considered. During the current monitoring period, no burns were developed for soil preparation. This is in line with the proposed in the PDD. Therefore, emissions within the project boundary are $GHG_E = 0$.
According to this, in the proposed project the net GHG removals by carbon sinks (actual net GHG removals) is equal to the sum of changes in the carbon stock of the project scenario.

$$C_{Actual} = \Delta C_{P,LB_T}$$

F.3.E.3. Calculation of leakage emissions

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*

Therefore, it does not require quantification within the current analysis period.

[24] http://www.corporinoquia.gov.co/files/Normas_sobre_aprovechamiento_forestal/resolucin_187_de_2007.pdf

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

The net removals for the monitoring period corresponding to the dates 02/10/2020 – 29//01/2023 are estimated by applying equation 1 of the BRC 0001 tool.

$$\Delta C_{ARB} = C_{ARB,t1} - C_{ARB,t2}$$

Where:

ΔC_{ARB}	Change in tree carbon stocks during the period between two points in time t_1 and t_2. tCO_2eq.
$C_{ARB,t1}$	Carbon stocks over time t_1. tCO_2eq
$C_{ARB,t2}$	Carbon stocks over time t_2. tCO_2eq

The *t1*, reference is made to verification 02 of the project. The data of this verification is observed in Table 22~~Table 22~~.

Table 22. t_1 Carbon stocks monitoring 2016-2020.

Balance t_1						
Strata	**Area (ha)**	***Pools* (tCO2)**				
		Above and below biomass (tCO2)	**Biomass Shrubs (tCO2)**	**Litter and dead Wood (tCO2)**	**Carbon Organic Soil (tCO2)**	**Total (tCO2)**
Low	2,256.2	51,615	63,063	11,355	626,125	
Steady	3,650.6	263,953	102,038	58,070		
Middle	6,144.9	776,424	171,755	170,813		
High	4,832.2	878,166	135,062	193,197		
Upper	2,297.1	594,077	64,207	130,697		
Natural Regeneration	2,824.3	78,941	0	0		
	22,005.4	**2,643,176**	***536,126***	***564,132***	***626,125.5***	***4,369,559***

The *t2*, reference is made to verification 02 of the project. The data of this verification is observed in Table 23~~Table 23~~

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Table 23. t_2 Carbon stocks monitoring 2020-2023

Balance t_2							
Strata	*Pools*						Total *($tCO_2e.$)*
	Area (ha)	***CO_2 total tree biomass***	***Shrubs***	**Cli,t**	**CDW**	**COS**	
Low	***2.154,6***	***90.918***	60.222	5.455	14.547	752,802	
Steady	***3.016,1***	***342.385***	84.302	20.543	54.782		
Middle	***2.185,2***	***341.104***	61.079	20.466	54.577		
High	***6.222,4***	***1.262.938***	173.920	75.776	202.070		
Upper	***5.362,0***	***1.397.714***	149.872	83.863	223.634		
RN	***3.100,5***	***86.660***	0	0	0		

	22.040,77	*3.521.719*	*529.396*	*206.104*	*549.609*	*752,802*	*5,559,630*

The net balance of the period 2020-2023 is defined at 1,190,071 *tCO₂*

Table 24. The net balance of anthropogenic net removals ΔC_{ARB} .

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)			
				Before 01/01/ 2013	From 01/01/ 2013 until 31/12/ 2020	From 01/01/ 2021	Total amount
Total	0	1.190.071	0	0	108.312	***1.081.759***	***1.190.071***

i. Estimated vintage for the period 2016-2020

For the annual distribution within the current verification period (Feb 2016 - Oct 2020), an analysis of the annual percentage weight for that period, according to the areas (ha) planted and their year of establishment for each stand model, was developed from the carbon growth models (tCha-1) that are in the registered PDD. The results and the development of this analysis are presented in the annex "*estimacion_vintage_2016-2020".*

The following table shows the distribution of the reduced units for the following years 2020 a 2023

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Table 25.Vintage 2020-2023

Year	Vintage
2020	108.312
2021	494.572
2022	541.801
2023	45.386
Total	**1.190.071**

Balance of Verified Carbon Credits that go to market.

According to the provisions of BCR V3.1, for projects in the AFOLU sector, a 20% buffer discount must be developed. In this way, the carbon balances are as follows.

Year	Project GHG emissions or actual net GHG removals (t CO2e)	Vintage	Buffer (20%	CCV (Verifi III)
2020	**9,1%**	108.312	21.662	86.649
2021	**41,6%**	494.572	98.914	395.657
2022	**45,5%**	541.801	108.360	433.441

2023	**3,8%**	45.386	9.077	36.309
		1.190.071	**238.014**	***952.057***

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

Amount achieved during this monitoring period. (t CO_2e)	The amount estimated ex-ante for this monitoring period in the PDD (t CO_2e)
1.190.071	**1.762.034**

~~F.5.1.~~E.5.1. Explanation of calculation of "amount estimated ex-ante for this monitoring period in the PDD"

The prevailing environmental conditions in the project area are suitable for the species proposed in the project. However, it was possible to find low development of plantations due to soil quality conditions. The species best tolerating these conditions is pine. *Tectona grandis*, *Eucalyptus pellita* and *Acacia mangium* have shown very low development and even suffered high mortality in some of the planted plots.

On the other hand, for the natural regeneration layer, there is evidence of the impact that the historical burns have left on the seed bank in the soil, leaving its reserve almost nil and at the expense of the contribution that nearby natural forests can provide to these sites. The development of the regeneration does not yet highlight the presence of trees with significant heights or appreciable diameters. The process is still in an early successional stage, for which, as noted, its biomass is estimated as if it corresponded to shrubs. This is a conservative position for a sink in the process of development.

These observations are the main reasons for the fact that the level of removals has not been in line with the ex-ante proposals.

~~F.6.~~E.6. Remarks on increase in achieved emission reductions

N.A

~~F.7.~~E.7. Remarks on scale of small-scale project activity

Not Apply

E.8. Compliance with applicable legislation.

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Since its inception, the project's design met the requirements for designing emission reduction projects under the Clean Development Mechanism, in particular the requirements set out by the UN Framework Convention on Climate Change (UNFCCC) regarding the contribution to sustainable development in the country. The project was approved as a CDM project on 10 May 2012, with the country itself, through its designated national authority, approving sustainable development contributions through declaration 202.

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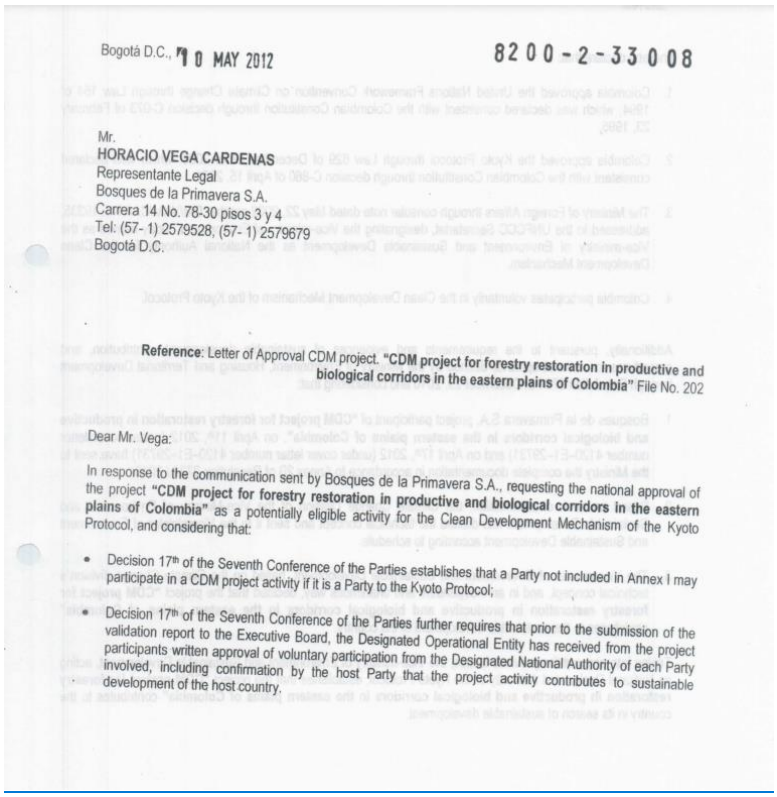

Bogotá D.C., 10 MAY 2012 8200-2-33008

Mr.
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Reference: Letter of Approval CDM project. **"CDM project for forestry restoration in productive and biological corridors in the eastern plains of Colombia"** File No. 202

Dear Mr. Vega:

In response to the communication sent by Bosques de la Primavera S.A., requesting the national approval of the project **"CDM project for forestry restoration in productive and biological corridors in the eastern plains of Colombia"** as a potentially eligible activity for the Clean Development Mechanism of the Kyoto Protocol, and considering that:

- Decision 17th of the Seventh Conference of the Parties establishes that a Party not included in Annex I may participate in a CDM project activity if it is a Party to the Kyoto Protocol;
- Decision 17th of the Seventh Conference of the Parties further requires that prior to the submission of the validation report to the Executive Board, the Designated Operational Entity has received from the project participants written approval of voluntary participation from the Designated National Authority of each Party involved, including confirmation by the host Party that the project activity contributes to sustainable development of the host country.

Likewise, during its implementation it has complied with legal requirements related to:

- Land tenure.
- Resolution No. 071641 (15/07/2020). Registration of plantations with the Instituto Colombiano de Agricultura (ICA).
- Agreement No 9 del 2015, Adjustment to the La Primavera Municipal Land Use Scheme Plan. The above in accordance with the norms for land use and its certification.
- Law 139 of 1994, Establishment of the forestry incentive certificate and other provisions.
- Law 1579 of 2012, By means of which the Statute for the Registration of Public Deeds is issued and other provisions are laid down. It establishes the clarity of domain in property ownership.
- Resolución 1447 del 2018 which regulates the system for the monitoring, reporting and verification of climate change mitigation actions at the national level. With regard to this component, it has been received from the RENARE platform that the project does not overlap with any other initiatives. The status of the project cannot be updated as the platform is no longer active.

-

Evidence of the above rules is supported in annex 7_Legal_Documents.

E.9. Risk and Permanence.

The BCR risk tool has been implemented, with an assessment of four components:

- Natural Risks

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- Financial Risks
- Organisational risk
- Social risks.

A cross-assessment between the impact and the probability of occurrence of these risks has been included.

The project is in its 18th year of implementation and has completed two verifications, one of them before the UNFCCC as a CDM project, fulfilling many of the expectations in terms of generating the environmental service derived from carbon removal. The stands have been maintained thanks to the silvicultural management of the plantations, the effective investments made by the partners, the management of resources derived from national incentives to the forestry sector, regional development and strengthening the forestry chain in the country and the region.

This has reduced uncertainty about the Environmental Carbon Service Mechanism as an effective scheme for promoting forestry activities in remote regions such as Vichada. The project consolidates a nucleus of more than 22,000 ha of new forest.

Risk tool adjusted to clarify values assigned to **impact** and **probability** components.

Risk is qualified by the combination of these two variables, the result being the level of risk in terms of %.

$$Impact\ x\ Probability = Risk\ (\%)$$

Each component is rated as follows:

Indicator	Score	Low	Medium	High
Impact Level	1 - 10	The risk generates low impacts if it were to occur and is in line with the resilience of the project to impact mitigation. It generates few consequences to carbon stocks if it were to occur.	The impact on carbon stocks is moderate and can be easily managed and mitigated in the medium term.	It is related to the degree of affectation of plantations and, therefore, to the reversion of accumulated carbon. The most severe impacts are those that can result in the death or partial loss of planted areas, with a slow and costly recovery response that could have catastrophic effects on the project.
Probability	1 - 3	**Zero or low probability of occurrence of the risk.** And its low occurrence is supported by specific conditions of the region (floods, landslides, etc.), time of project progress (investment, development of stands, overcoming critical moments in the development of the plantation, etc.), adequate implementation of silvicultural management, among others.	**The probability of occurrence is 50/50, it may or may not occur during the implementation of the project.** And the probability is reduced with the implementation of actions that reduce the probability (training, adequate forestry management, appropriate species for the region, financial and management capacity for financing, etc.).	**A risk that has a high probability** of occurrence or where there is a high degree of certainty that the risk will be present at some point during the life of the project. Many of these risks are those that cannot be controlled, such as fires caused by natural houses, floods, landslides, changes in political conditions in such long-term projects, etc.

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Using the BCR risk tool, the project is identified as medium risk (see Appendix: Risks_BCR_Easter_Plane_V02), with an average rating of 6.0%.

The highest risk component is associated with the reversions that may occur due to natural phenomena related to fire and the risks associated with pests and diseases, with a score of 14% y 8%. However, this is an element that has been strongly addressed in the region, as the burning of pastures as a management activity for grazing threatens forest areas, natural forests, and crops in the region. The companies have the equipment and technical capacity to fight fires, but they also have a program of work with local people, environmental companies, and the municipality to reduce the likelihood of fires, especially those caused by human activity.

On the other hand, there may be a high probability of fires caused naturally by lightning, which are impossible to control by humans. However, its impact may be medium on the carbon reservoirs since the lots have the proper protections and the nucleus are sufficiently distant from each other reducing the probability of mass impact on the entire project.

As for pests and diseases, their impact is high if they occur since they can lead to widespread mortality of the stands. However, the species selected for the project have shown the ability to adapt to the territory and have technological packages for their management, the species are adapted to be established in monospecific stands (CONIF, et al, 2018[25]) and the seed material is from certified sources. After 18 years of the project's establishment, no pest or disease attacks have been reported either for the project or in the region, therefore, its probability is low.

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[25] CONIF, Ministerio del Medio Ambiente y OIMT, Guía para Plantaciones Forestales Comerciales ORINOQUIA. https://www.itto.int/files/user/pdf/publications/PD39%2095/pd%2039-95-9%20rev%201%20%28F%29%20s.pdf

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Document information

Version	*Date*	*Description*
08.0	6 April 2021	Revision to: • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period. • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration change. • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan. • Provisions related to the Host Party. • Remove reference to programme of activities. • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines. • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.

Version	*Date*	*Description*
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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