FOREST CARBON PROJECT EL DORADO

Document prepared by: Reforestadora El Dorado S.A.S

Name of the project	***PROYECTO DE CARBONO FORESTAL EL DORADO***
Project holder	*Reforestadora EL Dorado S.A.S*
The project holder's contact information	***Jorge Díaz Murcia*** *Representante Legal Reforestadora El Dorado* *(+57) (1)6212161* *reforestadora@Concretosdorado.com* *Carrera 16A # 80 – 63 Oficina 702* *Bogotá D.C., Colombia*
Project participants	*Reforestadora EL Dorado S.A.S*
Version	*2.0*
Date	*23/07/2024*
Project type	*Afforestation/Reforestation*
Grouped project	*N/A*
Applied Methodology	*BCR0001 3.0 Version*
Project location (City, Region, Country)	*Municipality: La Primavera* Department: Vichada Country: Colombia
Starting date	30/06/2015
Quantification period of GHG emissions reduction	30/06/2015 a 30/06/2045

Estimated total and average annual GHG emission reduction/removals amount	1.235.502 tCO_2 Prom: 41.183 tCO_2 annual.
Sustainable Development Goals	*ODS 12 Responsible Consumption and Production* *ODS 13 Climate Action* *ODS 15 Life on Land*
Special category, related to co-benefits	*NA*

Table of contents

1 Project type and eligibility

1.1 Scope in the BCR Standard

The scope of the BCR Standard is limited to:	
The following greenhouse gases, are included in the Kyoto Protocol: Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O).	
GHG projects using a methodology developed or approved by BioCarbon, applicable to GHG removal activities and REDD+ activities (AFOLU Sector).	X
Quantifiable GHG emission reductions and/or removals generated through the implementation of GHG removal activities and/or REDD+ activities (AFOLU Sector).	X
GHG projects using a methodology developed or approved by BioCarbon, applicable to activities in the energy, transportation, and waste sectors.	
Quantifiable GHG emission reductions are generated through the implementation of activities in the energy, transportation, and waste sectors.	

Following the recommendations of the BioCarbon Registry and adapting the processes to international regulations related to the reduction of emissions due to the change in land use from non-forest to forest, especially those changes related to commercial reforestation projects, this project proposal will accommodate the recommendations of the AR_ACM0003 methodology "*Afforestation and reforestation of lands except wetlands*", which is compatible with the requirements of the BCR0001 methodology, using the tools recommended in this BCR methodology, developed for Clean Development Mechanism projects. The AR_ACM0003 methodology provides specific guidelines for accounting and is supported by a series of methodological tools for this purpose, guaranteeing transparency in the application of emissions factors, equations, and default values .

1.2 Project type

Activities in the AFOLU sector, other than REDD+	X
REDD+ Activities	

Activities in the energy sector	
Activities in the transportation sector	
Activities related to Handling and disposing of waste	

1.3 Project scale

N/A

2 General description of the project

The Forestal carbon proposal Reforestadora El Dorado (Angelik and La Maria properties) seeks to establish in the municipality of La Primavera (Department of Vichada, in the Llanos Orientales of Colombia), a reforestation project with commercial forest species and at the same time promote the recovery and improvement of remaining natural forests and Riverside forests, under passive restoration actions, aimed, among other objectives, at fixing atmospheric carbon through the growth and development of plantations and natural forests. This environmental service contributes to the goals of reducing greenhouse gas emissions at a global level, gives dynamism to the international carbon market and the local market, driven by the policies of a carbon tax for consumption and burning of fossil fuels, and its potential non-causation when carbon credits are purchased to achieve carbon neutrality for companies required to pay the tax.

The project proposal also aims to develop actions to protect the ecosystem and areas of special ecological interest that for years had been dedicated to extensive grazing, the continuous cutting and burning of grasslands, and savanna areas, which led to the deterioration of the soils in the region. With the purchase of the properties and legal ownership of them, the eradication of extensive livestock activities within the property and the total termination of the grassland burning activity begins. Although the region has great agroecological potential, actions are expected to be developed to improve soil use and management conditions.

The formulation and implementation of the project proposal face important challenges, such as establishing forestry production systems, where the environmental offer, road infrastructure, and labor, among others, classify the territory as having low or no forest potential. Hence, processes of change in land use from extensive livestock farming on degraded soils to the establishment of new forests for commercial or natural use, require species with special conditions of adaptability and with known and experienced technological packages.

The commercial forest species considered for the development of reforestation actions are *Pinus caribaea* with an intervention area of **1,177.05** ha and *E. pellita* with **176.18** ha.

For **regeneration zones**, as it is a passive process, everything focuses on ceasing the actions that inhibit the growth of native forests, that is, removing grazing and eliminating cutting and burning of grasslands, allowing the successional process of the forest, to develop naturally. There are **192.87** hectares as regeneration areas as part of the forest carbon project. Likewise, articulated with the corporation's environmental regulations, the withdrawals to water sources have been left, allowing the existing gallery forest to be protected, increase its area, and be coupled to the commercial forest units formed connectivity corridors, especially for the fauna. In this way, it is expected to have coverage with conditions similar to the native forests of the region, in structure and composition of species, which motivate the movement of fauna between ecosystems, and provide protection to essential environmental services for the region such as water, and that together with the commercial areas, contribute to the improvement of the chemical and physical conditions of the soil, for the development of sustainable agroecological activities and contribute to the mitigation of global climate change.

The start date of the initiative is June 30, 2015 (Annex_4), the date on which it materializes as a key action for the start of the reforestation activity, with the Signing of the Forest Incentive Certificate contract -CIF with the FINAGRO entity. In total, the project proposal has **1,601.6** eligible hectares.

The project initiative has support and incentives from the government to encourage the forestry sector (Forest Incentive Certificate, CIF) and is duly registered with regional and national environmental corporations such as the Colombian Institute of Agriculture (Instituto Colombiano de ICA).

It is estimated that, for the first 30-year accreditation period of the forestry project, its potential for net anthropogenic removals is of the order of **1,235,502** tons of CO2eq (Annex 5_Carbon Balance_Ex_Ante).

It is important to highlight that this forest carbon project initiative joins efforts to mitigate climate change. This challenge has been carried out since 2005 under the framework of the Clean Development Mechanism “Productive and Biological Corridors in the Eastern Plains of Colombia” (Cod 9199). The boost to forestry development in the Colombian Orinoquia and especially in La Primavera Region, in the department of Vichada, was born from an ambitious proposal of the National Government, for the *Renacimiento de la Alta Orinoquía de Colombia* (Annex 12, MINAGRICULTURA, 2004), which identified the

forestry potential of the region after the conditions of road infrastructure and services were improved.

At present and after 18 years since the initiative was presented, the infrastructure conditions in the territory have changed little, making forestry activity of low profitability and high risks that must be assumed by investors.

In this way, the generation of income from the environmental service associated with the removal of atmospheric CO_2 as a result of the creation of new forests contributes to the national goals of mitigation of global climate change in the agriculture sector, improves environmental conditions regional, recovers and improves soil conditions to become more productive areas in the future, which allows project proponents to assume economic risks, improving cash flows from the sale of the carbon environmental service.

2.1 GHG project name

Proyecto Forestal El Dorado

2.2 Objectives

General Objective

Develop a Commercial Forestry Center in the municipality of La Primavera-Vichada, which contributes to the economic, productive, social, and environmental development of the region.

The project was conceived to change the use of land dedicated to traditional extensive livestock farming, to sustainable forest production systems, to create a landscape of biological and productive corridors, that generates economic, social, and environmental benefits, including actions to the mitigation of climate change, the conservation and recovery of water systems and the conservation of the fauna and flora of the Orinoquia Alta, among others.

Specific Objectives

- Contribute to the establishment of a commercial forestry core in the region, with the planting of **1,353.23** hectares of forests of commercial species adapted to regional conditions such as ***P. caribaea*** *and* ***E. pellita.***
- Improve the conditions of the remaining forests in the region, especially in the project intervention area, allowing the passive regeneration of **192.87** hectares of native forests.

- Contribute to the climate change mitigation goals at the sectoral level, accepted by the national government in the meetings of the Parties before the Executive Board for Climate Change.
- Develop actions that contribute to the reduction of significant units of Greenhouse Gases (GHG) expressed as tCO_2eq, as a result of the creation of new forests on degraded soils.
- Certify the removal of atmospheric carbon ($tCO_2eq.$), generated by plantations and new forests, under nationally recognized certification processes.
- Generate direct and indirect jobs, through the technical training of the region's workforce, and the development of productive and social infrastructure, which can serve as a reference for other projects.

Economic benefits are expected from the environmental service of carbon capture, for the mitigation of Global Warming, the sale of wood, the development of tropical wood products, and the generation of productive alternatives for the region, among others. The project aims to meet the demand in domestic markets, especially those based on carbon tax collection and international voluntary markets, from companies interested in corporate social and environmental responsibility. This initiative is linked to an umbrella initiative that hosts four independent projects, which combine technical efforts to fix significant quantities of atmospheric CO_2 and promote local economies of scale, which allows demonstrating, such as the proposals for environmental services related to the removal of CO_2, can contribute to the development of the Orinoquia Alta of Colombia.

2.3 Project activities

The Carbono Forestal EL DORADO project is part of the AFOLU sector and develops GHG reduction and removal activities.

2.3.1 Modelos de rodal propuestos para el proyecto

Below is a description of each stand model and some specific activities.

Commercial stand model

The stand commercial model will be established in areas that are currently in abandoned pastures and managed pastures where extensive livestock activities were carried out. Due to these conditions and the need to generate a transition area between the pasture matrices and the forest areas, it is proposed to carry out monospecific commercial plantations with the species: *Pinus caribaea* and *E. pellita*, in the current project proposal.

One of the objectives of the business model is to promote the ecological restoration of surrounding areas by generating connectivity between fragments of native forests, becoming a safe transit zone for seed dispersers, such as birds, rodents, and mammals, and contributing to the protection of biodiversity.

Stand model for passive natural regeneration in protection areas

The system of protection areas for passive natural regeneration, consisting of **192.87** ha, is based on the protection of the areas surrounding the gallery forests, which, until the beginning of the project, were dedicated to livestock farming. The passive regeneration model aims to develop a gradual recovery of the region's natural forest covers. This model is developed in areas not suitable for commercial forestry activity (sites known as lowlands or spaces with pedological limitations for the species) and that are interconnected thanks to the gallery forests, present on the properties. For this, activities that reduce the natural recovery of the ecosystem, such as grazing and burning of grasslands, are eliminated, allowing the natural recovery process of the ecosystems. This model contributes to ecological connectivity between patches of natural forests and gallery forests, creating corridors between them and forest plantations. Being a passive natural regeneration, seed dispersal develops naturally (by fauna, air, or water), which enables an increase in the seed bank of the soil near the forest patches and facilitates the process of recovery. With this model, it is expected that in the long term, these areas will have the same characteristics of composition and floristic structure of the adjacent forests, fulfilling the same functional properties of the natural ecosystems of the region.

2.3.2 Species.

In this section, the species of the commercial model are described in detail, since passive natural regeneration will be promoted by the supply of seeds from the natural forest areas adjacent to the project. It is important to mention that due to the continuous traditional practice of burning grasslands in the region, it is possible that there is not enough availability of the native forest seed bank in the soil, therefore, dispersers are key to the recovery process.

The selection of species for the establishment of forest plantations in the project proposal was carried out based on the evaluation of the biophysical properties of the region and the

knowledge of its technological packages[1] (Trujillo, 2011[2]). It is important to highlight those species that have traditionally been used for reforestation in Colombia, specifically in the Colombian Orinoquía (CONIF, 1998[3]), or an altitude less than 1000 meters above sea level, CONIF recommends a series of species with high potential for reforestation, among which are the species selected by the project. The commercial model will use the species of *P. caribaea*, of which **1,177.06** ha will be established, and *E. pellita* with **176.18** ha.

- ***Pinus caribaea* Morelet.**: The species is very well adapted to natural regeneration management and is the only tropical pine that grows naturally at low elevations. Also, due to its ability to grow in practically any type of soil, it is one of the most planted pine species worldwide. It is used in pure plantations, along boundaries, and windbreaks, for erosion control, and recovery of watersheds and degraded sites. This pine is widely grown in plantations throughout the humid Tropics. (CATIE *et al.* 2006, USDA 2006). This pine is used to produce resins and lumber for sawmills. The need for a total annual volume of 220,000 m3 transformed to produce *machinery*, floorboards, furniture, and carpentry is estimated to cover the demand from the departments of Casanare, Meta, Santander, and the city of Bogotá. In the Orinoquia, the Caribbean pine grows in infertile soils, with good drainage in foothill areas; It generally does not grow on soils with poor drainage or a hard, impermeable layer; grows in sandy soils with good drainage, and acidic pH ranging from 4.3 to 6.5; resists saline, clay and heavy soils (Table 1).

- ***Eucalyptus pellita* F. Muell.**: This species grows between 0 and 700 meters of altitude, requires temperatures between 24 and 30ºC, average annual rainfall between 635 and 3000 mm, grows in the life zones of dry forest and tropical humid forest, tolerates slopes of 15-25%, requires well-drained, slightly acidic and deep soils (Table 1).

[1] Technological package: they are a set of tools validated by recognized institutions, for the development of agricultural, livestock, fish or forestry productive projects, which are within the reach of all producers who require them, to create opportunities that generate a sustainable competitive advantage.

[2] Trujillo, E. 2011. Pino Caribe: El Multipropósito Fuerte de su Género. Revista de la Madera y El Mueble. Edición 71 - Mar / May 2011.

[3] Corporación Nacional de Investigación y Fomento Forestal (CONIF). 1998. Guía para plantaciones forestales comerciales. Orinoquia. 48 pág.

P. caribaea *E. pellita*

Image 1. Forest species that are part of the project

The ecological characteristics of each species, (e.g. environmental and edaphic requirements) necessary for them to establish favorably in some place, are described in Table 1. These ecological and environmental supply conditions are typical of the Colombian Orinoquia.

2.3.3 Applied technology for the establishment of forest stands

It is important to highlight that the establishment activities and forest management of commercial stands, as well as natural regeneration areas, comply with the regulations of the regional environmental authority CORPORINOQUIA. The areas with the implementation of natural regeneration models will be exclusively dedicated to conservation and natural recovery, as transition areas between gallery forests and plantations, which have been essential to structuring comprehensive proposals related to the conservation of the resource. water, the recovery of degraded areas, and the promotion of biological corridors of the territory.

Within the procedures for the implementation of the commercial model, there are the following requirements: soil preparation, nursery production, plantation establishment, weed control, fertilization and pruning regimes, thinning, and harvesting. These procedures will be applied in a similar way in the plantation of the two commercial species. However, the specific procedures for each of the species involved are described in detail in the document: "Forest Establishment and Management Plans" (Annex 10). Below is a brief description of the activities proposed for the execution of the project.

Table 1. General description of the forest species selected in the Project

SCIENTIFIC NAME	WEATHER CONDITIONS							PHYSIOGRAPHIC CONDITIONS		EDAPHIC CONDITIONS				
	COMMON NAME	Elevation msnm	TEMP °C	PRECIP. mm (ANUAL)	RELATIVE MOISTURE	LIFE ZONE	PROVINCE OF HUMIDITY	SLOPE %	TOPOG.	DRAINS	TEXTURE	Ph	FERTILITY	DEPTH
Eucalyptus pellita	*Eucalipto*	0 -700	24 - 30	635 - 3000	Media	bs-T, bh-T	dry, wet	15-25%	Wavy	Good	FAr, Ar	Slightly, acid	Deficient, P, N	Deep
Pinus caribaea	*Pino caribe*	0-1500	22 - 26	600 - 3500	Hight	bs-PM, bmh-PM, bh-PM	dry, wet, very wet	10-25%	Wavy	Good	A-Ar	almost neutral	little fertile	Deep

2.3.4 *Nnursery*

The plant material for the plantation will be produced in a temporary nursery, for this purpose it will be installed in each of the farms that make up the project (Imagen 2). The best quality seeds will be used, and the seedlings will be produced in tubular bags (without bottom) 40 mm in diameter and 12 centimeters high, with good resistance and root formation. Seeds for commercial species will be from certified suppliers, such as El Semillero S.A.S[4] y Refocosta[5], the main suppliers of certified seed in the country.

*Image 2. Forest nursery of the **Pinus caribaea** species*

2.3.5 *Establishment of the plantation*

Planting will begin in the months of April, May, June, July, August, and September, which coincide with the months of greatest rainfall in the region. The technical specifications include the following:

- *Planting Density*: The planting density will be 1,040 trees per ha. Spaced at 3.1 x 3.1 m in square.
- *Plantation design:* will stand according to the altillanura pastures, without including bajos[6].
- *Land preparation:* Initially, weeds are cleared, and tall grasses are cut with cutting discs supported on iron plates in tractors. then a pass of the tractor will be made for the chisel plow with machinery (5-8 cm wide) for subsoiling, (Imagen 3). This chiseling practice prevents alterations to the soil, compared to traditional plowing completely turns the soil and displaces the arable layer. It has been shown that this

[4] http://elsemillero.net/
[5] https://www.refocosta.com/
[6] Bajos: areas with periodic flooding that limits the development of the roots of the proposed commercial species.

practice promotes the conservation of soil and water, improving their physical properties without affecting chemical conditions[7] (Amézquita et al, 2013[8]). This process does not generate emissions or significant alteration to the soil carbon pool (see box).

Image 3. General presentation of chisel plowing in soil preparation before sowing.

- SSimultaneously with this operation, soil acidity correctives will be applied with Dolomitic Lime and Calfos amendments.
- *Layout:* It will be executed with polypropylene ropes in a west-east direction, maintaining lanes of 3.1 m and distances between rows of 3.1 m (Image 4), for a total of 1,040 trees per ha.

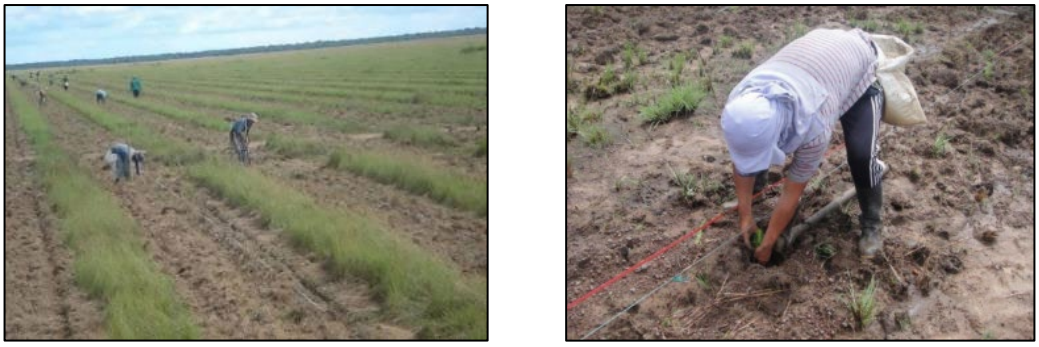


Image 4. Manual layout and planting of seedlings.

[7] http://www.fao.org/3/ar804s/ar804s.pdf

[8] Amézquita, E; Rao, I; Rivera, M; Corrales I y Bernal J. (Eds). Sistemas agropastoriles: Un enfoque integrado para el manejo sostenible de Oxisoles de los Llanos Orientales de Colombia. Centro Internacional de Agricultura Tropical (CIAT); Ministerio de Agricultura y Desarrollo Rural (MADR) de Colombia; Corporación Colombiana de Investigación Agropecuaria (Corpoica), Documento de Trabajo CIAT No. 223. 288 p. https://core.ac.uk/download/pdf/132664986.pdf

- *Sowing:* It will be done by removing the bag without crumbling the "pan de Tierra" and performing a slight root pruning. You should press your feet around the tree to avoid air pockets in the hole.

- *Fertilization:* It will be carried out immediately after sowing by applying 100 g per tree of a mixture prepared with N, P, K, S and B (10-17-20/5-6-0.2), 40 g of Dap, 40 g of Sulfomag and 10 g of 48% Borax per tree, that is, 41.6 kg per hectare of each of the first two products and 1.04 kg per hectare of borax. The application of other elements may be considered if necessary and according to nutritional monitoring (visual observations and analysis of leaf plant tissue) of the plantation, the required nutrients will be supplied.

- *Phytosanitary control:* Intense sanitary control (manual, chemical and cultural) will be carried out for the ants (*hormiga arriera*). Insecticides are generally applied with a thermos-nebulizer according to the product instructions, in the entrances and channels of the anthills (Image 5) or using baits (oats + orange juice, etc.) impregnated with insecticide. These actions will be complemented with the necessary controls, within an integrated pest and disease management program (IPM) that includes monitoring and timely reporting. An internal training plan is included for technicians and operators led by the technical director of the project.

Image 5. Phytosanitary control

- ***Fire control:*** commercial plots, which generally have an area of 11 hectares, will be surrounded by firebreak lines composed of roads and pipes. This type of corridors will not only be implemented in the areas of commercial stands but also in the areas adjacent to natural forests and withdrawal zones for the protection of water sources, as well as passive natural regeneration zones**.** (Image 6).

Image 6. Fire barriers or lines within commercial stands and in areas adjacent to passive natural regeneration.

Although firebreaks will be cleared during dry seasons, personnel will need to be trained to monitor and control during high-risk periods with the appropriate equipment and instruments for these tasks, such as back pumps, fire extinguishers, shovels, machinery, and other alternatives. To this end, a control pump was purchased for the project. The project initiative will promote the implementation of the Forest Fire Prevention and Attention Program, which includes training of Forestry Brigades and preventive forestry techniques, integrated into all nearby production centers and in coordination with local institutions (fire brigade, corporation environmental, and municipal authorities).

2.3.6 Planting plan

For the commercial stand model, the areas were established according to the following planting plan.

Table 2. Planting plan by species and stand model.

Year	Area (ha) by stand model and species								
	P. caribaea	**%**	***E. pellita***	**%**	**Reg. N**	**%**	**TOTAL**	**%**	**Accumulated**
2015	565,39	36,6%	0,00	0,0%	94,06	6,1%	659,45	42,7%	659,45
2016	568,57	36,8%	60,01	3,9%	98,80	6,4%	727,39	47,0%	1.386,84
2017	43,09	2,8%	116,16	7,5%	0,00	0,0%	159,25	10,3%	1.546,09
2018	0.00	0%	0,00	0%	0.00	0%	0,00	0,0%	1.546,09
2019	0.00	0%	0.00	0%	0.00	0%	0.00	0.0%	1.546,09
2020	0.00	0%	0.00	0%	0.00	0%	0.00	0.0%	1.546,09
2021	0.00	0%	0.00	0%	0.00	0%	0.00	0.0%	1.546,09
2022	0.00	0%	0.00	0%	0.00	0%	0.00	0.0%	1.546,09
2023	1.177,05	77.2%	176,18	10.3%	192.87	12.5%	1,546.09	100%	1.546,09

2.3.7 Forest management plan (planting system, use of fertilizers, forest shifts, among others).

The management plans were presented to qualify for the CIF in 2014, *Radicado Artemisa* 20150140 and 20140090), with their implementation in 2015 as stated in Administrative Act 11 of 2015. (Annex 10).

Activities related to pruning will only be developed in species that do not have natural pruning.

As for thinning, this is related to a gradual reduction in the density of trees per hectare, the objective of which is to have trees with larger diameters and greater commercial value at the end of the shift. Gradual reductions are projected, thinning 25% of the remaining trees. A final total density of 469 trees per hectare is expected (Table 3), depending on the quality of the soils and the development of the stands.

Table 3. Projection of thinnings for the commercial stand model

Initial density 1040 trees/ha.	**Remnant less mortality (20%)**	**Thinning (Trees/ha.)**	**% thinning and final harvest**
	832		
Thinning 1 (year 10, a 20% discount is made for mortality in the initial trees, on which 25% of the thinning is done)	624	208	25%
Thinning 2 (year 14, 20% discount is made for mortality in the initial trees and 25% is made on the remainder of the previous thinning in thinning 2)	468	156	25%
End turn	468	**364**	**100%**

However, this thinning will depend on the development and survival in the stands. The thinning will be redefined according to the results of the technical evaluations (Table 4).

The control of weeds and shrubs within the stands is developed in the first years of management to reduce competition for nutrients, water and light of the trees with these shrubs. It is expected that in year five, stand cleaning will not be required until thinning activities or final harvest.

Table 4. Plan of silvicultural activities for commercial stands for a management shift of 18 years (based on a first stand with planting in 2015).

GROWTH CYCLE SCHEDULE (18 AÑOS) *Pinus caribaea and E. pellita* Year 2015																		
	2015	2016	2017	2017	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
WORK / YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Adaptation and planting	■																	
Fertilization	■	■	■															
Weed control	■	■	■	■	■													
Sanitary control	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Reseeding	■	■																
Pruning			■		■				■									
Thinning*										■				■				
Fire Control	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Administration and surveillance	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Technical assistance	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Harvests																		■

*Thinning's will be subject to the development of the stands, and the degree of mortality that the stands may present. If a stand due to mortality causes reaches its self-regulation in density, the activities may be redefined, reaching up to two thinning's and varying their % intervention.

2.4 Project location

The project is in the municipality of La Primavera (5°29'26"N - 70°24'33"W), department of Vichada, eastern Colombia (Figure 1), the border with Venezuela. Its distance from the capital of the country, Bogotá, is close to 556 km.

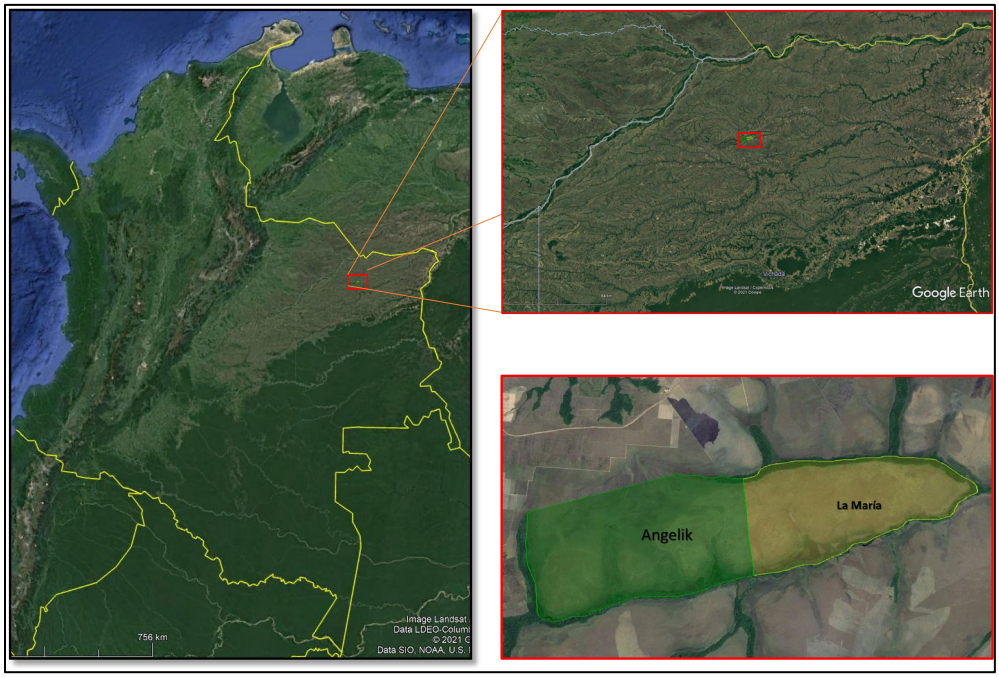


Figure 1. General location of the El Dorado Reforestation Forest Core

The center points for the location of the lots that are part of the project proposal are shown in Table 5.

Table 5. Central coordinates of the location of the lots that are part of the Reforestadora El Dorado project proposal.

Name	Center point		Eligible Area (ha)
	Latitude	Length	
Angelik	5° 26' 21.39" N	69° 30' 59.77" W	917.69

La Maria	5° 26' 45.22" N	69° 28' 39.75" W	680.39
Total			***1598.08***

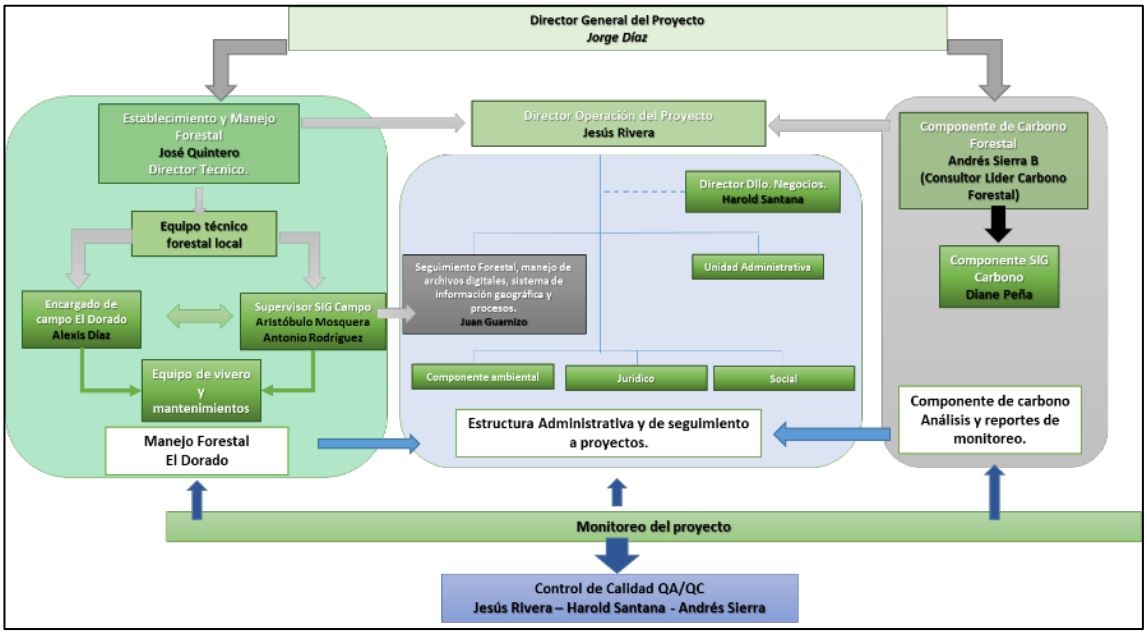
2.5 Additional information about the GHG Project

Organizational Structure

The Project Reforestadora El Dorado has a forestry technical assistance team with more than 15 years, of developing silvicultural interventions in the area where the project is located. This same team oversees providing technical advice to other forestry projects within the La Primavera Forest core, which are currently developing their forest carbon initiatives under Colombian national regulations.

On the other hand, there is a unit that supports actions related to the forest carbon component, whose responsibility is the follow-up and monitoring of the established variables, within the framework of the standards and methodologies adopted for the project. This team has worked for more than 10 years, building forest carbon initiatives, from formulation, validation, and registration; to the monitoring and verification of these projects.

The organizational structure and responsibilities are displayed in the following diagram.



Scheme 1. Operational structure for the management of the Reforestadora El Dorado Forest Carbon initiative

Environmental Authority with Jurisdiction in the Project Area

The **Regional Autonomous Corporations and Sustainable Development** (*Corporaciones autonomas regionals y de Desarrollo Sostenible*) in Colombia are e the first environmental authority at the regional level.

Corporación Autónoma Regional de la Orinoquía -Corporinoquia, It includes the departments of Arauca, Vichada, Casanare, the municipalities of Guayabetal, Quetame, Une, Paratebueno, Chipaque, Cáqueza, Fosca, Gutiérrez, Choachí and Ubaque in the department of Cundinamarca and Pajarito, Paya, Pisba Labranza grande and Cubará in the department of Boyacá, with the exception of the territory of the jurisdiction of Cormacarena (see Figure 2).

Mission: Corporinoquia as an environmental authority and administrator of natural resources, manages sustainable development, guaranteeing the supply of environmental goods and services, through the implementation of prevention, protection and conservation actions for a living region (source: http://www.corporinoquia.gov.co/).

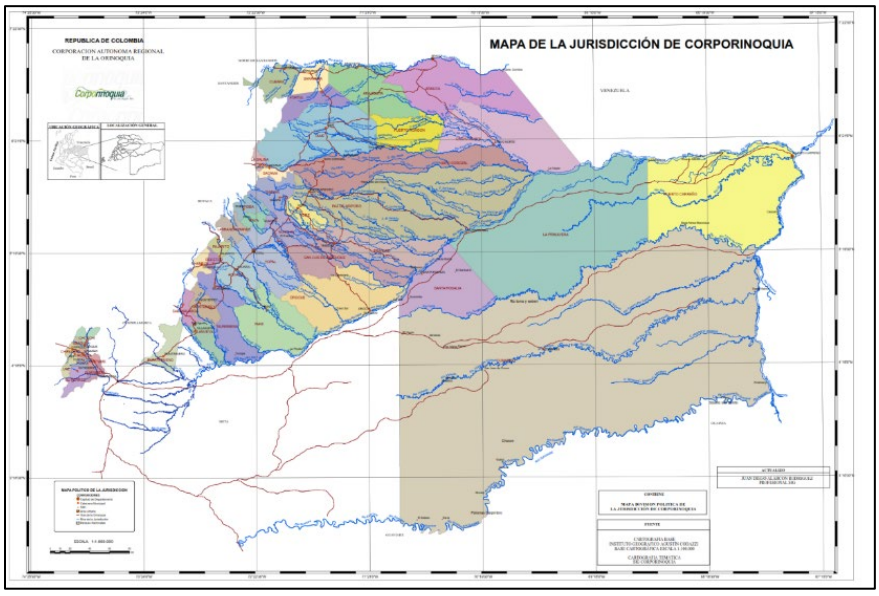


Figure 2. Jurisdiction of Corporinoquia. Source: http://www.corporinoquia.gov.co/

3 Quantification of GHG emissions reduction

3.1 Quantification methodology

BCR0001 V4.0 Methodology, which is compatible with the procedures of the **AR_ACM0003** methodology "***Afforestation and reforestation of lands except for wetlands*".**

3.1.1 Applicability conditions of the methodology

Table 6. Evaluation of the conditions of applicability of the BCR methodology

Condition of Applicability	Justification
a) **The areas of the geographical limits do not correspond to the category of Forest (according to the definition adopted by the country in which the project activity is proposed), nor to vegetation cover other than forest, at the beginning of the project activities nor five years before the project start date**[9]	Apply. The areas for reforestation, as demonstrated in the area eligibility analysis (see section 3.7.1), correspond to areas of unmanaged grasslands.
b) **The project areas do not correspond to the category of wetlands** [10]	Apply. The areas to be reforested do not involve wetlands, flooded lands, or lands susceptible to flooding. Eligible project areas are in areas in which soil property recovery activities can be carried out. See section 8.5

[9] Excepto para los casos en los que las actividades en el proyecto corresponden a restauración, rehabilitación y recuperación.
[10] Según el convenio Ramsar (artículo 1) "son humedales las extensiones de marismas, pantanos y turberas, o superficies cubiertas de aguas, sean de régimen natural o artificial, permanentes o temporales, estancadas o corrientes, dulces, salobres o saladas, incluidas en extensiones de agua marina cuya profundidad en marea baja no exceda de seis metros" (Ramsar 1971).

c) **The areas within the geographic limits of the project do not contain organic soils** [11]	The soils in which the project activities will be implemented do not consider organic soils. In the project area, Typic haplustox isohiperthermic, kaolinitic predominate, with a high presence of iron oxides, which is representative of oxisols. According to the general characteristics of the project area (Section 8 Environmental Characteristics), the soils are poor in organic matter, due to the inadequate use that was made, as established for the baseline (extensive livestock farming without management or improvement of grasslands). The soils in the project area present serious restrictions for agricultural use, due to their high susceptibility to degradation (Amezquita, 1999). Degradation is understood as the loss of some physical, chemical and biological qualities of the soil due to human intervention, which become negative production factors and affect agricultural sustainability. Finally, these pastures did not present management or external nutritional contributions, they were subjected to periodic burning processes for years, so that the grass shoots grew and were easily edible or digestible by livestock. Considering the above, the applicability condition is met.
d) **Carbon stocks in soil organic matter, litter and dead wood are likely to decline or remain stable in the absence of project activities, i.e. relative to the baseline scenario.**	N.A Because it is an AR project, which will be implemented in non-forested areas

[11] Según la definición de FAO (adoptada por el IPCC), los suelos orgánicos son suelos con contenidos de carbono orgánico igual o mayor que 12%

e) **Flood irrigation is not used**	Flood irrigation is not used in the project proposal (See section 2.3 Project activities)
f) **Drainage effects are negligible, so GHG emissions other than CO_2 can be omitted**	The composition of the soil is not altered, nor are activities carried out that drain the water content of the soil.
g) **Soil alterations due to project activities, if any, are carried out with appropriate, sustainable and soil conservation practices, which are not repeated in less than 20 years.**	Rather, project activities aim to improve soil quality in eligible areas (mainly through natural regeneration), which have been subjected to unsustainable and harmful agricultural practices such as periodic burning. (See section 2.3.1)

3.1.2 Methodology deviations (if applicable)

N/A

3.2 Project boundaries, sources and GHGs

3.2.1 Spatial limits of the project

3.2.1.1 Project Area

The forest property of the Reforestadora El Dorado located in the Municipio of La Primavera, in the department of Vichada, is divided into two properties which in turn are divided by areas planted under commercial stand models in the properties called Angelik and La María. (Figure 2). (Ver anexo 2_Informacion SIG)

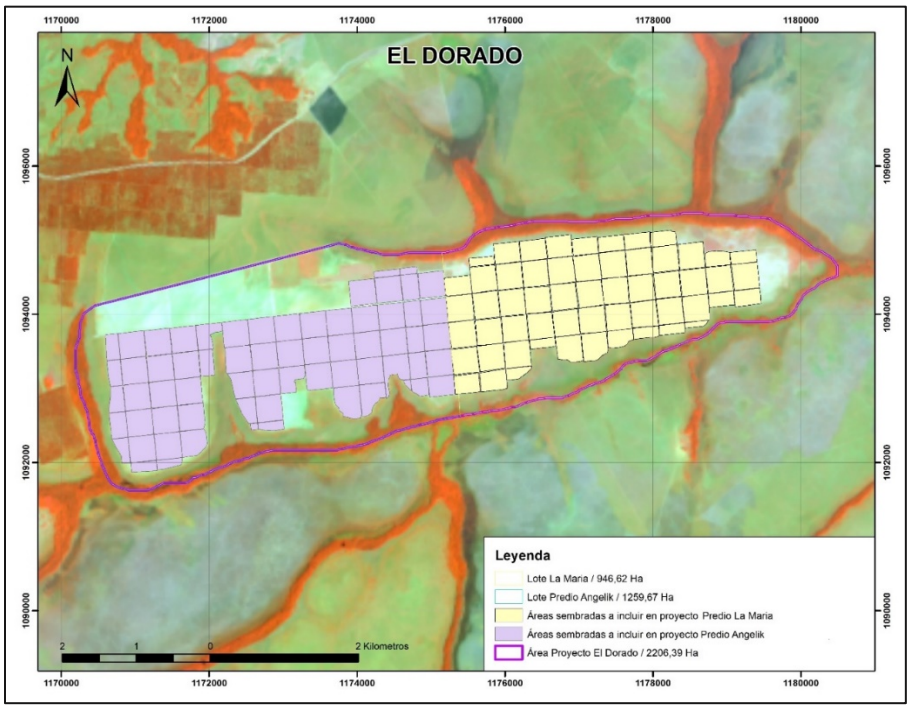


Figure 3. Properties planted under commercial stand models on the Angelik and La Maria properties of the El Dorado afforestation lands, in Vichada, and which are part of the current forest carbon proposal.

3.2.2 Carbon reservoirs and GHG sources

For the accounting of reduced emissions balances, the methodology considers the following carbon reservoirs or sinks.

Table 7. Carbon reservoirs or sinks for the project proposal based on the AR_AC0003 methodology.

Carbon Reservoir	Selection according to methodology	Justification	Consideration for the project
Above ground Biomass	Yes	It is the largest carbon reservoir in the project proposal	***Yes,*** se selecciona debido a es el principal reservorio de carbono en actividades de cambio del suelo, en la transformación de pastos a bosques.
Below ground Biomass	Yes	Carbon content is expected to increase with the implementation of the project.	***Yes,*** it is selected because, with the project proposal, the carbon content will be higher than the contents estimated in the baseline.
Dead wood, litter and soil	Optional	The carbon contents of these reservoirs may	***Yes.*** The areas to be intervened (unmanaged pastures) do not present

organic carbon Biomass		increase with project activity.	significant contents of leaf litter or dead wood on the soil surface, due to periodic burning, eliminating the possibility of accumulation of organic matter (Image 7). Likewise, soil organic matter is extremely low or non-existent in some areas. Therefore, with the project proposal, this reservoir will see its content increased (Image 8).

A. B.

Image 7. Comparative, presence of leaf litter on the ground between the baseline activity (A). Pastures with periodic burning and project activity (B.), presence of needle cover and detritus on the ground in Pino Caribea plots.

Image 8. Comparison between the content of organic matter in the soil of the baseline (unmanaged pastures, on oxisols) A and B, compared to the highest contents of organic matter present in the first horizons of the soil in the plantations (evidence of the soil in areas of pines)

3.2.2.1 Sources of emissions

Table 8. Types of Project Emissions Sources

Source	GHG	Selected (Yes/No/Optional)	Justification
Burning of woody biomass.	CO_2	No	CO_2 Emissions due to burning biomass are not accounted as a change in carbon stock.
	CH_4	Yes	Burning of Woody biomass for site preparation as a part of forest management is allowed under BCR0001 Methodology.
	N_2O	Yes	Burning of Woody biomass for site preparation as a part of forest management is allowed under BCR0001 Methodology.

Although the methodology allows burning of woody biomass as part of forest management, the project complies with national regulations that restrict the use of controlled burning as part of agricultural soil management (decree number 4296 of 2004). Considering what is defined in the decree, this activity is sanctioned by the regional

autonomous corporations. Therefore, burning and its potential emissions are ***NOT*** considered a project activity.

3.2.3 Time limits and analysis periods

3.2.3.1 Project start date

30/06/2015.

As described in section 10.4 of the BCR program document, (Programa BCR: Estándar de Carbono, 2024) (version 3.4), "the start date for GHG projects is when the activities *that result in actual reductions/removals of GHG emissions begin*". According to the methodology, the start date corresponds to the moment in which the implementation, construction or actual action of a GHG project begins, corresponds to the date in which the preparation of the site begins, the establishment of the crop, the beginning of the restoration activities or other actions related to the beginning of the mitigation initiative activities.

It is mandatory that only initiatives whose start date is defined within the five (5) years prior to the start of validation can be certified and registered. For the El Dorado Forest Carbon Project, an agreement was signed with the OEC on October 2, 2019. Therefore, this requirement is also met.

The start date of the project is 06/30/2015, which is supported by the signing of the Forest Incentive Certificate -CIF contract (*contrato de Certificado de Incentivo Forestal* -CIF. Acto Administrativo 11-2015. Anexo 9_Documentos_Legales) between Pavimentos El Dorado and the Fondo de Financiamiento del sector Agropecuario FINAGRO. The CIF is a financial support instrument, within the framework of the National Economic and Social Policy Council, to contribute to the solution of cross-cutting problems, such as financial barriers, identified in various productive sectors of the country, including forestry.

For this project proposal, with the signing of the contract the project proponents managed to reduce the investment risks, and guaranteed the financial support required for the establishment. Therefore, this action is assumed as the start of the activity.

Es importante mencionar que, de acuerdo con las condiciones establecidas para optar al incentivo forestal, se señala: "*Podrán ser susceptibles de acceder al CIF, todos aquellos proyectos de plantaciones forestales comerciales que, a la fecha de la presentación a través de la Ventanilla Única Forestal -VUF, no hayan sido plantadas".* Condición que fue cumplida durante la visita técnica realizada, como lo demuestra el contrato CIF.

It is important to mention that, by the conditions established to qualify for the forest incentive, it is stated: "*They may be eligible to access the CIF, all those commercial forest plantation projects that, as of the date of presentation through the Ventanilla Única Forestal -VUF,* have not been planted" Condition that was met during the technical visit carried out, as demonstrated by the CIF contract.

3.2.3.2 Quantification period of GHG emission reductions/removals

The period for the quantification of the removals and/or reductions of GHG emissions, for the Forestal El Dorado carbon project, which considers activities belonging to the AFOLU sector, is 30 years from June 30, 2015 to June 30, 2045.

3.2.3.3 Monitoring periods

The first monitoring period runs from June 30, 2015 to April 30, 2023. Monitoring will be carried out every 3 years, until the entire accreditation period is completed.

3.3 Identification and description of the baseline or reference scenario

This section describes the steps to identify the baseline or reference scenario. This corresponds to the scenario that represents the GHG emissions, which would occur in the absence of the project.

This means that the baseline must be defined in accordance with what is established in the latest version of the methodological documents and as described in section 11.2 of the BCR Standard.

After identifying the eligibility of the areas, taking into account that the eligible areas correspond to Non-Forest coverage and that they have been maintained, at least for 10 years, before the start date. For this project initiative, It was identified that the land use during the baseline period corresponds to grasslands (according to the land use analysis methodology Corine Land Cover[12]). Figure 4 and Figure 5, show that 100% of the eligible area before the establishment of the Stand models, are clean grasslands or grasslands.

[12] CORINE LAND COVER methodology (*Coordination of Information on the Environmental)* adapted for the country. The purpose of this methodology is to carry out a homogeneous inventory of the biophysical cover (coverage) of the Earth's surface based on the visual interpretation of computer-assisted satellite images and the generation of a geographic database.

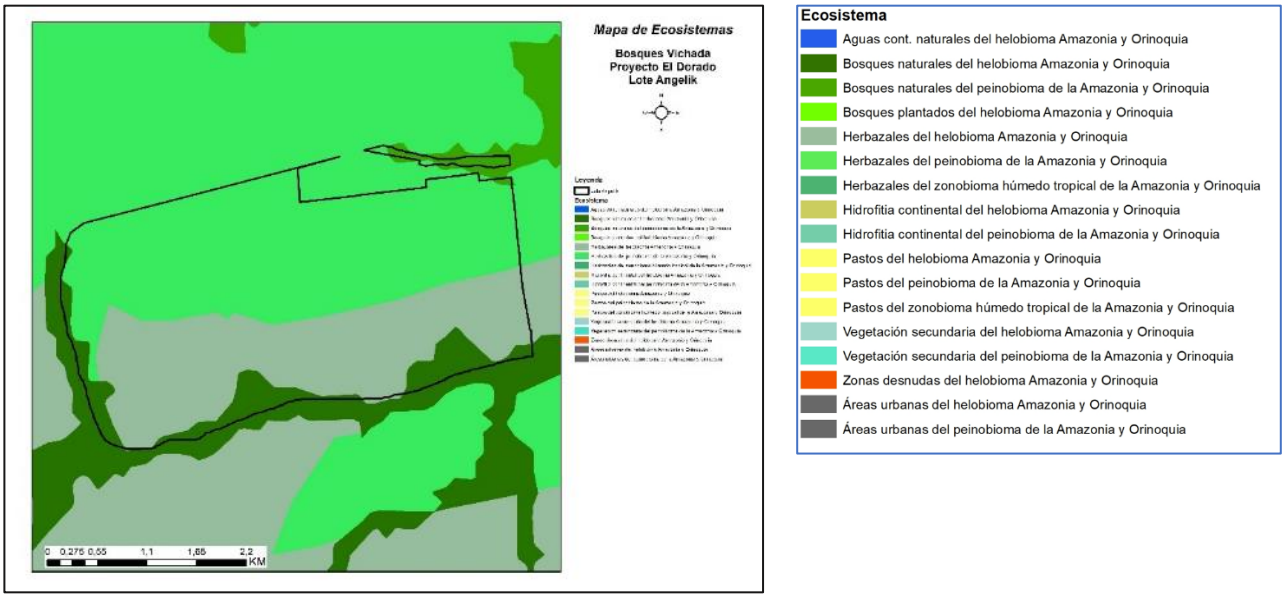


Figure 4. Land uses in the eligible areas corresponding to non-forest cover on the Angelik property

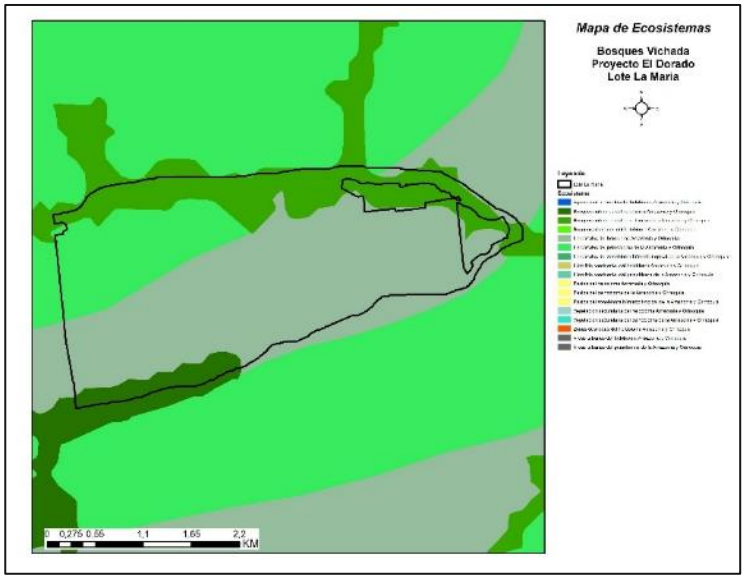


Figure 5. Land uses in the eligible areas correspond to non-forest cover on the La María property.

The images, processes, and results of the analysis are described in Annex 2. (Ex-ante spatial analysis)

3.4 Additionality

3.4.1 Baseline Scenario

According to the tool for constructing the additionality analysis[13], the project proponent must select the most appropriate criterion for the justification of the baseline scenario.

The criterion for the development of the baseline scenario for the El Dorado forest carbon project describes changes in carbon stocks within the project limits, identifying the most probable land use at the beginning of the project.

Step 0. Start date

As described in section 10.4 of the BCR program document, (Programa BCR: Estándar de Carbono, 2024) (version 3.3), "the start date for GHG projects is when the activities *that result in actual reductions/removals of GHG emissions begin*". According to the methodology, the start date corresponds to the moment in which the implementation, construction, or actual action of a GHG project begins, corresponds to the date in which the preparation of the site begins, the establishment of the crop, the beginning of the restoration activities or other actions related to the beginning of the mitigation initiative activities

The start date of the project is 06/30/2015, which is supported by the signing of the Forest Incentive Certificate -CIF contract (contrato de Certificado de Incentivo Forestal -CIF. Acto Administrativo 11-2015. Anexo 9_Documentos_Legales) between Pavimentos El Dorado and the Fondo de Financiamiento del sector Agropecuario FINAGRO.

Step 1. Identification of alternative scenarios.

The identification of alternative scenarios was carried out following the guidelines of the additionality tool of the BCR standard. The tool indicates that realistic and credible scenarios must be identified, in the absence of project activities. The baseline represents the continuation of economic activities that have occurred historically, are currently maintained, and are unlikely to change in the absence of project activity.

Step 1a.

[13] https://biocarbonstandard.com/wp-content/uploads/BCR_additionality.pdf

- Continuation of land use, before the start of the project. Lands with the presence of pastures, such as areas intended for extensive grazing on degraded soils.

Caracterización y generalidades de los posibles usos del suelo.

- **Cultural aspects**.

Conditions in the base scenario areas are homogeneous. At the beginning of the project activity, the predominant vegetation cover is grasslands and eroded soils, in which extensive livestock grazing has been the historical land use in the project area (Plan de Manejo de Tierras, EOT 2000[14]). No activities other than those mentioned above are identified, therefore, there is only one stratum in the baseline scenario: pastures.

Grassland burning is one of the regular practices associated with extensive livestock farming, which has been the dominant land use model for more than a century where, culturally and traditionally, periodic burning is used to renew pastures. The burning is carried out in the summer without any type of control and although it is a prohibited practice (EOT, 2000, pág. 73). Due to the location in a rural area far from the capital of the department, the lack of infrastructure and the high transportation costs for agricultural products, has allowed grassland areas to be the predominant land use, in more than 90% of the productive land of the Municipality of La Primavera (Land Management Plan, EOT 2000, page 137). The practice of extensive livestock farming results in an average occupation of 10 hectares per animal unit[15].

As defined by Tigrillos (2010), livestock is the basis of the economy of the department of Vichada and especially of the municipality of La Primavera. The explanation for this condition is the traditional way in which extensive livestock farming has been developed in herds – farms, with low production costs. The technologies used for livestock farming are old, in most cases, and are used in a large part of the Llanos Orientales. It is estimated that 90% of the land in La Primavera is dedicated to extensive non-technical livestock farming. The same author highlights how only 2% of the municipality's soils are being exploited in agricultural activities, many of which are found in the valleys of the Meta River, which is located more than 60 km from the area of the Projects.

[14] Esquema de Ordenamiento Territorial, 2000. Municipio de la Primavera.

[15] **La Unidad de Gran Ganado (UGG) o Unidad Animal (UA),** es un término que representa los requerimientos nutritivos de una vaca de 450 kg de peso vivo o un novillo de 500 kg de peso vivo los cuales consumen aproximadamente 13,5 kg de forraje seco por día

As mentioned before, in the area of project activity, land has historically been dedicated to extensive livestock farming, based on the regular burning of pastures, this trend has been increasing between 2001 and 2008, the Colombian Orinoquia The hectares of pastures for extensive livestock farming increased by more than 1.5 million (Viloria, 2009[16], p54). In addition to this, the limitations of soil quality and the lack of adequate land access roads have limited the development of other agricultural activities in the territory. Due to the above, extensive artisanal livestock farming on degraded soils (see general description of soil conditions) is considered the most probable land use activity.

Livestock farming practiced in the region usually lacks adequate technological packages, which generates greater pressure on grasslands considered the only source of food and energy available for livestock. Livestock activity, as it has been developing, leads to soil erosion and compaction, adding to the introduction of non-native grasses for livestock grazing, generating loss of biodiversity and land degradation. Because of the above, some areas are reported to have lost the natural regeneration capacity of the region's native flora.

Regarding the characterization of this baseline scenario, which corresponds to grasslands degraded by extensive livestock farming and regular anthropogenic burning of grass, the dominant plant species are recognized, which correspond to herbaceous plants, grasses, reeds, and xyrydaceae, among those found: Aristida sp. *Axonopus purpusii, Axonopus fissifolius, Digitaria decumbens, Eragrostis maypurensis*, *Panicum sp., Paspalum sp. Trachypogon plumosus*, among others.

- **Political aspects or local and sectoral land use regulations and land use alternatives.**

In general, government policies and incentives for reforestation have been very limited. Agriculture and livestock have been promoted by different policies and programs (Ministerio de Agricultura y Desarrollo Rural, 2005[17]. Pág. 17), but commercial forestry has not received the same support. The restoration of natural forests has been promoted through policies but has not received structured financing.

[16] Viloria, 2009. Documento de trabajo sobre economía regional. Geografía económica de la Orinoquia.
[17] MADR, AGROCADENAS 2005. La cadena Forestal y madera en Colombia. Una mirada global de su estructura y dinámica 1991-2005. Observatorio Agrocadenas, Colombia. Documento de trabajo No. 64.

As described in previous paragraphs, for agricultural production, the soils in the area have fertility limitations, low organic matter content, low availability and retention of nutrients, and associated with poor soil management conditions, making the agricultural production costs are high and unprofitable. It is estimated that only 2% of the local soils are being exploited for agricultural activity. Small plots (conucos) for subsistence agriculture and other traditional crops, such as cocoa and sugar cane, have traditionally been exploited by farmers and Indigenous groups. These groups often deforest riverside forests, through inappropriate and unsustainable practices, which degrade the soil (CORPORINOQUIA, 2008). Alluvial soils near larger rivers, although regularly flooded, are used selectively for crops such as corn, bananas, cocoa, sugar cane, rubber, pineapple, fruits and oil palm. Due to the low fertility in degraded areas with grass cover, these industrial cultivation activities cannot be developed.

- **Forestry activity:**

At the national level, several laws and regulations related to the forestry sector, mostly conservation-oriented, have been published before the project start date, but they have not been sufficient to encourage large-scale commercial forestry. A national forest policy was adopted through the national planning document CONPES 2834, 1996, to be developed within the framework of the Environmental Policy. Because the policy, at that time was strictly conservationist, did not allow forestry use for commercial purposes, so the forestry industry expressed the need to update it and pay attention to the guidelines established for commercial forestry, to sustainable rural development, which would allow us to combat poverty in these isolated regions, such as the Orinoquia. n the other hand, authors such as Acosta (2004[18]) argued that, at the beginning of the 2000s, the state lacked a policy to regulate the activity of commercial forestry, especially the rules that apply to private investors. By 2000, a more productive approach was adopted under the National Forestry Development Plan. The implementation of this plan had some limited resources to improve the competitiveness of the productive forest, through the promotion of research and development, but no funds were allocated for reforestation activities.

Colombian forestry legislation provides incentives for commercial reforestation through the Forest Incentive Certificate (Certificado de Incentivo Forestal CIF), under Law 139 of 1994. However, the impact of this incentive has not been significant and has not had a

[18] Acosta, 2004. Estudio de tendencias y perspectivas del Sector Forestal en América Latina Documento de Trabajo. http://www.fao.org/3/j4192s/j4192s00.htm

sufficient effect with the objective of promoting reforestation, this is due to the high transaction costs, and that the effectiveness of the incentive depends mainly on the availability of budgetary resources (Aldana, 2004[19]). When national fiscal resources are not allocated for this purpose, CIF Forest Certificates are not financed due to other priorities.

Commercial reforestation is an incipient and marginal activity in the department of Vichada, where only 0.1% of the land is dedicated to this activity and is concentrated in the municipalities closest to the interior of the country, such as Santa Rosalía and western Cumaribo.

Considering the above and considering the extensive rotation periods of forest plantations, (more than 15 years) these periods allow for a wait for investments in the forestry sector, while the infrastructure conditions improve, allowing the continuation of the activities temporarily, thanks to the help that the CIF gives to forestry project developers.

- **Road infrastructure:**

As mentioned before, livestock farming continues to represent the most plausible land use scenario in the project area, due to the low investment required in transportation, culture, tradition, and ease of land use maintenance. As detailed in Chapter 3, this region still lacks adequate roads for industrial agricultural development in the municipality of La Primavera-Vichada.

Regarding alternative productive activities in the project region, Chapter 3 develops an analysis of the aspects related to land suitability, investment, and cultural barriers, which explain why pastures and their easy maintenance are the coverage predominant vegetable.

- **Analysis of land use alternatives based on financial investment.**

In the municipalities of Vichada, particularly La Primavera, extensive livestock farming in natural savannahs (herd or farm, or livestock ranch) predominates. This type of livestock farming has been a historical adaptation to the conditions of regional ecosystems. Being a rustic productive activity with poor management of improved pastures, its productivity is low. Due to the lack of road infrastructure, transportation costs to trade centers are high,

[19] Aldana, C. 2004. Sector forestal colombiano: fuente de vida, trabajo y bienestar. CONIF. Número 50 de Serie de documentación. 102 páginas.

making profitability low (Bernal, 2010[20]). among the traditional agricultural products that could be planted in the area are rice, corn and soybeans (Caracterización Socioeconómica y Ambiental, y de Tenencia de la Tierra, Vichada. Misión Rural, INCODER[21]). Table 9 shows a comparison of the Net Present Value NPV, between alternative agricultural products and traditional livestock farming, versus forestry activities. The NPV value of the project proposal is 50% above these productive alternatives, with an improvement in activities. Although these reference values are from 2005, for the start date of the project (2011, reference for the analysis of the forestry project), the value does not vary, considering that the conditions of the road infrastructure, services and agricultural industry of the region have not changed.

Table 9. Income scenarios from alternative activities in the use of productive land. Scenario for productive activities in a first production cycle.

Productive activity	NPV (by hectare)	Source
Corn - current technology	-$ 155,592.8	**Corpoica, 2005.**
Corn with improved seed	$ 232,844.5	
Arroz secano - current technology	$ 449,549	
Arroz secano - Direct sowing.	$ 1,704,398	
Arroz secano semilla mejorada.	$ 641,006	
Soy - current technology	$ 972.032	
Soy - improved seed	$ 1,426,494	
Bovine livestock - breeding Current technology	$ 482.083	
Bovine livestock raises the use of forage alternatives for grazing and pasture nutrition.	$ 1,358,857	

[20] http://bibliotecadigital.agronet.gov.co/bitstream/11348/3942/1/041.pdf
[21] http://www.misionrural.net/fscommand/caracterizacion.pdf

Forestry project proposal including carbon certificates.	**$3,999,511**	Present proposal. (see financial flow [22]).

Another study developed in 2007 by the Colombian Agricultural Research Corporation (CORPOICA[23]), prepared a new cash flow analysis, considering combined scenarios of potential products for the Alta Orinoquia region. The potential products considered in this study were: corn, soybeans, rice, pineapple, cashews, timber such as Eucalyptus, rubber, and cattle farming.

Table 10. Analysis of financial profitability for different agricultural products, such as potential alternative land uses in the project region. Various production cycles

Product	Net present value (Colombian pesos)	Internal rate of return	Income generation
Corn	$ 8,237,490.3	7.1 %	It is not income-generating
Soy	$ 2,711433.0	6.2 %	It is not income-generating
Rice	$ 6,485,636.9	6.8 %	It is not income-generating
Eucalyptus	$ 4,909,302.3	6.8 %	**Possible**
Rubber	$ 4,909,302.3	3.2 %	It is not income generating, possible loss
Cashew	$ 1,026430.4	8.5 %	**Possible**
Pineapple	$ 88,493,667.1	6.2 %	**Possible**
Cattle	$ 117,769,223.0	6.3 %	**income generating potential**

Source: Modified from Corpoica 2007.

[22] Annex: D. Analysis of NO Permanence. Risk Analysis Development. Financial Risks

[23] Corpoica. 2007. Formulación y evaluación integral de proyectos productivos agroforestales para impulsar el desarrollo sostenible de la Orinoquia alta colombiana para el beneficio del mundo. Ministerio de Agricultura y Desarrollo Rural. 317 pág. https://repository.agrosavia.co/handle/20.500.12324/12015

The combination between the NPV and the internal rate of return shows the viability of profitability for investment in the agricultural sector, of potential products for the Altillanura region. In this context, although some of the products can eventually generate income, their production remains limited due to the conditions of road infrastructure, to be able to market them in markets outside the Orinoquia region, for this reason, the production of potential agricultural products does not is attractive to investors. On the other hand, timber products, except for rubber, are considered long-term income generators and an important source of employment (it is estimated that 11 hectares can provide 1 direct job and some indirect jobs, depending on the type of activity). In the estimation of the probable financial viability (table 10), for each of the crop alternatives, a better performance is observed in the estimation of the financial viability of the cashew-pineapple (mixed), corn-rice (mixed) and cattle. However, pineapple and cashews continue to present restrictions as an agricultural activity, since transportation and preservation limitations (perishable products) constitute a risk of product loss.

Without a doubt, the activity with the best profitability continues to be cattle farming. This means that livestock farming is maintained in the savanna areas dedicated to grazing.

Result in step 1a.

According to the previous descriptions, the most likely land use in the proposed project areas will continue to be grasslands on degraded soils for extensive **livestock farming**. Another alternative activity that has been developed in the region and that was implemented in the early 2000s, with financial support from the government, is **forestry activity**, which can be considered the second alternative land use activity.

Step 1b. Coherence of alternatives with regulatory and legal policies.

In the alternatives identified in Step 1a, the only conditions that would limit the development of activities would be some type of limitation related to territorial planning and permitted land uses.

According to the studies developed by INCODER, in the economic, environmental, and land tenure characterization, developed in the Rural Mission document, agricultural activities are congruent with the vocation of the land in the project area and the projections of the Colombian agricultural frontier (Image 9).

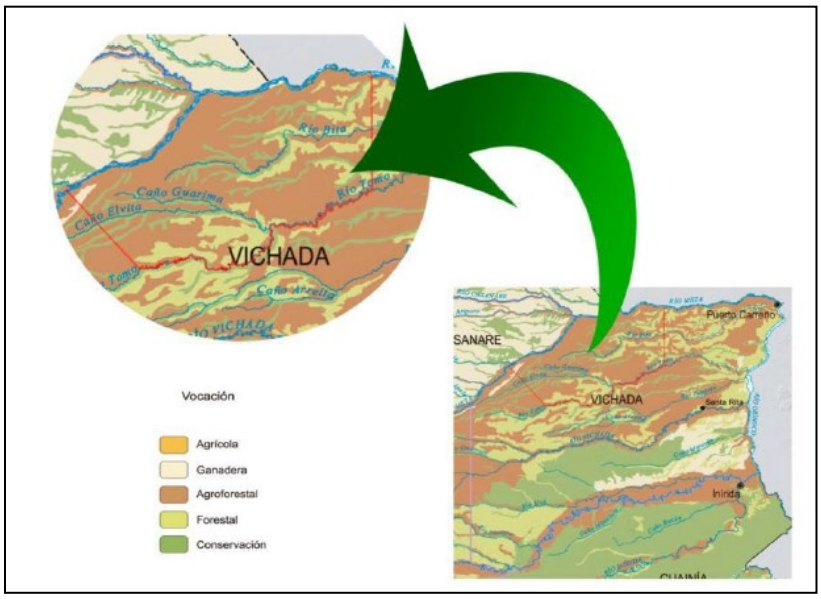


Image 9. Land Use Vocation in the Municipality of La Primavera, Vichada. Source: Misión Rural-INCODER, 2012.

TThe use of land for livestock farming, being a traditional and cultural land use, according to the suitability of the soil (Image 9), does not have any type of restriction for its development.

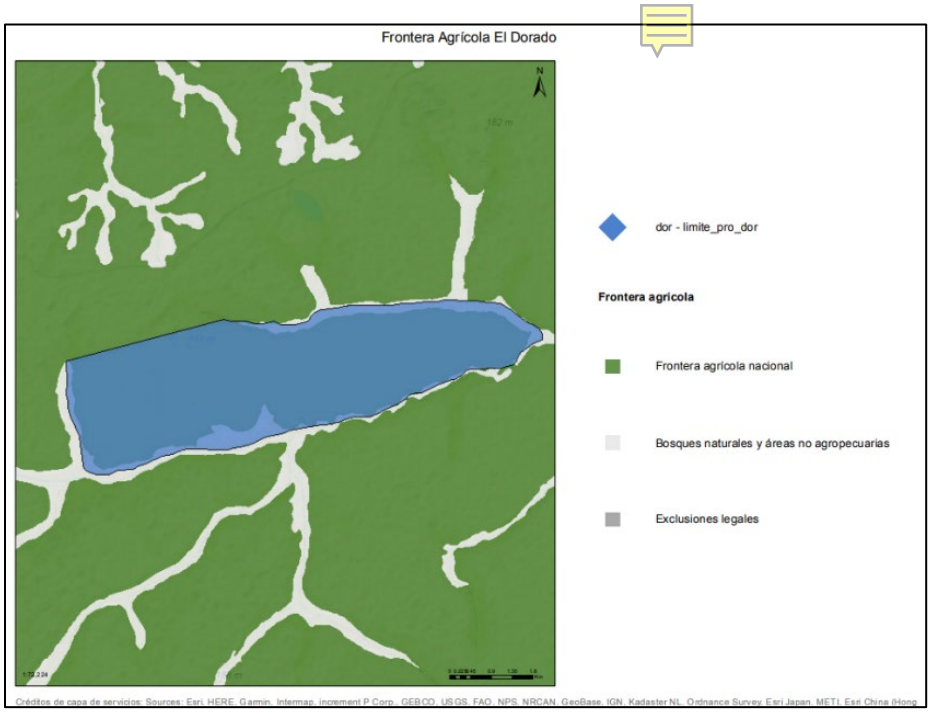


Figure 6. National soil planning, determination of the agricultural frontier, and legal exclusion zones. Source: https://sipra.upra.gov.co/#nacional

The territorial planning scheme of the municipality of La Primavera identifies Urban zones as those that delimit the urban perimeter zone, associated with the provision of public services. In the document, projected urban expansion zones are also established, corresponding to three subzones, determined by distances between 350 meters to 1000 linear meters, from the urban perimeters identified in the year 2000. The project areas, being located more than 80 kilometers from the urban expansion areas are within the rural area and are suitable for the development of activities (Art. 53, *esquema ordenamiento* territorial, 2000). En el Esquema de Ordenamiento, se definen algunas restricciones de uso, asociado a la zonificación de riesgo y amenazas naturales. In the Planning Scheme, some use restrictions are defined, associated with risk zoning and natural threats. Therefore, any rural productive project must request certification from the municipal and environmental authorities to determine whether the activities and use of the land are permitted or not. Art. 52 (UMATA, *secretaria de Agricultura*, CORPORINOQUIA).

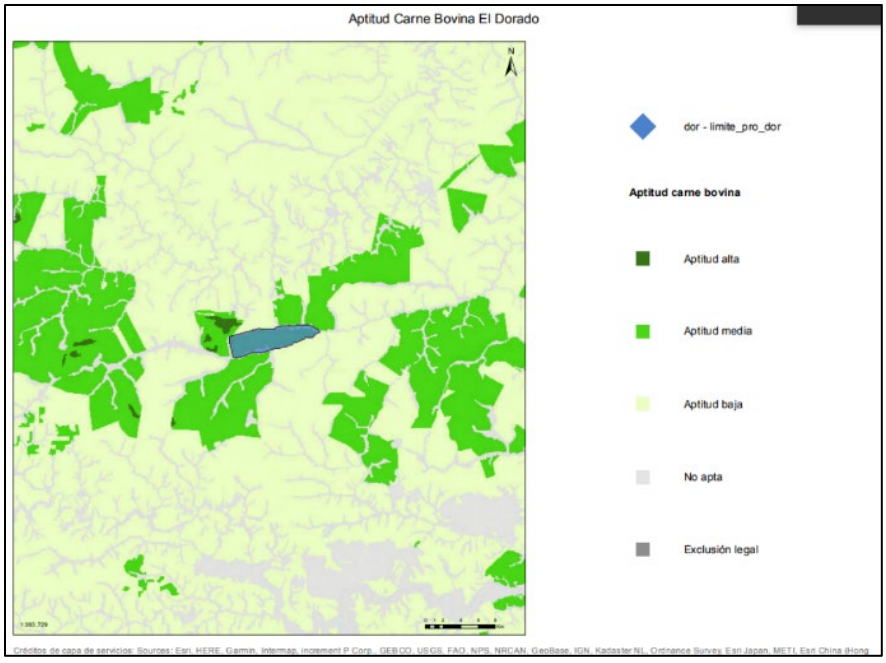


Figure 7. Soil suitability for bovine livestock activity. Source: SIPRA, from UPRA. https://sipra.upra.gov.co/

Article 52 of the territorial planning scheme of La Primavera (2000), also refers to the fact that the land will be used and occupied according to its original, agrological and potential vocation. The UPRA has determined the soils with forestry vocation in the Vichada region as suitable, but with limitations regarding the environmental and soil supply. However, it does not describe legal restrictions on the activity. Like agricultural and livestock activities, forestry activity must obtain the necessary permits for its development,

according to article 52, but this same article does not determine legal limitations for its establishment. In compliance with the law for forestry activity, land use certification was obtained for the El Dorado forestry project (13082018-CTD0267, *secretaria de Planeación,* Annex 9_Documentos_Legales /C.7 *Certificación de uso del suelo*), and is in accordance to the suitability of the soil, defined for the area (Figure 7).

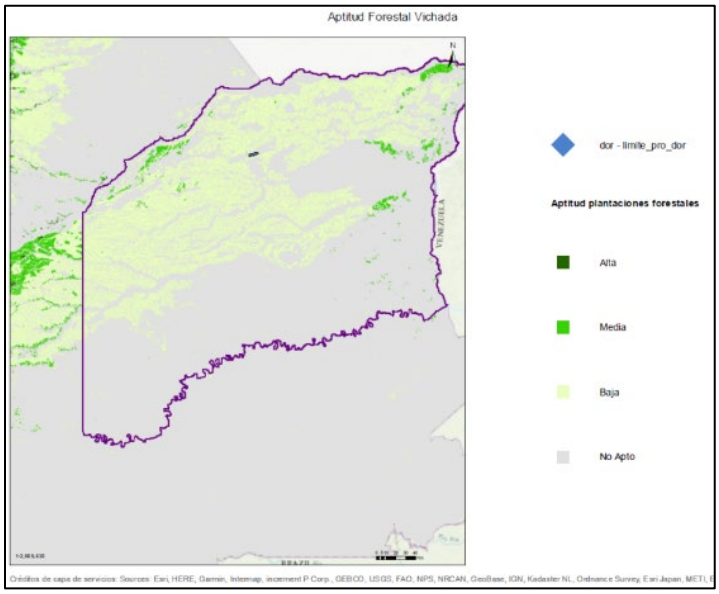


Figure 8. Aptitude and vocation of the soil for forestry activity in Vichada. Source: https://sipra.upra.gov.co/

The last legal requirement or restriction is associated with the ownership of the areas, where the owners can dispose of them without affecting the rights of others. However, private interest must yield to public or social interest. Therefore, project areas that are privately owned could not develop agricultural or productive activities if they were in areas of the national park system or national forest reserves, since these conservation figures limit the property right. private. Considering the above, areas of national parks, national forest reserves, state bleats, and other territorial ownership figures, whose administration oversees the local or national government, are excluded. In the department, a freedom for the formalization of private property is identified, at 94.4%, including the project area. Figure 8 and Figure 9 shows that there is no evidence of restrictions for the development of agricultural activities, such as areas registered in the National Registry of Protected Areas (Registro Único de Áreas Protegidas RUNAP) or vacant lands, on private lands, where the project is developed. The closest protected areas are the Tuparro National Park (eastern side of the image) located more than 100 km from the project area and the civil

society reserves La Pareja 1 and 2, El Cachicamo, Santana and El Gavilán, is located more than 20 kilometers (see Figure 10).

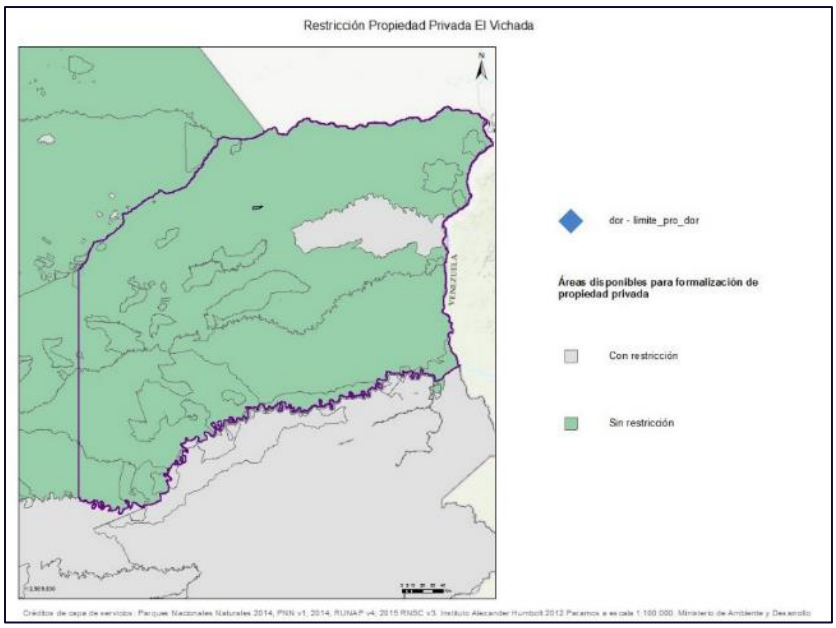


Figure 9. Availability for the formalization of private property in the project area

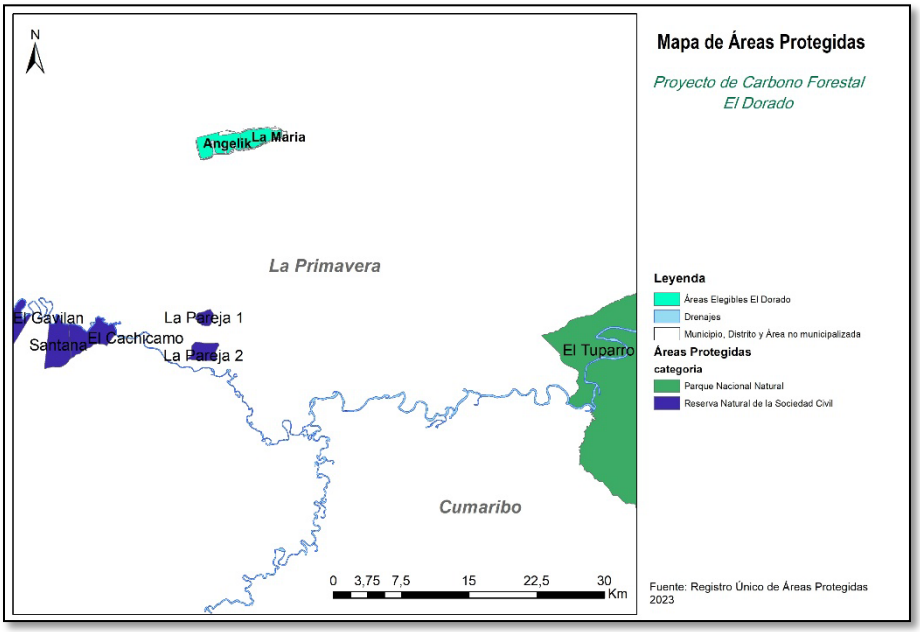


Figure 10. Location of protected areas and proximity to the project area

Result of sub-step 1b. The **extensive livestock** activities and **forestry** activities

identified in sub-step 1a, comply with the conditions of law and regulations applicable to their development in the project area.

Step 2. Barrier analysis.

As described in Chapter 3, there are a series of limitations for the development of land use alternatives, compared to the historical use of savannahs for cattle grazing.

Sub-step 2a. Identification of barriers

In this process, aspects related to the limitations for the implementation of project activities are mentioned, such as the lack of road infrastructure, cultural and social aspects, and barriers related to financial aspects. For the department of Vichada, one of the main limitations is the lack of road and river infrastructure, tertiary roads are used only in the summer, and the rest of the year in the rainy season, river transport is used, which transports the products to the Meta department and from there it is transported to main consumption centers such as Bogotá. Production costs increase mainly due to transportation and travel times. Additionally, the region does not have a technical industry, which limits the transformation of raw materials, which limits productivity and development in general.

For the analysis of barriers, a matrix is developed that relates the two activities identified in sub-step 1b, extensive livestock farming and forestry activity, compared to the existing barriers.

Table 11. Relationship matrix of potential activities and possible existing barriers

BARRIERS		EXTENSIVE LIVESTOCK FARMING	COMMERCIAL REFORESTATION	OBSERVATIONS
INVESTMENT	Capital	*	*	Livestock farming is considered a cultural and traditionally relevant practice, the investments required are lower than the investments that would be needed for the implementation of another agricultural activity, and the economic model for livestock activity is already defined. On the other hand, the development of forestry activity has incentives from the government, such as the CIF, and investors interested in developing the activity in the region. Investment and incentives could boost the process of forest stand establishment.
	Credits	*	*	Livestock farming is maintained in the region, even without the need for access to credit. However, it is a line of credit. Before the year 2000, incentives were created for the promotion of livestock farming throughout the country, such as the Fund for the Financing of the Agricultural Sector of FINAGRO and the livestock capitalization incentive, which allows actions to be taken for credit rediscounts (for example LEY 676 DE 2001 y ley 1094 del 2006), which allow improving the productivity and competitiveness of the livestock sector in the country, within the framework of state policy. For reforestation activities, as part of the productive forestry sector, since 1990, some financing and credit opening initiatives for the sector have been progressing. The above, as part of agricultural plans and policies in which forestry activities begin to be a priority for the country (for example: Law 26 of 1977, creates the Forest Financial Fund, among other laws and decrees generated since 1990). However, a lack of development in the sector is evident when evaluating the dynamics at the beginning of the 2000s (http://www.fao.org/3/AD392S/AD392s08.htm). The forestry incentive certificate (CIF) and other modalities of support for risk investment such as AgroIngreso Seguro, have created financing models for the agricultural sector for both small, medium, and large producers. (http://elsemillero.net/pdf/porque_invertir_plantaciones.pdf)
	Private Investment	*	*	Both cattle ranching and commercial reforestation have access to private capital. However, for reforestation, especially for commercial stand models, is restricted when native forest species are used, because these species do not have technological packages, making private capital investment highly risky. In 2007, the Forestry Investment Fund was created with an initial budget of US$27 million, from private capital from pension funds, insurance companies, and the Fund for the Financing of the Agricultural Sector -FINAGRO.

BARRIERS		EXTENSIVE LIVESTOCK FARMING	COMMERCIAL REFORESTATION	OBSERVATIONS
				https://sioc.minagricultura.gov.co/Forestal/Documentos/2011-04-30%20Cifras%20Sectoriales.pdf
Institutional barriers	Institutional changes and policies.	*	*	Policies for the agricultural sector in Colombia are in many cases due to state initiatives and not government initiatives, which is why implementation for the forestry sector in the long term is guaranteed, such as the National Council of Economic and Social Policy - CONPES, under which the CIF Reforestation incentive or a series of CONPES for agricultural development is created https://www.minagricultura.gov.co/Normatividad/Paginas/Conpes.aspx. Regarding institutional changes, these have little impact on livestock and forestry activities, since their development is in charge of the ministries, which are responsible for the implementation and continuity of policies for rural development.
	Size of properties for investment.	*	-	The UAF Family Agricultural Units, defined as the basic unit of agricultural, livestock or forestry production, are an extension that allows beneficiary peasant families to receive remuneration for their work and have a capitalizable surplus that helps to form their assets. department of Vichada the UAF has a size of 1,725 hectares. This extension of the UAF is a restriction and becomes a barrier for large-scale forestry developments in the region, especially for private investment, since profitability can be capitalized on larger extensions, which allow improving the relationship between costs and benefits, taking into account the high costs involved in establishing forest centers in the region. For this reason, extensive livestock farming without regulation on the farms continues to be more striking.
Technolo	Technology packages	*	*	Extensive livestock farming activities, being a traditional practice widely spread in the region, have an established form of implementation. For its part, commercial reforestation is characterized by the lack of information for commercial native species.

BARRIERS		EXTENSIVE LIVESTOCK FARMING	COMMERCIAL REFORESTATION	OBSERVATIONS
	Infrastructure and source materials.	*	*	There is the availability of certified seed for commercial forest species at the national level and the provision of a facility to store plant material (nurseries) for the development of the activity, which is associated with technological packages. http://elsemillero.net/ This condition is restricted to native forest species.
Local tradition	Knowledge and technology	*	-	Historically, extensive livestock farming is part of the culture of the productive community in the eastern plains, therefore, there are no restrictions for implementation. Grazing lands are the traditional land use. On the other hand, forestry activity and even extensive agricultural activities are not adopted by local communities, due to ignorance of management and lack of infrastructure for technical training, promotion in the secretaries of agriculture or development, and other local limitations for their implementation.
Social	Qualified personnel	*	-	As mentioned before, the Orinoquia has a large area of land with a very low population, which limits hiring labor for agricultural or industrial forestry activities. Except for extensive livestock activities, which may require a lot of labor for their development.

BARRIERS		EXTENSIVE LIVESTOCK FARMING	COMMERCIAL REFORESTATION	OBSERVATIONS
B Market barriers	Limited consumption centers.	*	-	With forestry development in the isolated regions of Orinoquia, such as the department of Vichada, it was expected that wood production would be exported to international markets. To achieve the mobilization of wood, the most appropriate route was by river through the Meta and Orinoco rivers, crossing through Venezuela. However, the conditions of relations between the two countries limited the transportation of Colombian products through the territory of the neighboring country. Currently, wood production depends on internal consumption, where transportation costs to the main markets mean that the relationship between costs and the benefit generated by the activity is reduced, added to the volatility of the price of wood in the region. The plantations in Vichada are more than 8 hours away by truck from the main market, located in the municipality of Villavicencio, in the department of Meta. While, less than 2 hours from the main wood market in Villavicencio, there are commercial forestry activities, which due to the proximity to the trade center, considerably reduce transportation costs.
Road	Suitable tertiary and secondary roads	*	-	Livestock production in the region is not affected by the lack of road infrastructure. In the municipality of La Primavera, despite being far from consumption centers, it is easy to mobilize livestock and get it to the markets. As has been described in generalities, the region has serious limitations in secondary and tertiary roads of good quality, in addition to the fact that they can only be traveled for a period of three months a year when summer conditions allow it. This is considered an important barrier to agricultural development in the region.
Environment	Suitability of Agricultural Soils	*	-	Current land uses have degraded the soil due to the continuous burning to which they have been subjected and have increased soil acidification and the presence of ferrous compounds. For the most part, the soils are not suitable for agricultural activity, unless large investments are made to recover the fertility of these soils.

*** Without barriers - With identified barriers.**

According to the analysis matrix of regional alternative activities, commercial reforestation presents a series of barriers, which make its development have a low probability, compared to the historical use of extensive livestock farming.

It is important to highlight that despite the growing forestry development that has been occurring in the department of Vichada, there are important gaps compared to other regions where forestry activity is carried out, in terms of economic growth, institutional capacity and productive and social development. These conditions are maintained, as described in the *Plan Departamental de Extensión Agropecuaria para el Vichada, 2020-2023 (Secretaria de Agricultura y Desarrollo Económico, Vichada, SF)*, where it is argued that the conditions of the department do not allow the sustainability of the business to be guaranteed. Forest.

Results of Sub-step 2a. Commercial reforestation activity presents a series of barriers that limit the probability of developing in the project area. Only **extensive livestock** farming as current land use is the activity that does not show barriers to its implementation.

Sub-step 2b. **Elimination of land use scenarios.**

Commercial reforestation activity presents a series of barriers and the only scenario without recognizable barriers is extensive livestock farming. Therefore, it is established that livestock farming is the only probable use of the land in the region of the project proposal.

Reforestation activities with commercial species: It is clear that, during the first decade of the 2000s, reforestation in the Vichada region had a slow increase and the activity was not prioritized in the economic development plans of the region. Reforestation activities without some type of additional incentive to the economic one, such as payment for the environmental service for carbon capture, were marginal, since the risk associated with the investment is high in regions where the environmental, institutional, infrastructure, capacity conditions technique and labor, among others, are important limitations for its development. The target markets for products derived from forestry activity are restricted by internal demand, and possible exports are affected by the political conditions with Venezuela. These reasons mean that Extensive livestock farming on degraded soils, as a historical and cultural land use, is defined for the Baseline, as the most probable land use, in the project area. The other agricultural activities were discarded from the beginning of the analysis, due to the low probability to generate financial profitability.

Sub-step 2c. Determination of the reference scenario.

Only extensive livestock farming on degraded soils does not present any barrier to its implementation.

Following the methodological tool "*Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities*", sub-step 2c indicates the application of a decision tree to the result obtained in sub-step 2b where the number is considered of land use scenarios. If there is a single land use scenario, which does **NOT** consider commercial reforestation as a possible scenario, then the baseline is determined by this single scenario. In this way, the land use of the Baseline will continue to be **extensive cattle farming in savannahs** with grass covers.

Considering the above, the investment analysis in step 3 is **NOT** required, since the baseline is already typified.

3.4.2 Traslape con otras iniciativas

he El Dorado carbon project initiative is part of the experience obtained in the *CDM Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia*, ID:9199, developed in the municipality of La Primavera, in the department of Vichada. This initiative under the CDM scheme is the only one in the region and is currently in the process of implementation under forest carbon schemes and does not overlap with the current proposal. As required in resolution 1447 of 2018 (RENARE), to access the registry and complete its phases, the project must not overlap with other initiatives, in the feasibility phase (art. 18 of resolution 1447). To demonstrate the above, as shown in the query of the RENARE record ID:1844, the project passed the feasibility phase, demonstrating that there are no overlaps with other initiatives and can move on to the formulation phase (see Image 10)

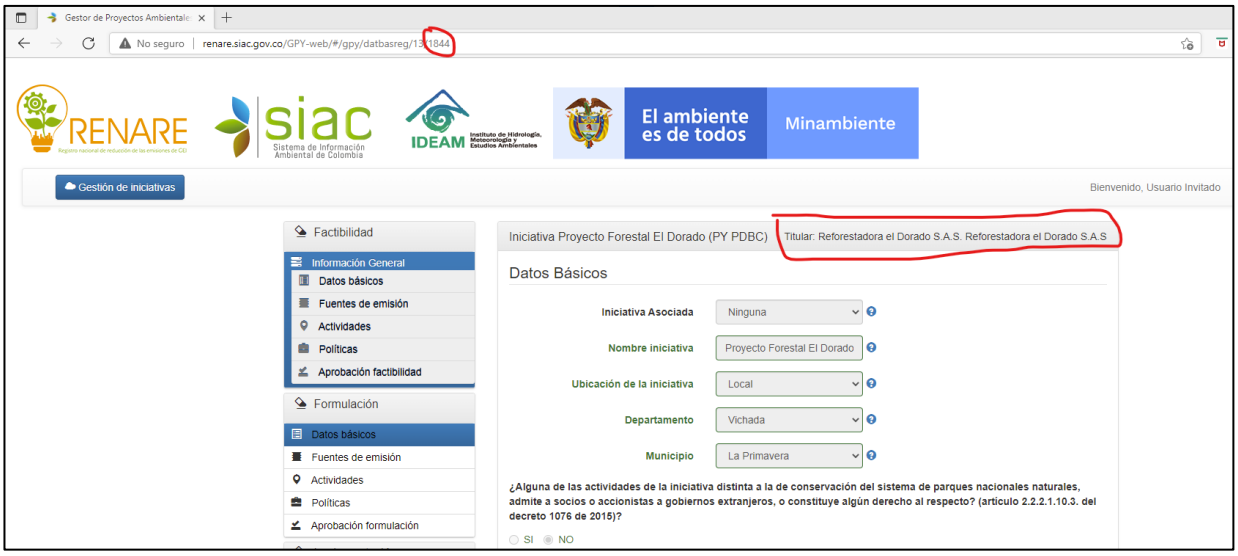


Image 10. Project registration in RENARE with ID:1844. Demonstrating that there is no overlap with other initiatives registered with RENARE.

3.5 Uncertainty management

According to the Methodological Document, GHG Removal Activities BCR001 of the BCR standard, the management of uncertainty is determined by a guide for the application of discounts for the quality and applicability of the data and the parameters used for the estimation of the reduction and/or removal of GHG emissions. This percentage is different and additional to the 20% reserve (see section 3.8).

According to Table 3 of Chapter 15, the discount factors that must be applied to the quantifications and final discounts of anthropogenic reductions must be made according to the degree of uncertainty.

The discount factor used for the discount quality and applicability of GHG estimation models, from the Methodological document GHG Removal Activities (%) is 20, taking into account that the values of density, factor (R:S) and biomass underground, data comes from the IPCC, as presented in section 3.9 Balance of Ex - Ante removals.

Additionally, the data and parameters used to calculate the reduction and/or removal of GHG emissions are consistent with the emission factors, activity data, projection variables of GHG emissions, and other parameters used for the construction of the national GHG inventory and the national reference scenario. However, by not applying the discounts mentioned in Table 3 of the Methodological Document GHG Removal Activities, the

uncertainty must be estimated by section 6.2 of the CDM methodology tool, for the estimation of carbon reserves in trees: Sampling error and uncertainty.

3.6 Leakage and non-permanence

Permanence is associated with the risk of not being able, in the long-term horizon, to maintain the removals fixed in the selected reservoirs and that for some reason they may return to the atmosphere.

The project, by developing reforestation activities with commercial objectives, has the projection of developing at least two rotations of the production process, that is, harvesting and planting. This is expected to recover the investment and generate profitability, as long as the road infrastructure conditions of the region allow it. In the short and medium term, the resources generated by the payment of environmental services associated with carbon will improve the income flow of the project proponents and are expected to include other timber and non-timber by-products (resins). In this way, the horizon of the activity, assuming rotations of 18 years for the forest species of the project, a continuous forestry activity of at least 36 years is expected, guaranteeing the permanence of the environmental service and the social and biodiversity benefits for the municipality of La Primavera, Vichada.

3.7 Mitigation results

The application of the AR_ACM0003 Methodology defines the procedures and considerations to take into account for the estimation of carbon removals by the project.

> Following the recommendations of the BCR standard, to guarantee the relevance and reliability of the estimates, it is necessary to:
>
> *- That the mitigation actions of the land use change sector, the carbon pools, the variables and parameters used for the estimates of the reduction of GHG emissions, must be appropriate and justified based on national information or international references appropriate for such an end.*
>
> *- Estimates of reduced GHG emissions must be based on the use of data, variables and models, from recognized and/or technically supported sources.*

Concerning the above, it should be noted that the country does not have a base of specific variables, models or equations to be implemented for forest carbon project initiatives and therefore follows the recommendations established by the IPCC (2003 and 2006) for greenhouse gas inventories. Faced with this condition, the country has presented national

climate change communications based on Tier 1 and Tier 2[24], s described in the document from INGEI page 21 (National Inventory of Greenhouse Emissions) in the third national communication[25]. his means that the country adheres to the IPCC emission factors and the data sources collected and described in scientific publications, for the project conditions.

For the El Dorado project proposal, the projected growth models were adjusted ex-ante for the proposed species and stand models. These growth models obey statistical adjustments supported by scientific literature and adjusted with values such as growth in volume of wood or biomass from national sources such as *Ministerio de Medio Ambiente y Desarrollo Sostenible, the Corporación Nacional De Investigación Y Fomento Forestal* – CONIF (Colombia) and other nationally recognized sources. Factors such as carbon content and contributions to carbon balances by sinks such as leaf litter, soil, dead wood, among others, are used in accounting based on scientific evidence, published in international journals and which are part of some studies for the proposed species. his process conforms to what is indicated by TIER I and TIER II, which is also recommended by *Documento Nacional del Sistema de Monitoreo Reporte y Verificación MRV para Colombia* (MADS, 2017[26]), While the country does not have specific levels for TIER III.

The following ex ante estimates meet the conditions of **Relevance and Reliability**, since they are supported by official national sources of information, international references, recognized and technically supported bibliography, allowing us to infer that the estimates are not overestimated or oversized, since they adjust to national requirements. The ex-ante projection values will be adjusted with official information such as species-specific equations, carbon contents and emission factors, among others, when this information is available.

---

[24] Tier 1: para la cual el Panel intergubernamental de cambio climático, por sus siglas en ingles IPCC, provee una base de datos consolidada a partir de factores obtenidos y evaluados en investigaciones internacionales y que de forma global resultan representativos.
Tier 2: en el que en función de los avances de información local es posible emplear los factores de emisión propios derivados de investigaciones específicas validadas o que hayan sido calculados con información propia del país.
[25] http://documentacion.ideam.gov.co/openbiblio/bvirtual/023634/INGEI.pdf
[26] https://www.minambiente.gov.co/images/AsuntosMarinosCosterosyRecursosAcuatico/Documento_MRV_Nacional_Consolidado__Julio_2017_V_FINAL_2_0.pdf

3.7.1 Eligible areas within GHG project boundaries (AFOLU sector projects)

For the analysis of coverage within the project limits, the definition of forest was considered in terms of structural aspects, according to the national definition, which defines:

> *"Land occupied mainly by trees that may contain shrubs, palms, guaduas, herbs and lianas, in which tree cover predominates with a minimum canopy density of 30%, a minimum canopy height (in situ) of 5 m at the moment of its identification, and a minimum area of 1.0 ha".*

With this definition and according to the BCR standard document (v3.3), in section 10.1.1, which determines that the project areas cannot correspond to the forest category, for at least five (5) years Before the start of project activities, if the areas meet this condition, they are considered as eligible areas for the carbon project. Considering the above, those areas with Riverside Forest, Water and Cloud coverage were delimited for each of the evaluated forest core and these areas would not be considered eligible. On the other hand, areas with pastures and bare lands are considered eligible.

The eligibility analysis must be carried out through a multi-temporal analysis of remote sensing images that, through interpretation, allows the changes in land use coverage to be determined (according to the Corine Land Cover land use categories adapted for Colombia).

The land cover and use maps were prepared from the interpretation of satellite images, following the following steps:

1. Selection of satellite images
2. Preprocessing
3. Identification of coverage

i) Image Selection

The selection of images was made through free distribution image portals, considering that the date of image capture was prior to the establishment of the plantations. To facilitate the processes and guarantee the consistency of the classification of land use and land cover, unified analyses were developed for the areas of the four forest carbon project initiatives, technically advised by the entity Proyectos Forestales, in the municipality of La Primavera, in the department of Vichada. These initiatives include the areas of the Reforestadora EL Dorado S.A.S project.

ii) **Preprocessing**

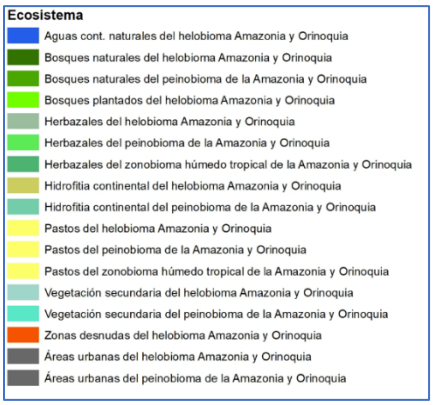
To evaluate the dynamics of land cover and land use in the study area, it is necessary to carry out a multi-temporal analysis for three (3) dates, during the historical reference period, which is counted from the start date. of the project (except for the date 2013). As mentioned, the dates selected for the change analysis were the years 2001, 2007 and 2013. The images selected for each date were georeferenced to obtain an adequate area quantification for each property. Preprocessing the images requires precise georeferencing of the images, to obtain positional consistency, to quantify the coverage areas identified as eligible areas.

For the *Landsat* image used in the production of the 2013 maps, it was necessary to carry out a process of homologation of the spatial resolutions between images, through the use of the panchromatic band, to obtain a spatial resolution compatible with the other images, like the *Aster* image and thus make a quantification of areas comparable between the analysis dates.

iii) Identification of Land Use and Land Cover.

From the non-forest forest layer, carried out for each of the lots and through visual identification, the coverage was established for each of the analyzed lots, using the national land cover and land use legend, Corine *Land Cover*[27]. The Corine Land Cover National Legend of Land Cover and Use, adapted for Colombia, is a hierarchical legend that allows describing, characterizing, classifying, and comparing the characteristics of land cover, interpreted from the use of satellite images of medium resolution. This legend has 6 levels of detail, whose level of detail variation will depend on the type of coverage identified. The level of detail with which the coverage was defined was level 3, which allowed discrimination between the agricultural pasture areas and the riverside forests present in each plot.

[27] La metodología CORINE (*Coordination of Information on the Environmental*) Land Cover adaptada para el país. Esta metodología tiene como propósito la realización del inventario homogéneo de la cubierta biofísica (cobertura) de la superficie de la tierra a partir de la interpretación visual de imágenes de satélite asistida por computador y la generación de una base de datos geográfica.



Land Use and Land Cover Map

As a result of the previous process, the land coverage and uses were identified, in the baseline, (see box of the Corine Land Cover methodology land use analysis) and as seen in the maps of Figure 11 and Figure 12, where the 100% of the eligible area prior to the establishment of the stand models corresponds to clean pastures or grasslands.

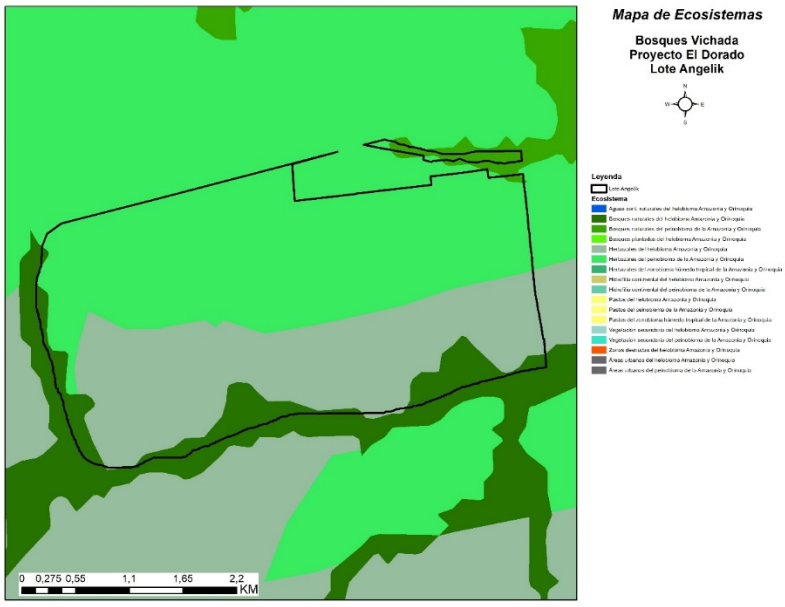


Figure 11. Land uses in the eligible areas corresponding to non-forest cover on the Angelik property

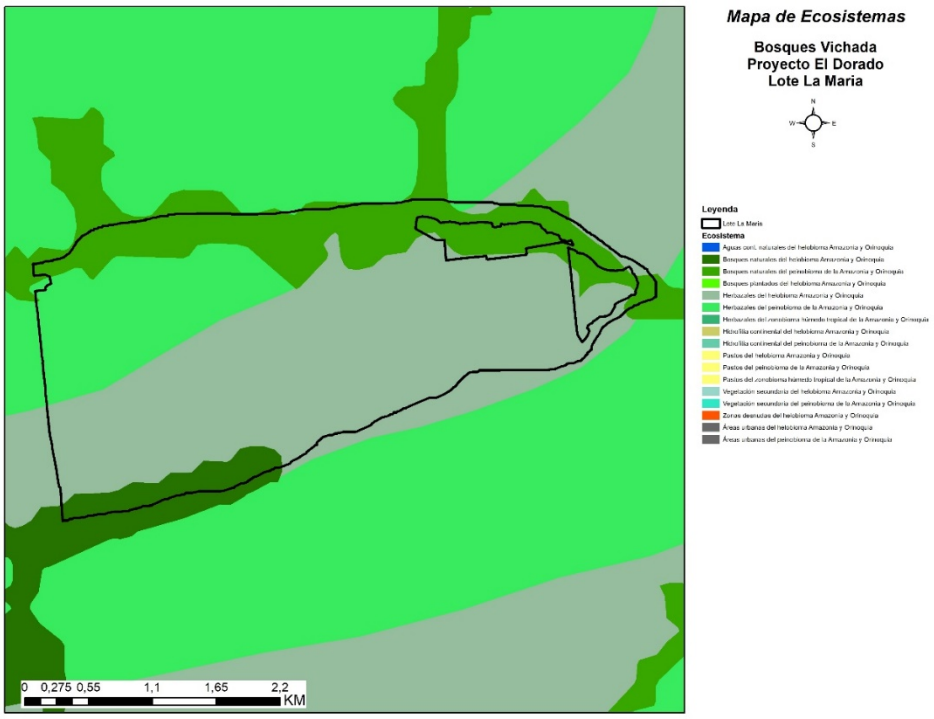


Figure 12. Land uses in the eligible areas corresponding to non-forest cover on the La María property

The images, processes and results of the analysis are found in Annex 2. (Ex ante spatial analysis)

Non-Forest Forest Areas

Non-forest forest maps are generated from the result of the classification of satellite images, selected for each date. The non-Forest category groups together the vegetal and anthropic covers that do not correspond to forests and bodies of water, so the classes of "No forest" and "water" were grouped separately, to generate the graphic outputs of each one of the properties to be analyzed. It is important to note that the non-forest coverage in the analyzed areas, historically corresponds to areas of unmanaged grasslands and that for years were subjected to annual burning processes for the regeneration of new pastures.

This dynamic has led to the degradation of soils and the loss of their physical and chemical properties (See Origen de la Sabana en los Llanos Orientales[28]).

Eligibility Analysis

Table 13, shows the results of the areas without forest (areas with unmanaged pasture coverage) for each of the years of analysis (period 2001-2013), which goes up to two years before the start of the project.

Table 12. Results for the eligibility analysis, based on methodological guidelines and limitations established by the corporation, for water source protection areas, for the analysis dates 2001, 2007 and 2013

Project		Property	Total Project Area (ha)					
			Property Area	Forest	Non-Forest	Protection Strips from Corporinoquia	Eligible area	Total (ha)
2001	Proyecto Forestal El Dorado	La Maria	945.20	97.98	792.83	240.9	680.39	1598.08
		Angelik	1243.67	91.57	1096.87	266.87	917.69	
2007		La Maria	945.20	95.31	795.5	240.9	680.39	1598.08
		Angelik	1243.67	99.66	1088.78	266.87	917.69	
2013		La Maria	945.20	101.44	789.38	240.9	680.39	1598.08
		Angelik	1243.67	94.92	1093.52	266.87	917.69	

In Figure 13, the Forest and Non- Forest areas can be seen for each evaluated year. These areas are considered eligible for the development of the forest carbon project.

[28] Agroecología y Biodiversidad de las sabanas en los Llanos Orientales de Colombia. http://www.bdigital.unal.edu.co/6627/1/AGROECOLOG%C3%8DA_Y_BIODIVERSIDAD_DE_LAS_SABANAS_EN_LOS_LLANOS_ORIENTALES_DE_COLOMBIA.pdf .

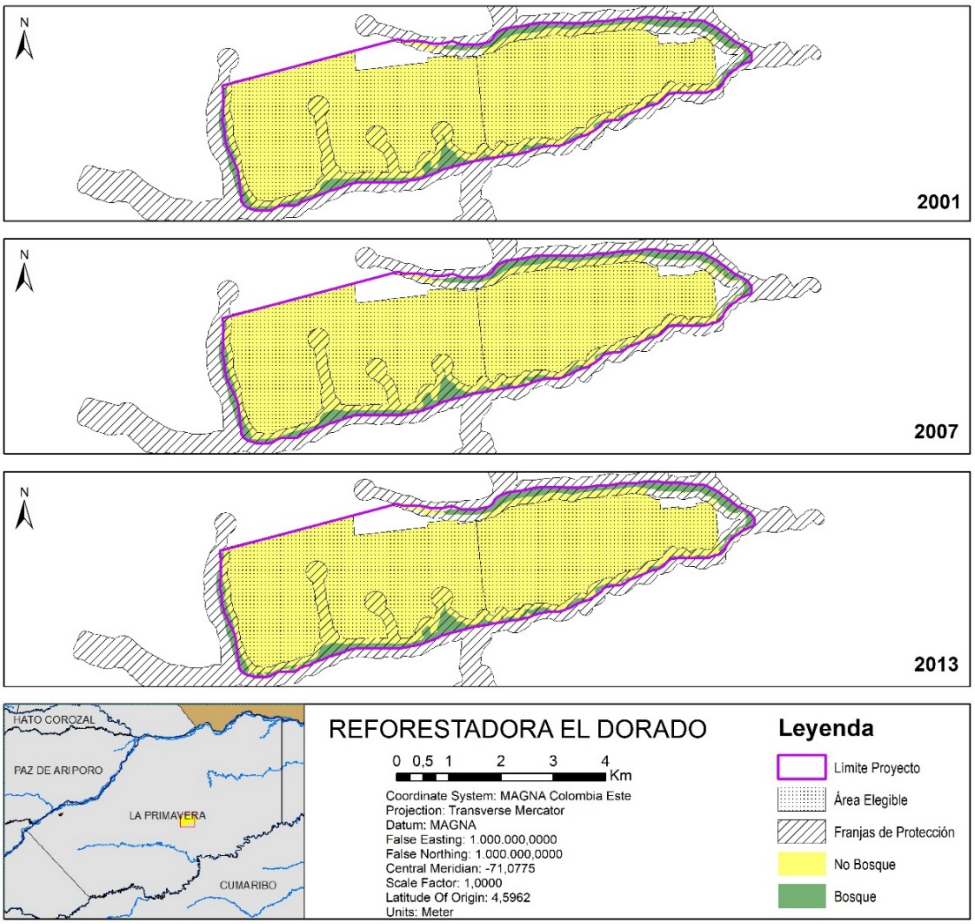


Figure 13. Non-forest areas (pastures) during the analysis period, meet eligibility in the project area. The dotted area delimits eligibility, without considering the withdrawal or protection areas, established by the environmental corporation Corporinoquia.

La Tabla 13, muestra los resultados de hectáreas elegibles para cada año y predio evaluado.

rom the final eligibility results, considering as eligible all areas without forest cover, which have been maintained for at least 10 years before the start of the project (as summarized in Table 13), the areas defined as protection strips are excluded. of riverbeds, streams, pipes and their sources, by the procedures established by the corporation CORPORINOQUIA

(Resolución 1130 del 2011[29]). Excluding areas restricted by the corporation, eligible areas by project are summarized in the following table:

Table 13. Eligible areas excluding retirement zones defined by the corporation

Project	Property	Area (ha)	Final Eligibility excluding areas according to resolution 1130. Area (ha)	Total
Reforestadora El Dorado.	**La María**	945.20	680.39	***1598.08***
	Angelik	1243.67	917.69	

3.7.2 Stratification (Projects in the AFOLU sector)

Stratification can be interpreted as a classification, in terms of the capacity for biomass or carbon accumulation by each type of land use. This classification will be determined by the types of plant species that make up the same use. However, it is important to consider stratifications based on the capacity to reduce net emissions. Faced with these considerations, the AR-AM0003 methodology defines the following (paragraph 5.2 of the methodology): For the baseline, it is sufficient to stratify the area according to the predominant vegetation type, canopy cover, or land use.

a) For the project proposal, a single stratum is considered in the baseline, corresponding to pastures used for extensive livestock farming.
b) For project activities, the following considerations are taken:
- Ex ante: planting plans, management and species.
- Ex post: considering the establishment activities and management plans implemented. This is reflected in the development of the stands.

3.7.3 GHG emissions reduction/removal in the baseline scenario

The removal balances for the baseline are defined by:

[29] Through which the regional criteria are defined for the development of forestry, agricultural and agro-industrial projects in the jurisdiction of Corporinoquia. http://www.avancejuridico.com/actualidad/documentosoficiales/2011/48139/r_corporinoquia_1130_2011.html

$$\Delta C_{BSL,t} = \Delta C_{TREE\_BSL,t} + \Delta C_{SHRUB\_BSL,t} + \Delta C_{DW\_BSL,t} + \Delta C_{LI\_BSL,t}$$

Equation (1) From The methodology.

Where:

$\Delta C_{BSL,t}$	=	Net greenhouse gas removals by reservoirs (GHG) in the line in year *t*; t CO_2-e
$\Delta C_{TREE\_BSL,t}$	=	Changes in the carbon contents of the forest biomass in the baseline, for the project area. Apply the methodological tool *"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*"; t CO_2-e
$\Delta C_{SHRUB\_BSL,t}$	=	Changes in the carbon content of the shrub biomass in the baseline, for the project area. Apply the methodological tool *"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*"; t CO_2-e
$\Delta C_{DW\_BSL,t}$	=	Changes in baseline carbon contents of aboveground dead wood in year t. Apply the tool, t. Apply the methodological tool, *"Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"*; t CO_2-e
$\Delta C_{LI\_BSL,t}$	=	Changes in baseline carbon contents of aboveground litter in year t. Apply the methodological tool, "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO2-e

The carbon stocks in the Baseline scenario correspond to those stored in the biomass of plant species, present in the areas identified as eligible. As established in previous chapters, the eligible areas correspond to those areas covered by unmanaged grasses or savannas that have historically been subjected to continuous burning; the presence of trees or shrubs is not evident, since the burning restricts their permanent presence.

According to Rao *et al* (2001), the productivity ranges of the native savanna grasses of the Orinoquía range on average between 3.60 and 5.22 tons of dry matter per hectare (t $MSha^{-1}$), considering the above-ground and belowground biomass. If 50% of the weight of this biomass is carbon (IPCC 2003), it is defined that these covers present 1.80 and 2.61 tons of carbon per hectare (t C ha^{-1}), respectively.

It is important to note that authors such as *Rippstein et al* (2001), have identified that the pasture and savannah land covers of the Altillanura Colombiana are very old, which allows us to assert that it is likely that the biomass of the native vegetation that has been subjected to historical cut and burn processes, remains at stable average values, generating a certain dynamic equilibrium. This suggests that even after intervention processes, the biomass of the existing vegetation recovers quickly to maintain balance, but this recovery does not compensate for all the supply of environmental resources that it provides to the ecosystem (limits due to soil fertility, degree of degradation and alteration of soil horizons and also the levels of chemical and physical indicators of the soil, among others). With this hypothesis and trying to model the behavior of recovery and accumulation of the carbon produced (t C ha^{-1}) n the biomass of the pastures, the biomass information (aerial

and radical) collected in the Carimagua region of Carimagua (Departamento del Meta) by Rao *et al.* (2001), or different alterations and variation in rest periods (weeks) after grass cutting and burning. To determine its growth and biomass accumulation, the Bertalanffy growth model was used ($C = A[1-exp(-bt)]\ 1/(1-m)$, Equation 1., belowthat describes the growth of the individual (living organism) as a function of life time. The cloud of carbon points and the model trend indicate that after felling, the carbon of the native vegetation stabilizes quickly around the fifth week, towards a constant value of 2.37 t C ha^{-1} (Figura 14). he results allow us to conclude that, indeed, after the intervention processes, the aerial biomass of the native vegetation recovers quickly and remains stable.

On the other hand, a study carried out in Carimagua (Departamento del Meta) in introduced and poorly managed pastures, concluded that this type of land coverage produces 2.9 t C $ha^{-1}año^{-1}$ after 17 years of establishment. These pastures incorporate greater amounts of carbon compared to savanna vegetation (Fisher *et al.* 1994). However, various authors affirm that the net growth in introduced pastures is limited to the first years of establishment. For example, in poorly managed pastures in El Cerrado (Brazil), initial net accumulation rates were high and were associated with considerable increases in carbon absorption. However, the respiration rates of soil microorganisms compensated for these gains over time (Davidson *et al.* 1995), but for the Orinoquia region of Colombia, the strong degradation and burning of soils reduces the macrobiotic activity of the soils reducing the effectiveness of the compensation.

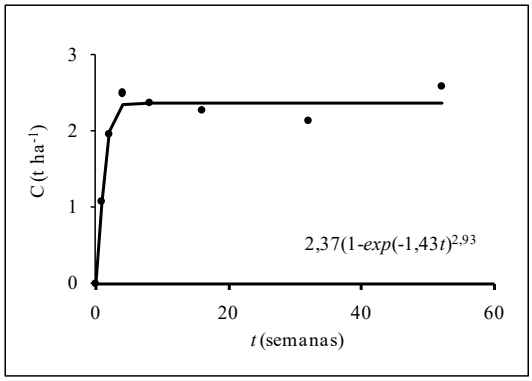


Figure 14. Carbon production in native savannas and unmanaged pastures in the Colombian Llanos Orientales region, estimation developed for one year of analysis. The beginning of the analysis corresponds to the rest period between two cuts and the burning of the non-forest land cover. The black dots are the carbon values corresponding to the biomass reported by Rao et al. (2001), after assuming 50% carbon in the biomass. The solid line corresponds to the estimates made using the von Bertalanffy model

Regarding the average residence period of the carbon contained in the biomass, in this type of savannas it is 10 years when it is not altered, and authors such as Trumbore (1995)

have estimated that the annual rates of carbon accumulation at 20 years, they decrease close to 10% of the observed net accumulation, during the first three years of growth. The evidence then suggests that carbon incorporation in savannahs reaches constant or even negative values, both for savannas and introduced pastures.

In this way, it is assumed that the carbon incorporated in the baseline for the Forestal project El Dorado S.A.S project initiative is between the extreme values of the mentioned contents, that is 1.8 y 2.9 $tCha^{-1}$ and is within the values of above ground and root biomass, incorporated in different pastures of the tropical region (1.8 y 5.0 t C ha^{-1}) reported by IPCC (2003).

Finally, considering the recommendations of the tool AR-Tool14 *"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*", in literal 5, paragraph 12, consideration f, it is recommended to assume the removals of the baseline as zero when:

> f) Land is subjected to periodic cycles (e.g. slash-and-burn or clearing-regrowing cycles) so that the biomass oscillates between a minimum and a maximum value in the baseline.

s detailed, burning in the grasslands of the Colombian plain is a cultural practice that has been developed for decades and includes the project areas. These burnings have been documented and have been the center of discussion for their prohibition or management[30], and regarding these activities, recommendations have been made to prevent their practice and spread. According to the above, changes in removals from the baseline are assumed to be **ZERO**.

3.7.4 GHG emissions reduction/removal in the project scenario

The balance of net removals is defined by the relationship between the changes in the net removals of the project activity and the emissions generated by its implementation.

---

[30] Tierra, fuego, agua... vida en el Bita. http://www.humboldt.org.co/images/pdf/notibita/notibita-06-web.pdf
https://elmorichal.com/tag/incendio-forestal-vichada/
https://es.mongabay.com/2019/07/incendios-norte-amazonia-deforestacion-colombia/
http://www.corporinoquia.gov.co/index.php/pages/2015-02-02-15-01-12/1069-foro-ambiental-busca-dar-a-conocer-que-impactos-tienen-las-quemas-para-el-medio-ambiente.html
https://www.contextoganadero.com/regiones/quemas-reducen-el-carbono-organico-del-suelo-en-la-orinoquia

According to ACM_0003, his allows emissions derived from the removal of herbaceous vegetation, burning of fossil fuels and application of fertilizers among other sources, not related to the elimination of tree or shrub components for soil preparation, can be considered **NOT** significant and therefore valued as **ZERO**. Thus AR-ACM0003, in the tool "*Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities",* defines the methodological steps for the respective calculation, which are applied in the following estimates of GHG reductions from the proposed project

Therefore, the calculation of net anthropogenic removals with the project proposal is defined by:

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t}$$

Equation (2), from the methodology

Where:

$\Delta C_{ACTUAL,t}$	=	Current net GHG removals by reservoirs in year *t*; t CO_2-e
$\Delta C_{P,t}$	=	Changes in carbon contents in the Project and that occur in the selected pools in year *t*; t CO_2-e
$GHG_{E,t}$	=	Increases in GHG emissions, different to CO_2, in the Project area as a result of implementation, in year *t*. It is estimated with the tool "*Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity*"; t CO_2-e

Changes in carbon content are defined by:

$$\Delta C_{P,t} = \Delta C_{TREE\_PROJ,t} + \Delta C_{SHRUB\_PROJ,t} + \Delta C_{DW\_PROJ,t} + \Delta C_{LI\_PROJ,t} + \Delta SOC_{AL,t}$$

Equation (3) From the methodology.

Where:

$\Delta C_{P,t}$	=	Changes in carbon contents in the Project that occur in the selected pools, in year *t*; t CO_2-e
$\Delta C_{TREE\_PROJ,t}$	=	Changes in carbon content in the biomass of trees in the Project in year *t* are estimated with 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

$\Delta C_{SHRUB\_PROJ,t}$ = Changes in carbon content in the biomass of shrubs in the Project in year *t* are estimated with 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

$\Delta C_{DW\_PROJ,t}$ = Changes in carbon contents in dead wood above ground in year *t* are estimated with the tool, *"Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"*; t CO_2-e

$\Delta C_{LI\_PROJ,t}$ = Changes in carbon contents in above-ground litter in year *t* are estimated with the tool, "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e

$\Delta SOC_{AL,t}$ = Changes in soil organic carbon content in year *t*, in areas of land that meet the conditions of applicability of the tool *"Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*"; t CO_2-e

3.8 Balance of net anthropogenic emissions derived from the implementation of the project

This balance is determined by:

$$\Delta C_{AR-CDM,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t$$

Equation (4)Equation 5 from the methodology

Where:

$\Delta C_{AR-CDM,t}$ = Anthropogenic net GHG removals by the selected pools, in year *t*; t CO_2-e

$\Delta C_{ACTUAL,t}$ = Current net GHG removals by pools, in year *t*; t CO_2-e

$\Delta C_{BSL,t}$ = Baseline removals, in year *t*; t CO_2-e

LK_t = GHG emissions from leaks, in year *t*; t CO_2-e

3.8.1 Estimation of current net GHG removals

Application of methodological tools.

- *AR-TOOL14 Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities.*

- *A/R Methodological tool, "tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities"*
- *Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project Activities.*

3.8.2 Above-ground Biomass

Is defined by:

$$\Delta C_{Above_{ground},proj,t} = \Delta C_{TREE\_PROJ,t} + \Delta C_{SHRUB\_PROJ,t}$$

Where

$\Delta C_{Above_{ground},proj,t}$	=	Changes in aboveground biomass carbon in year *t*. t CO_2-e
$\Delta C_{TREE\_PROJ,t}$	=	Changes in the carbon of the biomass of the tree component in the year *t*. t CO_2-e.
$\Delta C_{SHRUB\_PROJ,t}$	=	Changes in the carbon of the biomass of the shrub component in year *t*. t CO_2-e.

3.8.3 Estimate for trees

To define the carbon accumulation of a forest species, it is assumed as good practice (IPCC, 2003) develop projections based on its average annual increase (IMA), or based on growth curves by forest species and stand model in volume ($m^3ha^{-1}año^{-1}$), which is converted, through expansion factors, to carbon. The adjustment of asymptotic growth models is generally obtained through information taken in permanent plots, located in stands where the studied species grows, ensuring that they cover a wide range of ages and quality of the site (Zeide *et al.* 1993). For the Forestal Reforestadora El Dorado project, estimates were developed with information sources for IMA ($m^3ha^{-1}año^{-1}$) and wood density of woood (Tabla 15) from: Roncancio et al (1998),

Table 14. Average annual increases (IMA) in volume (V) and Carbon (C), were reported and calculated for the proposed species and assisted natural regeneration using expansion factors. P: wood density

Species	***P***	**IMA**		**Total yield (Biomass)**	**Source consulted**
	Average	***V***	***C (total above + below ground)***	***Biomass***	

	(g/cm³)	(m³ ha⁻¹ año⁻¹)	(t C ha⁻¹ año⁻¹)	(t ha⁻¹ año⁻¹)	
Pinus caribaea	585	13.0	14.1		Trujillo, 2007 y - 2011 CONIF, 1998.
Eucalytus pellita	640	19.5	17.3		Nieto et al, 2010
Regeneración natural	613		3.065	231*	Lewis, S.L. et al. 2009.

Information from studies carried out in Colombia was prioritized, specifically for the Llanos Orientales region. In other cases, volume expansion factors, biomass, or other dendrometric variables were used, which were obtained directly from technical literature or calculated from the equations generated for the calculation of carbon, in species or forest stand models. taking into account growth as a starting point.

Using dendrometric information (e.g. diameter, height, wood density and volume) found for each species (Tabla 16), the carbon content stored by them at different ages was estimated. The von Bertalanffy model was parameterized using Equation 1 (*von* Bertalanffy 1976, Zeide 1993, Lei & Zhang 2004) using the mathematical approximation method.

Equation 1. $C = A[1 - exp(-bt)]\ 1/(1 - m)$

Where:

C is the Carbon (t ha^{-1}),

T, is the time (years)

A, b *y* ***m*** are parameters of the equation.

The term *exp* corresponds to the exponential operator and A is the asymptote or maximum quantity that the organism can reach over time, which controls the maximum growth rate of the species.

This model suggests that the organism's anabolism rates are proportional to its mass to the power of 2/3, while catabolism is only proportional to mass. Therefore, the parameter *m* in the Bertalanffy model is 2/3 (Zeide 1993). In cases where said model was used, this

constant is assumed, since it has been observed empirically that this value allows estimating conservative asymptotic values, facilitating the iteration process of the other parameters and makes the term 1/1-*m*, becomes a constant term *c* = 3.

The mathematical approach consists of using a system of equations based on asymptotic values and average annual increases in carbon, to obtain a *von Bertalanffy-type* model (Equation 1). For this case, the asymptotes were available corresponding to the maximum amount of stored carbon that was found in the literature, for the selected species and the average annual increases (IMAs) in carbon and the initial carbon content, calculated as 1/3 of the asymptote.

The adjusted functions estimate the carbon accumulation trends in the potential scenarios and consequently, the aforementioned models constitute the additionality functions of the project.

The results for the productive stand model, for the species P. caribaea and for the passive restoration model are presented in Table 16.

Table 15. Regression parameters of the volume functions (m3ha-1) for commercial stand models with the species P. caribaea, the letters A and b are the regression parameters, c = 1/1-m, where m = 2/ 3.

Species	**Model**			**Database Source**
	A	**b**	**c**	
Pinus caribaea	234.0	0.1256	3.00	Roncancio et al, 1998
Eucalytus pellita	351	0.1256	3.00	Nieto et al, 2010.
**Regeneración Natural*	231	0.098	3.00	Phillips et al. IDEAM 2014, IPCC 2003

In Figure 15 and Figure 16, the volume accumulation curves over the time are observed ($m^3\ ha^{-1}\ año^{-1}$). These do not include changes due to thinning or mortality; this analysis is done in the final projection of the change in $tC\ año^{-1}$.

According to the annual establishment plans by species and their respective area, the estimate of carbon accumulation for the aerial and underground component is developed as follows:

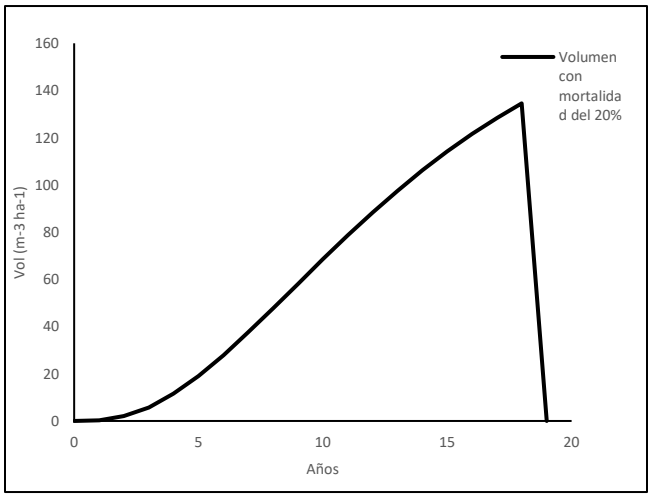


Figure 15. Modeling the volume growth (m3 ha-1 year-1) of the species P. caribaea var. hondurensis, using the von Bertalanfy growth model.

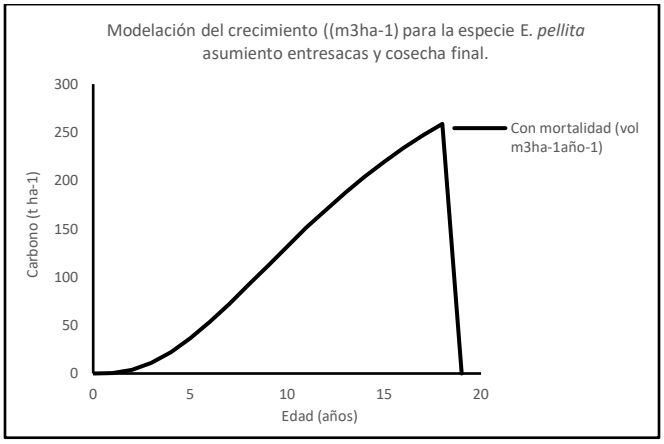


Figure 16. Modeling the volume growth (m3 ha-1 year-1) of the species E. pellita using the von Bertalanfy growth model.

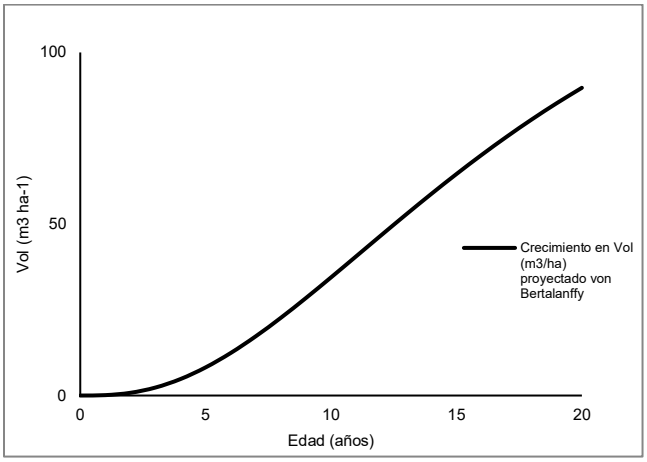


*Figure 17. Additionality functions (m3 ha-1 year-1) for the **natural regeneration** model considered in the project; The model was obtained after fitting von Bertalanffy equations*

In order to develop models based on silvicultural interventions, such as volume reduction and therefore carbon, as a consequence of thinning, models were developed with 25% interventions (reduction in 25% tree coverage). remaining totals) for each commercial stand model, in years 10 and 14 with a final harvest in year 18, this modeling assumes a mortality of 20%. For the natural regeneration model, no discount is applied for mortality and thinning, assuming a natural passive regeneration process.

The results of the behavior of the projections, for the commercial stand model with *P. caribaea* and *E. pellita* for a first rotation, can be seen in the figures: Figure 18 and Figure 19.

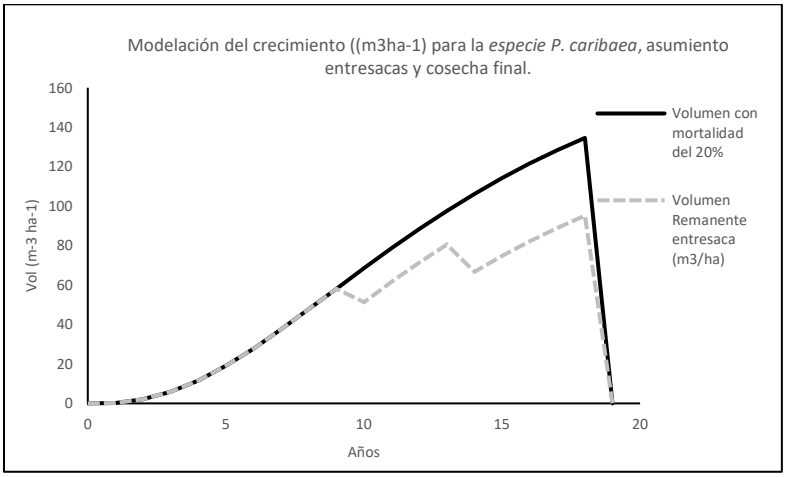


Figure 18. Volume behavior with thinning interventions in commercial forest stand models of P. caribaea. The solid line is the modeled projection and the dotted line refers to the change with thinning and final harvest.

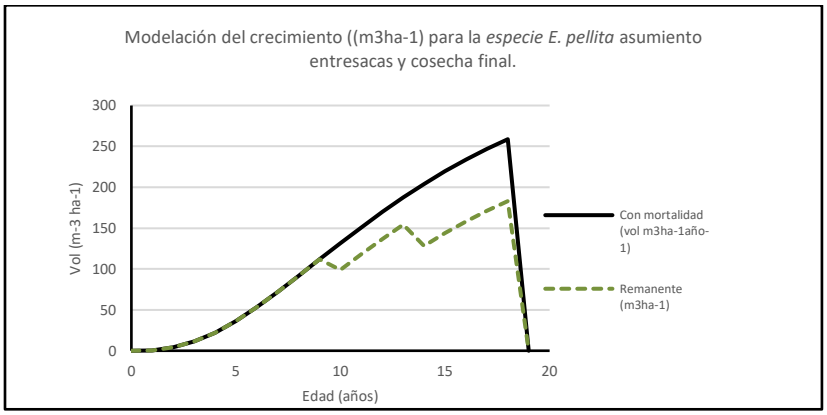


Figure 19. Volume behavior with thinning interventions in commercial forest stand models of E. pellita. The solid line is the modeled projection and the dotted line refers to the change with thinning and final harvest.

Year	GHG emission reductions/removals in the baseline scenario (tCO_2e)	GHG emission reductions/removals in the project scenario (tCO_{2e})	GHG emissions attributable to leakages (tCO_{2e})	Estimated Net GHG Reduction/Removals (tCO_{2e})
Year 0	0	-9	0	-9
Year 1	0	18.390	0	18.390
Year 2	0	44.465	0	44.465
Year 3	0	65.828	0	65.828
Year 4	0	92.979	0	92.979
Years 5	0	130.246	0	130.246
Years 6	0	176.177	0	176.177
Year 7	0	228.770	0	228.770
Year 8	0	285.946	0	285.946
Year 9	0	345.789	0	345.789
Year 10	0	405.091	0	405.091
Year 11	0	463.783	0	463.783
Year 12	0	522.318	0	522.318
Year 13	0	577.707	0	577.707
Year 14	0	630.454	0	630.454
Year 15	0	681.517	0	681.517
Year 16	0	729.246	0	729.246
Year 17	0	774.375	0	774.375
Year 18	0	816.292	0	816.292

Year 19	0	844.291	0	844.291
Year 20	0	858.064	0	858.064
Year 21	0	868.033	0	868.033
Year 22	0	883.068	0	883.068
Year 23	0	906.992	0	906.992
Year 24	0	940.155	0	940.155
Year 25	0	981.156	0	981.156
Year 26	0	1.028.091	0	1.028.091
Year 27	0	1.078.996	0	1.078.996
Year 28	0	1.132.075	0	1.132.075
Year 29	0	1.184.232	0	1.184.232
Year 30	0	1.235.502	0	1.235.502
Total	***0***	***1.235.502***	***0***	***1.235.502***

4 Compliance with Laws, Statutes and Other Regulatory Frameworks

Norm or Law	Characteristics	Compliance
Decree 1449 of 1977. Article 3.	Relates actions aimed at protecting water resources. Therefore, it defines measures for the withdrawal and protection areas. Establishing minimum margins of protection which are ratified by corporations in subsequent decrees.	The project defines the retirement areas in accordance with the regional standards of the Corporinoquia corporation. Likewise, for the Forest carbon component of the eligibility analyses, the areas that are within the protection and withdrawal strip were considered NOT eligible, even if these areas did not historically present forest cover.
Decree 1791-1996	The person who needs to take advantage of the natural resources of the Forests to satisfy basic needs, to market their products, to carry out scientific research or for the construction of works, must request the respective permit from the Corporation, by the required requirements.	Chapter CIF, see_Annexes) has served for the Corporations to register the plantation. Resolution 0687 of 1997 adopts this decree, which determines the actions by which the forest resource administration regime of the regional autonomous corporation of Orinoquia-Corporinoquia is issued.

RESOLUTION Nº 0687 OF DECEMBER 22, 1997	By which the forest resource administration regime of the regional autonomous corporation of Orinoquia - Corporinoquia is issued.	The project complies with Chapter VIII related to the conditions of commercial forest plantations and has had the required documents (e.g. establishment and management plan), for the start of activities adjusted to regional standards.
DECREE NUMBER 4296 OF 2004	Regulations for controlled open burning in rural areas.	The project complies with national and regional regulations and does not include in its management practices the burning of waste in soil preparation activities, or the burning of waste derived from maintenance.
Resolution 200.41-11-1130 of June 22, 2011. Update of 0687 of December 22, 1997. And Resolution 50041131571 of November 6, 2013.	By which the forest resource administration regime of the regional autonomous corporation of Orinoquia - Corporinoquia is issued. Corporinoquia, to guide regional productive development, adopts a tool that requires environmental management and technical procedures to develop sustainably the activities that are immersed within agricultural, forestry, and agro-industrial productive projects.	The El Dorado project has implemented the recommendations of the resolution and its updates, protecting water sources and remaining forests. The project has a registration file (File 800.38.17.0096) and monitoring in the Corporation where the monitoring of compliance is detailed. The environmental management policies are adopted and presented to the corporation periodically and their monitoring and follow-ups are recorded and included in the project file folder that resides in the Corporation (see annex 8_environmental commitments).
Decree 3930 of 2010.	Employing which Title I of Law 9 of 1979 is partially regulated, as well as Chapter 11 of Title VI-Part 11I- Book 11 of Decree-Law 2811 of 1974 regarding the uses of water and liquid waste and other provisions are dictated.	The project has the respective requests and approvals for the management of water resources and the potential polluting discharges that are generated. Complies with the due withdrawals for the protection of water sources established in article 40 of said decree (see previous paragraphs). The documents related to said decree rest in file Number **800.38.17.0096** of the Corporation related to the forestry project. Environmental management plans have been implemented. **See annex 9_Environmental_Commitments**

Law 1377 of 2010. Article 7	The purpose of this law is to define and regulate forest plantations and agroforestry systems for commercial purposes.	The project conforms to the definition of Forestry Activity for commercial purposes, specifically complies with Article 4 on the registration of plantations larger than 10 hectares with the Ministry of Agriculture and Rural Development or whoever takes its place, in this case, the ICA and has due registration of all plots planted in the project (See Annex 9_Legal_Documents) and article 7, related to the NO establishment of commercial forestry activities protective forest areas, special management areas or any other category of management, conservation or protection that excludes said activity, as well as strategic ecosystems, such as moors, mangroves, wetlands. As a principle of eligibility, no area will be established where at least 10 previously presented forest cover, likewise for registration it is evident that the areas to be intervened are not within any figure of conservation or ecosystem protection.
LAW 139 OF 1994.	By which the Forest Incentive Certificate is created, and other provisions are dictated.	The project complies with the conditions established by said law, meets the requirements and presents the documentation to access the CIF, having positive approval.
Document National Council of Economic and Social Policy (Conpes) 3827 of 2015.	Distribution of resources for the forestry incentive certificate for commercial purposes (CIF for reforestation) - validity 2015.	The project proposal, in compliance with Conpes 3827, demonstrates the suitability of the territory for the distribution of resources Validity 2012, for projects that begin this year, with prior approval of the compliance suitability. Furthermore, the selected species are within those required in Section III, related to suitable forest species Forest species that have technical supports that demonstrate export potential, among others such as: Acacia (Acacia mangium), Melina (Gmelina arbórea),***pine***(patula,***caribbean***, *tecunumanii, oocarpa, maximinoii*),***Eucalyptus***(great,***pellita***, *tereticornis*) and Teak (Tectona grandis), Rubber (Hevea brasiliensis) and Guadua (Guadua angustifolia).
Decree 2448 of 2012.	Partial moditification of decree 1824 of 1994. Definition of: forest species, native forest species, introduced forest species, protective-producing forest plantation, forest establishment and	The project is accepted at the time of approval and granting of the disbursements established by said decree, being consistent with Document Conpes 3724 which allocated the resources under the procedures described and defined before decree 2448 of 2012.

	management plan, eligibility, granting, payment, new plantation and forestry project.	
Resolution 1447 of 2018. RENARE	By which the monitoring, reporting and verification system of mitigation actions at the national level referred to in article 175 of Law 1753 of 2015 is regulated, and other provisions are dictated.	This resolution establishes the registration times for initiatives before RENARE. In compliance, the project initiative submitted formal registration to the Ministry of Environment and Sustainable Development in 2019. See letter delivered for registration (Annex 9. C.3. RENARE). Currently, after the platform is fully functional, the project is registered in the Feasibility Phase (see RENARE platform[31]) For the year 2021, the project achieved registration in RENARE with ID: 1721

5 Carbon ownership and rights

5.1 Project holder

Individual or organization	**Reforestadora El Dorado**
Contact person	Jorge Díaz Murcia
Job position	Representante Legal
Address	Carrera 16A # 80 – 63 Office 702 Bogotá D.C., Colombia
Phone number	(+57) (1)6212161
Email	reforestadora@Concretosdorado.com

[31] http://renare.siac.gov.co/GPY-web/#/gpy/datbasreg/13/1721

5.2 Other project participants

NA.

5.3 Agreements related to carbon rights

The carbon rights belong to the El Dorado reforestation company, there are no other parties involved in the project. Therefore, the benefits derived from the reduction of emissions from reforestation activities belong to Reforestadora El Dorado.

5.4 Land tenure (Projects in the AFOLU sector)

The Angelik and La María properties are registered under public instruments of the municipality of Puerto Carreño (Vichada) with the *matriculas inmobiliarias* registration numbers.

Table 16. List of matriculas inmobiliarias detailing the ownership of the Reforestadora El Dorado properties.

Property	***Matricula inmobiliaria*[32]**
Angelik	540-4687
Andalucía	540-4686

As established by the documents that demonstrate ownership, governance and the area under control, it is in the name of Reforestadora El Dorado S.A.S. The legal ownership documents are confidential in nature and are presented in Annex 9.

The evidence that demonstrates the ownership of the areas where the project is developed is found in annex 9_Documentos_Legales. The proposal to develop commercial forestry activities on the project properties and include the benefits from the sale of the

[32] Matricula Inmobiliaria: According law 1579 of 2012, It is a folio intended for the registration of the acts, contracts and rulings related to article 4, referring to real estate, which will be distinguished with an alphanumeric code or complex numeral indicative of the internal order of each office and the succession. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=49731#:~:text=Matr%C3%ADcula%20inmobiliaria.,en%20que%20se%20vaya%20sentando.

environmental service of carbon capture by the new forests, is found in the El Dorado_Artemisa folder, within Annex 10_Manejo_Forestal.

6 Climate change adaptation

N.A

7 Risk management

7.1.1 Risk Management

By the BCR standard tool to evaluate risks and non-permanence[33], the project proponent must identify the project risks, classified into environmental, financial, and social risks.

Natural Hazards

Among the natural risks identified for the project are risks from forest fires and risks from pests and diseases that may occur to the species selected for reforestation.

Annual fires induced by man, as a preparatory activity for pastures, are an activity that has been developed traditionally in the region, despite its prohibition by Colombian legislation, such as law 1930 of 2018 in article 5, where it is mentioned that burning is prohibited in moorland areas and resolution 532 of 2005, which establishes requirements, terms, conditions and obligations to carry out controlled open burning in rural areas in agricultural and mining activities. Through the use of techniques, protocols, permits, meteorological records, restriction areas, and protection strips, different from how grassland burning is carried out in the region (https://www.minambiente.gov.co/images/normativa/circulares/2009/circ_2000-2-155654_211209.pdf).

Induced fires, in many cases uncontrolled, are one of the greatest threats to agricultural activities in the region. In Colombia, 95% of forest fires are caused by humans[34]. he estimated risks of loss, despite not having supporting documentation for the project

[33] BCR Risk and Non Permanence Tool. Version 1.1: https://biocarbonstandard.com/wp-content/uploads/BCR_risk-and-permanence.pdf

[34] https://www.minambiente.gov.co/wp-content/uploads/2022/03/Como-orientar-la-gestion-del-riesgo-de-desastres-por-incendios-forestales-a-nivel-municipal.pdf

region, and even less for this type of activity (because it is recent in the region, less than 20 years) are not supported,

Social Risk

Regarding social risks, the risk due to forest governance and the lack of personnel has been identified, due to the low population density in the municipality and the low technical capacity.

Concerning this aspect, it is demonstrated that the current proposal is part of the initiative of a forestry nucleus in the Municipality of La Primavera, where the staff has experience in managing plantations in the region, with ***P. caribaea*** and with ***E. pellita*** in the commercial stand model. There is sufficient information and technological packages for its establishment and management. On the other hand, The La Primavera Organization and the entity Proyectos Forestales La Primavera, provide technical advice on the projects that are part of the core (see project structure), and have more than 15 years of experience in forestry activities in the region, including the development of the CDM project for Forest Restoration of Biological and Productive Corridors in the Eastern Plains, since 2005.

Financial Risk

Among the financial risks identified for the project are the reach of the financial break-even point and the financing of the project during the accreditation period.

To ensure the financing of the project, there is financial support from the government, through the Forest Incentive Certificate (CIF) that grants 50% of the costs for the establishment and management of the stands, during the first five years, reducing the risks. associated with this aspect.

A summary with the numerical assessment of the results of the risk tool is detailed in Table 12. More specific data and the development of the tool with its respective risk report is found in Annex 14 (Analisis de Riesgo).

Table 17. Results of the risk analysis associated with the analysis of the non-permanence of the project. Taken from the risk analysis template

Total Risk	Risk level rating	
Natural Risk	9	Low
Financial Risks	7	Low
Organizational Risks	12	Middle
Social Risks	11	Middle
Prom.	9,9	Low

As Table 17, shows, permanence risks are lower for the project proposal.

This analysis allows, in addition to evaluating permanence, to estimate the degree of risk that the project may have in the different implementation phases. Associated with this risk, a Buffer or reserves of reduced emissions units are established, which allow contingencies to be covered, in the face of reversals of the carbon accumulated in the project. The Buffer values, both for the ex-ante projections and for this monitoring, are shown in later sections

7.2 Reversal Risk

The risk of reversals is determined as low, even more so when the Project is in its 8th year of implementation and is developing its monitoring report together.

7.2.1 Loss Event Report

NA.

8 Sustainable development safeguards (SDSs).

The Safeguards for Sustainable Development tool of the standard is implemented. Below are those that can have a potential impact on these guards. The complete tool is evidenced in the annex 14.

Land use: Resource Efficiency and Pollution Prevention and Management

Could the project/initiative activities potentially entail or result in:	**Response**	**Mitigation or preventive action**
Air and water pollution resulting from project-related emissions, discharges, or improper waste disposal practices?	[ ] Yes [X] Potentially [ ] No	The mitigation actions were defined by the provisions of the Environmental Corporation. Therefore, the project has developed an environmental management plan, which describes the proper management of the waste derived from the activity, and any news is reported monthly to the Environmental Corporation.

Inadequate recycling and reuse of project-related resources, leading to unnecessary waste and environmental impact?	☐ Yes ☒ Potentially ☐ No	The mitigation actions were defined by the provisions of the Environmental Corporation. Therefore, the project has developed an environmental management plan, which describes the proper management of the waste derived from the activity. The project complies with national and regional regulations and does not include in its management practices the burning of waste in soil preparation activities, or the burning of waste derived from maintenance. Any news is reported monthly to the Environmental Corporation.

Water

No risks to these safeguards are identified.

Biodiversity and ecosystems.

No risks to these safeguards are identified.

Climate Change

No risks to these safeguards are identified.

Labor and Working Conditions

Lack of training	☐ Yes ☒ Potentially ☐ No	The Project must carry out the necessary and appropriate training, to train the personnel hired to manage the project activities.

Gender equality and Women empowerment

No risks to these safeguards are identified.

Land Acquisition, Restrictions on Land Use, Displacement, and Involuntary Resettlement

imposing restrictions on traditional land use practices, affecting the livelihoods and culturalpractices of communities in the project area.	☐ Yes ☒ Potentially ☐ No	Traditionally, land use corresponds to pastures for extensive cattle ranching and forestry activity is a change in agricultural practices in the region. However, the development of forestry activities brings benefits to the community, in terms of formal employment, hiring by legal provisions, and the technification of the workforce for forestry activities. To mitigate this risk, the project hires personnel by legal provisions and trains the hired personnel in different aspects related to the project activities.

Indigenous Peoples and Cultural Heritage.

There is no evidence of impact on this safeguard, especially because the Project is not located in an area of indigenous influence as presented in annex 14.

There is no evidence of impact on this safeguard, especially because the Project is not located in an area of Indigenous influence as presented in the

9 Stakeholder engagement and consultation

The project was socialized with the regional autonomous corporation (Corporinoquía), to obtain the necessary permits for the development of the project. There was also communication with local entities, such as the mayor's office, among others. At the national level, there was communication with the Ministerio de Agricultura and FINAGRO as executor of resources and to obtain the forestry incentive certificate CIF.

9.1 Summary of comments received

N.A.

9.2 Consideration of comments received

N.A

10 Sustainable Development Goals (SDGs)

With 7 years to go until Colombia's 2030 agenda is met, to achieve the Sustainable Development Goals, it can be highlighted that the implementation of the project, for the monitored reporting period, has managed to contribute especially to the reduction of degraded areas, increase in forests based on commercial stand models, protection of natural forests and watersheds and the reduction of human-induced burning that affect the ecosystems.

Table 18. Indicators related to the contribution to the Sustainable Development Goals

Goal	Contribution
	As a product of the thinning carried out in commercial stands and the selection of defective trees, a part of this material has been used to make fence posts, corrals and other wooden elements, necessary for maintaining the infrastructure of the farms. With this action, the consumption of wood from forest species from natural forests has been reduced. This raw material reduces the need to use posts made of plastic or cement, in addition to being biodegradable or the residual wood is used as firewood for homes. It has contributed to the protection of about 177.5 hectares of native forest (see eligibility chapter), this type of forest is characterized by being riverine and other hectares of forest have been allocated for the protection of the water ring and passive natural regeneration. The project area is 2,082.35 hectares, of which 177.54 hectares are natural forests and 300.8 hectares are intended for the protection of waterways, leaving 1,603.9 hectares as eligible areas. Of these eligible areas, the establishment in commercial stand models is only implemented in 1,353 hectares. The remaining 245 hectares are destined for natural recovery and firebreaks.
	1,353.23 hectares of new forests have been established, in areas previously dedicated to extensive livestock farming, on degraded soils. The removals achieved by the project, during this monitoring period, will be added to the national accounting through the RENARE platform, in which the project is registered, as provided by resolution 1448.

	The fires to which the Project areas have been subjected are eliminated and protocols are established for the acquisition of fire control equipment, allowing the conservation of the flora and fauna species of the region, previously threatened by the fires. burning for grassland renewal (1,353.2 ha of new forests) The gallery forest areas identified in the baseline are conserved and increased through the delimitation of the water ring zones, established by the corporation (300.8 ha). Additionally, some areas are maintained for natural forest regeneration. Although areas have been left for passive natural regeneration, these areas are not counted as new forest areas for the monitoring period, since the succession process is still in an early stage.
Other transversals	**Jobs**. 559 monthly jobs have been generated and monitored during the monitoring period. All jobs have social benefits, legal guarantees, training and job security. Women have been involved in nursery activities, accompaniment in the maintenance of camps and cocking food for workers. **Trainings.** The following topics have been addressed in the training: - Hazards in the workplace - - Safety and coexistence rules - - Safe handling of chemicals - - Differences between poisonous and non-venomous snakes. - - Standard Operating Procedure in case of ophidic accident. - - Good practices to ensure the good use of the water resource. - - Wildlife sighting. - - Environmental management plan sheets. - - Waste management - - Forest Fire Prevention The economic income of the staff has improved, guaranteeing more frequent and permanent jobs and income, unlike what is generated in extensive livestock activities. An improvement in income helps to boost the local economy in the municipal seat, which previously depended exclusively on the income generated by livestock activity.

In addition to the contributions to the SDGs, the BCR standard SDG compliance tool was applied, resulting in compliance with SDG indicators 12, 14 and 15.

See details in the application of the tool and its analysis (Anexo 13_ODS_Dorado).

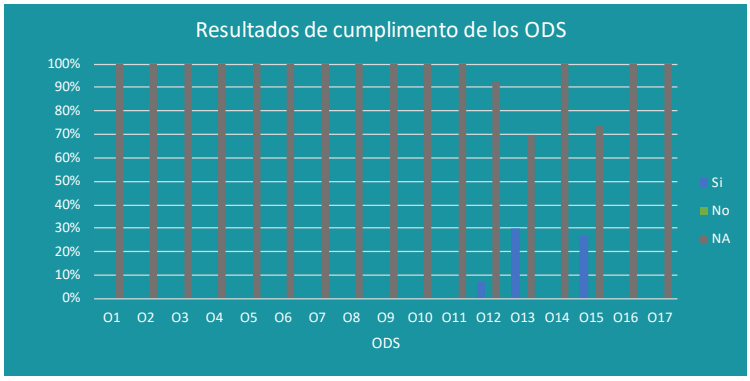
BioCarbon Registry

Desempeño del cumplimento de los ODS aplicables

Tabla de Resultados			
ODS	Si	No	NA
O1	0%	0%	####
O2	0%	0%	####
O3	0%	0%	####
O4	0%	0%	####
O5	0%	0%	####
O6	0%	0%	####
O7	0%	0%	####
O8	0%	0%	####
O9	0%	0%	####
O10	0%	0%	####
O11	0%	0%	####
O12	7%	0%	93%
O13	30%	0%	70%
O14	0%	0%	####
O15	27%	0%	73%
O16	0%	0%	####
O17	0%	0%	####

Nombre del Proyecto: Reforestadora El Dorado

ID del Proyecto: 0



11 REDD+ Safeguards (For REDD+ projects)

N.A

12 Special categories, related to co-benefits (optional)

N.A

13 Grouped projects (if applicable)

N.A

14 Other GHG program

The project is not assigned to other GHG projects.

15 Double counting avoidance.

For double counting, the project will be implemented under the following conditions:

1- It will be supported under resolution 1447 of 2018, registering on the RENARE platform and updating its status periodically to notify reduced and verified emissions.
2- It will be registered on a single platform for the recognition of emissions reduced by the implementation of the project.
3- The due verification audit processes will be developed, and evidence will be left that it does not belong to another transactional record.
4- To account for reduced emissions between periods, the verified emissions from previous periods will be discounted consistently.
5- Each one of the transactions and sales of reduced carbon units will comply with a single serial number and will be canceled only once.
6- A follow-up record will be implemented on each transaction and cancellation of the traded units and this information will be kept in the accounting files of the operator and the project proponent.
7- The recommendations established by the BCR standard will be followed to avoid double counting during the execution of the project.

16 Monitoring plan

16.1 Data and Parameters to Quantify Emissions Reduction

To implement the forest carbon project Reforestadora El Dorado, the methodology implemented establishes a series of procedures that guarantee an accounting of the greenhouse gases that would be mitigated, in this case, CO_2 captured and fixed in the forest covers that are growing. Therefore, after the project is approved and established, the implementation of monitoring is evaluated as follows:

16.1.1 Project boundary monitoring

It includes monitoring the areas that are part of the project. Those planted areas and the areas that are planned to be planted and that are under the control of the project must be included. Considering the above, many areas may not be planted due to soil conditions and flooding, among other causes. It seeks to include passive natural regeneration within the accounting. Another aspect to evaluate is the control over those areas where anomalies occur that affect the accumulation and conservation of captured CO_2, that is, areas affected by fires or pests, among others. Finally, it must be considered that the control

areas are those that have been planted. The planted areas DO NOT consider areas without forest that are intended for firebreak corridors or roads, therefore, they are not considered in the accounting, although they are part of the project. Nor are those areas that are planted and that are outside the eligibility analysis developed in the ex-ante phase considered in the accounting.

16.1.2 Monitoring of the forest establishment

In monitoring the establishment of stands, the aim is to guarantee the quality of the stands that are planted, considering that they comply with the procedures described in the proposed project. This monitoring must be carried out, at least during the first three years of the establishment of each lot and later, with longer monitoring periods, especially when pruning, thinning and final harvesting activities are carried out for each lot.

The components to consider are:

Species planted: in many cases, although the species have the appropriate technological packages, the development for the project region is not as expected, leading to high mortality rates and poor stand development, affecting CO_2 capture projections. In these cases, the change of species is necessary to provide continuity to the commercial forestry project.

Monitoring mortality and replanting: in the first year of establishment, it is important to maintain homogeneity of the stands, at optimal densities per hectare. This monitoring allows replanting in a timely manner, since, if late replanting is done within the same plot, in most cases, there is asynchrony in the development of the trees and different management plans would be required, in those spaces with late replanting.

16.1.3 Monitoring of Forest Management

These activities undoubtedly affect the greenhouse gas balances that are to be mitigated. Poor development of stands affects the growth and sequestration of atmospheric carbon in forests. Monitoring is associated with activities classified by species, lot, intervened area and farm. The monitored activities are: Clearing of lots after sowing (biomass removed and left inside the lots), pruning (intensity, biomass or volume removed), thinning or thinning, harvesting (intensity, biomass or volume removed), reseeding of stands that are of several rotations in the duration of the project, disturbances such as burning, diseases and losses of biomass, because of these alterations. Finally, the development of the trees is evaluated, through growth monitoring plots.

These activities undoubtedly affect the balance of greenhouse gases that are to be mitigated. Poor stand development affects the growth and capture of atmospheric carbon in forests. Monitoring is associated with activities classified by species, lot, intervened area and farm. The activities monitored are Cleaning of plots after sowing (biomass removed and left within the plots), pruning (intensity, biomass or volume removed), thinning or thinning, harvesting (intensity, biomass or volume removed), replanting of stands that whether there are several rotations over the duration of the project, disturbances such as burning, diseases and loss of biomass, because of these alterations. Finally, the development of the trees is evaluated through growth monitoring plots.

As mentioned, before; to monitor project development, it is necessary to use stand stratification.

Stand stratification: Stratification is key when performing reduced emissions assessments. It is recommended to develop stratifications based on aspects such as: species, sowing date, silvicultural management, among others, since it is presumed that these aspects will allow unifying lots that present similar removal conditions and carbon content. However, it is highlighted that stratification seeks to unify areas with similar carbon content, regardless of management or species, since these can have effects such as pests, fires, site qualities, among others that make stratification reformulate.

For the project initiative, staging will initially be developed into two types of stands:

- Commercial stand model: composed of species of commercial interest that will be cared for through silvicultural management.
- Passive natural regeneration: areas that were designated for protection, where no productive interventions are carried out and recovery will be carried out through natural succession processes, without anthropogenic intervention. These areas correspond to areas adjacent to bodies of water, protection areas defined by the environmental authority, or areas not suitable for the cultivation of forest species.

These two stand models will be stratified based on the development and accumulation of biomass – carbon. Initially, monitoring will be carried out based on the interpretation of

satellite images, through indicators such as the Normalized Difference Vegetation Index[35] (NDVI), which allows estimating the quantity, quality and development of vegetation.

For this stratification, four levels are proposed for each type of stand:

- Low
- Regular
- Medium
- High

Below is the list of the most relevant monitored variables, applied in the forestry project, in the three aspects indicated above.

Table 19. Variables for monitoring project areas.

Variable	Observation
ID Stratum	*Stratum, considering those initially established and the changes that may occur with the progress of the project.*
Coordinates of polygons or lots.	*To control planted areas. They must be in longitude and latitude.*
A_{it}	*Polygons of planted areas, at a time t, and within a defined stratum j.*
A_T	*Total area that corresponds to the sum of all the lots that are part of the project.*
Adist	*Areas altered by natural or human disturbances (harvests, thinning).*

Table 20. Variables for monitoring the forest establishment

[35]El NDVI: es un índice que permite medir el verdor y la densidad de la vegetación, captada en una imagen de satélite. La vegetación sana tiene una curva de reflectancia espectral muy característica de la cual se calcula la diferencia entre dos bandas: la del rojo visible y la del infrarrojo cercano. El NDVI es la diferencia expresada numéricamente entre -1 y 1

Variable	Observation
Location	*Geographic position where each activity takes place.*
A_{ikt}	*Area intervened by activity*
Site preparation	*Preparation of sites at the beginning of the project in ha.*
Biomass removed before establishment.	*Only tree biomass is considered for site preparation emissions.*
Species	*Species that are actually planted by layer.*
Survival check I,j, k.	*Survival after planting.*
Plantation	*Planting date of the lots.*

Table 21. Variables for monitoring forest management

Variable	Observation
Prepared area $_{i,j,t}$	*Area cleaned before establishment. These areas generally correspond to the same ones that are planted.*
Biomass removed in soil preparation.	*Biomass removed during cleaning.*
Planted area $_{(i),j,t}$	*Areas under control that are effectively planted*
Fertilized area	*Fertilized area, to establish good management procedures, but it is not considered as emissions.*
Areas to be cleaned	*Area that is subject to clearing where stands are established.*
Pruned Area	*Area where stands are subjected to pruning.*

Variable	Observation
Thinning area	*thinned area*
Biomass removed by thinning or its percentage	*It can affect the carbon content of stands and monitoring is necessary.*
Harvested area	Areas that complete their rotation cycle.
Harvested volume	*Reported volumes in harvests by species.*
Reestablished areas	*Amount of replanted area and year, to start a new rotation.*
Disturbed Area	*Area affected by disturbances such as fires, plagues, mortality, etc. The survey is carried out with GPS.*

Other elements to monitor are related to the social and biodiversity component.

Social Component: The project has generated benefits to the community, through the generation of jobs in the project area, complying with national standards and regulations for hiring, seeking to train hired personnel.

The project has verified that the development of activities does not affect territories with the presence of ethnic communities.

Monitoring of the social component of the project is done through monitoring of annual employment indicators and number of training sessions.

Componente Biodiversidad: The monitoring of this component is articulated with the requirements developed by the environmental authority Corporinoquia. The Corporinoquia Autonomous Corporation requests monitoring and control of the impacts on biodiversity that the project activities may generate, especially to vulnerable species or Conservation Object Values (VOC). To evaluate the state of biodiversity, the list of species present in the region and their conservation status will be updated, based on recent regional studies, added to the monitoring developed by the project. Following the environmental requirements of the *Corporación Autonoma Corporinoquia*, periodic monitoring of biodiversity in the areas of influence of the project must be carried out. To

comply with the corporation's requirements, environmental management measures were formulated (file 800.38.17.0096), presented to the corporation for evaluation and approval (See annex_8., MMA_DORADO_2019_09_05).

Additionally, the project will implement measures for the management and quality of information, in terms of collection, processing and storage, to optimize the control and quality of information. Information management will be carried out through a control plan in the collection of information, archiving, verification and internal audit of the final information, guaranteeing the integrity of the data accumulated for each monitoring period and throughout the execution of the project.

16.2 Variables to monitoring

The following tables describe some of the data and parameters used, defined in the methodological tools AR_AM_TOOL 12 and AR_AM_TOOL 14. The data presented describe the source of the data, and the processes that must be followed for the measurement.

Data/ Parameters:	$A_{PLOT, i}$, $A_{SHRUB,i}$, Ai
Data unit:	ha
Description:	Sampled plot area; stratum area
Data source:	Field measurement
Measurement procedures (if they exist):	Standard operating procedures, described in the national forest inventory, are applied. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.
Monitoring Frequency	At each verification
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied.

Data/ Parameters:	*Ai*
Data unit:	ha
Description:	Area of stratum *i*
Data source:	Field measurement
Measurement procedures (if they exist):	Standard operating procedures, described in the national forest inventory, are applied. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied.
Comments:	-

Data/ Parameters:	*APLOT,i*
Data unit:	ha
Description:	Total area of the sampling plots in stratum *i*
Data source:	Field measurement
Measurement procedures (if they exist):	Standard operating procedures, described in the national forest inventory, are applied. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)

QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied
Comments:	-

Data/ Parameters:	$a_{p,i}$
Data unit:	m²
Description:	Litter sampling area selected in plot *p* in stratum *i*
Data source:	Measurement
Measurement procedures (if they exist):	Standard operating procedures, described in the national forest inventory, are applied. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied
Comments:	Values of 0,50 a 1 m² , are often used as reference values for sampling the selected litter. If primary information is not available, information from scientific literature may be used for conditions like those of the Project.

Data/ Parameters:	$CC_{SHRUB,\ i}$

Data unit:	dimensionless
Description:	Shrub cover in stratum *i* of the shrub biomass
Data source:	Field measurement
Measurement procedures (if they exist):	Considering that the biomass in shrubs is smaller than the biomass in trees, a simplified method could be used to estimate the canopy cover in shrubs. A visual estimate of cover could be carried out by any method such as the transect method or using the relascopio method.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied
Comments:	When the land is subject to a periodic cycle (for example, slash and burn or clearing - regeneration) the shrub cover oscillates between maximum and minimum values in the baseline, and the average value of the shrub cover is equal to 0.5 of the biomasses estimated unless the information provided is verifiable and transparent to justify a different value.

Data/ Parameters:	$B_{LI\_WET,p,i}$
Data unit:	Kg
Description:	Moist weight of the litter sample collected from plot *p* of stratum *i*; kg
Data source:	Field measurement in sampling plots
Measurement procedures (if they exist):	Standard operating procedures, described in the national forest inventory, are applied. In the absence of these, the

	manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied.
Comments:	-

Data/ Parameters:	DAP
Data unit:	cm or any length unit as specified
Description:	Diameter at breast height of a tree. To determine it, equations (1) and (2) are proposed, DBH could be any diameter or dimension measurement (for example, basal diameter, root neck diameter, basal area, etc.) used as a data source for the model.
Data source:	Field measurement in sampling plots
Measurement procedures (if they exist):	Standard operating procedures, described in the national forest inventory, are applied. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied
Comments:	-

Data/Parameters:	*Dn*
Data unit:	Centimeters (cm)
Description:	Diameter of the *n* piece of dead (fallen) wood that intersects (or falls) with the Transect. This applies to debris sampling
Data source:	Field measurement along linear transects in sampling plots
Measurement procedures (if they exist):	Standard operating procedures, described in the national forest inventory, are applied. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied
Comments:	-

Data/Parameters:	*H*
Data unit:	Meters (m)
Description:	Tree height
Data source:	Field measurement in sampling plots
Measurement procedures (if they exist):	Standard operating procedures, described in the national forest inventory, are applied. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.

Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	Quality control/quality assurance (QA/QC) procedures described in the national forest inventory are applied. In the absence of these, the published manual of quality control/quality assurance procedures, or the IPCC GPG LULUCF 2003, may be applied
Comments:	-

Data/Parameters:	*T*
Data unit:	Year
Description:	Period between successive carbon storage estimates.
Data source:	Recorded time
Measurement procedures (if they exist):	N/A
Monitoring Frequency	-
QA/QC procedures	-
Comments:	If two of the successive estimates of carbon storage are taken to different times in a time of year t2 and t1, (for example, in the month of April in the year t1 and in the month of September in the year t2) , a fraction of value could be assigned to time T

16.3 Information related to the evaluation of the environmental impact of GHG project activities

The projects follow the standards established by the regional environmental corporation Corporinoquia, to avoid any environmental impact on regional ecosystems. Although forest plantations do not require an environmental impact analysis for their development, they must meet the requirements established by corporations, such as environmental management plans or measures.

16.4 *Data and additional information to establish the baseline or reference scenario*

16.5 N.A Information related to the evaluation of the environmental impact of GHG project activities

The projects follow the standards established by the regional environmental corporation Corporinoquia, to avoid any environmental impact on regional ecosystems. Although forest plantations do not require an environmental impact analysis for their development, they must meet the requirements established by corporations, such as environmental management plans or measures.