Proyecto Forestal El Dorado
MONITORING REPORT

Document prepared by Reforestadora EL Dorado S.A.S

Date of issue (*Version 4.0 13/03/2025*

Monitoring Report Template (Version 1.1)[1]	
Name of project	***PROYECTO FORESTAL EL DORADO***
BCR Project ID	*BCR-CO-956-14-001*
Registration date of the project activity	*10/09/2024*
Project holder	*Reforestadora EL Dorado S.A.S*
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Version number of the Project Document applicable to this monitoring report	*Version 4.0* *(13/03/2025)*
Applied methodology	*BCR0001 V4.0*

[1] The instructions in this form are a guide. Do not represent an exhaustive list of the information the preparer shall provide under each section of the template.

Monitoring Report Template (Version 1.1)[1]	
Project location (Country, Region, City)	*Municipio: La Primavera,* *Departamento: Vichada* *País: Colombia*
Project starting date	*30/06/2015*
Quantification period of GHG reductions/removals	*30/06/2015 a 30/06/2045*
Monitoring period number	*1*
Monitoring period	(30/06/2015 to 30/04/2023)
Amount of emission reductions or removals achieved by the project in this monitoring period	***193,998***
Contribution to Sustainable Development Goals	*SGD 12 Responsible Consumption and production* *SGD 13 Climate Action* *SGD 15 Life on land*
Special category, related to co-benefits	*N.A*

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1 General description of project

The Forestal carbon proposal of 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 faces important challenges, such as establishing forestry production systems, where the environmental offer, road infrastructure, 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, 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 date is June 30, 2015. This start date is supported by the activities report developed for the month of June 2015. This shows the nursery activities developed for the Proyecto Forestal El Dorado between June 1 and June 30, 2015. In addition to this, the Forestry Incentive Contract (CIF) supports that the activities were initiated.(Annex 9),

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).

The monitoring period reported for verification accounts for a net anthropogenic removal of the order of **193,998** tCO_2 for all sinks considered (above-ground biomass, underground biomass, soil organic carbon, shrubs, leaf litter and dead wood above ground). It should be noted that in this type of commercial stand models where the pinus species predominates, the production of leaf litter is important, as well as dead wood on the ground, especially that resulting from pruning and other silvicultural activities, these residues (leaf litter and dead wood) are left inside the plantation. Likewise, the production of native shrubs is predominant within the plantations, these are left there until several years pass, before thinning interventions or final harvests are made, becoming part of the area biomass sinks in the stands. The final balances, after making a 20% discount (**38,800** tCO_2) that goes to the buffer, result in a final balance of **155,199** tCO_2 as carbon credits available for the period.

Finally, 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” (CDM Cod 9199, now BCR-CO-261-14-001). 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 20 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.

1.1 Sectoral scope and 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	

The Proyecto Forestal El Dorado (Angelik and La Maria properties), is an initiative framed in the AFOLU sector. It is a project classified as ARR for reforestation with commercial forest species, which seeks to promote the recovery and improvement of remaining natural forests and riverside forests, under passive restoration actions. For the present period, net removals are valued at 193,998 tCO2eq.

1.2 Project start date

30/06/2015.

As described in section 10.4 of the BCR program document (BCR Program, version 3.4), *"The start date for GHG Projects is when the activities that result in actual reductions/removals of GHG emissions begin. For ARR activities, this starting date corresponds to the time on which site preparation, the establishment of crop, commencement of restoration activities, or other actions related to project activities begin".*

Furthermore, 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[2]. For the El Dorado Forest Carbon Project, an agreement was signed with the OEC on October 2, 2019 (see annex 9). Therefore, this requirement is also met.

The date is June 30, 2015. This start date is based on the activity report developed for the month of June 2015. This shows the nursery activities developed for the El Dorado project between June 1 and June 30, 2015. In addition to this, the signing of the Forestry Incentive Certificate -CIF contract is attached. Administrative Act 11-2015. Annex 9) between Pavimentos El Dorado and the Agricultural Sector Financing Fund FINAGRO. The CIF is a financial support instrument, within the framework of the National Council for Economic and Social Policy, 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, guaranteed the financial support required for the establishment. Therefore, this action is assumed as the start of the activity.

It is important to mention that, in accordance with the conditions established to qualify for the forest incentive, it is highlighted that: "*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.

1.3 Project quantification period

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

The monitoring period to this verification is from 30/06/2015 to 30/04/2023

[2] The initiation validation, once you have a commercial agreement signed with the Conformity Assessment Bodies (CAB).

1.4 Project location and project boundaries

1.4.1 Project location

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

The center points for the location of the lots that are part of the project proposal are shown in the Table 1.

Table 1. Center points of the location of properties 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	922.57
La Maria	5° 26' 45.22" N	69° 28' 39.75" W	681.40
Total			***1,603.0***

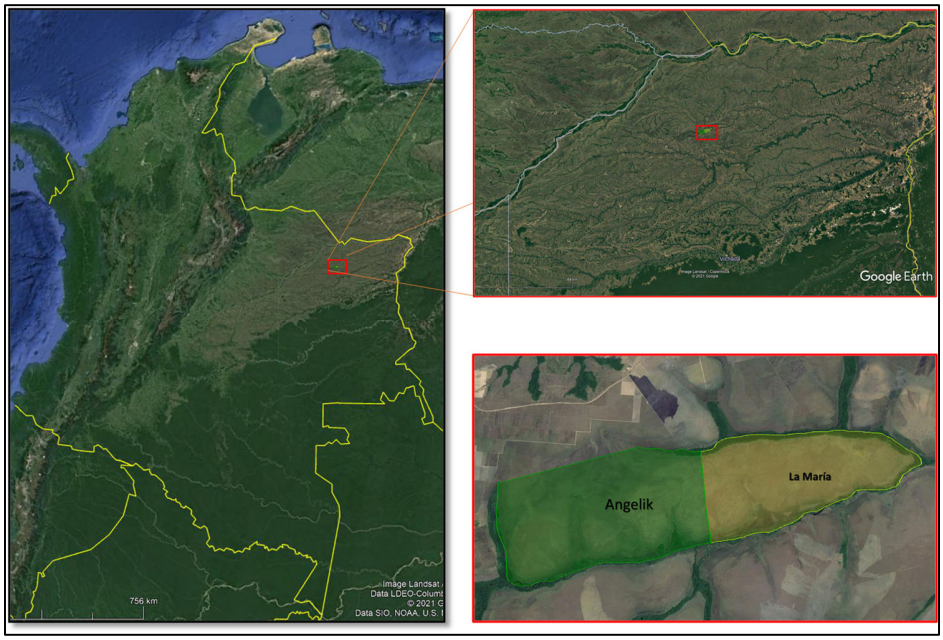

Figure 1. General Location of Forest Initiative Reforestadora El Dorado.

1.4.2 Project Boundaries

Project Area

The forest property of the Reforestadora El Dorado located in the Municipio of La Primavera, in the departamento 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). (see annex 2).

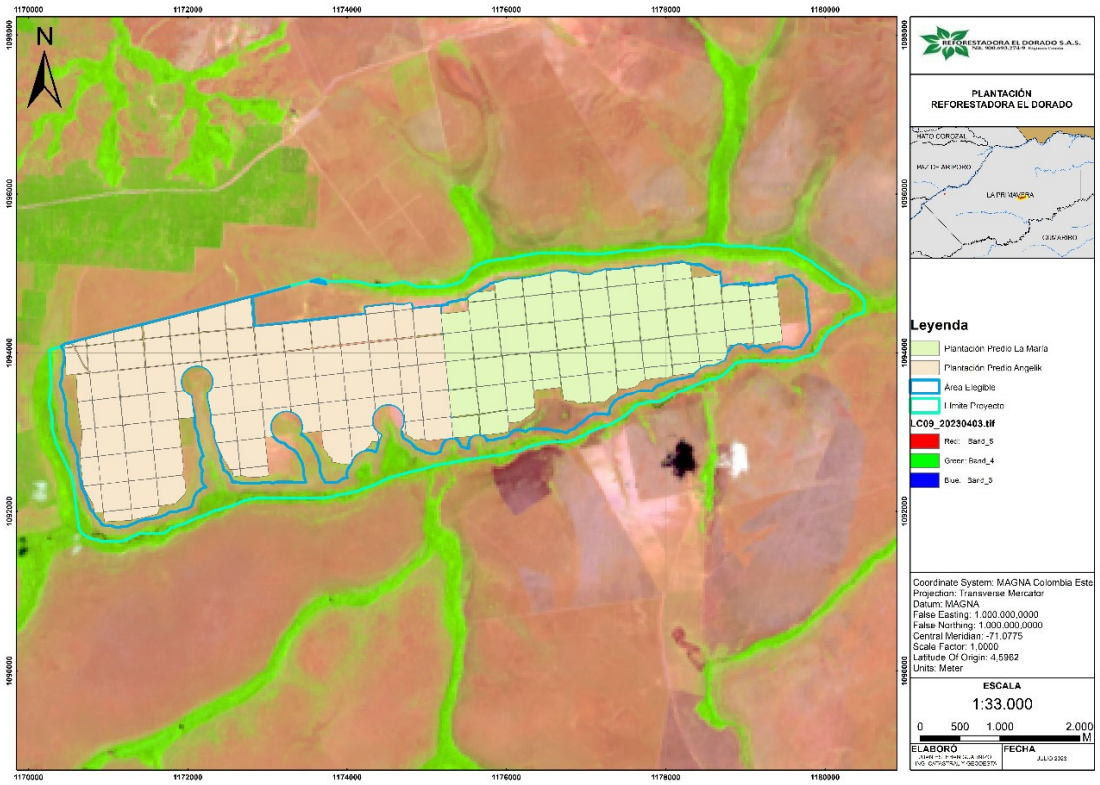

Figure 2. Properties planted under commercial stand models on the Angelik and La Maria properties of the El Dorado Forest in Vichada, and which are part of the current forest carbon proposal.

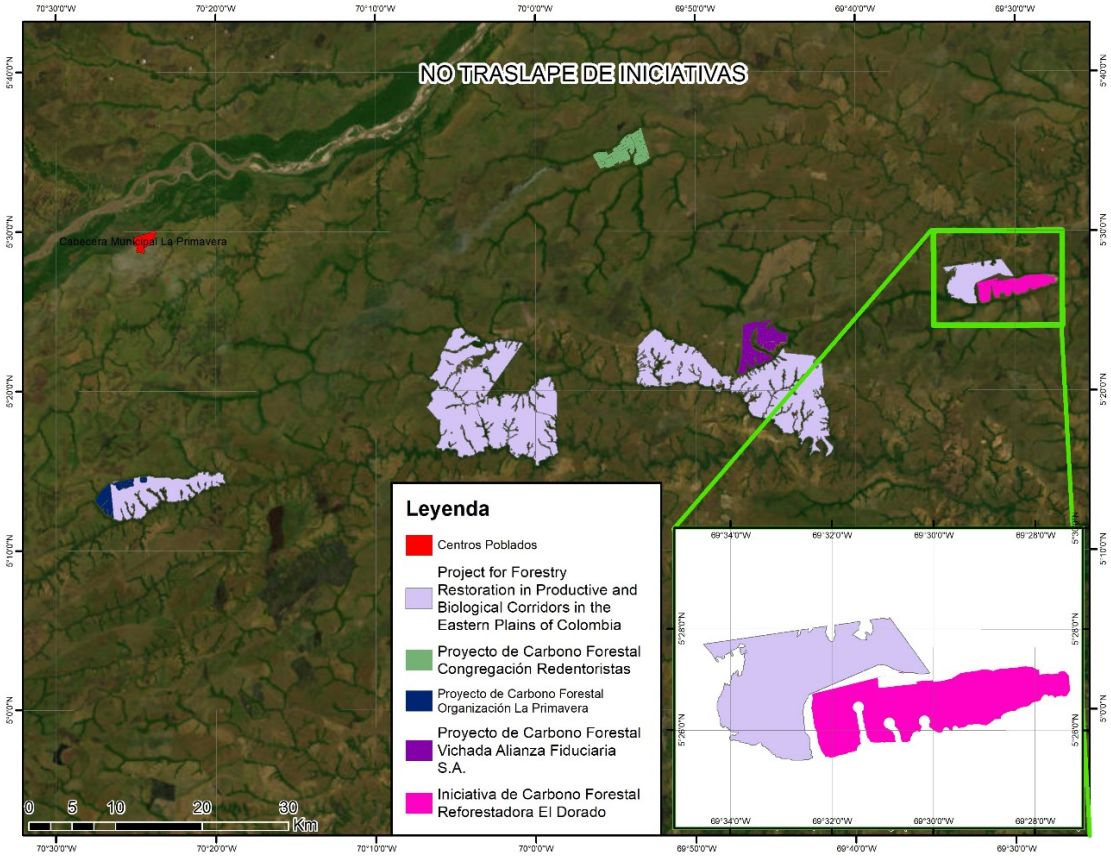

Figure 3. Not Overlapping with other GHG initiatives

1.5 Summary Description of the Implementation Status of the Project

Project operation start date and period

The date of this report considers the development of activities from **June 30, 2015 – April 30, 2023**

It is important to highlight that the Proyecto Forestal El Dorado initiative, is articulated with the production processes of a larger nucleus, which is part of the forest CDM initiative that gave origin to the project. Due to the above, many of the management, maintenance and other activities presented here link actions developed that are part of the monitoring of the project in general, which for the current monitoring cut did not allow detailed discrimination by lot and year. Below is a summary of the activities carried out and indicators related to job creation within the framework of the project are described.

In general, management activities were carried out periodically according to the needs of the plantation and its development. The most recurrent activities focused on weed

control, pest control and fertilization, as they were carried out every year. So me activities, such as thinning, are not yet considered because the timeframe for this activity is not met.

See Appendix 10, Activity Monitoring, for the support for these activities and the records of the work carried out.In general, management activities were developed periodically according to the requirements of the plantation and according to its development. The most recurrent activities focused on weed control, pests and fertilization, as they were carried out every year. Some activities such as thinning are not yet considered because the times for said activity are not met.

The supports for these activities are found in Annex 10.

The following table shows an example of these activities.

Table 2. Type of activities according to the requirements of the plantation according to stage of development.

	Year																													
	2015				2016				2017				2018				2019				2020				2021				2022			
	Forest management																													
Year lots	*Land preparation*	*controls weeds,*	*Fertilization*	*Pruning*	*Land preparation*	*controls weeds,*	*Fertilization*	*Pruning*	*Land preparation*	*controls weeds,*	*Fertilization*	*Pruning*	*Land preparation*	*controls weeds,*	*Fertilization*	*Pruning*	*Land preparation*	*controls weeds,*	*Fertilization*	*Pruning*	*Land preparation*	*controls weeds,*	*Fertilization*	*Pruning*	*Land preparation*	*controls weeds,*	*Fertilization*	*Pruning*	*Land preparation*	*controls weeds,*	*Fertilization*	*Pruning*
2015	X	x	x		x	x	x		x	x			x		x		x	x	x	x	x				x				x			
2016					x	x	x		x	x	x		x	x				x			x			x	x				x			
2017									x	x	x		x	x	x		x				x				x							

2 Title, reference and version of the baseline and monitoring methodology applied to the project

2.1 Methodology applied

The methodology applied to the project is BCR0001, version 4.0 and Table 3 summarizes the tools used in the development of the project for baseline and monitoring.

Table 3. Methodology and Tools used in baseline and monitoring

Title	**Version**
BCR0001	4.0
BCR Tool Permanence and risk Manegement	1.1
BCR Tool SDG	1.1
A/R Methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities"	01
AR-Tool14 *"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*",	04.1
A/R Methodological Tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities"	01.1.0
AR- Tool12 A/R Methodological tool *"Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"*	03.0
BCR Tool *"Avoiding Double Counting (ADC)"*	2.0
SDSs Tool. Sustaniable Development Safeguards	1.1

Winrock Sample Plot Calculator use equations from: A/R Methodological Tool "Calculation of the number of sample plots for measurements within A/R CDM project activities"	02.1.0

3 Contribution to Sustainable Development Goals (SGD)

With 6 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 period described in this monitoring report has managed to contribute especially to the reduction of areas degraded, has increased forest cover based on commercial stand models, has contributed to the protection of natural forests and waterways, and has reduced human-induced burning that affects ecosystems.

The Table 4 describes the contributions of the project to the sustainable development indicators.

Table 4. Indicators that have contributed to the Sustainable Development Goals.

Objective	Contribution
	***12. Responsible consumption and production*** As a product of the thinning carried out in commercial stands and the release of defective trees, a part of this material has been used for fence posts and corrals, and other wood needs for maintaining the infrastructure of the farms. With this, the consumption of wood from forest species from natural forests has been reduced. This raw material reduces the need to use plastic wood or cement posts, and has the characteristic of being biodegradable or a source of energy such as firewood in homes in the territory. The project has contributed to the protection of 508.15 hectares of native forest (see eligibility chapter), an ecosystem characterized by riverside forest, and other hectares have been allocated for the protection of the water circuit and passive natural regeneration. The project area is **2,194.28** hectares of which 196.36 hectares are natural forests, **508.15** hectares are intended for the protection of waterways, leaving **1,603.9** hectares eligible. Of the latter, only **1,353** hectares are planned for establishment in commercial stand models, leaving about **245** hectares for natural recovery and firebreaks.

	**1,353.2** hectares of new forests have been established, in areas that were previously dedicated to extensive livestock farming without management and on degraded soils. These coverages have achieved the removal of **193,998** tons of CO_2eq. For the current period, they will be added to the national accounting under the mechanism of the RENARE platform, of which the project is already a part.
	The burnings to which the project areas were subjected are eliminated and protocols for the acquisition of equipment for fire control are established, allowing the prevalence of the flora and fauna species of the region that were previously threatened by conflagrations for grassland renewal (**1,353.2** ha of new forests) The areas of riverside forests identified in the baseline persist and increase in the water ring zones, according to the standards of the Corporación Autonoma Regional (**508.15** ha). Likewise, areas are left for natural regeneration. Although areas have been left for passive natural regeneration, this restoration is not quantified as new forest areas for the monitoring period, since the succession process is still in a very early stage.
Other transversal indicators of the project	**New Jobs:** 559 monthly jobs have been generated and monitored in the monitoring period. All of these have had all the conditions of social benefits, training and job security. **Women's Participation**: Women have been involved in nursery activities, accompaniment in the maintenance of camps and preparation of food for workers. **Trainings**: The trainings have developed the following topics. - 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 - Prevention of Forest Fires The economic income of the staff has improved, guaranteeing more frequent and permanent jobs and income than those received in extensive livestock activities. The improvement in income helps to boost the economy in the municipal seat, which previously depended purely on income from livestock activity.

Table 5. Project contributions to the achievement of sustainable development goals

Number of SDGs to contribute	SDG	Activities that contribute	Consolidated Supports (Current Verification Period)
SDG 12	As a product of the thinning carried out in commercial stands and the release of defective trees, a part of this material has been used for fence posts corrals, and other wood needs for maintaining the infrastructure of the farms. With this, the consumption of wood from forest species from natural forests has been reduced. This raw material reduces the need to use plastic wood or cement posts and has the characteristic of being biodegradable or a source of energy such as firewood in homes. territory. It has contributed to the protection of the native forest ecosystem characterized by being a gallery forest, and other hectares have been allocated for the protection of the water circuit and passive natural regeneration.	Commercial wood production in sustainable models.	1.353,2 Hectares of crops that generate raw materials. Areas of commercial forests established with species adapted to environmental conditions and recommended for the region. GIS and Shapefile Bases
SDG 13	Hectares with change in land use, promoting new forests where historically they were not identified (ha). Reduction of greenhouse gas emissions derived from the environmental service of the capture of atmospheric CO_2 ($tCO_2eq.$) by trees in proposed stand models	Conservation of forests and protection from burning. / Monitoring and control of disasters in reforestation activity. / Reforestation to sequester atmospheric carbon	1.353,2 hectares of new commercial forests for ecosystem connectivity. GIS and Shape file databases and satellite images demonstrating the establishment of the rodales and withdrawal areas for projection.

SDG 15	Hectares of degraded soils that are protected and recovered by the implementation of new forested areas (ha). Expansion and protection of the water circuits and gallery forests of the territory. New areas (ha) of native forests or spaces suitable for due processes of natural succession and subsequent establishment of natural cover. Protection of natural ecosystems and biodiversity by reducing burning, soil degradation, and alteration of connectivity corridors between forest patches. (ha of protected natural forest).	Area of new forests / Area of withdrawals for causes / Increase forests for the supply of raw materials / By planting new forests, reduce the amount of degraded soils.	Reduction of degraded soils with new commercial forests. GIS and Shape file databases and satellite imagery demonstrating the establishment of stands and setback areas for the project. These areas are consistent with those that were historically subjected to burns and degradation processes.

Additionally, the BCR SDG compliance tool was implemented, resulting in compliance with SDG indicators 12, 13 and 15.

3.1 See details in the application of the tool and its analysis (Annex 13).Compliance with safeguards for the Sustainable Development Goals.

In compliance with the application of the tools developed by BCR, the project updated the No Net Harm assessment to the Sustainable Development Safeguards V1.1 assessment. The results of the application of this tool allow the following indicators to be identified as potential indicators, which are presented as control or mitigation measures in the implementation of the project.

The other indicators are either not generated in the project or would not apply to it.

Land use: Resource Efficiency and Pollution Prevention and Management

Could the project/initiative activities potentially entail or result in:	**Response**	**Mitigation or preventive action**
Inadequate recycling and reuse of project-related resources, leading to unnecessary waste and environmental impact?	☐ Yes ☒ Potentially ☐ No	The Project complies with the measures of adequate management of the resulting wastes in forestry activities, within the framework of environmental regulation established by the corporation. Waste will be properly disposed of according to the corporation's standards. (See Anex_8)

Water

Could the project/initiative activities potentially entail or result in:	Response	Mitigation or preventive action
Exacerbating water scarcity or depleting water resources?	☐ Yes ☒ Potentially ☐ No	It has already been argued that the project does not take water directly from water sources; the permits applied for are for use in the housing units. On the contrary, it promotes the infiltration of water into the aquifers. The Project requests permission to use the water resources from the environmental corporation. These permits rest as evidence in the environmental permit portfolio and in the project's environmental management measures plan.

Biodiversity and ecosystems

Introducing invasive species, which could negatively affect native flora and fauna and disrupt local ecosystems? *	☐ Yes ■ Potentially ☐ No	Although the commercial forestry species established in the project are considered non-native, they do not affect fauna or flora because they are NOT classified as invasive. And they are accepted by national entities for forestry development. (CONIF, 1998[3])
Altering ecosystem dynamics, including changes in species composition, trophic interactions, or nutrient cycles on the environment?	☐ Yes ■ Potentially ☐ No	The project, being a land use change activity, may promote changes in the composition of the flora in the baseline, i.e. in the poorly managed pastures and flora, which alters the trophic networks that develop in this land use. However, new covers will bring and promote positive benefits by improving nutrient flow, bringing new habitats for fauna, and generating connectivity between forest relicts.
Chemical contamination or pollution negatively impacting biodiversity in soil, water, or air?	☐ Yes ■ Potentially ☐ No	Forestry activities, as mentioned above, will have activities for the efficient use of fertilizers and agrochemicals, avoiding the contamination of ecosystems. These actions will be monitored by the project's technical team and followed up by Corporinoquia Corporation. To mitigate this potential effect, the recommendations for the proper management of these wastes will be followed in accordance with the corporation's standards.
Inadequate monitoring and assessment of biodiversity within the project area, making it Challenging to identify and address changes over time?	☐ Yes ■ Potentially ☐	The project does not consider developing a systematic long-term biodiversity monitoring process in the project area. However, changes that are perceived or determined by the environmental corporation will be reported in accordance with regional environmental regulations.

[3] https://www.itto.int/files/user/pdf/publications/PD39%2095/pd%2039-95-9%20rev%201%20%28F%29%20s.pdf

	No	Noting that new forests are promoting the connectivity of patches of natural forests and new wildlife refuges. These actions are within the environmental management measures of the project.

4 Double Counting and participation under other GHG Programs.

The Project is not attached to other GHG programs or registries, see PDD.

5 Compliance with Applicable Legislation

The activities carried out by the Forestry Project are governed by Colombian regulations at various levels: national, regional, departmental and municipal. These regulations cover environmental, economic and control aspects.

Forestry management was approved by FINAGRO during the process of reviewing and granting the CIF funds with which the project was initially financed; Environmental monitoring is carried out in accordance with the requirements of the Corporación Autónoma Regional de la Orinoquía -COPORINOQUIA- and is guaranteed through the annual presentation of environmental compliance reports and subsequent monitoring and follow-up visits, which corroborate the integrity of the strategic ecosystem protection areas, waste disposal processes, and the responsible and concessioned use of natural resources established in Resolution 1130 of 2011.

The area where the forest plantation will be established is in line with the Municipality's Land Use Plan, which promotes forestry as one of the pillars of development.

These norms and their regulatory complements are presented in the table of legal regulations (Table 4), which is periodically reviewed and updated in the participatory spaces of each entity to ensure effective management of compliance and when there are new requirements or changes in the norms, the DOCUMENT CONTROL PROTOCOL and the PROTOCOL FOR INFORMATION COLLECTION AND RETURN are applied.

An example of compliance with these standards is compliance with the requirements of the local environmental corporation. The corporation conducts periodic on-site audits to evaluate compliance with environmental requirements. If there are requirements from the Corporation, they are systematically recorded in the project file (file 800.38.17.0096), which also contains the responses to them. This file is constantly updated and monitored by CORPORINOQUIA.

On the other hand, since they are registered in the ICA records, the entity in charge makes technical visits to the project to evaluate technical compliance. During these visits, the project proponent presents all the documents related to the management of the stands and to the management of pests and diseases.

Regarding the compliance with the forestry development policies, especially those related to the application of the Forestry Incentive Certificate (CIF), the project demonstrates its compliance with the agreements and manages an information base that lists the stands established, the management carried out and the verification carried out by the FINAGRO technicians who evaluate the compliance. All this information is kept in the project files.

5.1 Application of legal requirements

Listed below are some of the main legal requirements for the development of the Forestry project proposal.

Table 6. Legal requirements for the implementation of the El Dorado Forest Carbon Project

Normativity / Legal requirement	Characteristics	Compliment
Decree 1449 de 1977. Article 3.	It relates the actions that seek the protection of 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,	The chapter XI of decree 1791 of '96 determines that: for commercial plantations it is sufficient to obtain registration with the Colombian Institute of Agriculture

	in accordance with the required requirements.	ICA (Instituto Colombiano de Agricultura[4]) and the forest establishment and management plan presented by the beneficiary of the CIF Forest Incentive Certificate. (Annex 9), which will serve as evidence for the autonomous corporations to grant registration to the plantation. Resolution 0687 of 1997 adopts this decree, which determines the actions by which the forest resource administration regime of the Corporación Autonoma Regional de la Orinoquia - Corporinoquia is issued.
RESOLUTION N.º 0687 OF DECEMBER 22, 1997	By which the forest resource administration regime of the Corporación Autónoma Regional de la Orinoquia - Corporinoquia is issued	The project complies with Chapter VIII related to the conditions of commercial forest plantations, and has delivered 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 (quemas) in rural areas.	The project complies with national and regional regulations, and does not include in its management practices the leaving 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 Corporación Autónoma Regional de la Orinoquia - Corporinoquia is issued. Corporinoquia, in order to guide regional productive development, adopts a tool that requires environmental management and technical procedures to develop in a sustainable way the activities that are immersed within agricultural, forestry	The El Dorado Forest Reforestation 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 monitoring and compliance with regulations is described. The environmental management policies are adopted and presented to the corporation periodically and the monitoring and follow-up are recorded and included in the project file folder that resides in the Corporation. In Annex (P) of the Biotic and Social Component, some sections of these evaluations are presented.

[4] https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=1296

	and agro-industrial productive projects.	
Decree 3930 of 2010.	By means of 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 it may generate. Complies with the due withdrawals for the protection of water sources established in article 40 of this decree (see previous paragraphs). The documents related to said decree rest in file **Number 800.38.17.0096** of the Corporation (Corporinoquia) related to the forestry project.
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 Law 139, meets the requirements and presents the documentation to access the CIF, having positive approval.
Document National Council of Economic and Social Policy (Consejo Nacional de Politica Económica y Social 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),* ***Pinus*** (*pátula,* ***caribea****, tecunumanii, oocarpa, maximinoii*), ***Eucalyptus*** (*grandis,* ***pellita****, tereticornis*) y Teca (*Tectona grandis*), Caucho (*Hevea brasiliensis*) y Guadua (*Guadua angustifolia*).
Decree 2448 of 2012.	Partial modification of decree 1824 of 1994. Definition of: forest species, native forest species, introduced forest species, protective-producing forest plantation, forest establishment and management plan, eligibility, granting, payment, new plantation and forestry project.	The project is accepted at the time of approval and granting of the disbursements established by said decree, being consistent with Document Conpes 3724 that allocated the resources under the procedures described and defined prior to decree 2448 of 2012.

Resolution 1447 of 2018. RENARE	By which the monitoring, reporting and verification system of mitigation actions at the national level is regulated, established in the 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 with the resolution, the project initiative submitted the formal registration to the Ministry of Environment and Sustainable Development, in September 2019 (Annex 9). In response, it was argued that at the time, the RENARE registration platform had not been launched, so registration should be done when the platform was operating. All processes have been complied with since the platform was put into operation. See letter delivered for registration (Annex C. National Standards C.3. RENARE). Currently, after the platform is fully functional, the project is registered in the Feasibility Phase (see RENARE platform). For the year 2021, the project achieved registration in RENARE with ID: 1721

5.2 Follow up to ensure that national regulations and laws applicable to the project are updated.

Due to the long duration of the accreditation period of the project, it is understandable that the rules and laws surrounding the forestry sector, environmental compliance, regulations for projects providing environmental services related to carbon change. For this reason, the project has delegated the **Carbon Business Unit** and the **Legal Department of the Forestry Projects Unit** and directly responsible to El Dorado Project for the continuous updating and compliance of regulations.

- In the case of monitoring in the context of forestry regulations, the emphasis is on the following:
- Regulations of the Ministry of Agriculture Regarding
    - Registration of forest plantations for commercial use.
    - Definition of species authorized for planting in Colombian territory.
    - Management of natural, protective and productive forest plantations.
    - Management and administration of commercial forest plantations.
    - National Forest Politics.

The monitoring of these updates is carried out on the platform of the National Forest Policy Guidelines[5].

- For the environmental elements of the forest plantations, the guidelines of the Regional Autonomous Corporation CORPORINOQUIA will be followed. The project has a monitoring register in the Corporation with ID: **800.38.17.0096**, and periodically a record of compliance with the environmental regulations applicable to forestry activities in the region must be established.
- For the carbon-related environmental service elements, the project is subject to the norms established by the Ministry of the Environment and Sustainable Development. In this respect, it should be noted that the project is registered in the RENARE platform[6], which provides guidelines for the registration of the National Greenhouse Gas Emissions Reduction Register in compliance with resolution 1447 of 2018 and its amendments.

6 Climate change adaptation

New commercial stands have been established, a total of **1,353.2** hectares with species adapted to the environmental conditions of the territory and the qualities of degraded soil that the territory presents, derived from historical burning. These new forests will protect the soil, reduce its exposure to the prevailing climatic factors, recovering the physical and chemical conditions of the soil.

The Proyecto Forestal El Dorado is aligned with the strategies proposed in the National Climate Change Policy[7], that seek to shape effective policy to influence decision-making to advance towards sustainable, climate-resilient and low-carbon development.

Within the framework of the action plan of the National Climate Change Policy, the forestry project is aligned with the territorial strategy for low-carbon and climate-resilient rural development, whose lines of action in which the project activities can be framed are:

Table 7. Project activities related to the lines of action of the national climate change policy

[5] https://observatorio-economia-forestal-3-mads.hub.arcgis.com/pages/Normativa
[6] Registro Nacional de Reducción de emisiones de GEI. https://renare.ideam.gov.co/GPY2-web/#
[7] Política Nacional de Cambio Climático. Colombia. Ministerio de Ambiente y Desarrollo Sostenible, 2017

Line of action	Project Activity
Line 1: Promote agricultural and fishery production systems that are better adapted to high temperatures, droughts or floods, to improve the competitiveness, income and food security of vulnerable populations.	The implementation of a commercial forest production system, with species approved by the Ministry of Agriculture (*Pinus caribaea*, *Eucalyptus pellita* and *Acacia mangium*), which have demonstrated great adaptability to the acidic soils of the Colombian Orinoquia region, as well as flexibility to the high temperatures characteristic of the region.
Line 3: Promote comprehensive actions on farms, in chagras or communities that help the efficient use of land, and where the conservation of existing natural covers on farms, the restoration of degraded areas, low-carbon livestock intensification, the implementation of agroforestry systems, family farming, the reduction of deforestation and the restoration of degraded areas, and technical assistance or agricultural technology transfer that increases competitiveness and decreases vulnerability to climate change	As a protection measure, the project maintains strict compliance with the areas of withdrawal from the water and forest strips established by Corporinoquia[8], in which no activities are carried out for commercial purposes, on the contrary, the natural regeneration of the transitional vegetation of the native gallery forests is protected and promoted, which are closely monitored in order to act in almost any natural or anthropic event that may occur in these areas
Line 7: Promote sustainable forest management, sustainable use of natural resources, conservation of forests and water margins, as well as restoration of degraded areas within farms	The project activities that add efforts related to line 7 of the National Climate Change Policy are associated with the protection and non-intervention ((buffer non-eligible areas, see GIS Annex), corresponding to the protection margins of forests and water bodies, which implies that in the project area, deforestation and degradation of natural forests is zero since the beginning of the activities. Indirectly, the pressure on regional natural forests is reduced by offering the local market wood of legal commercial origin and registered with the

[8] Resolución 1130 de 2011. Corporinoquia. 2011.

	ICA with quality standards and transformation processes, which guarantee the duration of the wood products offered.
Line 9: Incorporate into the planning, improvement and rehabilitation of land adaptation infrastructure the assessment of the effects of climate change on water availability, as well as the implementation of options to address climate risks (such as floods or droughts), including those aimed at encouraging efficient use of water by users.	In the area of project development, it makes sustainable and responsible use of water resources, meeting the consumption goals proposed in the Efficient Use and Water Saving Program associated with the concession of use of groundwater[9], proposed by the project and supervised by the Regional Autonomous Corporation of Orinoquia (CORPORINOQUIA), which establishes the commitment to reduce water consumption to 25% by 2030, with respect to historical consumption before the implementation of the plan. To meet this objective, the project will carry out the due diligences before the CORPORACIÓN to request permits for the use of water resources in the basic operations of the project (see Annex_8).

The Proyecto Forestal El Dorado demonstrating its commitment to contributing to GHG mitigation, also carries out actions related to climate change adaptation, derived from the implementation of project activities, adding to the lines of action of the National Climate Change Policy.

¡Error! No se encuentra el origen de la referencia. describes the actions carried out by the project, through the implementation of activities to contribute to climate change adaptation.

Table 8. Project actions that contribute to adaptation to climate change

[9] Medidas de Manejo Ambiental, Organización La Primavera, expediente 800.33.1.10.0019. Annex_9

BCR adaptation action	Project adaptation action
a) consider one or more of the strategic lines proposed in the National Climate Change Policies and/or focus aspects outlined in the regulations of the country where the project is implemented	Yes, the project activities fall under lines of action 1, 3, 7 and 9 of the 2017 National Climate Change Policy, as described in **¡Error! No se encuentra el origen de la referencia.**.
b) improve conditions for the conservation of biodiversity and its ecosystem services, in the areas of influence, outside the project boundaries, i.e., natural cover on environmentally key areas, biological corridors, water management in watersheds, among others	Yes, the project excludes the water rounds adjacent to the drainage: Elvita River and Caño Terecay, thus contributing to the water management of the basins. This was demonstrated in the analysis of the eligible areas of the project. (See Project Document[10]
c) implement activities that generate sustainable and low-carbon productive landscapes	Reforestation with commercial species *Pinus caribaea*, *Eucalyptus pellita* and *Acacia mangium*, have a positive impact on the sustainable productive landscape in the Orinoquía, since they have the technological packages approved by the national government, which are part of the zoning for forestry activities prepared by the UPRA (Unidad de Planificación Rural Agropecuaria)[11] [12].
d) propose restoration processes in areas of specific environmental importance.	The buffer strips of areas established by CORPORINOQUIA for the protection and conservation of natural resources and the environment have been preserved. The project promotes restoration activities through passive regeneration actions in areas that were previously non forest. (See Project Document)
e) Designs and implements adaptation strategies based on an ecosystem-based approach.	The project implements an ecosystem-based approach by preserving and restoring environmentally important

[10]https://globalcarbontrace.io/storage/PCR-CO-697/initiatives/PCR-CO-697-142-001/Documento%20de%20proyecto.pdf
[11] https://upra.gov.co/en/Documents/01_Proyectos_Normativos/201802_lineamientos.pdf
[12]https://www.datos.gov.co/Agricultura-y-Desarrollo-Rural/Zonificaci-n-de-aptitud-para-plantaciones-forestal/u4aa-xujw/data?no_mobile=true

	areas, such as buffer strips and water bodies. Passive regeneration is promoted in previously degraded areas, and forest species adapted to local conditions are used to maintain the ecological and productive stability of the landscape. Additionally, the exclusion of water bodies protects the functionality of watersheds, enhancing the ecosystem's resilience to extreme climate events
f) It strengthens the local capacities of institutions and/or communities to make informed decisions that enable them to anticipate negative effects resulting from climate change (recognition of vulnerability conditions) and to seize opportunities arising from anticipated or observed changes.	The project strengthens local capacities through collaboration with entities such as CORPORINOQUIA, the La Primavera Fire Department, the La Primavera Mayor's Office, the Municipal Hospital, and local residents, ensuring that reforestation and conservation activities align with national policies and the shared interests of the community. Additionally, training sessions are provided for workers, and joint efforts are carried out with the aforementioned entities on sustainable forest management and soil and water conservation practices, promoting knowledge on climate resilience. These actions enable communities and authorities to make informed decisions regarding land use and the protection of strategic ecosystems in the region

Within the framework of afforestation projects, climate change adaptation is a fundamental axis to ensure the sustainability of initiatives and maximize environmental and socio-economic benefits. Given the vulnerability of the AFOLU sector (Agriculture, Forestry, and Other Land Uses) to climate change, various actions and strategies are implemented in line with best adaptation practices, ensuring that forest plantations not only capture carbon but are also resilient and contribute to the sustainable development of local communities.

The main adaptation measures include:

1. Forest production systems adapted to extreme climatic conditions Management strategies and selection of tree species resistant to high temperatures, droughts, and floods (such as Pinus caribaea) are applied, improving plantation productivity and stability, ensuring competitiveness, and reducing risks associated with extreme climatic events.

2. Efficient land use and conservation of natural cover An integrated land-use approach is adopted, promoting the conservation of natural forests, the establishment of ecological

corridors, and the restoration of degraded areas while respecting the buffer zones required by CORPORINOQUIA. Additionally, land use is ensured to be consistent with the territory's vocation and agroecological conditions, fostering sustainable agriculture and agricultural technology transfer to enhance the resilience of local communities.

3. Reduction of GHG emissions in agroforestry activities Advanced forest crop management techniques are implemented, replacing conventional planting practices with methods that minimize soil disturbance and promote the efficient use of agricultural inputs. These actions not only reduce the carbon footprint but also increase the economic viability of forestry initiatives.

4. Specific measures for climate change adaptation Improved seeds resistant to climate variations are used, and water management is optimized through rainwater harvesting, recycling, drainage, and efficient irrigation. Additionally, reforestation in areas near water bodies is promoted to prevent erosion, and soil management practices are applied to reduce compaction and optimize fertilizer use, minimizing environmental impact.

Collectively, these actions strengthen the resilience of forest plantations to climate change and generate positive impacts on food security, the local economy, and ecosystem conservation. Through an integrated and sustainability-based approach, afforestation projects actively contribute to climate change mitigation and adaptation, aligning with global commitments to sustainable development and environmental protection.

7 Carbon ownership and rights

7.1 Project Owner

Individual or Organization	**Reforestadora El Dorado S.A.S**
Contact Person	Jorge Díaz Murcia
Position	Legal Representative
Adress	Carrera 16A # 80 – 63 Oficina 702 Bogotá D.C., Colombia
Phone Number	(+57) (1)6212161
e-mail	reforestadora@Concretosdorado.com

7.2 Land Tenure

The Angelik and La María properties are registered under public instruments of the municipality of Puerto Carreño (Vichada) with the following real estate registration (Real Estate Registration) numbers.

Table 9. List of real estate licenses, detailing the ownership of the Reforestadora El Dorado properties

Property	Real Estate Registration
Angelik	540-4687
Andalucía	540-4686

As established by the real estate registration, land ownership and use, it is an area under control in the name of Reforestadora El Dorado S.A.S. The legal ownership documents are confidential in nature and are presented in Annex 9. (Ownership to the auditing and certifying entities of the project).

The evidence that demonstrates the ownership of the areas where the project is developed is found in annex 9_Legal_Documents. The proposal to develop commercial forestry activities on the project properties and include the benefits from the sale of the environmental service of carbon capture by the new forests, is located in the El Dorado_Artemisa folder, within Annex 10_Forest_Management.

Considering that the properties where the project initiative is developed are privately owned, the carbon rights are attributed to the owners of these areas. Land tenure conditions were maintained at the end of the current monitoring period, as evidenced by the certificates of title and freedom of the properties. (see Annex 9).

7.1 Responsible for the mitigation project

Table 10. Contact Information of project managers

Alexis Dias Murcia	Director of the Forest Carbon Project **reforestadora@Concretosdorado.com** (+57) (1)6212161

	Carrera 16A # 80 – 63 Oficina 702 Bogotá D.C., Colombia
Jesus Rivera	Project operations manager jesusrivera@proyectosforestales.com (+57) 601 257-9467 Carrera 14 # 78 - 30 Floor 3 Bogotá DC, Colombia
Harold Santana Rivera	Business Development Director. haroldsantana@proyectosforestales.com (+57) 601 257-9467 Carrera 14 # 78 - 30 Floor 3Bogotá DC, Colombia
Andrés Sierra B.	Forest Carbon Consultant andsierrab@gmail.com (+57) 601 257-9467 Carrera 14 # 78 - 30 Floor 3 Bogotá DC, Colombia
Juan E. Guarnizo	GIS Manager mdl@proyectosforestales.com (+57) 601 257-9467 Carrera 14 # 78 - 30 Floor 3 Bogotá DC, Colombia

8 Environmental Aspects

The Department of Vichada is the second largest department in Colombia with a territorial area of 105.947 km^2, occupying 8,7% of the national territory. Located in the east of the country, in the Orinoquía region, made up of 4 Municipalities (Puerto Carreño, Cumaribo, Santa Rosalía and La Primavera) and 25 inspections. It limits to the north with the Meta River that separates it from the departments of Casanare, Arauca and the Republic of Venezuela. To the east, with the Orinoco River that separates it from the Republic of Venezuela. To the south, with the Guaviare River that separates it from the departments of Guainía and Guaviare and to the west, with the departments of Meta and Casanare. The extensive plains of the Eastern Plains occupy a good part of the department's territory with some terraces such as the Vichada, Mono and Mataven hills (secretaria de Planeación y Desarrollo Territorial, 2016).

The capital of the department is Puerto Carreño, with an area of 12,409 km2 and an approximate population for the year 2013, of 15.258 inhabitants. The municipality of Cumaribo with an area of 65,674 km2 and a population of 35.146 inhabitants (approximately 50% of the population is indigenous), Santa Rosalía with an area of 2.018

km^2 and a population of 3,877 inhabitants and La Primavera with an area of 20.141 km2 and a population of 14,294 inhabitants. With an approximate population for 2017 of 75.468 inhabitants in the Department, being 0,14% of the Colombian population according to the DANE population projection (UNAL, Sede Orinoquía, 2018).

It has a participation in the national GDP of 0.12%; The economy of the department is mainly characterized by: 52.2% in agriculture, livestock, hunting, forestry and fishing; 15,2% in public administration and defense, education and social services; 13.1% for trade, repair, transportation and accommodation; 6.1% for electricity, gas and water; 4.7% for construction; 3.4% for real estate activities; 2.8% information and communications; 2.5% artistic, entertainment and recreational activities; This is according to a report from the Ministry of Commerce, Industry and Tourism, which specifies the distribution of the gross domestic product for the department of Vichada (UNAL, Orinoquía headquarters, 2018).

The economy of the Department is mainly constituted, 57%, in the agricultural sector, livestock, hunting, forestry and fishing. In livestock farming, the vaccine stands out, which is developed in natural savannahs, mainly in the municipality of La Primavera.

As evidence in the non-generation of impacts, the tool of safeguards to the sustainable development goals is developed (annex 14)

8.1 Climate

The average altitude of the Municipality is 117 m high which, according to the classification of thermal floors proposed by Caldas for the American tropics, corresponds to the warm thermal floor. In the four municipalities that make up the department of Vichada, very special agroclimatic conditions occur in which, according to data collected at the IDEAM meteorological stations, it is said that in the department: it rains 166 days a year with an average annual precipitation of 2,255 mm , which indicates a very marked rainy season, followed by a dry season (see Figure 4); which end up becoming limiting factors for agricultural development due to excesses or deficits of water.

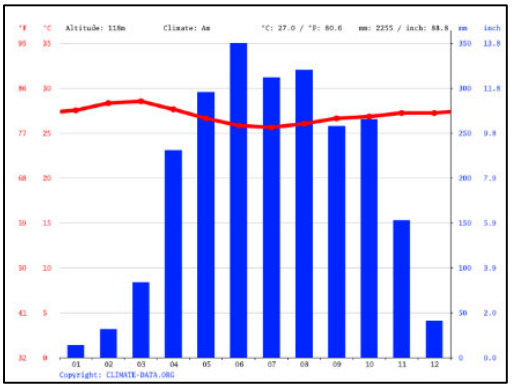

Figure 4. Distribution of precipitation throughout the year in the municipality of La Primavera Vichada. The driest month is January, with 13 mm. Most of the precipitation in the municipality falls in June (months on the horizontal axis), and the average is 336 mm, for an average annual precipitation of 2,225 mm. Source: Climate-Data.org

There is an average annual relative humidity of 70%, the average annual temperature is 28.2 °C; The potential evapotranspiration reaches 2,136 mm, showing an environment in which water is very easily lost from the soil due to evaporation, which conditions the development of different plant species.

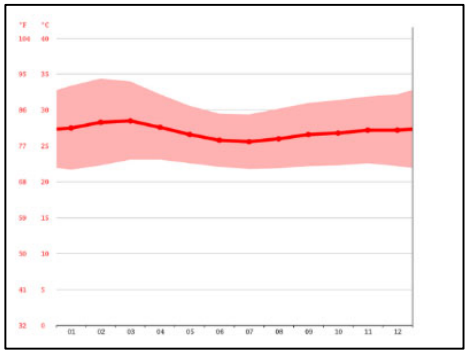

Figure 5. Behavior of the average temperature over a period of one year for the municipality of La Primavera Vichada. Its highest peak is located in March with 28.5 °C and the lowest in July with 25.6 °C, presenting a variation of 2.9 °C. Source: Climate-Data.org

8.2 Soils

According to the study of soils and land zoning of Vichada prepared by the Agustín Codazzi Geographic Institute, 36% of the department (3.6 million hectares) has areas suitable for agricultural, livestock and forestry production; This potential can be exploited if appropriate agronomic practices are carried out to improve soil conditions, where there are low contents of organic matter, high acidity and in some sectors toxic levels due to aluminum; This large amount of land has the potential to expand areas of soybean, corn and rice crops for agroindustrial development and extensive livestock farming as the

main livestock production (National University of Colombia, Orinoquía headquarters, 2018).

The department of Vichada has an area of 100,242 km2, of which 6,123,261.2 ha correspond to areas with a forestry vocation, where forestry and agroindustrial projects are currently being developed for commercial purposes, emphasizing exotic species that stand out for their technological packages and capacity. of adaptation to the environmental offer of the territory. Noteworthy are the species Acacia mangium, Pinus Caribaea, Eucaliptus grandis, Eucalipto pellita, Eucalipto tereticornis and Pino oocarpa, among others.

8.3 Hydrography

The department of Vichada belongs to the great basin of the Orinoco River. The Municipality of La Primavera has the particularity that several water sources arise and die in its territory. The lands of the Municipality are deeply irrigated, as they are crossed by numerous rivers, pipes, streams and other minor streams, among which the Meta River stands out due to its flow and importance, which serves as a natural boundary with the departments of Arauca and Casanare. The main basins of the municipality belonging to the Great Basin of the Orinoco River correspond to the sub-basins of the Tomo and Bita rivers that belong to the Great Basin of the Orinoco River, with a percentage of area in the territory of the municipality of La Primavera of 43.5% and 52.5%. %, respectively. At the same time, the subbasins of Caño La Balsa, Caño Aguas Claras, Laguna de La Primavera, Caño Aguaverde and Caño La Culebra are also found as sub-basins that make up the Meta River in the town of La Primavera, as the most important (CORPORINOQUIA, 2008)

One of the main drainages in the municipality of La Primavera is the Bita River, which crosses the department from west to east, until it flows into the Orinoco River on the border with Venezuela. The project area is located in the upper part to the east of the Bita River, near where this river originates and close to the Caño Lobo and the Elbita River which flows into the Tomo River (Figure 6 and Figure 7)

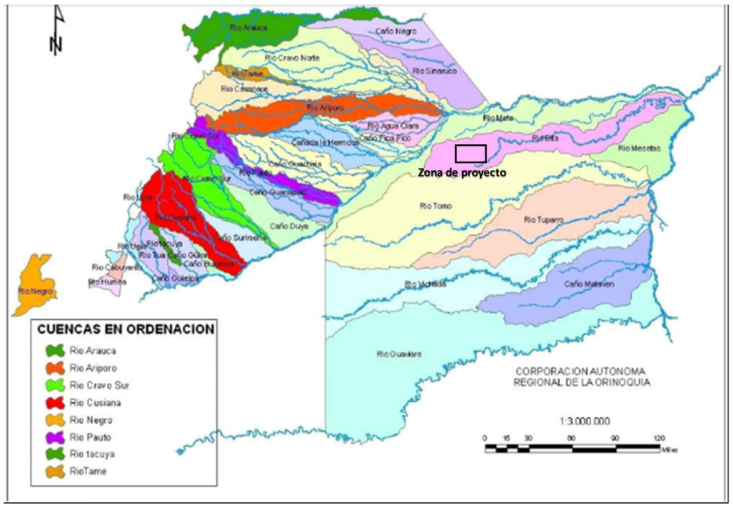

Figure 6. Hydrographic basins of the jurisdiction area of Corporinoquía. Source: CORPORINOQUÍA, 2013. Plan de Gestión Regional Ambiental 2013-2025

Figure 7. Main rivers and channels around the project area. Source: taken and adapted from geographic data viewer, geological service of Colombia (SGC Servicio Geológico Colombiano).

The Bita River is an important tributary that has its origin in several streams that originate in the high plains to the west of the municipality of Puerto Carreño. In its route from west to east, more than 200 km are navigable in winter, by small boats. As tributaries it has numerous channels, including: El Bravo, Pendare, Cabrillas, Avión and Tres Matas

(Gobernación del Vichada, 2011[14]). The richness of biodiversity in the sub-basin characterizes it as a location of vital importance for natural conservation within the rural area of the municipality, therefore, expanding the conservation and reserve zones will result not only in an environmentally strategic area, but also a point of local development, which can integrate sustainable activities such as ecotourism (Secretaria de Planeación y Desarrollo Territorial, 2016).

The Tomo River rises in front of the Carimagua Lagoon in the Department of Meta, and runs through the area from west to east; It is navigable by boats of up to 10 tons from La Palmita to Caño Guaripa and from this point to its mouth in the Orinoco River, by boats of up to 150 tons, over a distance of 280 km. Among its tributaries are: Caño Urimica, Guaira pali, El Boral and El Negro (Gobernación del Vichada, 2011).

The Guaviare River, located in the south of the department, is another fluvial limit of the Orinoquia. Its origin is in the Cordillera Oriental, west of the department of Meta. It is one of the largest in the region, but with rugged navigability due to the rapids formed in some sectors of its course. Figure 8 shows the density of the Vichada water network. (Ecofondo, 2005[15]).

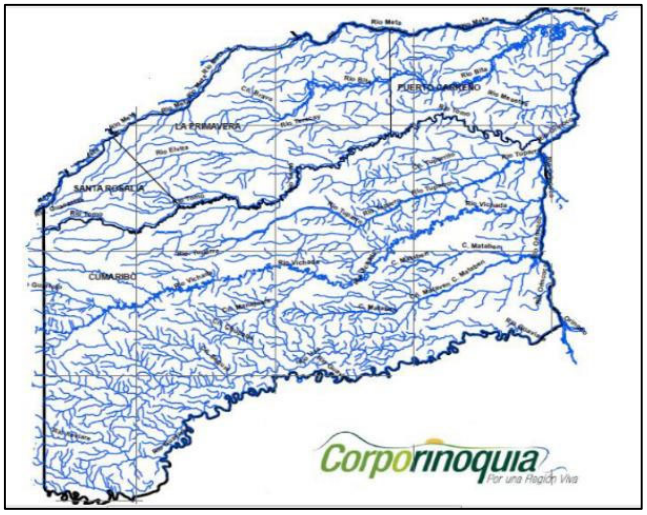

Figure 8. Main water currents of Vichada. Source: CORPORINOQUÍA, 2013. Plan de Gestion Regional Ambiental 2013-2025

[14] Gobernación del Vichada, 2011. Plan vial departamental del Vichada 2011-2019, Puerto Carreño.
[15] Ecofondo, 2005. El agua en la Orinoquia.

However, the great surface and underground water wealth widespread in the Orinoquia region is not distributed spatially and temporally homogeneously. Additionally, there is a marked deficiency in the availability of information on the regional water supply and the quality of the resource, as a consequence of the lack of an adequate hydroclimatic monitoring network and the difficulty in operating it regularly. From the few data available on historical flows in some streams, the growing loss of the regulation capacity of hydrographic basins can be deduced, as a great difference is observed between the extreme flows recorded. (CORPORINOQUIA 2006).

8.4 Physiography, topography and geology

According to the physiographic and landscape analyzes in the Region, it is inferred that the municipalities of La Primavera, Puerto Carreño, Santa Rosalía and approximately 50% of the territory north of the municipality of Cumaribo are part of a plain physiographic subprovince. high, which is between 90 and 120 meters above sea level, and has a very gentle inclination towards the east of the country, it is also known as the overflow plain of the rivers coming from the cordillera Oriental (CORPORINOQUIA, 2013).

This system is characterized by the presence of inherited forms such as alluvial dikes (spaces that are not flooded during winter), flood basins and partially filled drainage axes known as estuaries (CORPORINOQUIA, 2017). Likewise, within the high plain the great landscapes listed below are contemplated:

- The Altillanura structural-erosion that consists of an almost flat undulating terrain with some terraces
- Residual high plain of the shield, which consists of the flat plain with artificial soils (alluvial-colluvium)
- Depositional - erosional high plain that is composed of deposits of sand, silt, clay and gravel, are strips of variable width next to the main rivers.

Approximately 50% of the territory south of the municipality of Cumaribo contains the Physiographic subprovince of the Orinoquia-Amazon Transition Forest. It is an extensive low-lying jungle strip, mixed with open Amazonian savanna vegetation. The strip is characterized by presenting a highland landscape in which there are gently undulating areas and others with a broken relief; Its well-developed and nutrient-poor soils have deposits of fine sediments, basically in river beds. (CORPORINOQUIA, 2013).

Topography

The geoforms are mostly savannas, strips of slope forest and gallery. There are low areas that flood during the winter when numerous rivers and pipes overflow. The territory of the department of Vichada corresponds to the region of the Eastern Plains and in it

four physiographic groups are distinguished: the poorly drained Orinoquia Alluvial Plain, the well-drained Orinoquia Altillanura, the Alluvial Strip of the large rivers and the Guiana Shield. The first is formed by low beaches located to the north in the municipalities of Puerto Carreño and La Primavera, covered by savannah vegetation and temporarily floodable. The Altillanura, with different degrees of dissection, occupies the largest area of the department between the Meta and Vichada rivers; It is covered by savanna vegetation alternating with gallery forests, and in its interior, by tropical jungle forest between the Tuparro and Vichada rivers. The Aluvion Strip extends parallel to the Meta, Tomo, Bita, Tuparro and Orinoco rivers, covered by intervened gallery forests. Finally, the Guayanés Shield is located in isolated sectors in the east of the department and is characterized by the presence of rocky outcrops and plateaus dissected in white sediments. The main cover is made up of mosaics of forest, shrub and degraded savanna vegetation. There are some orographic features such as the Mono and Mateavení hills and the Casuarito hills. (CORPORINOQUIA 2008). In the case of the study area where the forestry project will be carried out, the geomorphology corresponds to the physiographic unit of Altillanura

Geology

In the Orinoquia, the typology of soils and their evolution are linked to the origin of the sedimentary megabasin located between the Guayana Shield and the Eastern Flank of the eastern mountain range. Quaternary deposits of fluvial origin predominate, Tertiary sedimentary rocks (sandstones, mudstones and limestones) resting on sediments from the Cretaceous, Paleozoic and felsic crystalline rocks from the Precambrian. On these materials, piedmont landscapes are developed, extensive Pliopleistocene plateaus, with variable dissection, alluvial and aeolian plains partially dissected and cut by long and narrow recent and current alluvial valleys, associated with large rivers. The Faults over which the Meta River runs establish two clearly differentiated subregions, the Altillanura (plain) and the so-called Orinoquia Floodplain. (Mendivelso 2003, mentioned by Malagón 2004).

In addition to the aforementioned characteristics, there are frequent burnings, which are carried out in the project areas to promote the regeneration of pastures for livestock. Burning generates progressive degradation that affects soil fertility. On the other hand, the most common land use in the area has been extensive livestock farming, which has caused soil erosion and compaction processes. On the other hand, the introduction of non-native grasses for cattle grazing has generated changes in biodiversity and soil degradation. Therefore, if livestock activities had continued in the project area, the soils would not have the capacity to develop regeneration processes of the native flora.

Soils

The soils of the altillanura present an ochric horizon on the surface, which increases its content of organic materials as the transition is established to areas with greater precipitation or to those low and to the estuaries, places where the plant formation associated with the riverside forest provides biomass, significantly increases moisture content and the soils present humbric or tissue horizons. The type of humus is tropical acid *mull*, with average compositions of fulvic acids to humic acids greater than 1.2 and its humin content is less than 50%. The contribution of biomass is low (2.2 to 3.8 t ha^{-1} $año^{-1}$) in herbaceous savannas but can increase to 28 or more t ha-1 year-1 under the covers depending on the rainfall regime, the length of the dry season and available nutrients (Lamotte citado por Malagón 2004).

The rainy season influences the loss of the few soluble or exchangeable elements in the soil, generating high acidity. The pH of the soil is generally lower than 5.0 and in dry seasons the polymerization of humic substances is favored, such as the hardening of horizons and cementation (petroferrous materials) from the dehydration of iron compounds. The alteration in the flat or dissected plain not affected by hydromorphism, presents an advanced degree, manifested in the mineralogical composition of sands and silts. In the clay fraction, kaolinite, iron and aluminum oxyhydroxides integrated 2:1:1 predominate, with interlamellar aluminum, pyrophyllite and gibbsite (IGAC 1995).

Soil degradation corresponds mainly to ferralization processes (formation of oxisols), through high transformation processes and loss of elements Ca, Mg, K, Na and Si, among others. The formation of Ultisols occurs in a lesser proportion. Additionally, there are some formations of Espodosols, Inceptisols, transitional to Oxisols. Indicators of these processes, in addition to the mineralogical ones, are those associated with the very low cation exchange capacity (CEC), values less than 4 meq/1000 g of the effective capacity. (Rippstein, et al, 2001).

Image 1. Soils of the project area. The continuous burning of grasses on soils with oxisol characteristics causes a hard layer of ferrous material called plinthite to form[16].

The effect of the marked climatic seasonality, its relationship with tropical savannah vegetation and the formation of humus, together with advanced alteration, has caused a very low fertility, both current and potential, which leads to specific agronomic practices based on establishing, maintain and improve plant varieties adapted to these conditions (Cortés 1982, cited by Malagón 2004). A soil analysis carried out for the El Deseo farm of the Organización La Primavera S.A. subproject is presented in Table 11.

Table 11. IGAC Soil analysis, El Deseo property. (Organización La Primavera 2006).

Description	Characteristics	Percentage (%)
Granulometry	Sand	45.60
	Silt	36.30
	Clay	18.10
Texture	Loam	
pH		5.00
Changeable acidity	A.I	0.79 meq/100g
% acidity saturation Interchangeable	S.A.I	
Organic Material	Organic Carbon	0.32
Change complex	Cation exchange capacity (CEC)	2.1 meq/100 g
	Calcium	0.04 meq/100 g
	Magnesium	0.01 meq/100 g
	Potassium	0.01 meq/100 g

16 When there is influence of groundwater in the O zone at 125 cm from the ground, a firm clay material with a high iron content (plintite) usually forms. When exposed to air or burning, it dries and becomes irreversibly hard (laterite or stone forms a layer or hard concretions. http://www.fao.org/tempref/fi/cdrom/fao_training/fao_training/general/x6706s/x6706s01.htm ferruginosa).

Description	Characteristics	Percentage (%)
	Sodium	0.04 meq/100 g
	Total Bases	0.10 meq/100 g
Percent base saturation		4.70%
Phosphorus		No detected

These results are consistent with those reported by Rippstein et al (2001) for the Colombian altillanura, specifically for the undulating altillanura. See Table 12.

Table 12. Textural and chemical properties for soils from the undulating highlands in Colombia. (Taken and modified from Rippstein et al, 2001)

Element	Dry Savanna and undulating Altillanura
Clay (%)	30.4
Sand (%)	41.9
Silt (%)	27.5
M.O (%)	0.9
P (ppm)	0.9
pH	4.7
AL (meq/100 g)	1.4
Ca (meq/100 g)	0.1
Mg (meq/100 g)	0.1
K (meq/100 g)	0.1
S (pmm)	5.5
B (pmm)	0.2
Zn (pmm)	0.3
Mn (pmm)	0.4
Cu (pmm)	0.2
Fe (pmm)	52.8

8.5 Ecosystems

The Eastern Plains of Colombia are an extensive savannah that goes from the foothills with the cordillera oriental, reaches the Orinoco River in the east and extends in a north-south direction from the Arauca River to the Guaviare River; It has an approximate area of 266,300 km2, in which three large landscapes can be identified. (CORPORINOQUIA, 2013):

- The *piedemonte llanero*

- The floodplain
- And flat and undulating altillanura

The first corresponds to a narrow strip located between 700 and 500 meters above sea level, which has a typically plain climate, with average temperatures of 23 to 30 ºC and a biseasonal rainfall regime with 3.000 to 4000 mm of annual precipitation. The second landscape is the region located west of the Meta River, known as the Casanare and Arauca savannahs and is probably the largest area of land in the north of the South American continent, which is below 200 m in altitude. The last corresponds to the area located between the Meta and Guaviare rivers where the foothills of the Cordillera Oriental begin, between the Humadea river and the Sierra de La Macarena that reaches the Orinoco river. The lowest and eastern part, known as the Orinoqués platform, is a territory with gentle slopes approximately 100 kilometers wide, which runs parallel to the Orinoco River and connects with the floodable alluvial valleys of the Vichada, Tuparro, Tomo and Bita rivers, among others.

More than 90% of the region is part of the tropical savannah ecosystem. These are open formations without a uniform tree canopy, where a perennial herbaceous matrix extends continuously and sometimes appears covered by low-growing woody plants or scattered palms. The main genera of grasses found in them are: *Andropogon, Aristida, Axonopus, Leptocoryphium, Panicum and Trachypogon*. One of the most outstanding features of this biome is its tolerance to natural fires, adaptation to conditions of intense drought and flooding according to the variable patterns of precipitation, as well as the generalized low fertility of soils and winds. powerful. These ecological factors have conditioned and helped the evolution of species through morphological, phenological and functional adaptations. The relationship of fire in the evolution of these savannahs can be verified by the existence of woody species of a pyrophilous nature (*Curatella Americana, Byrsonima crassifolia, Bowdichia virgiliodes, Xylopia aromatica, Miconia sp*.) (Alvarado et al. 1991, Bosques de La Primavera 2006).

Below is a general description of the ecosystems present in the region:

Image 2. Images of the land uses and ecosystems that determine land uses in the Colombian highlands and in the project area

The formation of “pyrophilic edges” is especially noticeable in the contact areas between the highland forests and the savannahs. In general terms, the dominant species are herbaceous, grasses and some sedge, juncaceae and xyrydaceae, among which the following stand out: *Aristida sp., Axonopus purpusii, Axonopus fissifolius, Digitaria decumbens, Eragrostis maypurensis, Panicum sp., Paspalum sp., Trachypogon plumosus*, among others. Along the main rivers and canals of the region, riverside or riparian forests develop. These formations are important from an ecological point of view as they serve as corridors for the dispersal of wild fauna and flora. They are characterized by the presence of palms in the canopy and co-dominant strata. Some characteristic species are: *Socratea exorrhiza, Astrocaryum vulgare, Oenocarpus minor, Attalea maripa, Euterpe precatoria, Iriartea deltoidea, Bactris gasipaes, Mauritiella armata.* Las pricipales especies arbóreas presentes son*: Terminalia amazonica, Tabebuia serratifolia, Ceiba pentandra, Jacaranda copaia, Hymenaea courbaril, Enterolobium schomburgkii, Parkia pendula, Callophyllum sp., Inga sp., Spondias mombin, Guatteria sp., Bombacopsis quinatum*, entre otras (Alvarado et al. 1991).

Life Zones

In the department of Vichada, the tropical humid forest (bh-T) life zone predominates according to the Holdridge classification system. This area is located from sea level to 1.000 m altitude and is characterized by temperatures between 24 and 35 °C and rainfall between 2.000 and 4.000 mm. (Holdridge, 1978).

Below is a general description of the ecosystems present in the region:

Savannah

It is an ecosystem created through anthropic transformation due to the deforestation of the Orinoquía jungle, which is mainly due to the slashing, slashing and burning process for the establishment of pastures for livestock and crop areas. These practices result in eroded and impoverished soils which, after being abandoned, are colonized by fast-growing pioneer species such as the balso, a tree with extraordinarily light wood, and the yarumo. Deforestation occurs on two fronts: that which descends from the mountains and that which ascends from the plain; Among these are the last remnants of humid forest. There are many places where this type of forest has completely disappeared, thus breaking the connectivity between the Andean jungle, the foothill jungle and the riverside forest that goes deep into the sheets.

Periodic fires, loss of soil nutrients and intensive grazing keep the landscape transformed for a long time. The elimination of this habitat is undoubtedly one of the main threats to the primates of the piedemonte llanero, such as **the titi, the choyo monkey and the marimondas**, which are among the most endangered in the entire region.

Flood Planins

These plains, subject to flooding for approximately seven to eight months a year, have a rainy period between March and November and a short summer from December to February; To the east, its limit is defined by a geological fault that develops in a southwest-northeast direction. The Meta River follows the course of this fault and undermines the walls of the eastern block and the plateau, which is almost 40 to 50 m higher. In the flood plain, the ecological processes, soils, flora, fauna and land use are determined by the behavior of floods and make up groups that involve several ecosystems, which is why they are considered macrosystems, in which There are permanent, temporary aquatic environments and dry land savanna, but the largest area corresponds to temporary aquatic environments.

Within this landscape of savannah covers, there are humid or hyperseasonal sheets, aeolian or semiseasonal sheets, zurals, estuaries, morichales and flooded forests.

Within the existing coverage for the jurisdiction of Corporinoquia, there are almost all types of coverage and land use, due to the extension of the region and the wide range of heights ranging from 0 meters above sea level in the municipalities of Orocué, San Luis de Palenque and Maní in Casanare and Arauca, Puerto Rondón, and Arauquita in Arauca, among others and up to 3500 meters above sea level in the municipalities

of Sácama and La Salina in the north-west of the department of Casanare and Labranzagrande, Paya and Pisba in the moor in the department of Boyacá.

Zurales

They form in depressions with very gentle slopes, remain flooded most of the year for up to nine months and have dark-colored soils, rich in organic matter. From the air, a reticulated pattern can be seen, made up of mounds of different sizes called zuros; The lowest ones, 30 to 50 cm, are found on the edge of the zural and termite mounds grow on them; Those of greater height, one to two meters and more widely spaced, develop towards the interior of the zural.

Some zurales reach surfaces of 5 km^2 and densities of 900 to 1000 mounds per hectare; Each mound has its own humidity gradient that determines the colonization of different species, among which grasses predominate, although rare families such as Eriocauláceas and Burmaniaceas and common ones such as Cyperaceae, Melastomataceae and legumes grow; occasionally on top of a mound crowned by termite mounds, which remains dry longer, some bushes develop. The water that circulates between the zurales is transparent, poor in nutrients and its drainage system forms a closed microbasin, which is sometimes interconnected with estuaries and morichales. (Banco de Occidente, 2005[17]).

Morichales

Some rivers and canals in the floodplain have, along their course, narrow strips of riverside forests dominated by the moriche palm (Mauritia flexuosa), which has fan-shaped leaves and grows associated with timber trees of the family of the Anonaceae, such as the plank and with myristicaceae, such as the palo sangre. These forests, where there is also an abundance of shrubby melastomataceae and other palms such as the one known as milpesos, a very promising oil species, are important for the maintenance of a varied fauna, in which large wild mammals such as peccaries and tapirs stand out[18].

[17] La Orinoquia de Colombia. https://www.imeditores.com/banocc/orinoquia/creditos.htm
[18] Banco de Occidente, Op Cit.

Image 3. Morichales ecosystem, the high presence of palms from flood-prone areas stands out

The ground water table determines the structure and composition of floodplain gallery forests; Compared to those of the high plains, they are less diverse and structured and their herbaceous and shrubby strata are poorer and with few species tolerant to flooding. The soil, from which the dense tangle of fine roots and pneumatophores of palms and trees emerge, structures specialized in gas exchange, is almost bare, muddy and with little leaf litter; Towards the outer edges there is a narrow strip of dense forest of low height, 10 to 15 m, which abruptly cuts the open vegetation of the savanna.

The moriche palm is perhaps the most widely distributed and possibly the most abundant in the Amazon and Orinoco basins; Its optimal habitat is in flooded lands or with very poor drainage, below 900 m altitude. The indigenous people call it “the tree of life” because its uses are very numerous: the orange pulp of the fruits is highly nutritious due to its high protein and oil content; Excellent quality fiber is extracted from the young leaves and the adult leaves are used as roofs for homes; Mojojoyes, cockroach larvae, are raised in the fallen trunks and are used as a complement to the protein diet; dead logs serve as nesting sites for very valuable birds such as macaws and parrots; During high waters, the fruits are dispersed by water currents and are part of the diet of large fish that feed on seeds and fruits such as the yamú or bocón[19].

Flood Forest

Some of the last relicts of the flood forests are found in the flood plains of the Meta, Cusiana, Pauto and Casanare rivers, on a landscape enriched by alluvial sediments of Andean origin, deposited during the last floods.

[19] Banco de Occidente, Op Cit.

Image 4. General appearance of the flooded forest

A determining factor in flooded forests is the duration of the flood; In the highest places, called benches or high meadows, the waters drain quickly and in a few days the land is fertilized with fertile silt; There the jungle presents a complex and diverse structure, with large trees such as the caimitos, the chivechas or rubbers, the ceibas, the jobos, the maracos with their clusters of enormous fruits on the stem and the mortecinos, Lecitidaceae that produce pestilent flowers. The abundance of palms such as the royal, the milpesos, the moriche and many others.

In the lowlands, lows or shoals; The water remains for seven to nine months, most of the rainy season. The most common species in the lowlands are the swamp búcaro and the totumo[20].

Wetland areas

For the eligible areas of the Proyecto Forestal El Dorado, the information is superimposed with the zoned areas of permanent wetlands for Colombia, prepared by the Ministerio del Medio Ambiente y Desarrollo Sostenible[21]. As a result of the aforementioned step, it is evident that in the wetland areas, there is no establishment of forest plantations for commercial purposes, it can be stated that almost all the areas delimited as wetlands are outside the eligible areas of the project. The minimum overlaps occur due to the difference in survey scales of the wetland layer (scale

[20] Banco de Occidente, Op Cit.
[21]Humedales, 4 septiembre 2020, actualizado el 15 de marzo de 2021, MADS. https://www.arcgis.com/home/item.html?id=a499da66b2814db48888343283b57cdb,

1:100,000, and information obtained from primary data type Raster vs. Project information scale 1:10,000 and primary data obtained from the field with GPS of property limits)

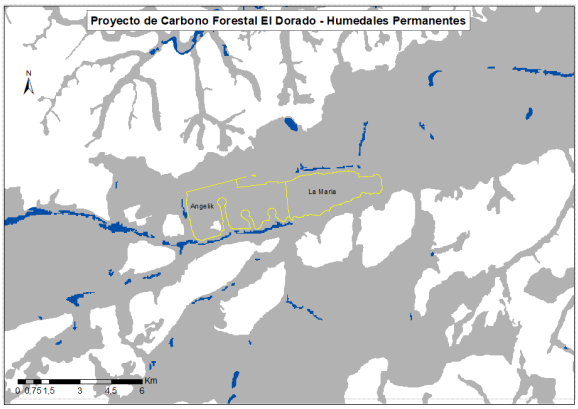

Figure 9. Eligible areas and areas determined as permanent wetlands in the project region

Land Use and Land Cover

In the department of Vichada it is possible to differentiate five types of vegetation: savannah covers, gallery forests, transitional jungle, planted forests and flora associated with wetlands and bodies of water. The vegetation cover represents 42% of the total area of the department, with forests being the predominant land use coverage, concentrated mainly in the south of the department, in an almost continuous region of tropical forest. In a lower percentage are the gallery forests located in the north of the department and the pastures covering 39% of the departmental total. (see Table 13)

Table 13. Land Use and Land coverage identified for the Department of Vichada, identified from satellite images (clouds correspond to unidentified areas). Source: CORPORINOQUÍA, 2013. Plan de Gestión Regional Ambiental 2013-2025

Land Use and Land Coverage	Area (ha)	Percentage (%)
Forest	4,249,583.35	42.55
Water	48,744.35	0.49
Crops	995,830.06	9.97
Clouds	138,864.67	1.39
Grasslands	3,935,092.05	39.4
Rastrojos	283,819.08	2.84
Rivers	142,934.28	1.43
Shadows	51,574.25	0.52
wastelands	140,495.17	1.41
Urban	1,192.95	0.01

Total	**9,988,130.22**	**100**

Land Use

In the municipality of La Primavera, land uses vary between urban and rural areas. In the urban area, the predominant uses are for industry and commerce. For the rural area, the gallery forests and the flood zone are used in the summer to plant temporary crops of corn, banana and cotton. They are also used to support livestock farming and small dairy industries. Approximately 90% of the rural lands of the Municipality are used for large livestock (cattle and horses) and small livestock (sheep and pigs), most of the economy depends on activities related to livestock, and only approximately 2% , is used in pancoger agriculture. Generally, these crops are located in small plots called conucos on the banks of the canals and small areas of forest are cut down for these crops. Another 2% is used to improve pastures on larger livestock farms with artificial grass crops such as *Brachiaria humidícola* and Llanero grass and, finally, 6% is used for logging in areas such as Santa Cecilia, Marandúa y Urillano (Esquema de Ordenamiento Territorial, EOT 2000).

Controlled burning is common to promote the renewal of pastures, which improves their adaptation for livestock grazing. During the summer, the pastures are very dry and due to their texture, the cattle cannot digest it easily. Therefore, the popular practice is to burn it once or twice a year to obtain the regrowth of the grasses so that it can be better assimilated by the livestock. On the other hand, during intense summers, natural fires are common, generated by high temperatures or by the transport of ashes resulting from burning to regenerate pastures, in nearby places. Fires, both those carried out for the regeneration of pastures and natural fires, cause degradation in the soil, since they cause loss of minerals and a decrease in porosity, generating larger flooding areas in winter and less natural recovery capacity of native flora. On the other hand, gallery forests are affected by common fires since on some occasions they are impacted by flames and lose their density.

Fauna and Flora

Colombia, with more than 24500 species of vascular plants, ranks second, after Brazil, in the ranking of countries with the greatest plant diversity on the planet. (Espinosa *et al.*

2008[22], Bernal *et al.* 2016[23]). New taxa for science and new records of species from poorly inventoried areas are frequently documented in the country, such as the Orinoquia region.

For the Colombian Orinoco River basin, more than 26000 systematized records of plants are known in the main herbaria of the country, representing around 4,900 species (Cárdenas et al. 2017 in prep.). In general, studies to understand the biological diversity of this basin have been directed 60% at estimating the composition and 40% at determining the way in which these biological components are organized (structure) (Correa et al. 2005). Within these estimated percentages, the contribution of the Vichada department has been low, which is why it occupies third place in the entire basin, in relation to studies carried out on both flora and fauna. However, due to its richness in different species and ecosystems, the Orinoquia is one of the most biologically diverse regions in the world. (Lasso *et al.* 2010[24]).

This is how the Andén Orinoqués, in the department of Vichada, which represents one of the most complex landscapes of the Orinoquia due to the great variety of ecosystems and the presence of unique species, is a unique remnant of biodiversity, however, the flora present in this landscape has been little studied (Castro-Lima, 2010[25]).

In the northern part of the Orinoqués Anden, the presence of flat savannahs with some sporadic outcrops of the Guayanés Shield stands out; while in the southern area, Amazonian-type jungles predominate with sporadic or continuous outcrops locally called Tepuyes, these correspond to ancient rock formations dating from the Precambrian, their age ranges between 500-1600 million years. (Etter 2001[26]).

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[22] Espinosa, D. y S. Ocegueda C. (Eds.) 2008. El conocimiento biogeográfico de las especies y su regionalización natural, en Capital natural de México, Pp. 33-65, vol. I: Conocimiento actual de la biodiversidad. Conabio, México,

23 Bernal. R., S. Gradstein y M. Celis. 2016. Catálogo de Plantas y Líquenes de Colombia Volumen I. Primera edición. Bogotá. D.C. Universidad Nacional de Colombia (Sede Bogotá). Facultad de Ciencias. Instituto de Ciencias Naturales. Volúmenes I y II. 1500 p.

24 Lasso, C. A., J. S. Usma, F. Trujillo y A. Rial (Eds.). 2010. Biodiversidad de la cuenca del Orinoco: Bases científicas para la identificación de áreas prioritarias para la conservación y uso sostenible de la biodiversidad. Instituto de Investigación de Recursos Biológicos A. von Humboldt, WWF-Colombia, Fundación Omacha, Fundación La Salle e Instituto de Estudios de la Orinoquia (Universidad Nacional de Colombia). Bogotá, D.C., Colombia, 609 p.

[25] Castro-Lima, F. 2010. Avance del conocimiento de la flora del Andén Orinoqués en el departamento del Vichada, Colombia. Revista ORINOQUIA - Universidad de los Llanos - Villavicencio, Meta. Colombia. Volumen 14 - Sup (1): 58 – 67 p.

[26] Etter A. El Escudo de Guayana, en A. Etter (ed.) Puinawai y Nukak. Caracterización Ecológica General de dos Reservas Nacionales Naturales de la Amazonía Colombiana. Serie Investigación 2. Instituto de Estudios Ambientales para el Desarrollo – IDEADE. Bogotá. 2001pp. 31-42.

This landscape presents high floristic diversity due to the presence of numerous ecosystems such as: Los Tepuyes with three unique plant formations, the forests at the base of Tepuy, forests at the top of Tepuy and chasmophyte vegetation; Low and high savannas, gallery forests, morichales, mountain forests, saladilsales and floodplain forests of the Orinoco River. The rocky outcrops are scattered throughout the area, bordering the Orinoco River. From north to south are Cerro Banderas and Cerro el Bita in Puerto Carreño; in the Bojonawi reserve, the lagoon stone, Caricare, Morrocoy hill and Campana; in the Guacamaya reservation, the Canavallo, Guacamaya and El Tigre hills. In the Ventanas reserve, the Ventanas hills follow the hills of Guáripa, Dagua, Casuarito, Mesetas, Tuparro, Santa Rita and Mataven. (Castro-Lima, 2010).

In research carried out by Castro-Lima (2010), in the Andén Orinoqués, in a floristic inventory, 1010 species were identified, belonging to 123 families and 473 genera. Passiflora sclerophylla Harms and Combretum cf. llewelynii Macbr, can be considered as new records for Colombia and the genus Cavanillesia is a new record for the Orinoquia. In Figure 10, families with more than 10 species are recorded; The Fabaceae family has the highest number of species 147, followed by Rubiaceae with 64 and Myrtaceae 40 species.

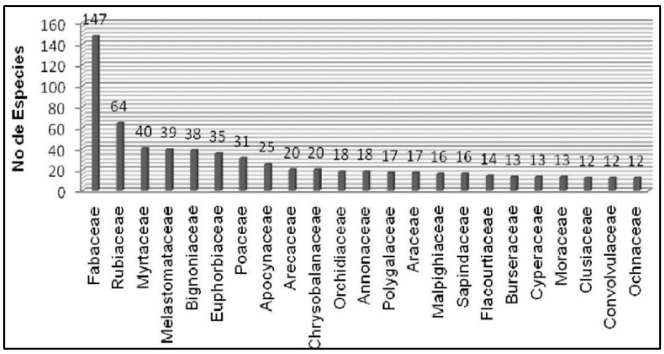

Figure 10. Registry of families with more than 10 species reported in the Orinoqués Anden

Once the floristic inventories have been carried out in the different ecosystems of the Orinoqués Anden, it is observed that some species can occupy one or more ecosystems, such is the case of *Copaifera pubiflora*, which is present in the floodplain forests of the Orinoco and in the forests of the top of the Tepuyes; *Calophyllum brasiliense* is found in riverside forests and mixed morichales; *Attalea maripa* and *Syagrus inajai* are found only in the forests associated with rocky outcrops, while the presence of *Cavanillesia sp* is exclusive in the forests at the base of the Tepuy. The most common species is *Tapirira guianensis*, as it is found in the sheets, gallery forests and bushes, even on the edges of the morichales. In Figure 11, the highest number of species grow in well-drained areas

(460), followed by semi-aquatic areas with 409 species, as these environments occupy the largest area of the landscape. (Castro-Lima, 2010).

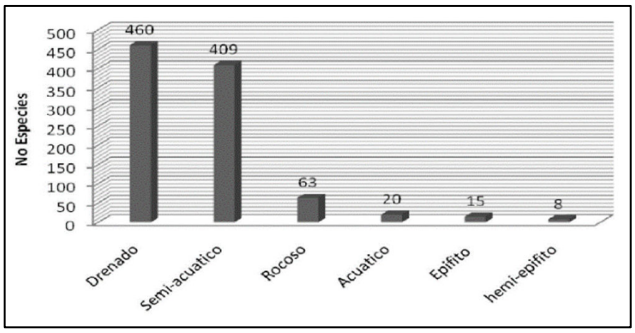

Figure 11. Number of flora species by growth environment in the Anden Orinoqués in Vichada, Colombia

Of the flora species found, 845 are of importance for the diet of wildlife, such as birds, mammals, fish and reptiles (Figure 12).

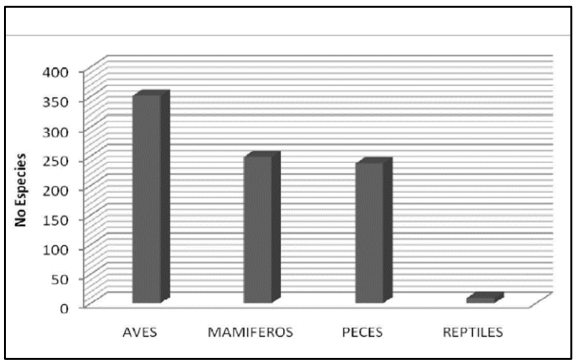

Figure 12. Flora species associated with fauna feeding in the Orinoqués Andén

Likewise, a study carried out by Mosquera *et al*., 2017[27] in the Bita River stands out, where the floristic inventory recorded a possible new species of the genus Perama (Rubiaceae) and four new records for the country: *Genlisea sanariapoana*

[27] Mosquera, H. R., M. F. González, H. Mendoza, O. Díaz-Vasco y C. Gutiérrez. 2017. Flora. Pp. 47-87. En: Trujillo, F. y C. A. Lasso (Eds.). IV. Biodiversidad del río Bita, Vichada, Colombia. Serie Editorial Fauna Silvestre Neotropical. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH). Bogotá, D.C., Colombia.

(Lentibulariaceae), *Polygala microspora* (Polygalaceae) y *Borreria pygmaea* (Rubiaceae) (Table 14).

Table 14. Taxonomic and chorological news reported during the study in the Bita River

Taxón	Colección de referencia	Importancia
Perama sp.	MFG 3192, MFG 3202, MFG 3211	Posiblemente es una nueva especie, se revisaron todas las especies de *Perama* del neotrópico y no coincide con ninguna.
Genlisea sanariapoana	MFG 2997	Nuevo registro para el país, solo había sido reportada en Venezuela. Nuevo registro para el país. Podría ser una nueva especie, aún no
Sauvagesia sp.	MFG 3210	se han revisado todas las especies de *Sauvagesia* del neotrópico. Nuevo registro para el país, solo había sido reportada en Venezuela.
Polygala microspora	MFG 3209	Nuevo registro para el país, solo había sido reportada en Venezuela.
Borreria pygmaea	MFG 3212	

It is important to mention that 23 new records were found for the flora of Vichada, which are not included in the list of species in the Colombian Plant Catalog, among which the species *Drosera biflora* (Droseraceae), a carnivorous herb that has been reported for the Amazon, Guayana, the Macarena mountain range and the Magdalena Valley, in an altitudinal range of 50 to 640 m; a small fern of the genus Ophioglossum (Ophioglossaceae), of which three species have been reported for the country with distribution in the Andes, Guayana, Sierra la Macarena, Pacific and Sierra Nevada de Santa Marta; and *Brachystele guayanensis* (Orchidaceae), one of the two species of the genus reported in Colombia (Bernal *et al.* 2016).

Also noteworthy is the study carried out by Mijares, et al., 2017[28] where 18 taxa were determined, which constitute new records for the vascular flora of Colombia. The specimens are deposited in the Orinocense Herbarium (HORI) at the National University of Colombia (Orinoquia Headquarters), the National Herbarium of Colombia (COL) and the ICESI Herbarium in Cali (Image 5). The 18 species recorded in this contribution constitute new records for the vascular flora of Colombia, highlighting: *Nectandra bartlettiana Lasser* (Lauraceae), *Muellera crucisrubierae* (Pittier) M. Sousa, *Enterolobium barinense* L. Cárdenas & Rodr.- Carr. (Fabaceae), *Duguetia riberensis* Aristeg. Ex Maas & Boon (Annonaceae), *Dulacia cyanocarpa* Sleumer (Olacaceae) and

[28] Mijares, F.; Aymard G. & Pérez-Buitrago, N. 2017. Nuevos registros para la flora vascular de Colombia presentes en la Orinoquia y reseña histórica de las expediciones botánicas a la región. Biota Colombiana 18 (2) – 2017. 72 – 87 p.

Gouania wurdackii Steyerm., taxa that were considered endemic to the flora of Venezuela

Regarding the fauna of the Orinoquía, it is represented in literature and tradition by the animals that have been most evident to the human eye or ear, or those that most frequently appear in the stories, legends and fears of the people or those that are the most frequent target of hunting for consumption. The best known and most easily observed in the Eastern Plains include the sabanero deer (*Odocoileus virginianus*), the chigüiro (*Hydróchaeris hydrochaeris*), and the red corocora (*Eudocimus ruber*).

The Orinoco fauna also includes one of the animals with the most powerful vocalization in the animal kingdom, such as the araguato or big-necked monkey (*Alouatta seniculus*), which can be heard several kilometers away, or the various species of macaws (Am spp.), whose flocks break the silence of the morning when they go to their usual feeding places or at dusk when they return to their roosts. It also includes several animals that are considered dangerous to humans, such as the panther (*Panthera onca*), the black güío or anaconda (*Eunectes murinus*), the Orinoco caiman (*Crocodylus intermedius*) and the caiman cuatronarices (*Bothrops atrox*).

This is the natural region that contains a higher percentage of the national birdlife; Among the best-known groups are the waders or ciconiiformes, whose order includes all the herons, egrets or greatcoats and within which are the largest birds in the country; Other members of this order are the corocoras, which stand out for their beautiful colors, as well as for their massive movements from their feeding areas to their roosts or herons. Another group of great showiness and relevance is that of ducks or anseriformes, particularly the pisingos (*genus Dendocygna*), which present massive local migrations from the plains to the foothills, which add to the transcontinental migrations. (Defler & Ródriguez[29]).

[29] DEFLER, T. & RODRÍGUEZ, J.V. S.F. LA FAUNA DE LA ORINOQUIA. Fundación Natura y Conservación Internacional de Colombia.

Image 5. Photographs of the new records for the vascular flora of Colombia, collected in Orinoquía, department of Arauca. ***A)*** *D. riberensis,* ***B)*** *T. duckei,* ***C)*** *T. medinae,* ***D)*** *M. burchellii,* ***E)*** *Murdannia aff. M. triquetra,* ***F)*** *M. tovarense,* ***G)*** *M. crucisrubierae,* ***H)*** *E. barinense,* ***I)*** *C. aromatica,* ***J)*** *P. corymbosa var. brasiliensis* ***K)*** *C. africana,* ***L)*** *P. microphyllus,* ***M)*** *D. cyanocarpa* ***N)*** *N. bartlettiana,* ***O)*** *J. orinocensis. Photographs m y o F. Castro-Lima.*

However, there are hundreds of other lesser-known animal species that make up. This rich fauna. Although the species for which there is more information in the country are found in the Eastern Plains, the fauna of Orinoco as a whole has been little studied and its diversity is much higher as we approach the jungle area south of sheets. The extremes in topographic variability and abundance of vegetation generate diverse horizontal levels of species richness, thus diversity is lowest in the plains, but increases as one moves towards the southwest. Additionally, the multiplicity of some groups of vertebrates increases from the level of the savannahs towards the foothills and decreases from the foothills towards the heights of the páramos.

In the Orinoco macro-basin, 318 species have been recorded, of which 196 are associated with the terrestrial and aquatic ecosystems of the ecoregion of the Colombian Eastern Plains, reporting 12 orders, 127 genera and 35 families, the most diverse orders being Chiroptera (105 species), Rodentia (29 species) and Carnivora (17 species) (Pardo-Martínez y Rangel-Ch. 2014, Solari et al. 2013, Trujillo et al. 2010, Ferrer et al. 2009a). The Orinoco mastofauna is made up of Andean, Amazonian and Escudo Guyanese elements. (Correa et al. 2006); en ella se encuentran las mayores concentraciones poblacionales de este grupo faunístico en el país (Rodríguez-Mahecha et al. 2006a), pero es la región que presenta la menor diversidad específica de mamíferos en el país (Ferrer *et al*. 2009) y un nivel de endemismo bastante bajo (Rodríguez-Mahecha et al. 2006a).

In the department of Vichada, few investigations have been carried out regarding the structure, composition and diversity of the mastofauna; the studies have been concentrated mainly in the El Tuparro National Natural Park (Defler 1982, Defler 1986, Gómez-Camelo et al. 2009, Patiño et al. 2005, Trujillo et al. 2008), near the municipality of Puerto Carreño (Botello-Castillo 2001, Gómez-Camelo 2004, Parra 2006, Velasco-Gómez 2004 and Trujillo and Mosquera 2016) and in the Orinoco basin (Bermúdez-Romero et al. 2004, Carrasquilla 2002, Carrasquilla and Trujillo 2004, Castelblanco et al. 2009, Muñoz-Saba et al. 20015, Trujillo et al. et al. 2017). Some image records of mammals from the region are presented. See Image 6

In the Orinoquia region, a total of 783 of the 1,889 bird species reported for Colombia (Donegan et al. 2011) have been recorded, representing about 40% of the total number of species in the country. It is estimated that about half of the birds reported for the Orinoquia are found in the department of Vichada (Figure 17). According to Acevedo-Charry et al. (2014), 368 species have some kind of record in this department, while the Colombian Biodiversity Information System (SIB Colombia 2015) includes records of specimens of 350 bird species for Vichada represented in the country's biological collections, most of which come from the Matavén forest and the Tuparro National Natural Park. For the Bita River, there is a document that lists 155 bird species present

in the basin (Corporinoquia 2015). However, it is believed that there are many more records, but there are gaps in knowledge about biodiversity (Arbeláez-Cortés 2013), for example for Vichada, a situation that occurs in other departments of the Orinoquia.

Image 6. Images obtained on the day with camera traps: a) Cebus albifrons, b) Hydrochoerus hydrochaeris, c) Leopardus pardalis, d) Puma concolor, e) Puma yaguaroundi, f) Myrmecophaga tridactyla. Source: Taken from the reports and studies mentioned.

Image 7. Photographic record of birdlife in the Region. Source: Taken from the referenced studies.

Knowledge about the biological diversity of the Bajo Orinoco geographic region is limited (Rosales et al. 2010), and for the department of Vichada the figure for amphibian and reptile diversity is still far from being known. In the national context, of the 806 species of amphibians reported, only 29 are registered for Vichada (Acosta-Galvis 2017) and 25 of these are associated with the Bajo Orinoco corridor, thus positioning the fauna of this department as one of the most unknown. from the country. Reptile records are still uncertain and according to published studies, a total of 72 species are recognized for this corridor (Acosta-Galvis et al. 2010). Below are some photographic records of amphibians and reptiles of the Region. See Image 8.

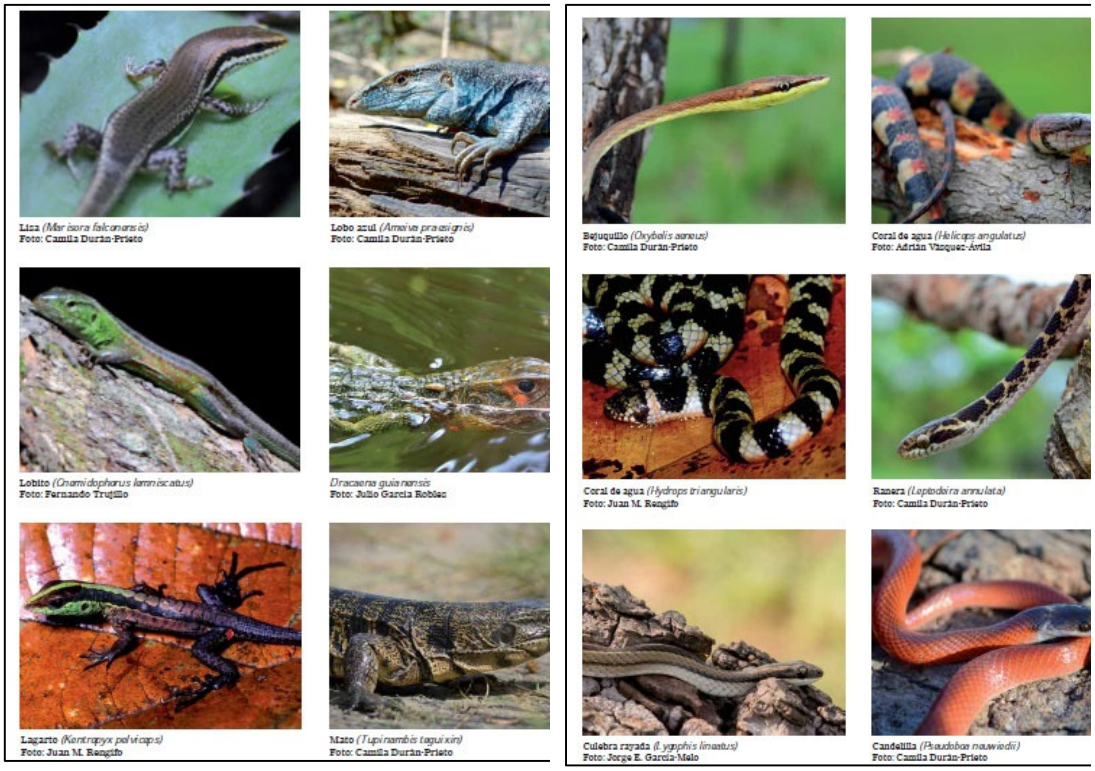

Image 8. Photographic record of some species of amphibians and reptiles of the Orinoquia Region

In Colombia, the Orinoco River basin concentrates 57.6% (995 spp.) of the national ichthyological wealth (Maldonado-Ocampo et al. 2008; Álvarez-León et al. 2013), which places it as the first with greatest fish diversity in the country (Image 9). The fish diversity of the Orinoquia has been studied in the sub-basins of the Meta rivers (Eigenmann 1914, 1919, 1921, 1922, Myers 1930, Cala 1977, Galvis et al. 1989, Sánchez et al. 1999, 2003, Usma et al. 2016), Tuparro (Maldonado-Ocampo and Gregory 2007), Tomo (Maldonado-Ocampo et al. 2006) and Ariporo (Villa et al. 2015); at the confluences of the Guaviare, Inírida, Atabapo and Orinoco rivers (Lasso et al. 2009); in the foothills of the Casanare department (Urbano-Bonilla et al. 2009), in the Casanare rivers (Villa et al. 2011, Maldonado-Ocampo et al. 2013), in the Casanare basin in Arauca, in the Lipa rivers , Tame and Tocoragua (Mesa et al. 2015); and for the entire basin (Lasso et al. 2004, Galvis et al. 2007).

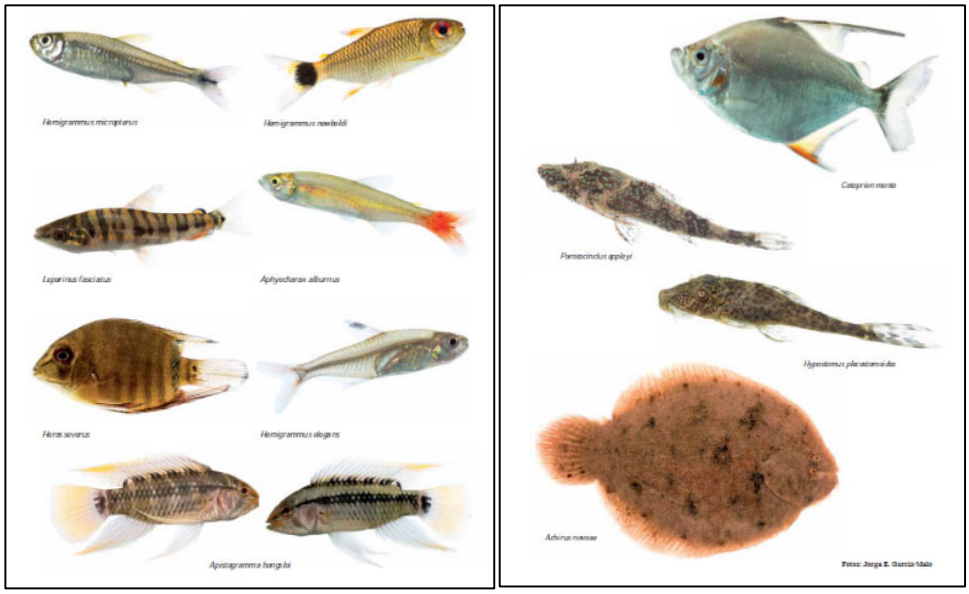

Image 9. Photographic record of some species of fish in the Region

Endangered Species

The chigüiro (*Hydrochaeris hydrochaeris*) is an important rodent in the area and is threatened because of the indiscriminate hunting to which it is subjected due to the high demand for its meat and skin. The freshwater dolphin (*Inia geoffrensis*), the Antillean manatee (*Trichechus manatus manatus*) and the giant otter (*Pteronura brasiliensis*) are aquatic mammals that are equally threatened. Among mammals, pressures on their habitat represent the most important threat to species such as the leopard (Leopardus pardalis) and the Cebus apella. The plains caiman (*Caiman intermedius*) is one of the most studied crocodiles in the basin, since it is an emblematic species of the area, of commercial importance, endemic and in a critical state of conservation. The morrocoy and charapa turtles (*Geochelone denticulata and Podocnemis expansa*) are also in danger of extinction; Of these species, local inhabitants consume the eggs and meat or are hunted very small for export as aquarium pets. (Gobernación de Vichada 2008, CORPORINOQUIA 2004).

Table 15, shows the list of species reported as threatened in the Eastern Plains Region and the Transitions of the Colombian Amazon. Image 10, shows some of the emblematic species of the Colombian plain that are under some degree of threat. The listings and monitoring are supported by research carried out by some

entities such as the Omacha Foundation,[30] which issues periodic reports on the status of species and activities for their conservation. The aforementioned data are those used by the project to guide actions that improve their habitat in the project area. Many of these species depend on the high plains, specifically in the areas of the Orinoquia savanna, for their survival, an area where the Forest Project will be developed. But it is crucial to conserve the gallery forests, increase their areas and have means of connectivity between forest relics (such as forest plantations) for the movement of fauna between the forests, which will be preserved, improved and protected with the implementation of the project. This will conserve habitats and allow gene flow between populations.

[30] https://omacha.org/

 *Leopardus pardalis* https://omacha.org/especies-amenazadas-felinos/	 *Cebus apella* Mico Maicero Foto: Cristian Castro Morales
 *Hydrochoerus hydrochaeris* https://colombia.inaturalist.org/photos/34844190	 *Caiman intermedius* (Caiman llanero) https://sostenibilidad.semana.com/medio-ambiente/
 *Chelonoidis carbonarius* Morrocoy Sabanero (c)ivanlau https://colombia.inaturalist.org/taxa/539039-Chelonoidis-carbonarius	 *Inia geoffrensis* https://omacha.org/

Image 10. Some endangered animal species in the Orinoco region.

Table 15. Threatened fauna species in the Orinoquia region. EN: endemic, VU: vulnerable, NT: near threatened, LR: low risk, DD: insufficient data.

Scientific Name	Common Name	Category
Fishes		
Osteoglossum ferreirai	Arauana Azul, Arawana	*EN*
Colossoma macropomum	Cachama Negra, Cherna, Gamitana	*NT*
Brachyplatystoma juruense	Apuy, Manta Negra, Camisa Rayada	*VU*
Brachyplatystoma filamentosum	Valentón, Plumita, Lechero, Pirahiba	*EN*
Brachyplatystoma flavicans	Dorado, Plateado	*EN*
Brachyplatystoma vaillantii	Blancopobre, Pirabutón, Capaz	*EN*
Goslinea platynema	Baboso, Saliboro, Garbanzo	*EN*
Paulicea luetkeni	Saliboro, Bagre Sapo, Peje Negro	*EN*
Pseudoplatystoma tigrinum	Pintadillo Tigre, Bagre, Caparará	*EN*
Primates		
Aotus brumbacki		*VU*
Aotus vociferans		*LR*
Ateles belzebuth		*VU*
Callicebus torquatus		*LR*
Cebus apella		*LR*
Saimiri sciureus		*LR*
Cacajao melanocephalus		*VU*
Mammals		
Leopardus pardalis	Leopardo	
Cerdocyon thous	Zorra	
Hydrochaeris hydrochaeris ithsmius	Chigüiro	
Myrmecophaga tridactyla	Oso hormiguero, oso palmero	*VU*
Reptiles		
Crocodylus intermedius	Caimán del Orinoco, llanero	
Podocnemis expansa	Tortuga charapa	
Geochelone denticulata	Tortuga morrocoy	
Birds		
Neochen jubata	Pato Carretero	*NT*
Falco deiroleucus	Halcón colorado	*DD*
Pauxi pauxi	Paujil Copete de Piedra	*VU*
Polystictus pectoralis	*Tachurí Barbado*	*NT*

Source: Mojica (2002), Renjifo (2002), Corporinoquía (2004)[31]

[31] RENGIFO, L. M., A. M. FRANCO-MAYA, J. D. AMAYA-ESPINEL, G. H. KATTAN Y B. LÓPEZ-LANÚS (eds.). 2002. Libro rojo de aves de Colombia. Serie Libros Rojos de Especies Amenazadas de Colombia. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt y Ministerio del Medio Ambiente. Bogotá, Colombia.

8.6 Environmental Benefits

The project obtained the permits established by the regional environmental authority Corporinoquia (CORPORINOQUIA is an environmental services government agency in the Colombian Orinoquia region).

It has file Number 800.33.1.10.0019 from the Corporation related to a forestry project. Environmental management plans have been implemented and applications for environmental permits have been developed. (See Annex_8_Environmental Commitments).

Environmental management plans have been implemented and applications for environmental permits have been made.

Awareness-raising actions have also been carried out for the protection of wildlife inside and outside the projects. Among these are the signage and messages alluding to the protection of the environment, in addition to the good management of waste within the project.

Image 11. Signs referring to wildlife conservation.

Mojica, J. I., C. Castellanos, J. S. Usma y R. Álvarez (eds.). 2002. Libro rojo de peces dulceacuícolas de Colombia. Serie Libros Rojos de Especies Amenazadas de Colombia. Instituto de Ciencias Naturales - Universidad Nacional de Colombia y Ministerio del Medio Ambiente. Bogotá, Colombia.
Corporación Autónoma Regional de la Orinoquía (CORPORINOQUIA). 2004. Plan de Acción 2004-2006. Yopal, Colombia.

It is important to mention that the project has been developed on land dedicated to livestock farming. These soils have historically been affected by annual burns, resulting in the degradation of the physical and chemical properties of the soil.

Likewise, burning has led to the destruction of habitats and fragmentation of ecosystems, isolating fauna and eliminating the possibility of genetic exchange between forest patches. The project has contributed to the connectivity of these forest relicts, the forest cover reduces the loss of water in the soil by evaporation and the roots of the trees promote the rupture of hardened soils, aerating the innermost parts of the soil and allowing the infiltration of water to deeper areas.

The project reduces surface runoff, which leads to soil degradation and loss of fertility by washing away nutrients, and with its cover, generates a regulating effect on soil humidity and provides significant quantities of organic matter necessary for the recovery of fertility.

In this way, the project, by promoting new forests in areas vulnerable to soil degradation, contributes positively to the care and conservation of flora and fauna, reduces burning, and contributes to making the territory more resilient to climate change conditions. The processes of environmental management measures that allow mitigating the potential negative effects and that are applied to the project can be seen in annex_8_compromiosos _ambientales.

9 Socioeconomic Aspects

9.1 Population

Prior to the implementation of the project, it was estimated that the department of Vichada had a total population of 55,872 inhabitants, that is, 0.53 inhabitants per km^2. With a balanced distribution between men and women, where a little more than 40% of the population was distributed in the population under 14 years of age. The working population (adult population) for the region is assumed to be in the range of 15-65 years and covers about 55% (Figure 13).

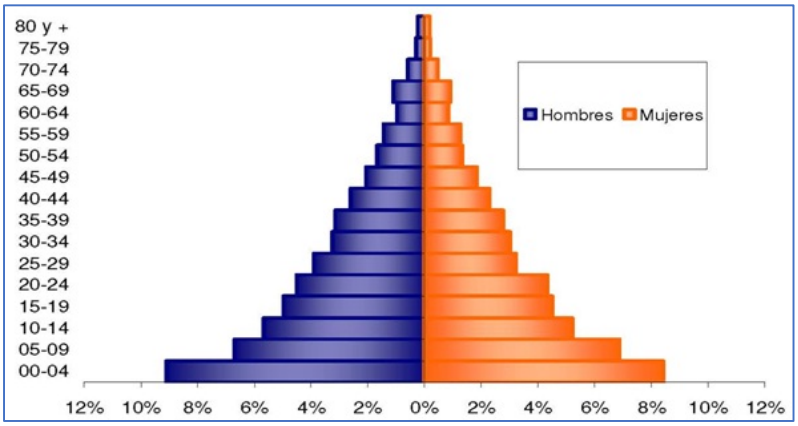

Figure 13. Population distribution years prior to the start of project activities. Source DANE, 2010.
https://www.dane.gov.co/files/censo2005/PERFIL_PDF_CG2005/99000T7T000.PDF

According to the pyramidal shape of the population graph, it is assumed that the population of the department is progressive, that is, where the young population strongly dominates over other groups.

In 2016, the year of the project's implementation, the population was estimated at 73,702 people, that is, an increase of 31% in a period of six years, with an estimated 0.73 people per km2, which is low for the size of the territory.

Population in the Vichada department.

- N°. People in Cabeceras: 30,660
- N°. People in Rural Areas: 43,042
- **Total: 73,702**

Of these inhabitants, the percentage of the working population remains unchanged. This is related to the highest proportion of the young population registered before 2010. However, as seen in Table 16, the young population has decreased, and the adult population has increased. It can be inferred that in the future, the working population will begin to reduce, if the age trend continues, which could imply possible difficulties in finding labor in the territory. However, it should be noted that the majority of the population (58%) is concentrated in the rural area, therefore the contribution to the generation of employment in the rural sector is a contribution of the project to the development of the territory.

Table 16. Age distribution for the department of Vichada, year 2016[32].

Age range	>1 year	1-4	5-14	15-44	45-59	>60
Total number, by age group	2094	8115	18554	31621	8228	5090
(%)	2.84	11.01	25.17	42.90	11.16	6.91

A detailed view of the municipality of La Primavera, where the project activities are located, shows that despite being the second largest municipality in Colombia (larger even than other departments in the country), it only has 21.5% of the population of Vichada, with a total of 15,886 inhabitants (Table 17), of which it is estimated that 16% is indigenous population. The average number of people per square kilometer is 0.74, which is consistent with the departmental average.

Table 17. Populational distribution for the different municipalities of Vichada

People by department										
Municipalities	Distribution by age ranges						Distribution by sex		Total	% on Municipal total
	<1 year	1-4	5-14	15-44	45-59	>60	Men	Women		
Municipality - Puerto Carreño	382	1,580	3,792	7,890	1,650	706	8,420	7,580	16,000	21.71
%	2.39	9.88	23.70	49.31	10.31	4.41	52.63	47.38	100	
Municipality - Santa Rosalía	132	498	1,048	1,664	503	231	2,076	2,000	4,076	5.53
%	3.24	12.22	25.71	40.82	12.34	5.67	50.93	49.07	100	
Municipality - Primavera	411	1,642	3,774	6,715	2,253	1,091	7,979	7,907	15,886	21,55
%	2.59	10.34	23.76	42.27	14.18	6.87	50.23	49.77	100	
Municipality - Cumaribo	1,169	4,395	9,940	15,352	3,822	3,062	18,862	18,878	37,740	51.21
%	3.10	11.65	26.34	40.68	10.13	8.11	49.98	50.02	100	

[32] http://www.vichada.gov.co/indicadores/poblacion-2016

9.2 Population distribution

According to DANE (INCODER, 2012), for the entire department of Vichada there are 31 registered indigenous reservations occupying a total area of 3,557,432.82 hectares, housing a total of 3,947 families.

Human settlements are made up of colonizing population, immigrants from the rest of the country and ethnic groups. According to data from the National Department of Statistics (DANE, 2012) cited in the *Geographiando 2.0* portal, the total projection of the indigenous population for the department of Vichada in 2012 is 27,596 people, concentrated especially in the Municipalities of Santa Rosalía, Carreño and Cumaribo, where the largest extensions of natural tropical forest of Vichada are present in the Orinoquia-Amazon transition. In the municipality of La Primavera, for the years prior to the start of activities, there was a small indigenous population, corresponding to three indigenous reservations (Campo Alegre and Ripialito, La Pascua and La Llanura), the three corresponding to the Guahibo people and covering only 4.7% of the territory of the municipality of La Primavera (Figure 1Figure 14)

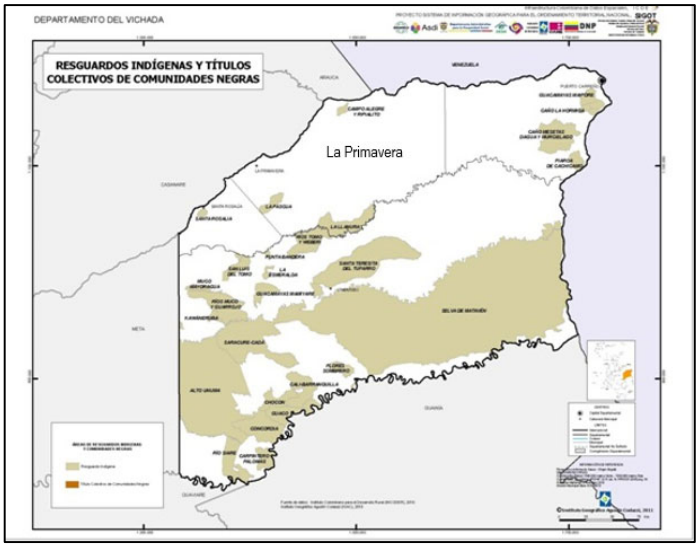

Figure 14. Distribution of the indigenous population in the Department of Vichada. Source: Geographic Information System for Planning and Territorial Ordering – (SIG-OT), 2010)[33].

[33] http://sigotvg.igac.gov.co:8080/

9.3 Society and economic

Livestock is the first link in the economy of the municipality of La Primavera, it is estimated that more than 50% of the department's livestock are in the Municipality. For 2014, a few 125,750 head of cattle was estimated. An extensive activity where it is estimated that only 3% of the properties dedicated to livestock farming have implemented pasture improvement[34]. The main economic activity of the Municipality is livestock farming developed extensively in herds - farms - farms, with low production costs because it is carried out in a traditional way, using native pastures, with little technology and low efficiency.

La Primavera - Vichada, has 90% (21,415.78 km2) of rural land dedicated to livestock, especially breeding and rearing (weaning and growing calves). The livestock carrying capacity is estimated at 0,06 head of livestock per hectare in the municipality, a value that supports being called extensive, and which is significantly below the national average which is estimated at 0,65 large livestock unit per hectare (Viloria, 2003[35]) contributing only 1% of the country's bovine heads. Although livestock activity is the main source of income for the municipality, it requires little labor, since large herds can be managed by very few people under traditional ways of production.

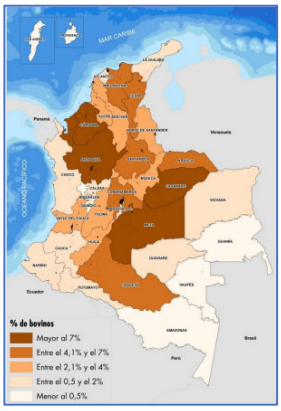

Figure 15. Contribution of bovine heads by department to the national inventory (2014). Source: National Agricultural Census 2014[36].

[34] Plan de desarrollo La Primavera 206-2019. http://laprimaveravichada.micolombiadigital.gov.co/sites/laprimaveravichada/content/files/000110/5457_pddlpv.pdf

[35] Viloria, J. 2003. La ganadería bovina en las llanuras del Caribe colombiano. BANCO DE LA REPUBLICA. https://www.banrep.gov.co/sites/default/files/publicaciones/archivos/DTSER-40.pdf

[36] https://www.dane.gov.co/files/CensoAgropecuario/avanceCNA/PPT_9.pdf

Other sources of income are related to the production of cotton, corn, and bananas, whose production is achieved with traditional systems and little technology, in the plains of the Meta, Orinoco and Guaviare rivers. Agriculture, incipient, is destined only for self-consumption due to the suitability of the soil, limited labor force and high production and transportation costs.

Regarding unsatisfied basic needs (UNB) in the department of Vichada, for the years prior to the implementation of the project activities, they ranged from 66% to 100% for the period 2005-2010[37], slightly improving the UBN conditions. for the other municipalities and maintained high NBI values for La Primavera at the end of the period. Hence, the project proposal is expected to contribute significantly to the generation of employment, the improvement in the living conditions of the population and the economy of the territory. Reference indicators on which the forestry project initiative hopes to contribute.

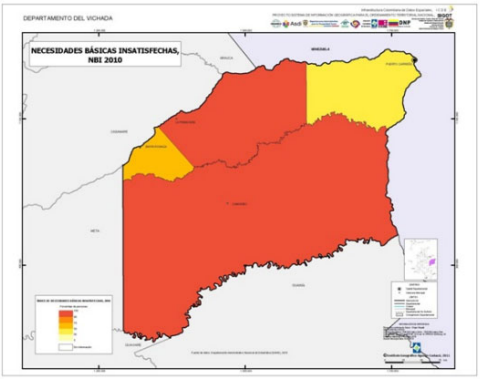

Figure 16. Unsatisfied basic needs department of Vichada year 2010: Source: https://sigot.igac.gov.co/sites/sigot.igac.gov.co/files/sigot/Mapas%20Tematicos/Departamentales/Vichada/Vichada_NBI_2005_V2_2012_01_18.pdf

37 https://sigot.igac.gov.co/sites/sigot.igac.gov.co/files/sigot/Mapas%20Tematicos/Departamentales/Vichada/Vichada_NBI_2005_V2_2012_01_18.pdf
http://www.odc.gov.co/portals/1/regionalizacion/caracterizacion/RE082015-caracterizacion-regional-problematica-asociada-drogas-ilicitas-vichada.pdf

9.4 Index of Living Conditions for Vichada

According to the National Planning Department (DNP) with data from 2005 cited by (Geographic Information System for Planning and Territorial Ordering (SIG-OT), 2010), only Puerto Carreño has a higher Living Conditions Index (LCI). at 70, the rest of the department presents values between 25 and 70. As can be seen, the municipalities, being further from the border with Venezuela and distant from the interior of the country, their quality-of-life conditions are reduced by aspects related to deficiencies in communication routes that improve commerce, sources of employment, income precipitates in the economically active population and state investment. This makes the department and the municipality of La Primavera a territory rich in land, but poor in state investment.

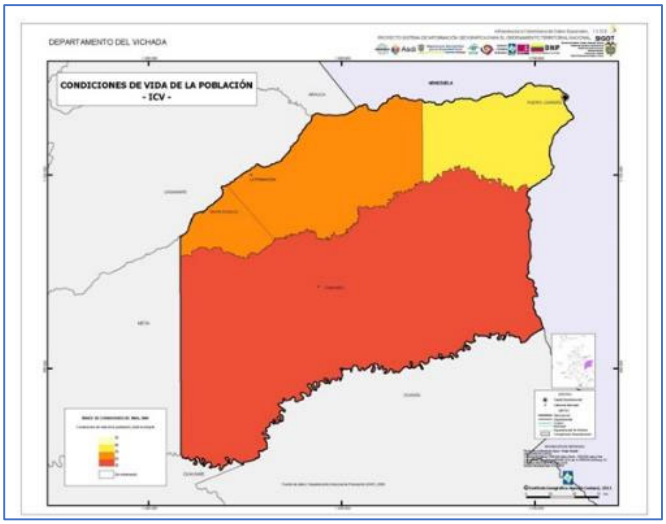

Figure 17. Living conditions of the population of Vichada. In yellow the best conditions and in red and their transitions the worst living conditions. Source: https://sigot.igac.gov.co/sites/sigot.igac.gov.co/files/sigot/Mapas%20Tematicos/Departamentales/Vichada/Vichada_ICV_Total_V2_2012_01_18.pdf

9.5 Social benefits expected

Among the social benefits are the generation of direct and indirect employment, the modernization of the workforce, the development of productive and social infrastructure that can serve other projects, demonstrating at the local level how reforestation activities can contribute to the economy and sustainable development of the region, to the generation of productive alternatives and sources of employment (one hectare of reforestation uses more labor than extensive livestock farming). The future wood

transformation chain associated with the project's forestry production cycle will need trained and qualified personnel, promoting new labor skills in the community.

The project proposal has contributed to the generation of new jobs in the region, which have been provided with the legal employment contracts and benefits that by law must be granted to workers in Colombia, such as health and pension benefits and training for the development of their work. For this monitoring period, approximately 559 jobs have been generated.

Table 18. Number of jobs for the monitoring period 2015-2023

Year	Jobs
2015	84
2016	92
2017	156
2018	123
2019	24
2020	24
2021	24
2022	24
2023	8
Total, general	**559**

9.6 Identification of ethnic communities in the territory

Complementary to the BCR Certification and Registration program, the presence of indigenous and black communities is evaluated. As described in previous sections, the department of Vichada has the presence of indigenous communities. Taking into account the location of the indigenous reservations, the spatial identification analysis of ethnic communities was developed, near or within the areas of intervention of the project. This consultation is certified by the Ministry of the Interior.

Step 1. National territorial information sources related to land ownership are consulted. For the above, ethnic communities recognized by the Ministry of the Interior and to which collective titles have been granted by national resolution are considered. This information is cross-referenced with the spatial information on the properties that will be linked to the project proposal.

As a result of this process, it was found that the department of Vichada only has three recognized indigenous reservations that have territories in the department. These are: La Llanura, Campo Alegre and Ripialito, and La Pascua. The latter is perhaps the closest

to the project areas, located at a distance of close to 6.5 km. This demonstrates that there is no presence of communities in the project areas. (Figure 18).

Paso 2. The Ministry of the Interior, through certification 0890 of December 16, 2019, determines that there is NO presence of black or indigenous communities in the area of direct influence of the project. (ver **Anexo 14**.)

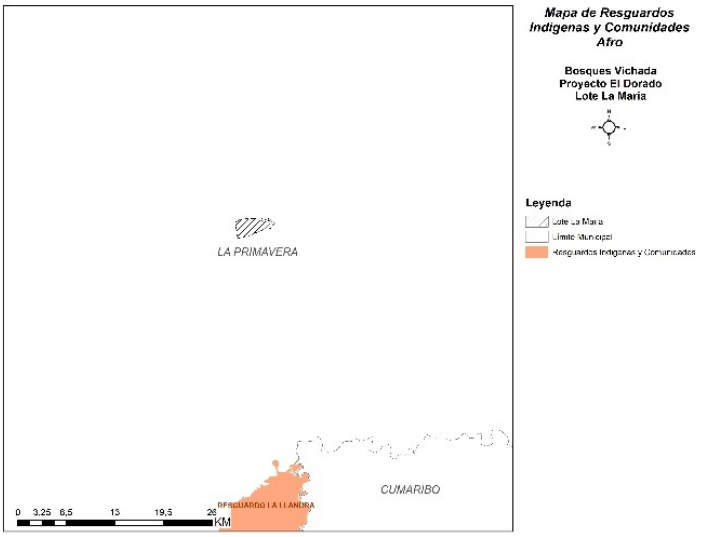

Figure 18. Location of the project centers and proximity to ethnic communities

10 Stakeholders' 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 Ministry of Agriculture and FINAGRO as executor of resources and to obtain the forestry incentive certificate.

Among the interested parties, government entities such as the municipal mayor's office stand out. The project is articulated with the entity to fulfill the objectives of the territorial development scheme, in the specific lines of productive alternatives for the region and the generation of employment.

This articulation is done through the participation in sectoral meetings held by the mayor's office, fairs, and reporting of activities to the extension agents of the secretaries. Much of this interaction is done verbally.

Another interested party is the **Corporinoquia Environmental Corporation**, which, as detailed above, is the one who ensures due compliance with environmental regulations for forestry activity in the region. With the entity and as evidenced in the annexes, the activities carried out in compliance with the regulations are recorded and minutes are drawn up relating compliance with these.

In previous years, there were other key actors, such as FINAGRO, especially for the implementation of the CIF Forest Incentive Certificate scheme, which the properties enjoyed for their establishment and maintenance until year 5 of planting. After the commitments established by the CIF have been fulfilled, the interaction with FINAGRO technicians is reduced and the monitoring of the stands continues to be the responsibility of the Reforestadora El Dorado S.A.S.

Finally, through the training process, the project is socialized in a comprehensive way with workers and operational personnel through annual training, periodic meetings and compliance processes with external entities. These activities are not limited to technical training and risk prevention, but also include a detailed explanation of the economic and operational dynamics of the project. In this way, it ensures that all staff are informed and aligned both in terms of safety and efficiency, as well as in understanding the financial and functional objectives of the project.

11 REDD+ Safeguards

N.A

12 Special categories, related to co-benefits

N.A

13 Implementation of the project

13.1 Implementation status of the project

Date of start of the project and period of operation

The period for this report considers the development of activities from **June 30, 2015 – April 30, 2023**

The project currently has 1,353.23 ha of established commercial stands. Distributed in two species:

- *Eucalyptus pellita*: 176.18 ha
- *Pinus caribaea*: 1,177.05 ha

The current verification one corresponding to the years 2015-2023, that is, 8 years have passed since the beginning of the activities.

It is important to highlight that, the Proyecto Forestal El Dorado initiative is articulated with the production processes of a larger nucleus, which is also part of the forest CDM initiative that gave rise to the current project. Therefore, many of the management, maintenance and other activities presented here link actions developed that are part of the monitoring of the project in general, which for the current monitoring period did not allow detailed discrimination by lot and year. Below is a summary of the activities carried out and indicators related to job creation within the framework of the project are described.

In general, management activities were developed periodically according to the requirements of the plantation and according to its development. The most recurrent activities focused on weed control, pests and fertilization, as they were carried out every year. Some activities such as thinning are not yet considered because the times for said activity are not met. Table 19 shows an example of these activities.

The supports for these activities and minutes of work carried out are found in the *annex 10*.

Table 19. Activities and tasks developed by the project in the monitoring period

	Year Activity								
Activity	2015	2016	2017	2018	2019	2020	2021	2022	2023
Weed Control	57	123	142	85	19	0	0	0	0
Fertilization	57	123	85	19	0	0	0	0	0
Pruning	0	0	0	0	57	66	0	0	0
Insect and pest control	57	123	142	142	142	142	142	142	142
Firebreak Rounds	142	142	142	142	142	142	142	142	142

13.2 Changes after the GHG project registration

N/A

14 Grouped Project

N/A

15 Monitoring system

15.1 Description of the monitoring plan

To obtain verification of reduced emissions for the project, activities are developed to determine reduced emissions, through the establishment of forest plantations and the development of natural regeneration (stand models) within the eligible areas.

Initially, an analysis of the established areas and their development was carried out. To apply the processes defined by the AR-ACM0003[38] methodology, in the project areas, in the estimation of carbon captured by reforestation activities, a staging was developed that allows the established areas to be separated, according to their biomass/carbon content. Likewise, an analysis of the growth and advancement of vegetation in the process of passive natural regeneration was carried out, for the respective carbon capture analyses. However, this stratum has not presented significant progress compared to the contents of the baseline (savanna grasslands).

Compared to the hectares established by each stand model, only the commercial one was characterized with the presence of forest cover for the species considered, *P. caribaea* and *E. pellita*. For the natural regeneration component, no significant increases in cover were identified and therefore in the accumulation of carbon, for which this stratum is not counted for the present monitoring period.

[38] Afforestation and reforestation of lands except wetlands - Version 2.0

15.1.1 Project boundary monitoring

Spatial Analysis

The process of quantifying areas and determining development states of plantations can be summarized in five steps, as described in the following diagram (see annex 2. GIS process).

Figure 19. process flow diagram for area quantification

Identification of the study area

Spatial analysis begins with the identification of the study area. The study area is defined by the properties of Angelika and La María, which are part of the Proyecto Forestal El Dorado, of Reforestadora El Dorado S.A.S, in the municipality of La Primavera, in the department of Vichada, Colombia. (Figure 20).

Figure 20. General location of the El Dorado forest carbon initiative

It is important to mention that the region has very similar biophysical conditions throughout its entire length, such as heights above mean sea level, low gradient slopes, meandering drainage, relict gallery forests located along the springs and drainages. simple ones that progressively feed larger drainages, soil composition and savanna landscapes and ecosystems; describe the particularities of the eastern plain of the country.

Search and download satellite images

Once the study area has been determined, satellite images that cover the area and that also meet the scale and mappable area requirements are acquired. For this case, satellite images from the Sentinel 2[39] mission of the Copernicus[40] earth observing program were selected. Sentinel 2 is a European high-resolution, wide-range multispectral imaging mission for Earth monitoring.

[39] https://sentiwiki.copernicus.eu/web/s2-mission
[40] https://sentiwiki.copernicus.eu/web/copernicus-programme

The images have a spatial resolution of 10 meters, that is, each pixel represents the average reflected energy of an area of 200 square meters, radiometric resolution of 16 bits and is managed by the European Space Agency (ESA) and are freely distributed, through different platforms that provide the inventory of images at different levels of processing for terrestrial observation[41].

To cover the area of projects, three images were downloaded that were acquired through the USGS[42] portal. This date coincides with the dry season of the region, allowing high quality of the image and few areas of cloud cover that hinder or modify the values recorded by the sensors of the spectral camera mounted on the satellite.

Figure 21. Image acquired for the analysis of emissions reductions, for the El Dorado forest carbon project initiative, in the Municipality of La Primavera - Vichada.

Satellite Images Processing

In this initial step, you begin to obtain information from the images. It consists of assigning to each pixel of the areas of interest, a certain class according to the legend that is established, for the analysis area. For this study, a legend was defined based on

[41] www.esa.int

[42] www.earthexplorer.usgs.gov

the strata of vegetation development, present in the plantations of each property. 4 classes (strata) were established: High Stratum, Middle Stratum, Regular Stratum and Low Stratum; These strata were defined considering the state of development of the vegetation in the four projects that make up the forest core, in order to homogenize the separation criterion between the strata and guarantee consistency in the information.

Once the legend is defined, the classification is prepared. For this case, the supervised classification technique was used through sampling of each of the classes defined in the legend and the maximum likelihood with null class was used as the association algorithm, since due to the conditions in which it is presented information (crops), have a defined spatial association and are mainly differentiated by their spectral response[43].

The seeding (sampling) process consists of taking representative samples of each of the classes that make up the legend. These samples must be sections of the fully identified cover, without mixing with other soil covers, without the presence of clouds, shadows or any another factor that modifies the spectral response, captured by the sensor present on the satellite. Samples must be taken randomly over the entire image, where between each sample the standard deviation does not increase by more than 8 points[44].

To complement the information for the classification, it was decided to create a vegetation index (Figure 22), the NDVI (*Normalized Difference Vegetation Index*), which allows highlighting the information of the near infrared band (at this wavelength, the vegetation presents levels of particular reflections that help with the analysis of the state of the plants)[45].

[43] Fundamentos de Teledetección, Emilio Chuvieco. 1996

[44] Universidad de Murcia. (s.f.). Universidad de Murcia. Obtenido de Fotointerpretación y Teledetección: http://www.um.es/geograf/sigmur/teledet/tema09.pdf

[45] Yengoh et al 2016.

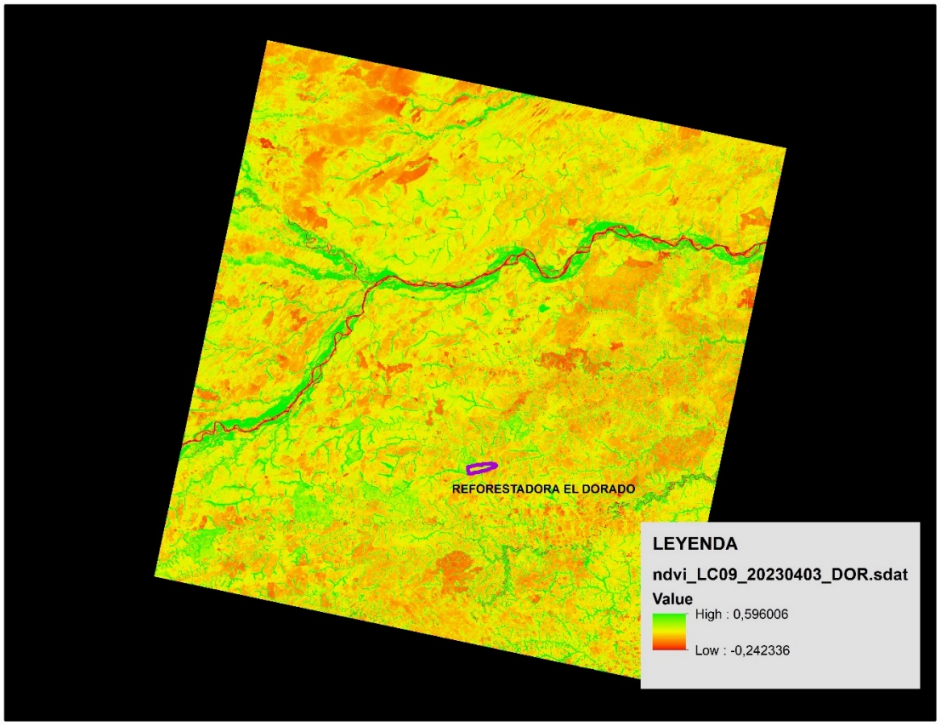

Figure 22. Example of Normalized Difference Vegetation Index, NDVI.

Once all the inputs are ready and the sampling (seeding) has been carried out, the algorithm is run, managing to assign a qualitative value to each pixel in the area of interest, according to the legend defined for the classification.

Like all semi-automated processes, supervised classification can present errors when assigning pixels to each of the classes. This process consists of a visual review of the entire study area and evaluating the class of each of the pixels that, at the discretion of the interpreter, must be reclassified. This process is the most time-consuming as it requires a lot of time and detail.

Primary comparison

To evaluate the quality of the process and adjust the information according to what was observed in the field, the data obtained in the plot surveys were added as samples to the sampling process, and were taken into account in the manual editing phase of the classification. In this way, the statistical sample increases without systematic errors, reducing the variances between the classes to be classified. It is important to clarify that when classifying all plantation covers, they may present similarities in their spectral

responses, and thus achieve low correlations between the training areas and the resulting classes.

The field plots were classified considering the amount of carbon retained, calculated based on the amount of biomass found.

Data and complementary information to determine the baseline or reference scenario

For the project, no leaks have been determined resulting from the implementation of project activities.

Social and Environmental Effects of project activities

Environment Effects

In the environmental component of the Proyecto Forestal El Dorado, it complies with regional environmental standards, therefore, an Environmental Management Measures Plan (MMA[46], see annex8) was prepared for approval by the regional environmental entity CORPORINOQUIA and the process has been loaded with file 800.38.17.0096. In this way, it is possible to monitor environmental permits for forestry work. Among the studies developed within the framework of the MMA, they are related:

- Water pumping tests,
- Percolation tests,
- Geoelectrical prospecting of groundwater using the method of vertical electrical surveys
- Technical document for discharge permit application.
- Technical document for the application for groundwater concession.
- Minutes are included on the proper disposal of industrial waste.

See annex 8.

Biotic Component

Regarding the biotic component, the project has implemented actions to evaluate the biotic status in the terrestrial ecosystems identified in the project area. This allows for an evaluation of the state of the baseline and how project activities can generate positive or

[46] Documento de Medidas de Manejo Ambiental según resolución 1130 de 2011 y 1753 de 2013 "Por medio de la cual se definen los criterios regionales para el desarrollo de proyectos forestales, agrícolas y agroindustriales en la jurisdicción de CORPORINOQUIA"

negative impacts on these ecosystems. Mechanisms such as temporary sampling plots have been used to make these evaluations in ecosystems such as riverside forests.

Figure 23 shows the location of the plots for the evaluation of flora in gallery forests.

Figure 23. Sampling points using plots for the evaluation of flora in riverside forests.

Table 20, describes the coordinates of the established plots, as well as their measurements.

Table 20. Coordinates of the flora monitoring points in the El Dorado project area.

Plot	North	East	Size
1	5°25'58.9"	69°30'7.2"	10x100
2	5°25'55.3"	69°32'22.3"	20x50

Floristic Composition

In the Proyecto Forestal El Dorado, there are plant formations where native species in different stages of development predominate, which together make up the Natural Forest, being part of the riverside forests located on the banks of the Caño Terecay.

There are also Natural Forest Relics, which are part of the “Morichales”; These are characterized by their typical vegetation, which develops in tributary areas as part of

ephemeral drainage of runoff waters, especially in the longer winter season, where heavy rains occur.

Of great importance is the growth dynamics of the Natural Regeneration of the Forest in its first successional states, which is essential to maintain the heterogeneity of the floristic composition, which favors the condition of balance in the development of the vegetation, in its different strata.

The Management of the Natural Forest, identified in the project area and which is around the eligible areas, has allowed maintaining the conditions of the floristic composition. Currently there is no type of anthropogenic intervention, where the different native species are conserved and protected in all successional stages of development.

In the existing plant formations, there are various tree-type species, some of them on the verge of extinction, therefore, it is necessary that these species propagate by natural means, such as birds, and that this dispersion allows for the expansion of the areas where these species develop and new relics of native vegetation originate.

In the Natural Forest, according to field information, 26 species belonging to eighteen (18) families were found, the species with the highest density being the *Palma Maporilla* with 70 individuals per ha, followed by the *Palma de Moriche* and the *Laurel Negro*, with thirty individuals per hectare each. The following table presents the floristic composition of the Natural Forest for the two sampled plots.

Table 21. Results of the evaluation in the flora plots in the forest areas around the eligible areas in the El Dorado project.

Common Name	Scientific Name	Family	Density IN/HA
CARAÑO	*Protium Asperum*	Burseraceae	20
ARENILLO	*Tetrorchidium Rubrivenium*	Euphorbiaceae	20
CUERO DE SAPO	*Symplocos Amplifolia*	Symploceceae	10
CABO DE HACHA	*Aspidoperma Excelsum*	Apocynaceae	5
GUAMO NEGRO	*Inga Spectabilis*	Fabaceae	25
BALSO	*Ochroma Pyramidale*	Malvaceae	10
MADROÑO	*Rheedia Madrunno*	Crusiaceae	20
LAUREL NEGRO	*Nectandra Sp*	Laureaceae	30
CHAPARRO DE AGUA	*Xylopia Aromatica*	Annonaceae	15
CACHICAMO	*Calophyllum Lucidum*	Clausiceae	25
CORDONCILLO	*Piper Aduncum*	Piperaceae	5
PALMA ARACO	*Scratean Exorrhiza*	Arecaceae	20

PALMA CUCURITA	*Attalea Maripa*	Arecaceae	5
LECHERO	*Ficus Sf*	Maraceae	20
PALMA DE MORICHE	*Mauritia Flexuosa*	Arecaceae	30
PALMA MAPORILLA	*Euterpe Precatoria Mart*	Arecaceae	70
COTO DE MONO	*Eschweilera Punctata*	Lecythidaceae	10
MOSQUITO	*Terminalia Amazonia*	Combretaceae	5
QUINCE DIA	*Tapirira Guianensis*	Anacardiaceae	5
RABO DE PAVA	*Cupania Amaricana*	Sapindaceae	20
SIMARUBA	*Simarouba Amara*	Simaroubaceae	10
SALADILLO	*Cariapa Llanorum*	Clusiaceae	15
MORTECINO	*Endlicheria Sp*	Laureaceae	25
SANGRITO	*Crhoton Lechleri*	Euphorbiaceae	5
YARUMO	*Cecropia Engleriana*	Cecropiaceae	5
MULATICO	*Tacarcuna Amamvifolia*	Euphorbiaceae	5

A synthesis by family (shows the predominance of Aracaceae, Lauraceae y Clusiaceae).

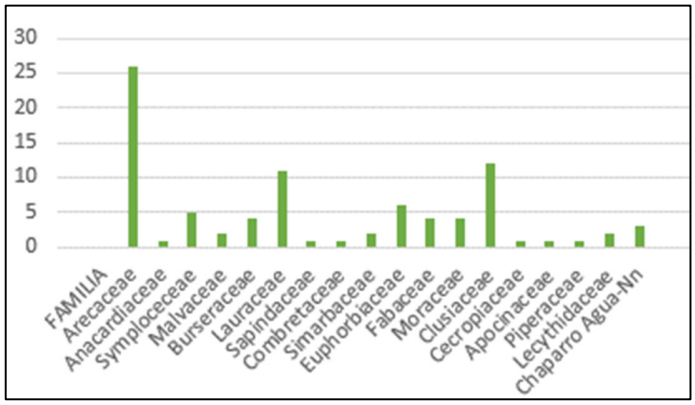

Figure 24. Distribution by flora families, identified in the sampling plots in the natural forest of the EL Dorado project (individuals/ ha^{-1}).

Indicators of the sampled vegetation

Abundance

According to the data obtained, the Palma Maporilla species report the highest value of relative abundance with 16.09% followed by the black laurel with 6.90%.

Table 22. Summary of the abundance indicator for the main identified species

Specie	Scientific Name	Abundance	
		Aa	Ar %
Palma Maporilla	*Euterpe Precatoria mart*	14	16,90
Laurel Negro	*Nectandra Sp*	6	6,90
Cachicamo	*Calophyllum Lucidum*	5	5,71
Madroño	*Rheedia Madrunno*	4	4,6
Chaparro De Agua	*Xylopia Aromatica*	3	3,45

Frequency

According to what was evaluated, the species with the highest absolute frequency (100) and relative frequency (6%) correspond to *Caraño, Arenillo* and *Guamo Negro*. Species such as the *Palma Araco* and the *Cabo de Hacha* are also found, with absolute frequency (50%) and relative frequency (3%).

Table 23. Results of the frequency indicator for the main species

Specie	Scientific Name	Frequency	
		Fa	Fr %
Caraño	*Protium Asperum*	100	6
Arenillo	*Tetrorchidium Rubrivenium*	100	6
Guamo Negro	*Inga Spectabilis*	100	6
Palma Araco	*Scratean Exorrhiza*	50	3
Cabo De Hacha	*Aspidoperma Excelsum*	50	3

Dominance

This indicator relates the basal area of the individuals, in relation to the space (area) occupied, in the sampled plot and the equivalent area in hectares. Regarding this indicator, the most dominant species is the *Attalea maripa* palm, which reports a value of 0.834 for absolute dominance and 19.34% for relative dominance; followed by *Palma de Moriche*, which reports an absolute dominance value (0.574) and a relative dominance of 13.32%. The result of the predominance of palms over other species is considered normal, because the ecosystems are characterized by presenting this type of conglomerates and in many cases, they give their name to the morichales forests. It is important to highlight that the ecosystems evaluated are characterized by being gallery forests, which can be permanently or semi-permanently flooded.

Regarding tree species, *Cabo de Hacha* is next in absolute dominance of 0.552 and with a relative dominance of 12.79%; followed by *Quince Días* with an absolute dominance of 0.431% and a relative dominance of 10.0%. Finally, the *Simarouba amara*, with an absolute dominance of 0.169 and relative dominance of 3.93% (Table 24).

Table 24. Results of the dominance indicator, for the main species identified

Specie	Scientific Name	Dominance	
		Da	Dr %
Palma cucurita	*Attalea maripa*	0,834	19,34
Palma moriche	*Mauritia flexousa*	0,574	13,32
Cabo De Hacha	*Aspidoperma Excelsum*	0,552	12,79
Quince días	*Tapirira guianensis*	0,431	10,00
Simaruba	*Simarouba amara*	0,169	3,93

Figure 25 summarizes the indicators described above, for all the species found in the sampling area, highlighting higher values, such as the species *Attalea maripa* (Palma cucurita) stands out as the dominant species.

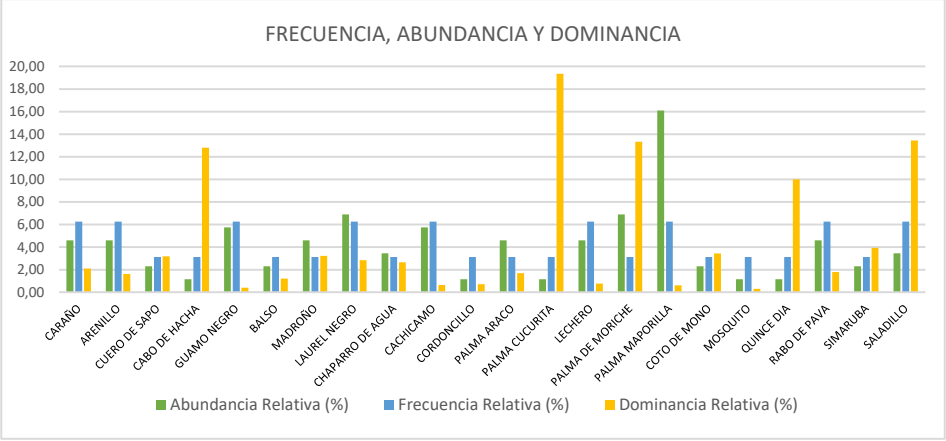

Figure 25. Ecological indicators for the species found in the natural forest sampling area in the El Dorado Forest Project

The Importance Value Index (IVI) includes the three previous indicators (abundance, frequency and dominance) by species, where the Cucurita Palm, as we reviewed in the dominance component, has the highest IVI indicator in the ecosystem evaluated. It is worth mentioning that this palm is recognized for its ecological and social importance, because it is considered an important source of food for birds and is used as raw material

for construction and obtaining natural fibers, which are used by the community of the eastern Colombian plains.

Table 25, presents the 10 species with the highest values for the Importance Value Index and Figure 26 graphically describes this indicator.

Table 25. Importance Value Index for the 10 most outstanding species as a result of the sampling process in natural forest in the EL Dorado Project

Common Name	I.V.I
PALMA CUCURITA	7.87
PALMA DE MORICHE	7.78
SALADILLO	7.71
PALMA MAPORILLA	7.65
CABO DE HACHA	5.68
LAUREL NEGRO	5.32
QUINCE DIAS	4.75
CARAÑO	4.31
CACHICAMO	4.21
ARENILLO	4.15

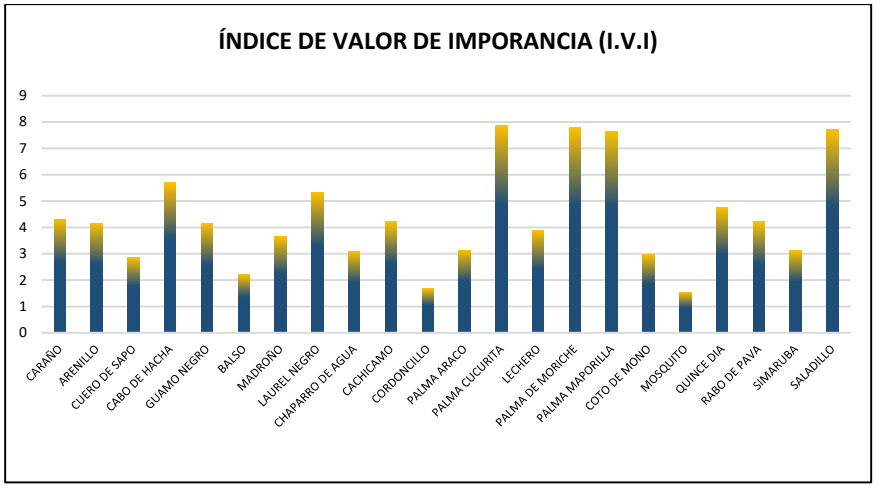

Figure 26. Behavior of the IVI for the flora species found in the sampling plots in natural forest in the EL Dorado Project

Fauna

The area where the forestry project is developed has large areas of natural forest, which are receiving areas for fauna. Within these areas, there are the morichales (places around the project areas, which were sampled and described in detail in previous sections), this vegetation does not dry out during the year, therefore, they house a great wealth of fish, which attracts a wide variety of waterfowl, squibs, alligators, and many other species that use this ecosystem as a feeding site.

Although a systematic evaluation of the benefits to the territory's fauna has not been developed, through opportunistic findings it has been possible to identify how mammal species, especially deer (*Odocoileus virginianus*), make use of the plantations to move between a patch. from forest to another, in addition, traces of peccaries (*Nahuatlism of Coyámetl*) have been identified in the plantations and in the firebreak corridors. Also, some turtles have been sighted that, fleeing the heat in the open areas of the grasslands or in the sheets, find refuge and home within the plantations, especially in the leaf litter.

Finally, great diversity of birdlife in the eastern plains has been documented; it increases with the arrival of migratory species. This is how migratory birds move from the north in the season from October to May, and those from the south move between May and September; These dynamics of local migrations are determined or related to changes in the availability of food and water. For this reason, it has been determined that, regarding migratory species, it is necessary to identify where and how the species move in the area, as well as the seasonality and/or time of year, in which this flow of species occurs. and relate it to the recovery of the native forest and new forest covers.

Endangered Species in the project region

Colombia approved the CITES convention through Law 17 of 1981, the administrative authority is the Ministry of the Environment and scientific authorities were appointed by decrees 1420 of 1997 and 125 of February 3, 2000 and correspond to: Instituto de *Investigación de Recursos Biológicos* Alexander *von Humboldt* (IAvH), Instituto *Amazónico de Investigaciones Científicas* (SINCHI), *Instituto de investigaciones Marinas y Costeras (INVEMAR), Instituto de Investigaciones Ambientales del Pacífico (IIAP), Instituto de Hidrología, Meteorología y Estudios Ambientales* (IDEAM) and Instituto de Ciencias Naturales of Universidad Nacional de Colombia.

The species covered by CITES are included in three appendices and are classified according to the degree of protection they need. Appendix I includes species that are in danger of extinction; trade in these is authorized only under exceptional circumstances. Appendix II includes species that are not necessarily classified as endangered, but their trade must be controlled to prevent their use from threatening their survival. Appendix III

includes species that are protected in at least one country, which has requested assistance from other CITES parties in controlling trade.

Although the project has not yet implemented its biodiversity monitoring measures, it is important to highlight how the forest core projects associated with this initiative, as they advance in their implementation, have managed to identify a series of fauna species with some degree of threat as summarized in Table 26.

These results serve the Proyecto Forestal El Dorado as a baseline for when follow-up actions are developed and recorded.

Table 26. Preliminary Fauna Inventory. Source: taken from the Dorado Project

No.	Group	Common Name	Specie	Threat category UICN	CITES
1	Birds	Pajuil	*Crax alector*	LC	No
2		Pato siriri	*Dendrocygna viduata*	LC	III (Dinamarca)
3		Mirla	*Columba sp.*	LC	No
4		Loros	*Especie sin identificar*	-	-
5		Águila	*Spizaetus ornatus*	LC	II
6		Garza común	*Ardea alba*	LC	III (Dinamarca)
7		Arrendajo	*Cacicus cela*	LC	No
1	Mammals	León	*Puma concolor*	NT	I
2		Chigüiro	*Hydrochoerus*	LC	No
3		Venado	*Mazama americana*		
4		Armadillos	*Dasypus*	LC	No
5		Oso hormiguero	*Myrmecophaga*	VU	II
6		Danta	*Tapirus terrestris*	EN (Colombia),	II
7		Araguatos	*Alouatta seniculus*	LC	II
8		Mico maicero	*Cebus apella*	LC	II
9		Puerco espín	*Coendou prehensilis*	LC	No
10		Conejo silvestre	*Sylvilagus sp.*	LC	No
11		Lapa	*Cuniculus paca*	LC	III (Austria, Honduras)
12		Ñeque o guatín	*Dasyprocta punctata*	LC	III (Austria, Honduras)
13		Chuchas o	*Metachirus*	LC	No
1	Reptiles	Guio negro	*Eunectes murinus*	DD	II
2		Guio perdicero	*Boa constrictor*	EN	II
3		Cuatro nariz	*Bothrops atrox*	-	No
4		Cascabel	*Crotalus durissus*	LC	III (Austria, Honduras)
5		Coral	*Micrurus sp.*	-	No

According to the secondary information found, there are studies carried out by the Colombian Interinstitutional Group of Private Conservation Tools -G5- in the area of

influence of the project, associated with the activity of commercial reforestation with introduced species, which include analysis of biodiversity in the Bita River basin, with characterizations of the fauna present in the forestry projects object of the study and listed in the publication "Sustainable Forest Management in plantations in the Bita River basin, Vichada, Colombia[47].

Landscape Ecology

Felines are classified as an umbrella species, this allows us to infer that, from the presence of feline populations in an area, there are sufficient prey to feed these carnivores and that there is associated biodiversity, under favorable conditions. Large cats are generally the first to disappear from ecosystems, due to their requirements (large areas for movement and numerous prey) and their low reproductive rate, for this reason their presence can indicate the good state of conservation of the ecosystems.

Due to the great importance of this species, areas have been identified where this species is located and through which it moves, called: **The Jaguar Corridor**. The most important area of this corridor is located in the middle and northern Magdalena of the Orinoquia Figure 27. The corridor corresponds to a tenuous line, in these areas of Colombia, a great conservation effort is required by the competent authorities and the residents. If these areas of the corridor are not protected, it can lead to the loss of connectivity, not only of the populations in the north and east of the country, but also between jaguar corridors in Central and South America.

[47] Pacheco, M., Peñuela, L., Solano, C., Galán, S (Eds.) 2014." Manejo Forestal Sostenible en plantaciones en la cuenca del río Bita, Vichada, Colombia".

Figure 27. The Jaguar corridor[48].

The eastern corridor is identified and monitored, based on multiple samplings with interviews and camera traps, to detect the presence of jaguars and delimit the local extinction limit. The most important corridors in the plains are the gallery forests along the Meta, Casanare and Arauca rivers. Taking into account this and many other attributes of the biodiversity of the area, in which the Reforestation project is developed, hunting of **ANY** species of fauna is **prohibited** as a measure to protect biodiversity and contribute to the conservation of the Jaguar corridor.

Social Effects

In accordance with the corporation's requirements, an analysis of the social population structure and functionality was developed in the area of influence of the project, highlighting that this analysis was carried out including years prior to the start date of the project and serves as a reference for the assessment of the improvement of the project's social indicators. As a result of the analysis, follow-up actions have been implemented

[48] https://medium.com/panthera-field-notes/carbon-credits-the-newest-tool-for-funding-jaguar-conservation-9201684d2a4b

to improve social conditions. This analysis file is part of the monitoring files for this component, presented to the corporation and is found in annex 8. The employees generated by forestry activities were described in previous sections.

The project has developed a pilot survey to determine the socio-economic conditions of the neighbors. It is worth mentioning that the neighboring areas are large, and the administrators or workers of the property remain there constantly. Likewise, within the framework of technical activities articulated between the spring forestry core, advised by Forest Projects, several training sessions have been developed for workers and technicians who advise the Proyecto Forestal El Dorado. Table 27, shows a list of the training and attendance at each one.

Table 27. List of training and attendees

Trainings	Amount	People
Safety and coexistence rules, storage and handling of chemical products, Waste Management, Mechanical risk. **Hand care, equipment management**.	2	48
Management of wastewater and domestic water, management of liquid chemicals, fuel and oil.	1	4
Total	**3**	**52**

Monitoring of physical limits of the project

These include the areas that are part of the project. They must include those that have been planted and will be planted, and that are under control. Likewise, many areas may not be planted due to soil conditions, and flooding, among others, and it is intended that they be included in the accounting for passive natural regeneration. Another aspect is to control areas where anomalies occur that affect the accumulation and conservation of captured CO_2, such as fires, pests, etc. Finally, it must be taken into account that the control areas are those planted, that is, areas that do not have forest covers such as firebreak corridors or roads, should not be considered in the accounting, even if they are part of the project, in addition to those areas that are planted and that are outside the eligibility analysis developed in the ante-ante phase.

15.1.2 Monitoring of the forest establishment

Here we want to guarantee the quality of the stands that are planted, realizing that they comply with the procedures detailed in the proposed project. This monitoring must be carried out at least during the first three years after establishing each lot and with longer

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, despite the species having the appropriate technological packages, their development for the project region is not as expected, leading to high mortality and poor development of the stands, affecting the projections of CO_2 capture, for which the change of species is necessary to provide continuity to the commercial forestry project.

Monitoring mortality and replanting. It is important in the first year of establishment to maintain homogeneity of the stands at optimal densities per hectare. This monitoring allows for replanting promptly, since late replanting within the same plot, in many cases, generates asynchrony in the development of the trees and would require different management plans in those spaces with replanting.

15.1.3 Monitoring of Forest Management

These activities undoubtedly also affect the greenhouse gas balances that are to be mitigated, given that poor stand development affects their growth and atmospheric carbon capture. The aspects to be monitored are associated with activities carried out by species, lot, intervened area, and farm. These are Cleaning of plots after sowing (biomass removed and left within the plots), pruning (intensity, biomass, or volume removed), or thinning, harvesting (intensity, biomass, or volume removed), replanting of stands that are of several rotations over the duration of the project, monitor disturbances such as burning, diseases and biomass loss because of said condition. Finally, the development of the trees is evaluated through growth monitoring plots.

To monitor the development of the project, the stratification of the stands is necessary.

Stand stratification: Stratification is the key when carrying out reduced emissions assessments. It is recommended to develop stratifications based on aspects such as species, sowing date, and 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, and site qualities, among others that make stratification reformulate.

For the current project proposal, stratification will be developed, initially discriminating into two types of stands:

- **Commercial stand model:** composed of species of commercial interest that will be subjected to silvicultural management.

- **Passive natural regeneration:** areas that were intended for protection, where productive interventions are not carried out and their recovery process will be carried out through natural succession processes without anthropogenic intervention. These areas correspond to areas of withdrawal from water sources, protection places, or areas not suitable for the cultivation of forest species.

These two stand models will have stratifications based on their development and accumulation of biomass-carbon, which will be initially evaluated with satellite image processes, using indicators such as the Normalized Difference Vegetation Index, which allows estimating the quantity, quality, and development of vegetation based on the measurement of the intensity of radiation of certain bands of the electromagnetic spectrum from certain satellite images.

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

- Low
- Steady
- Middle
- High.

Below is the list of the most important variables to monitor and that will be applied in the forestry project, in the three aspects indicated above.

Table 28. Variables for project monitoring.

Data/Parameters:	$A_{PLOT,}$
Data unit:	ha
Description:	Sampled plot area, Strata area. 500 m^2
Data source:	Field measurement
Measurement procedures (if any):	The measurement protocol developed for the project is followed.
Monitoring Frequency	At each check
QA/QC procedures	Rectification of plot areas in the field. Quality control of measurement equipment.
Data/Parameters:	A_i
Data unit:	ha

Description:	Area of Strata *i* Low: **587,14 ha** Regular: **218,70 ha** Medium: **395,33 ha** High: **152,05 ha** **Total**: **1.353,2 ha**
Data source:	Measurement using remote sensors.
Measurement procedures (if any):	Standard operating procedures prescribed in the national forest inventory apply. 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	Control is carried out with forest establishment and management data.
Comments:	-

Data/Parameters:	$CC_{SHRUB,\ i}$
Data unit:	dimensionless
Description:	Shrub cover in Strata I of the shrub biomass
Data source:	Field measurement. Or default data. It can be visual **0.5**
Measurement procedures (if any):	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 relascope method.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	
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, on average the shrub cover is equal to 0.5 of the estimated biomass unless the information provided is verifiable and transparent to justify a different value.

Data/Parameters:	DAP
Data unit:	cm.

Description:	Diameter at the breast height of a tree.
Data source:	Field measurement in sampling plots. Diametric tapes.
Measurement procedures (if any):	The protocol procedures developed for the project are applied.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	We try to have new diameter tapes in each monitoring. Metallic diameter tape is recommended to avoid material elongation due to humidity, which happens when they are made of fiberglass or other plastic material.
Comments:	-

Data/Parameters:	*H*
Data unit:	Meters (m)
Description:	Tree height
Data source:	Field measurement in sampling plots Digital hypsometers
Measurement procedures (if any):	The protocol developed for the project is applied.
Monitoring Frequency	Each verification (minimum every 2 years, maximum 5 years)
QA/QC procedures	Quality control is carried out in the field, through the remeasurement of some individuals. A hypsometer is reserved in the office for quality control
Comments:	-

Data/Parameters:	*T*
Data unit:	Year
Description:	The period between successive carbon storage estimates.
Data source:	Recorded time 30-06-2015-30-04-2023 7.8 years.
Measurement procedures (if any):	N/A
Monitoring Frequency	-

QA/QC procedures	-
Comments:	If two of the successive estimates of carbon storage are taken to different points in time in a year t_2 and t_1 (for example, in the month of April in year t_1 and in the month of September in year t_2), then, a fraction of value could be assigned to T

Proposal for the implementation of the monitoring plan for changes in carbon content in established stands

- **Verification of species and strata**: The stands involved in the project are verified against the species and strata predefined in the project and will be stored in the database, according to the stand model to which they belong.
- **Survival**: This is quantified in the field by sampling in temporary circular survival plots, with an area of 200 m^2 (FIGURE 1) Survival monitoring is carried out approximately three months after the plots are planted. It is established that, if a survival of less than 90% of the initial amount planted is detected, the missing material must be replanted with the same species, seeking to keep the plots homogeneous in age and development. The estimate is made through a simple count of the individuals within each plot, verifying their state of vitality; Then the density of living individuals is determined and finally compared with the initial establishment density.

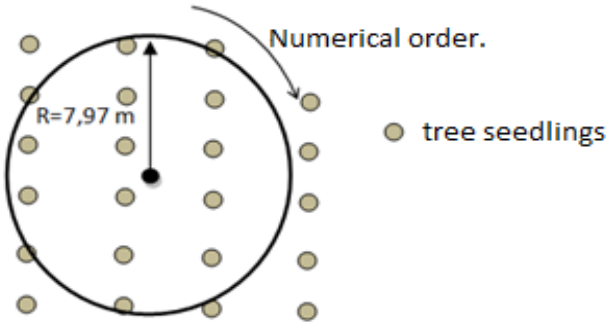

Figure 28. Scheme of the temporary survival monitoring plot.

Monitoring of net removals by sinks and data acquisition

The monitoring of this component is carried out through temporary or permanent plots, in which the dynamic growth process of the plantation is evaluated, to estimate the carbon content present in the aboveground and belowground tree biomass of the project.

The inventory of the plots allows evaluation of the correspondence of the species planted with those proposed in the project, in addition to the planting densities.

The protocol for establishing plots and measuring dasometric variables will be followed to estimate the volumetric increases in each stand. This information will serve as input to validate the volumetric equations by species, or to reformulate new equations that allow the volume to be modeled more realistically. achieved by the species planted for the project area.

Below are some of the most important parameters to monitor:

Stratification

The defined strata will be monitored in a database where species, area, lot, planting date, etc. appear. which will be stored in physical and digital format. Said database will be additionally supported with the respective cartography. The updating of areas that are incorporated into the project is suggested to be done quarterly, allowing permanent control and monitoring of the areas by Strata.

Monitoring of the strata

The areas of the previously defined strata will be periodically monitored according to the criteria established in the monitoring of the scope of the project (previous paragraphs), seeking to identify parameters of changes in the initially established areas, and promoting the unification of strata considered dissimilar in the phase. ex-ante. According to the changes in carbon accumulation in each monitoring period, a new stratification may be proposed that groups stand with similar accumulations and other aspects in common. If a pre-sampling is developed before the first monitoring, then the results of this will allow a re-stratification, based on changes such as:

- Age
- Forestry management
- Possible variation in carbon capture
- Cost-effectiveness in the monitoring process
- Disturbances (plagues, fires, pathologies, etc.)

Some changes in the parameters defined above are only detected after the development of the first monitoring, such as carbon capture.

Monitoring changes in carbon contents

Mapping

Maps of different scales may be used, however, large-scale maps such as 1:10,000 are recommended to facilitate the distinction between models and lots. It is advisable to have a series of maps of this type by strata and the generation of a single map for field monitoring will be avoided. In this way, the groups in charge of the inventory will have facilities to make tours and locate distinguishable sites in the field to access in subsequent monitoring or to facilitate access for the group intervening in the monitoring. This cartography will document altimetric references, geographical features (such as drainage), road infrastructure (here primary and secondary roads are included, characterizing their type, that is, paved or not), possible division of the lots, characterizing the location of the stand with dissimilar colours from each other. There will be a general map of the lots and models that summarize the maps generated for field monitoring. This can be of a higher scale (1:50,000, 1:100,000) and will serve as support for monitoring planning. For each monitoring period, the project map base will be updated, and data on areas planted and under control for said period will be included. As support for cartography, aerial photographs may be used for plot location procedures.

Sample size.

A series of sampling plots will be established to identify the changes and evolution of carbon accumulation in the stands. These plots will be established having cost-effectiveness criteria, maintaining a level of precision of ±10% of the mean, with a confidence level of 95%.

The procedure to calculate the sample size follows method *I* of the methodological tool for calculating sample size.[49]:

Steps:

- Identify the parameters according to the project proposal, to estimate the amount of sample needed.

[49]Calculation of the number of sample plots for measurements within A/R CDM Project activities. see 02. (EB 46 Report Annex 19).

Parameters:

A: Total project area; ha

i: Strata

Ai: Area of each Strata *i*; ha

AP: Monitoring plot area; ha

sti: standard deviation of the estimate by *strata i*

Calculate all plots of the defined size for the entire project area:

$$N = \frac{A}{AP}; \quad N_i = \frac{A_i}{AP},$$ Equation 1 from the tool

where:

N: maximum number of possible plots in the project area

N_i: maximum number of possible plots in the area of strata i.

Estimate the allowable error, based on the desired precision levels and by estimating the average volume (or biomass).

$$E_1 = Q_1 * p$$ (Eqn 2 of the tool)

Where:

Q1: Estimated average value for volume or biomass in the project. Q, tha^{-1}, $m^3\,ha^{-1}$.

P: Precision level (e.g 10%)

E1: Allowable error (±10% of the average)

Estimate the number of plots for the entire project assuming equal costs of establishing the plots, using the following equation:

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

Equation 5 from the tool

Where:

n: total number of plots in all strata of the project

$z_{\alpha/2}$: the value of the statistic z, for α = 0.05 (indicated for a 95% confidence level), zα/2 = 1.9599

Estimate the number of plots per stratum assuming equal establishment costs:

(Eqn 6 of the tool)

Where:

st_i : standard deviation of the estimate for the strata i.
i: 1, 2, 3, … L strata of the project

n_i: number of plots in the strata *i*.

The number of plots per Strata for the project can be determined using the tool generated by Winrock International[50].

Type of plots

The shape of the monitoring plots is rectangular with a size of 500 m^2 of area (20 x25m) on all systems (**¡Error! No se encuentra el origen de la referencia.**). In the event of situations in which a plot of these dimensions cannot be established, the shape of the plot will be adjusted to ensure that the plot area is maintained 500 m^2.

[50]Winrock Terrestrial Sampling Calculator.www.winrock.org/ecosystems/files/Winrock_Sampling_Calculator.xls

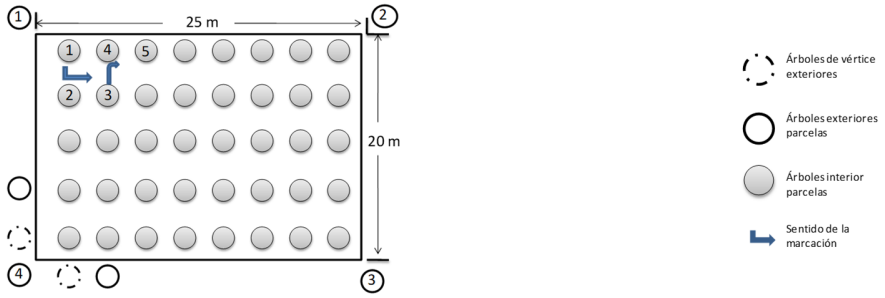

Figure 29. Survey of monitoring plots. The dimensions correspond to 25m x 20m, for an area of 500 m2

Location and survey of the plots

After having carried out the distribution of the plots systematically on a map of the established coverage, with the geographical points the center point of the plot is in the field with the help of GPS. The entry route to the plot must be marked to facilitate its subsequent location in other monitoring or audit processes. This point will be called vertex one and in a clockwise direction, the initial lateral corridor of 25 m is established, until vertex 2 is located and so on Figure 29. Then the three exterior trees that determine each of the vertices are marked (with the respective vertex number). In this way, the plot is delimited. Then we proceed to mark each of the trees with successive numbering. You should try to have permanent markings, with plates that do not damage the tree and paint. Finally, information is placed on tree 1 with paint detailing the plot code and planting date. These procedures are shown in more detail in the protocols designed for this purpose.

Measurement and estimation of carbon content over time

The estimates of the removals will be made using the equations available in the scientific literature for environmental conditions like those of the project, equations proposed by the IPCC good practice guides for stand models and their species, and some of the recommendations from the tool “Demonstrating appropriateness of allometric Equations for estimation of aboveground tree biomass in A/R CDM project activities” to define equations to apply ex-post. Finally, if possible, equations will be built with primary information about the project.

Therefore, from the monitoring plots the dendrometric variables are breast height diameter (dbh, at 1.3 m above ground level) and total height (h).

The expansion factors of the aboveground biomass are those suggested by the Good Practices Guide, in addition to the root–stem relationships for estimating belowground biomass. However, new values reported by the literature or estimated under conditions and species like those of the project may be used, giving priority to national information.

From the information collected in the first monitoring period, new volume equations can be adjusted, and appropriate estimates made for the proposed project and the species considered.

Quality assurance and control in monitoring procedures

The procedures established by the project will be followed, guaranteeing the quality of the information collected and its proper filing.

The procedures initially consist of training the personnel in charge of taking, collecting, and filing information. As a second instance, the real capacity of the personnel in charge of making analyses and estimates will be evaluated, based on the monitoring information carried out. Likewise, there will be forestry technicians who will support the execution activities of establishing the stands, so that they are by the approaches described and the objectives set by the project.

A management structure is established that allows viewing a scale of command and those responsible to guarantee control over the quality of the information.

For the training of personnel, there will be a series of protocols, formats, and forms that allow standardizing the processes of establishing monitoring plots, collecting information in the field (dendrometric variables), incorporating the collected information, analysis, etc. Therefore. According to the methodology, four fundamental stages are considered to ensure transparent and accurate estimates of GHG removals provided by the project:

- **Reliability in field measurements.**

The protocols designed for the training of personnel in charge of establishing plots and in charge of measuring dendrometric variables (height, diameters, circumference at chest height), guarantee the standardization of procedures. The training of said personnel will oversee a forestry engineer and be supported by technicians, who will be in charge of directing the monitoring teams.

The need to adjust said protocols will be periodically evaluated, without generating alterations in the values of measurements made previously. Adjust the protocol, each time to the condition of the region, planting dynamics, and incorporation of areas under control that will enter the project.

The training time will be as long as necessary to guarantee sufficient knowledge in the handling of measuring equipment and instruments. Therefore, training must have theoretical and practical measurement procedures and avoid errors in measurement and typing of information.

- **Procedure for identifying measurement errors**.

This audit procedure consists of carrying out a subsequent verification of the data obtained from the forest inventory or monitoring and will have the following characteristics and steps:

- It will be carried out by personnel different from those who carried out the inventory and who will be characterized by having extensive experience in forest inventory procedures and estimates of wood volumes for various species. Of special consideration, the person in charge of this measurement must be unaware of the results of the measurements to be audited.
- Between 10 and 20% of the total plots established in the forest inventory should be taken.
- The instruments used must present similar characteristics to those used in the initial inventory (see Figure 30).

Figure 30. Equipment verification and quality control.

- The measurement procedures will be adjusted according to the established manual steps or measurement protocols with which the staff was trained.
  - Location of the plots
  - Survey of plots
  - Measurement of diameters at chest height (*dbh*) and total heights.
- Compare the information obtained with the original information taken by the forest inventory crews.

- Identification of errors. This is done by comparing both information (original inventory and audit) in a paired manner.
- If errors are identified, they are corrected and recorded, expressed as a percentage of all plots that were remeasured, to provide an estimate of measurement error. The estimation error is given by:

$$\boldsymbol{Error}(\%) = \frac{\boldsymbol{Data_1 - Data_2}}{\boldsymbol{Data_2}} \boldsymbol{x100}\%$$

The allowable error should not exceed 10%.

Verification of input data and analysis

The information entry phase, to bring the information into digital spreadsheets, will be carried out by qualified personnel for this work and its analysis will be carried out by personnel trained in the estimation of carbon content in biomass.

To detect errors in the entry of data into the digital spreadsheets, a person other than the one initially in charge of entering the data will type between 10 and 15% of the field forms into an additional spreadsheet. The results of the two calculations (original and audit) are compared to detect errors. Any errors noted will be corrected in the original file.

Estimation of typing error:

$$\boldsymbol{Error}(\%) = \frac{\boldsymbol{Number\ errors}}{\boldsymbol{Total\ data}} \boldsymbol{x100}\%$$

When errors are identified due to adjustments to integer values in decimal measurements, these should be adjusted to the lowest order integer to guarantee conservative evaluations of the measurements.

Procedures for managing GHG reductions or removals and related quality controls for monitoring activities

Protocol for registration and protection of information[51]

[51] These steps are presented in Spanish according to the established protocol.

ES UN PROCESO DE 7 PASOS

- Identificación de la necesidad
- Levantamiento de información
- Revisión de información en oficina
- Organización de información
- Archivo físico
- Archivo digital
- Back up

IDENTIFICACIÓN DE LA NECESIDAD

- En este punto se establece la mejor forma de toma de información para la solución a una necesidad que puede ser de diversos tipos y responder a diferentes áreas de la organización, como contable, SIG, SST, Ambiental, Comercial, Legal:
  - físico o de campo; fotos, levantamientos gps, toma de muestras, elaboración de estudios, entre otros, levantamiento de parcelas.
  - información externa; como certificaciones, actas de trabajos realizados, imágenes de satélite, documentos de contratistas, soportes de compras.
  - Información interna; balances, informes, análisis, estudios, entre otros.

LEVANTAMIENTO DE LA INFORMACIÓN

- Una vez se establece como se satisface la necesidad, se procede a identificar los recursos necesarios:
  - Económicos
  - Equipos
  - Recurso humano idóneo
  - Logístico
  - Medio de entrega

REVISIÓN DE INFORMACIÓN EN OFICINA

- Toda la información es centralizada en las instalaciones de la empresa en Bogotá después de su consecución, esto debido a que en dichas instalaciones es donde se cuentan con los recursos de revisión y almacenamiento de la misma.
- Toda información relacionada con el funcionamiento de los proyectos, es admitida por la dependencia correspondiente para su análisis y revisión
  - Esta revisión se hace por el personal especializado en el manejo de la misma aplicando conceptos apropiados a la naturaleza de la información.
  - Se realiza con el fin de determinar que responda con las necesidades identificadas.

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  - Se realiza con el fin de determinar que responda con las necesidades identificadas.

ORGANIZACIÓN DE INFORMACIÓN

- La información se organiza diferenciada por proyecto elaborado en cada dependencia, creando las subcarpetas por temática en los ordenadores disponibles en la oficina de Bogotá para cada dependencia. Esto relacionando en los nombres de los archivos las versiones creadas y eliminando las anteriores que no tengan validez.
- Una vez organizada la información se procede a archivar en dos componentes, físico y digital.

ARCHIVO FÍSICO

- El archivo físico se encuentra ubicado en la oficina de Bogotá de la organización, en donde se relaciona cada documento por temática y proyecto con fiel copia del insumo o documento elaborado, respetando en orden de archivo la vigencia del documento.

ARCHIVO DIGITAL

- Para complementar la integridad del archivo físico, ya que algunos datos son de origen digital, en cada dependencia se hace una completa custodia de la información diferenciada por proyecto y con sub-clasificación temática. Este es el archivo mas completo que sirve como soporte y consulta de información.

BACK UP

- El respaldo de información se realiza de dos maneras
  - Copia en disco de externo: Cada mes se realiza copia de seguridad en un disco de gran capacidad externo, que se custodia en una locación externa a las instalaciones de las oficinas en Bogotá, cuya custodia esta encargada directamente de la Gerencia del establecimiento.
  - Copia en la nube: En servidores en la nube, se respaldan temporalmente los datos de los proyectos durante su ejecución. Una vez se finalizan los procesos se respalda en oficina y en medios magnéticos externos y se dan de baja en el servidor.

With the previous process, the project built a database of information from the Technical, Legal and Carbon components, which was grouped into folders, in order to associate it with the project's monitoring indicators, for this verification. This information has been separated by folders, with the latest versions (see Figure 31). However, the complementary information is kept in the digital files of the companies that are part of the project and is duly supported to avoid its loss. The folders and attachments are located in the cloud, shared in GOOGLE DRIVE files, for access when required by the audit. The use of this archiving tool allows access to information, through differentiated permissions, to whoever requests it, and generates reports on modified or added files, reporting who made the change and safeguarding a temporary file, until the administrator approves the changes. or deletion of files or folders.

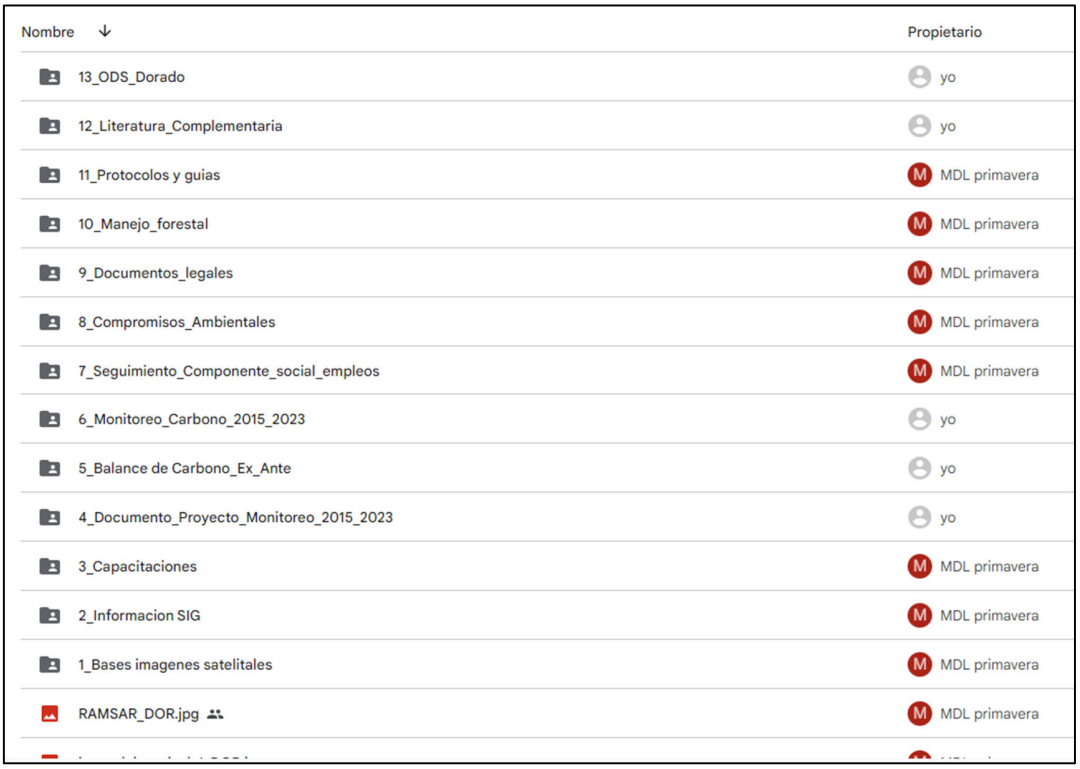

Figure 31. Information provision, security and quality control

In this folder system, there are scanned legal documents, technical work information, field forms completed and duly scanned in digital formats. Likewise, it was available:

- *Spatial analysis to verify the planted project areas that receive maintenance or interventions such as pruning, thinning, among others. Each intervention is recorded with date and updated versions. The La Primavera Forest Project CDM unit is in charge of the analysis and custody processes of the base information.*

This information feeds the databases related to Productive Forestry Technical aspects, Carbon Technical aspects and support necessary to guarantee Financing agreements such as the CIF.

- *Analysis of carbon estimates and balances: include statistical analyzes by stratum.*
- *The project databases are continually updated and completed under the Certification and Registration program.*

Analysis of recorded information

All data were verified and corrected before doing the information analysis. Among errors identified, although infrequently, was the indifferent use of the comma (,) as a decimal separator, when it should be a period in the database. This was corrected.

Statistical analysis.

No outliers were identified per stratum and the significant difference between them was evaluated using statistical packages (see Annex 6). The respective uncertainty analyzes were applied and the discounts recommended by the methodological tool were made.

The Units in charge of safeguarding the information are:

1- ***Field technical unit and silvicultural activities:***
They are in charge of: monitor forestry work, implement forest inventories, biodiversity monitoring according to the corporation's standards and document actions and record of them.
This unit and its team safeguard information in physical and digital format, which is shared with the central unit in Bogotá.

2- ***Legal Unit***
In charge of contracts and legal aspects related to the project. This unit is in charge of agreements or contracts for reduced emissions transactions. In charge of linking the information for the transactional records (Proclima), following the due registry protocols and delivering the information to the RENARE platform.

3- ***Carbon technical unit:***
It is responsible for carrying out spatial analysis, related to plot areas, forest coverage, and spatializing the project areas.

Roles and responsibilities for monitoring and reporting variables relevant to the calculation of reductions or eliminations

The structure for the monitoring process is described below.

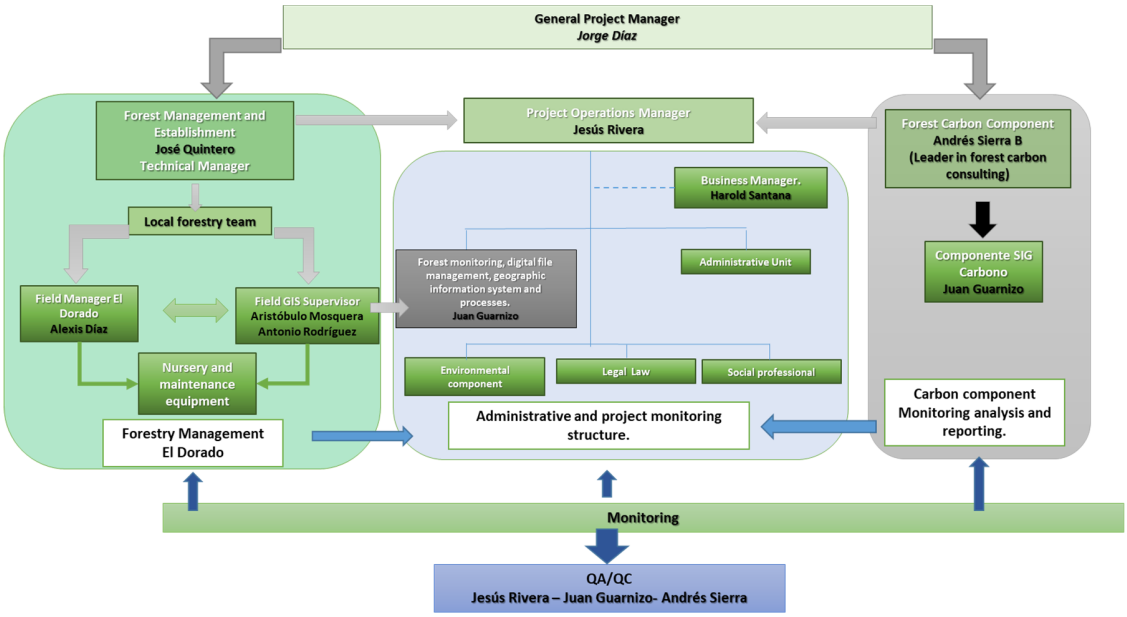

Figure 32. Structure of roles and responsibilities for project monitoring.

15.2 Variables to monitoring

Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter	$CC_{SHRUB, i}$
Data unit	Dimensionless
Description	Shrub canopy cover in shrub biomass Strata i
Measured /Calculated /Default:	Default
Source of data used	National source, national forest inventory, IPCC, UNFCCC, or Field measurement
Value (s)	*0.5*
Indicate what the data is used for (Baseline/Project/Leak Emissions Calculations)	Applied in the carbon shrub biomass *Strata i.Baseline, Project Emissions Calculations.*

Justification of choice of data or description of measurement methods and procedures applied	Taking into account that biomass in shrubs is lower than biomass in trees, a simplified measurement method can be used to estimate shrub canopy cover. An ocular estimate of the crown cover can be made.
Additional comments	AR-Tool 14. When land is subjected to periodic cycles (e.g. slash-and-burn or clear-regrowth cycles) such that shrub crown cover oscillates between minimum and maximum values at the baseline, An average shrub canopy cover equal to 0.5 is used unless transparent and verifiable information can be provided to justify a different value.

Data / Parameter	***CF***
Data unit	*tC td.m-1*
Description	*Carbon fraction of dry matter for species of type j*
Source of data used	*D´lima et al 2016* *IPCC 2003*
Value (s)	*Pino Caribeae 0.63* *E. pellita 0.49*
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline, Project emission calculation. *Actual net GHG removals by each species in the project activity.* *Applied in the eq. 68 of the methodology AR-AM0004 v.04 and AR-Tool 0014, in section 11 for the biomass and carbon shrubs. Applied in the eq. 68 of the methodology AR-AM0004 v.04 and AR-Tool 0014 V.4.2 in section 11 for the biomass and carbon shrubs.*
Justification of choice of data or description of measurement methods and procedures applied	Default value
Additional comments	It was applied to each stand model.

Data / Parameter	*R j*

<table>
<tr><td>Data unit</td><td>Dimensionless</td></tr>
<tr><td>Description</td><td>Root-shoot ratio appropriate for biomass stock. for species j</td></tr>
<tr><td>Source of data used</td><td>Table 3A.1.8 of IPCC GPG LULUCF, 2003</td></tr>
<tr><td>Value (s)</td><td>
<table>
<tr><th>Fact.</th><th>P. caribaea</th><th>E. pellita</th></tr>
<tr><td>Biomass <50tha-1</td><td>0.46</td><td>0.45</td></tr>
<tr><td>50-150 tha-1</td><td>0.32</td><td>0.35</td></tr>
<tr><td>>150</td><td>0.23</td><td>0.2</td></tr>
</table>
</td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline, Project emission calculation.
Actual net GHG removals by each species in the project activity.
Applied in the eq. 68 of the methodology AR-AM0004 v.04 and AR-Tool 0014, in section 11 for the biomass and carbon shrubs. Applied in the eq. 68 of the methodology AR-AM0004 v.04 and AR-Tool 0014 V.4.2.</td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied</td><td>Calculation of actual net GHG removals by sinks</td></tr>
<tr><td>Additional comments</td><td>Conservative choice of default values:

1. If in the sources of data mentioned above. data are available for conditions that are similar to the project (same vegetation genus. Same climate zone similar forest type). then mean values of default data may be used and are considered conservative;

2. Global values may be selected from Table 3A.1.8 of the GPG-LULUCF (IPCC 2003). or equivalently from Table 4.4 of the AFOLU Guidelines (IPCC 2006). by choosing a climatic zone and species that most closely matches the project circumstances.

3. Alternatively. given that many datasets of root-shoot ratios are relatively small because of the difficulty of determining this parameter. Conservative selection of a</td></tr>
</table>

	value from the global study by Cairns *et al.* (1997) is likely to provide a reliable default value.

Data / Parameter	Root-shoot ratio, *Rs*
Data unit	dimensionless
Description	Root-shoot ratio for shrubs
Source of data used	IPCC and UNFCCC AR Tool 0014 V4.2.
Value (s)	0.4
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Actual net GHG removals in project and baseline.
Justification of choice of data or description of measurement methods and procedures applied	Value applied and accepted by default for carbon estimates in shrubs. Data are provided by IPCC procedures 2003-2006.
Additional comments	This process is applied to the shrub's biomass

Data / Parameter	BDR_{sf}
Data unit	dimensionless
Description	The ratio of shrub biomass per hectare in land having a shrub crown.
Source of data used	AR Tool 0014 V 04.2
Value (s)	0.10
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Actual net GHG removals in project and baseline.
Justification of choice of data or description of measurement methods and procedures applied	Value applied and accepted by default for carbon estimates in shrubs. Data are provided by IPCC procedures 2003-2006.
Additional comments	This process is applied to the shrub's biomass

Data / Parameter	b_{FOREST}
Data unit	t d.m. ha^{-1}
Description	Default above-ground biomass content in forest in the region where the A/R CDM project activity is located
Source of data used	National source, national forest inventory. the tropical humid forest in Colombia. Phillips, et al, IDEAM 2014.
Value (s)	231.7 t d.m. ha^{-1}
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Applied in the biomass and carbon shrubs in the regeneration stratum.
Justification of choice of data or description of measurement methods and procedures applied	Value applied and accepted by default for carbon estimates in shrubs. Data are provided by IPCC procedures 2003-2006.
Additional comments	This process is applied for the early successional states in the natural regeneration and PNR, accord tool AR-AM Tool 0014 V4.2.

Data / Parameter	***DLP***
Data unit	%
Description	Desired level of precision
Source of data used	-
Value (s)	10%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	(ii) Calculation of actual net GHG removals by sinks
Justification of choice of data or description of measurement methods and procedures applied	Value applied and accepted by default for carbon standard.

Additional comments	Required for the calculation of the number of plots ex-post

Data / Parameter	$z_{\alpha/2}$
Data unit	Dimensionless
Description	Value of the statistic z (normal probability density function)
Source of data used	*Excel program*
Value (s)	1.97
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Measured, according to the confidence level
Justification of choice of data or description of measurement methods and procedures applied	(ii) Calculation of actual net GHG removals by sinks
Additional comments	Required for the calculation of the number of plots ex-post

Data and parameters monitored

Data / Parameter	A_{PLOT}, *i*, $A_{SHRUB,i}$, *Ai*
Data unit	*Hectares*
Description	*Sampled plot area; stratum area*
Measured /Calculated /Default:	*Standard operating procedures prescribed in the national forest inventory apply. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.*
Source of data used	*Field measurement*
Value (s)	*500 m2*
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	*Estimation of biomass content at the plot level during sampling.*

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	*30m measuring tapes.*
Measurement/reading/recording frequency	
Calculation method (If applicable)	
QA/QC procedures applied	*Prescribed quality control/quality assurance (QA/QC) procedures on 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 / Parameter	*Ai*
Data unit	*Hectares*
Description	*Stratum area*
Measured /Calculated /Default:	*Standard operating procedures prescribed in the national forest inventory apply. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.*
Source of data used	*Remote Sensing*
Value (s)	**Strata** / **AREA (ha)** **Low** 587.14 **Regular** 218.70 **Medium** 395.33 **High** 152.05 **Total** 1,353.2
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	*Estimation of biomass content at stratum level.*
Monitoring equipment (type, accuracy class, serial number,	*GIS processes*

calibration frequency, date of last calibration, validity)	
Measurement/reading/recording frequency	*Each verification (minimum every 2 years, maximum 5 years)*
Calculation method (If applicable)	*Measured*
QA/QC procedures applied	*Prescribed quality control/quality assurance (QA/QC) procedures on 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 / Parameter	*nPlots,i*
Data unit	*plots*
Description	*Total of sampling plots in stratum i Total area of sampling plots in stratum i*
Measured /Calculated /Default:	*Standard operating procedures prescribed in the national forest inventory apply. In the absence of these, the manual published by SOPs, or that of IPCC GPG LULUCF 2003, will apply.*
Source of data used	*Field measurement*
Value (s)	**Strata** / **n** **Low** 30 **Regular** 10 **Medium** 17 **High** 10 **General Total** 67
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	*Determine adjustments to biomass estimates at the stratum level.*
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	
Measurement/reading/recording frequency	*Each verification (minimum every 2 years, maximum 5 years)*

Calculation method (If applicable)	
QA/QC procedures applied	*The sampling protocol was applied, and training of field personnel was developed. The developed procedure and the information obtained are then evaluated.* *Development of error control according to PD* *In each verification process, new measuring tapes will be available to ensure correct operation and accuracy of measurements.*

Data / Parameter	*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 collar diameter, basal area, etc.) used as a data source for the model.*
Measured /Calculated /Default:	*Measured*
Source of data used	*Field measurement in sampling plots*
Value (s)	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	*Applied in allometric or volume equations, for each species.*
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	*Diametric tapes (±1mm error)*
Measurement/reading/recording frequency	*Each verification (minimum every 2 years, maximum 5 years)*
Calculation method (If applicable)	
QA/QC procedures applied	*Data cross-checking is performed on the sampling plots. New diameter tapes were used during the development of the inventory.* *The staff was trained in the correct way to measure and use the equipment.* *An audit process was carried out, and under cross-verification the data was corroborated in a sample of more than 10% of the established plots.*

	This process was performed with metallic diametral tapes, which show fewer variations in precision.

Data / Parameter	*H*
Data unit	Meters (m)
Description	Tree height
Measured /Calculated /Default:	Measured.
Source of data used	Field measurement in sample plots.
Value (s)	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Applied in allometric or volume equations, for each species.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	*Forestry laser II*
Measurement/reading/recording frequency	*Each verification (minimum every 2 years, maximum 5 years)*
Calculation method (If applicable)	
QA/QC procedures applied	
Comentarios	Height measurements were taken on all plots in the commercial stands and on all trees in the plots. This was in line with the recommendations of the monitoring plan and PDD, as it was suggested to sample only a proportion of the trees and to develop allometric equations to estimate the heights of the unmeasured trees. The field team received additional training on the correct establishment of plots, including equipment management, reading and maintenance. To verify that the plots had the correct areas, more than 10% of the established plots were remeasured.

Data / Parameter	*T*
Data unit	*Año*
Description	*Time period between successive carbon stocks estimates.*
Measured /Calculated /Default:	*N.A*
Source of data used	*Measured*
Value (s)	*7.8 years*
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	*Estimate the reduced emissions for the monitoring period.*
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	
Measurement/reading/recording frequency	
Calculation method (If applicable)	
QA/QC procedures applied	
Commentaries	

15.3 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 Quantification of GHG emission reduction / removals

16.1 Baseline emissions

Reference emissions are considered zero.

Source	Gas	Selection	Considerations for the project.

Burning of woody biomass.	CO_2	No	Emissions from burning biomass are counted as a change in carbon content.
	CH_4	Yes	The methodology allows the burning of woody biomass as part of site preparation and as part of forest management.
	N_2O	Yes	The methodology allows the burning of woody biomass as part of site preparation and as part of forest management.

Although the methodology allows the 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). According to the said decree, this activity is sanctioned by the regional autonomous corporations. Therefore, burning and its potential emissions are NOT considered in the project activity.

16.2 Project emissions/removals

16.2.1 Identification of the sampling area.

The sampling area corresponds to the plots planted within the Proyecto Forestal El Dorado.

16.2.2 Stratification

Stratification is key when performing reduced emissions assessments. It is recommended to develop stratifications based on aspects such as species, sowing date, and 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, and site qualities, among others that make stratification reformulate.

The stratification procedure was developed by identifying the areas and analyzing satellite images, as described in section 15.1.2. As a result, the stratification of the development states of the forest plantations established in the projects was obtained.

- Low
- Regular
- Medium
- High

These strata can be identified in Figure 33 for the project plots. This thematic map shows the development stages, sample distribution and field inventory work.

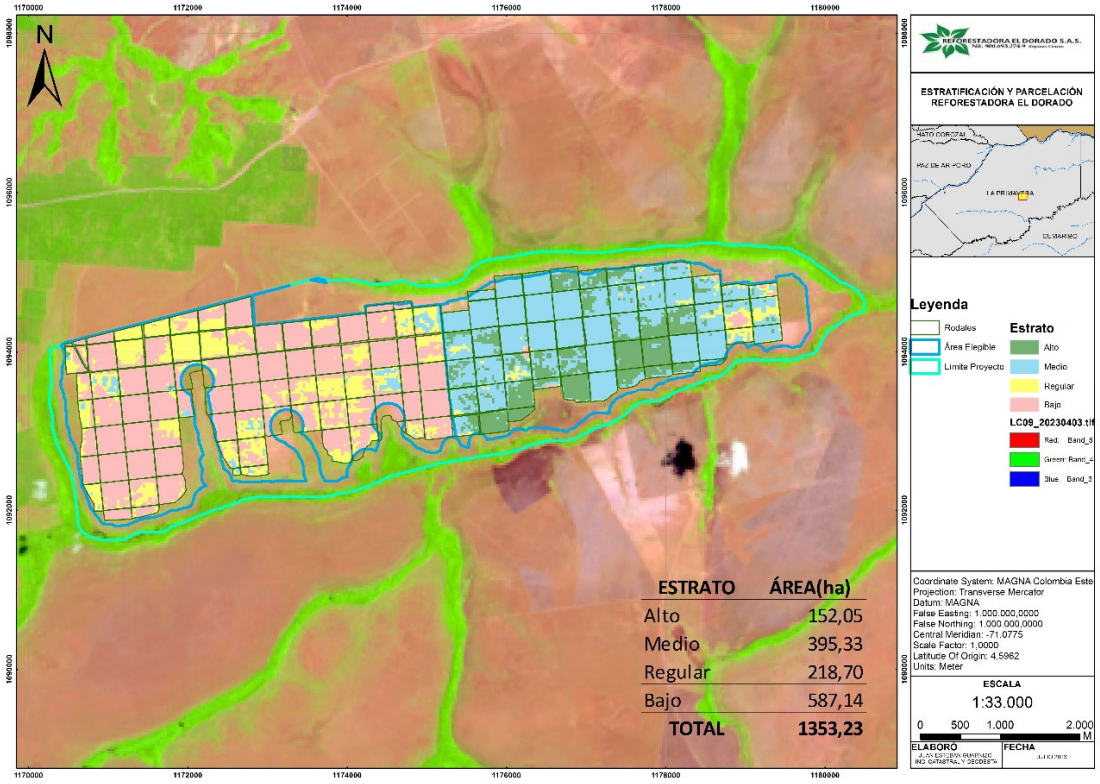

Figure 33. Stratification and plots El Dorado Project

Comparison with Primary Information

To increase the quality criteria of the process and further adjust the information to the reality found in the field, the data obtained in the plot surveys were added as samples to the seeding process and were considered in the manual editing phase. of the classification, thus, the statistical sample is increased without systematic errors, reducing the variances between the classes to be classified, which should be clarified, as they all respond to plantation coverage, they may present similarities in their spectral responses, and thus achieve low correlations between the training areas and the resulting classes.

The field plots were classified considering the amount of carbon retained, calculated based on the amount of biomass found.

Table 29. Result by stratum

Project El Dorado	
Strata	**Area (hectares)**
Low	587.14
Regular	218.7
Medium	395.33
High	152.05
TOTAL	**1,353.2**

16.2.3 Field Inventory Results

Based on the stratification and areas of each stratum, a sample size distribution was developed following the UNFCCC methodological recommendations for the CDM reforestation project.

A total of 67 plots were established in the Proyecto Forestal El Dorado, distributed across the four strata as follows (Table 30). However, only the plots in the Low, Regular and Medium strata are considered for the Proyecto Forestal El Dorado.

Table 30. Number of samples inventoried in the sampling of the strata.

Strata	Plots established
Low	30
Regular	10
Medium	17
High	10
Total	67

The plots established in the Proyecto Forestal EL Dorado area are presented in Table 31.

Table 31. Plots in the El Dorado Forest Project area

PLOT	Strata	N	E
dor_1_51	Low	5° 26' 39.244" N	69° 29' 54.054" W
dor_1_19	Low	5° 26' 23.737" N	69° 31' 10.165" W

PLOT	Strata	N	E
dor_1_30	Low	5° 26' 31.770" N	69° 31' 0.058" W
dor_1_49	Low	5° 26' 3.591" N	69° 31' 51.268" W
dor_1_36	Low	5° 26' 18.190" N	69° 31' 22.775" W
dor_1_16	Low	5° 26' 17.501" N	69° 30' 56.005" W
dor_1_20	Low	5° 25' 46.223" N	69° 31' 37.197" W
dor_1_21	Low	5° 25' 39.315" N	69° 32' 3.118" W
dor_1_37	Low	5° 26' 27.894" N	69° 31' 19.657" W
dor_1_46	Low	5° 26' 45.464" N	69° 31' 21.468" W
dor_1_45	Low	5° 26' 34.830" N	69° 32' 4.798" W
dor_1_32	Low	5° 26' 50.870" N	69° 31' 34.239" W
dor_1_22	Low	5° 26' 2.694" N	69° 32' 3.961" W
dor_1_25	Low	5° 26' 51.721" N	69° 27' 47.826" W
dor_1_17	Low	5° 26' 36.598" N	69° 30' 49.125" W
dor_1_31	Low	5° 26' 42.218" N	69° 31' 44.777" W
dor_1_34	Low	5° 25' 48.353" N	69° 32' 12.133" W
dor_1_47	Low	5° 26' 13.898" N	69° 31' 41.138" W
dor_1_35	Low	5° 26' 20.284" N	69° 31' 33.492" W
dor_1_54	Low	5° 26' 36.250" N	69° 30' 34.477" W
dor_1_52	Low	5° 26' 17.744" N	69° 29' 50.604" W
dor_1_8	Low	5° 26' 17.939" N	69° 31' 53.289" W
dor_1_15	Low	5° 26' 28.560" N	69° 30' 37.676" W
dor_1_53	Low	5° 26' 14.751" N	69° 30' 31.646" W
dor_1_38	Low	5° 25' 55.616" N	69° 31' 3.656" W
dor_1_44	Low	5° 26' 31.672" N	69° 31' 42.330" W
dor_1_43	Low	5° 26' 24.057" N	69° 31' 54.309" W
dor_1_55	Low	5° 26' 53.546" N	69° 30' 10.719" W
dor_1_33	Regular	5° 25' 40.853" N	69° 31' 48.440" W
dor_1_27	Regular	5° 26' 53.552" N	69° 27' 37.098" W
dor_1_18	Regular	5° 26' 40.528" N	69° 30' 20.762" W

PLOT	Strata	N	E
dor_1_42	Regular	5° 26' 45.323" N	69° 27' 50.729" W
dor_1_7	Regular	5° 26' 26.236" N	69° 32' 5.383" W
dor_1_2	Regular	5° 26' 5.198" N	69° 29' 37.287" W
dor_1_23	Regular	5° 26' 59.629" N	69° 28' 8.837" W
dor_1_28	Regular	5° 26' 30.055" N	69° 29' 17.168" W
dor_1_26	Regular	5° 26' 55.260" N	69° 27' 57.714" W
dor_1_9	Regular	5° 26' 41.615" N	69° 29' 39.970" W
dor_1_29	Medium	5° 27' 4.367" N	69° 29' 20.995" W
dor_1_11	Medium	5° 26' 15.473" N	69° 29' 31.726" W
dor_1_12	Medium	5° 27' 4.211" N	69° 28' 12.468" W
dor_1_40	Medium	5° 26' 33.887" N	69° 28' 41.897" W
dor_1_41	Medium	5° 27' 9.594" N	69° 28' 26.131" W
dor_1_10	Medium	5° 26' 46.721" N	69° 28' 40.480" W
dor_1_4	Medium	5° 27' 2.424" N	69° 29' 35.393" W
dor_1_48	Medium	5° 26' 41.219" N	69° 29' 19.200" W
dor_1_39	Medium	5° 26' 23.049" N	69° 29' 25.022" W
dor_1_24	Medium	5° 26' 41.035" N	69° 28' 10.124" W
dor_1_13	Medium	5° 26' 27.900" N	69° 29' 42.776" W
dor_1_5	Medium	5° 26' 34.407" N	69° 27' 57.796" W
dor_1_1	Medium	5° 26' 21.992" N	69° 28' 44.668" W
dor_1_3	High	5° 26' 7.140" N	69° 29' 22.590" W
dor_1_6	High	5° 26' 34.623" N	69° 28' 27.795" W

Estimating the sample quantity

To estimate the sample size, *Winrock's CDM A/R Sample Plot Calculator Spreadsheet* Tool was used, which applies equations and statistics for estimating sample size. The tool uses a maximum error level of 10% and a minimum confidence level of 90%.

The following table shows the results of minimum plots for the project and for each stratum and the number of actual plots established for the Proyecto Forestal El Dorado.

Table 32. Sample unit relationship (plots) established in the Reforestadora El Dorado forest carbon project initiative, in La Primavera, Vichada.

Strata	Plots established	Estimated Plots
Low	30	3
Regular	10	3
Medium	17	3
High	10	6
Total	67	15

In total, 67 rectangular plots were set up, each with an area of 500 m2, in the areas where the commercial stand model or forest plantations have been established. In this monitoring and verification period, despite considering the passive natural regeneration model, this will not be quantified due to the low development that has been identified through satellite images, assuming for this stratum, a conservative estimate regarding the removal of carbon derived from this stratum.

In this monitoring period, only the plots of the low, regular and medium strata, which are predominant in the plantations of the Proyecto Forestal El Dorado, were considered. In this way and according to the table above, the minimum sample size established by the methodology is met.

16.2.4 Carbon Account

Aboveground and Belowground Biomass

For the estimates of accumulated carbon per hectare, the equations available in the specialized literature were used, which were for the species and variety (where possible) of trees considered in the plantation, following the default values and procedures established by the IPCC (2003, 2006), when applicable. All the results described here can be found in the calculation tool: annex 6. *Balances de carbono_2015-2023*

Table 33. Applied equations taken from Annex 4, section 4.2, of IPCC 2003

Pinus Caribaea	Seedlings or trees less than 2 cm DBH or without DBH.	A value of 0.1125 kg of biomass per tree is applied. This value was obtained by destructive sampling in the same plantations.

	Trees from 0.6 cm to 56 cm DBH.	***BA=0.887+[(10486*DAP^2.84)/(DAP^2.84)+376907)]*** Equation cited by IPCC 2003[52].
Eucaliptus. pellita	For all diameters.	***BA=1.22*(DAP^2)*ht*0.01*** Equation cited by IPCC 2003.

DBH: Diameter at breast height (1.3 m) above the ground. BA: Biomass (kg), ht: total height of tree. Taken from IPCC 2003. Tables 4.A.1 y 4.A.3.

The carbon content in the below-ground component was estimated following the methodological recommendations of the IPCC 2003, which determines different factors to be applied according to the biomass content per hectare and for each species. It is important to clarify that only in the IPCC 2003 Good Practice Guide, a specific reference is made to which factors to use for root biomass in conifer plantations, eucalyptus plantations and other broadleaf species (Table 34**¡Error! No se encuentra el origen de la referencia.**).

Table 34. R values for P. caribaea and E. pellita species according to IPCC 2003., table 3A.1.8

Plantation	Reference aboveground biomass (tha^{-1})	R Factor. (Root-shoot relationship)
Conifer plantations	<50	***0.46***
	50-150	***0.32***
	>150	***0.23***
Eucalyptus plantation	<50	***0.45***
	50-150	***0.35***
	>150	***0.2***

Uncertainty

For the estimation of uncertainty in the calculations, the procedure described in the methodological tool *AR-TOOL14 V04.2*, *Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, section 3: Definition and Notation, paragraph 6 Uncertainty:*

[52] IPCC. 2003. Annex 4. Section 4.2. Examples of allometric equations for estimating above-ground and below-ground tree biomass.

Uncertainty: *Uncertainty - is in the mean value of an estimated parameter equal to the estimated standard error of the mean expanded at 90 per cent confidence level divided by the mean value, expressed as percentage.*

The tool in appendix 2 establishes the values that must be discounted when the uncertainty in the data exceeds 10%. The result of applying the above procedures is presented in Table 35.

Table 35. Result of carbon estimates (tCO2ha-1) in aboveground and belowground reservoirs by plot and stratum.

LOW		REGULAR		MEDIUM		HIGH	
Plot Cod	CO_2 ha^{-1}	Plot Cod	CO_2 ha^{-1}	Plot Cod.	CO_2 ha^{-1}	Plot Cod	CO_2 ha^{-1}
DOR_1_14	57.208	DOR_1_18	59.943	DOR_1_10	158.094	DOR_1_1	205.489
DOR_1_15	42.180	DOR_1_2	77.643	DOR_1_11	152.552	DOR_1_3	219.458
DOR_1_16	13.787	DOR_1_23	86.543	DOR_1_12	162.293	DOR_1_5	204.860
DOR_1_17	24.936	DOR_1_26	96.639	DOR_1_13	164.129	DOR_1_6	246.474
DOR_1_19	8.343	DOR_1_27	59.774	DOR_1_24	164.129	DOR_2_1	175.777
DOR_1_20	14.291	DOR_1_28	95.085	DOR_1_29	148.542	DOR_2_12	237.191
DOR_1_21	11.540	DOR_1_33	55.311	DOR_1_39	161.521	DOR_2_2	184.091
DOR_1_22	17.465	DOR_1_42	62.702	DOR_1_4	160.154	DOR_2_3	207.451
DOR_1_25	23.600	DOR_1_7	65.634	DOR_1_40	166.331	DOR_2_5	232.577
DOR_1_30	6.683	DOR_1_9	102.963	DOR_1_41	154.863	DOR_2_8	209.701
DOR_1_31	21.029			DOR_1_48	160.470		
DOR_1_32	21.899			DOR_2_10	136.567		
DOR_1_34	12.116			DOR_2_11	158.695		
DOR_1_35	13.137			DOR_2_4	158.548		
DOR_1_36	8.711			DOR_2_6	177.017		
DOR_1_37	15.633			DOR_2_7	182.452		
DOR_1_38	42.598			DOR_2_9	182.913		
DOR_1_43	46.577						
DOR_1_44	45.501						
DOR_1_45	16.864						
DOR_1_46	13.937						
DOR_1_47	19.751						
DOR_1_49	9.759						
DOR_1_50	15.154						
DOR_1_51	4.177						
DOR_1_52	39.965						
DOR_1_53	42.213						
DOR_1_54	35.252						
DOR_1_55	55.384						
DOR_1_8	31.692						
Stati	*Mean*	***24.380***	Stati sti cs Regu	**76.224**	Stati sti cs Med	***161.722***	Stati-	***212.307***

LOW			REGULAR		MEDIUM		HIGH	
	Mean adjusted	***21.993***		***76,639***		***161.722***		**209.062**
	Stand Desv	**15.388**		17.839		*11.511*		*22.389*
	N	*30*		10		17		*10*

Uncertainty management in applying conservative estimation principles.

In order to maintain conservative data principles in the project's net anthropogenic removals balances, the recommendations in BCR0001 V4.0 Section 15. 15 and those in PDD Section 3.5 for ex-post estimates.

It should be noted that for the current monitoring period, the project does not have equations or data such as the R:S ratio for forest species and established stands, for which it uses equations and information recommended by IPCC (2003). This leads to the development of the discounts defined in BCR0001 V4.0. For the present monitoring, a discount to the mean value of carbon stock per stratum was estimated at 40% of the standard deviation using IPCCC information (see Table 3 of module BCR0001 v4.0).

To apply the discount, proceed as exemplified in Table 4 of BCR0001 V4.0.

Thus, the adjusted data of average carbon values per ha (tCO_2ha^{-1}) for each stratum are as follows:

Stratum	Above and below ground carbon ($tCO2\ ha^{-1}$)	Adjustment of the mean by Uncertainty Discounting ($tCO2\ ha^{-1}$)*
Low	24.38	22.47
Regular	76.22	72.09
Medium	161.72	159.77
High	212.31	207.12

* Value used in final accounts (see ANEXX 6, Carbon_Balance_2015-2023_Dora_13_03_2025_V04_Solo_Dorado.xls)

Soil Organic Carbon

For its estimation, the tool was used: "*Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*".

This tool, according to the conditions of the pre-existing soil material in the project area, its management and state of degradation, sets a value for each hectare that is part of the project, defined by the following equation:

$$\Delta SOC = \frac{44}{12} \sum A_i * dSOC_{t,i} * 1year$$ *Equation 8 from methodological tool.*

ΔSOCAL,t: Change in soil organic carbon content t C ha^{-1} yr^{-1}.

dSOC: Annual rate of change of soil organic carbon content. t C ha^{-1} yr^{-1}.

A_i: Area of each stratum of the project ha.

I: Stratum *i*

For this estimate, the tool "ARWG30_SOC_Tool_Multizones.xls" was used, that applies the established procedures mentioned in the tool "*Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*".

Under the conditions of the project areas, the annual rate of change in organic soil carbon content is dSOC = 0.8, per hectare per year. This value, multiplied by 44/12, results in a change of 2.93333 tCO2 per year per hectare in the soil carbon sink. The results for the areas accumulated to 2019 are shown in Table 36.

Table 36. Estimation of soil organic carbon

t	Year	Area (ha)	Accumulated area (ha)	CO_2 (t)
0	2015	565.39	565.39	0.00
1	2016	628.58	565.39	1,659.99
2	2017	159.25	1,193.98	3,505.51
3	2018	0.00	1,353.23	3,973.07
4	2019	0.00	1,353.23	3,973.07
5	2020	0.00	1,353.23	3,973.07
6	2021	0.00	1,353.23	3,973.07
7	2022	0.00	1,353.23	3,973.07
8	2023	0.00	1,353.23	3,973.07

	1,353.23		29,003.94

Other sinks

Shrubs

This reservoir was estimated following the methodological recommendations and using the default factors determined by the methodological tools. This component assumes a relationship between the aboveground biomass content for the types of natural forests present in the project area and the content related to the areas established for each year of intervention. The balances for this component are shown in Table 37.

Table 37. Carbon content estimates for the project's shrub reservoir

ha	2015	2016	2017	2018	Amount
	565.39	628.58	159.25	0.00	1,353.23
Default tool values for Shrubs (t.d.m ha^{-1})					
CF_S					0.47
R_S					0.4
BDR_{SF}					0.1
b_{FOREST}					231.7
$CC_{SHRUB.I}$					0.50
44/12					3.67
$b_{SHRUB,i}$					11.585

Table 38. Shrub sink removal tCO_2

		2015	2016	2017	2018	Amount
	ha	565,39	628,58	159,25	0,00	1,353.23
Year	2015	0				0.0
	2016	1376	0			1,375.7
	2017	1376	1528	0		2,903.8
	2018	1376	1528	396	0	3,299.6
	2019	1376	1528	396	0	3,299.6
	2020	1376	1528	396	0	3,299.6
	2021	1376	1528	396	0	3,299.6
	2022	1376	1528	396	0	3,299.6
	2023	1376	1528	396	0	824.9
						21,602.6

Litter

The litter was considered for this verification, but this component was not measured directly. The indirect processes considered by the methodological tool were used: *Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities V. 03.1* "*The estimates are assumed from the results of the carbon content of the trees present in each stratum* ($C_{tree,i,t}$), multiplying by a DF_{LI} *conversion factor, which expresses the carbon content present in the litter, as a percentage of the content identified in the biomass of the trees".*

Although the methodological tool recommends a general factor, it also suggests applying other values when these are based on specific analyses carried out for the project species under similar conditions. For litter, the factor of 10% was assumed, which is the result of the average values identified in other studies for the *Pinus sp* species in the tropical region. (see annex 6.)

Table 39. Estimates of carbon removals (tCO2 ha^{-1}) from the leaf litter component for the monitoring period

DF_{LI}	*10%*	
Stratum	**Area (ha)**	**Litter $C_{LI,t}$ (tCO2)**
Low	**587.14**	1,319.31
Regular	**218.70**	1,576.57
Medium	**395.33**	6,316.25
High	**152.05**	3,149.24
Total		**12,361.37**

Dead wood

It is estimated from default values, recommended by the methodological tool. This tool suggests an expansion factor of 6%, which relates the dead wood on the ground with respect to the aboveground carbon in each stratum. This average value was multiplied by the areas of each stratum in the monitored project area.

The results of estimated dead wood carbon per hectare are shown in Table 40.

Table 40. Carbon estimates per hectare in the aboveground dead wood biomass component

DF_{DW}	Area (ha)	6%
Stratum		CDW,i, t ha-1
Low	587.14	791.59
Regular	218.70	945.94
Medium	395.33	3,789.75
High	152.05	1,889.55
Total		**7,416.82**

Total reductions in GHG emissions or net GHG removals by sinks achieved in this Monitoring period.

According to the applied and validated methodology, it is assumed that the carbon contents in the baseline are zero C_{bsl}= 0.

It is assumed that the leakage due to displacement of activity was zero. $L.K_{conversion}$= 0.

Uncertainty Estimation

Applying the procedures established by the AR-AM-Tool-14-V4.2, equation 15.

$$u_C = \frac{t_{VAL} \times \sqrt{\sum_{i=1}^{M} w_i^2 \times \frac{s_i^2}{n_i}}}{b_{TREE}}$$

Where:

C_{TREE} = Carbon stock in trees in the tree biomass estimation strata, t CO_2e.
CF_{TREE} = Carbon fraction of tree biomass; t C (t d.m.)$^{-1}$.
B_{TREE} = Tree biomass in the tree biomass estimation strata; t d.m.
A = Sum of areas of the tree biomass estimation strata; ha.
b_{TREE} = *Mean tree biomass per hectare in the tree biomass estimation strata; t d.m. ha^{-1}.*
w_i = *Ratio of the area of stratum i to the sum of areas of tree biomass estimation strata (i.e. w_i= A_i/A); dimensionless*
b_{TREE} = Mean tree biomass per hectare in stratum *i*; t d.m. ha^{-1}

uc = *Uncertainty in* C_{TREE}

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

s^2_i = *Variance of tree biomass per hectare across all sample plots in stratum i; (t d.m.* $ha^{-1})^2$

n_i = Number of sample plots in stratum *i.*

For the current monitoring period, the uncertainty result associated with the sampling is 7.05%.

According to the same AR-AM-Tool-14-V4.2, in section 37, If estimated by Equation (15) is greater than 10 per cent, is made conservative by applying uncertainty discount according to the procedure provided in Appendix 2. In this case, this discount would not apply because it is less than 10%. However, in accordance with the recommendations of BCR00001 V4.0, a 40% discount is made for the use of equations taken from the IPCC for above-ground biomass calculations. (see anexo 6_Balance_Carbono:2015_2023).

16.3 Leakages

No leaks were identified as a result of the implementation of project activities during the monitoring period. The baseline activity was related to pastures for extensive livestock farming, developed in specific areas within the same property, under an intensive livestock farming model.

16.4 Net GHG Emission Reductions / Removals

Year	*Baseline emissions / removals (*tCO_2e*)*	*Project emissions / removals (*tCO_2e*)*	*Leakage emissions (*tCO_2e*)*	*Net GHG emission reductions / removals (*tCO_2e*)*
2015	*0*	0	*0*	0
2016	*0*	717	*0*	717
2017	*0*	4,878	*0*	4,878
2018	*0*	13,509	*0*	13,509

2019	*0*	24,363	*0*	24,363
2020	*0*	35,009	*0*	35,009
2021	*0*	44,102	*0*	44,102
2022	*0*	51,105	*0*	51,105
2023	*0*	20,316	*0*	20,316
Total	*0*	*193,998*	*0*	*193,998*

Table 41. Reduced overall CO2 accounting, considering all carbon pools, strata and project areas.

Stratum	Area (ha)	tCO2 Aboveground + Belowground Biomass (tCO2)	Shrubs *CSHRUBS* (tCO2)	Dead Wood *CDW* (tCO2)	Litter *CLI* (tCO2)	COS (tCO2)	Final Account (tCO2)
Low	587.14	13,193	21,603	792	1,319	26,024.13	***193,998***
Regular	218.70	15,766		946	1,577		
Medium	395.33	63,162		3,790	6,316		
High	152.05	31,492		1,890	3,149		
Total, Reservoir	***1,353.2***	***123,614***	***21,603***	***7,417***	***12,361***	***29,004***	
Proportion (%)		***63.9%***	***11.1%***	***3.8%***	***3.8%***	***6.4%***	***100%***

An estimated net anthropogenic reduction of **193.998** tCO_2eq s estimated. he reserves or units of reduced emissions that are allocated to the buffer are **38.800** tCO_2eq, which is equivalent to 20% of the total. Finally, a total of **155.199** tCO_2eq of verifiable carbon credits (VCC) is estimated, which can be estimated as units.

Table 42. Final account of emissions reduced for the monitoring period 2015-2019

Removals per year (tCO2eq).			
Year	**Buffer**	**tCO2 Net**	**Total**
2015	0	0	0
2016	143	574	717
2017	976	3,902	4,878
2018	2,702	10,807	13,509

2019	4,873	19,490	24,363
2020	7,002	28,007	35,009
2021	8,820	35,281	44,102
2022	10,221	40,884	51,105
2023	4,063	16,253	20,316
	38,800	**155,199**	**193,998**

The file of the greenhouse gas removal balances developed for the project can be found in the annex *6.*

16.5 Comparison of actual emission reductions with estimates in the project document

According to the estimates made ex-ante, it is evident that for the current verification period, they are below what was expected. For the cut-off of 2023, the expected removals were **193,998** tCO2.

Compared this value with the actual measurements measured at the cut-off of the 2023 period, a difference of **32.2%** below is estimated.

Table 43. Ex ante projections of net removals.

Year	tCO2 Net	Net Ex ante verifications
2015	-9	
2016	18,390	
2017	44,465	
2018	65,828	
2019	92,979	
2020	130,246	
2021	176,177	
2022	228,770	
2023	*285,946*	***285,946***
2024	345,789	
2025	405,091	
2026	463,783	
2027	522,318	
2028	577,707	
2029	630,454	
2030	681,517	
2031	729,246	
2032	774,375	
2033	816,292	
2034	844,291	

2035	858,064	
2036	868,033	
2037	883,068	
2038	906,992	
2039	940,155	
2040	981,156	
2041	1,028,091	
2042	1,078,996	
2043	1,132,075	
2044	1,184,232	
2045	1,235,502	

16.6 Remarks on difference from estimated value in the registered project document

The related causes of the lower estimates may be associated with factors such as:

- Conditions for slower development of the stands due to the quality of the sites, soil quality, and adaptability of some species such as *Eucalyptus pellita* to the prevailing conditions. In this case, it is evident that a high percentage of Eucalyptus trees are present, with very little mortality, but very low development is evident.
- It should be noted that the Natural Regeneration stand model is not yet included in the current monitoring periods due to its very low development. This may also influence the values to be lower than the estimates.
- These estimates are discounted by 40% associated with the uncertainty derived from the use of general IPCC equations for the same species.

16.7 Permanence and risk management.

The project developed a risk analysis tool, based on the Continuity and Risk Management V1.1 tool, for the components identified in the tool. Values were assigned for the probability of the process occurring and the level of impact it could have on the reversion of the service.

The principal elements assessed according to the tool were:

- Environmental Risk
- Financial Risk
- Social Risk

Impact scores are distributed from 1 to 10 and probability of occurrence from 1 to 3. The combination of these scores for a carbon impact event ranges from 1 to 30 points.

Impacts are classified as low if they are between a value ≤ 5% affected, medium if between >5%-≤10% and high ≥10%.

The analysis carried out showed that the greatest risk is associated with possible fires in the region, due to anthropogenic and cultural processes related to the burning of pastures, which could at some point get out of control and affect the plantations. However, as a mitigation mechanism, the project has an action plan derived from early fire warnings based on IDEAM reports and in coordination with the environmental company. Fire control equipment and qualified personnel are also available.

No fires affecting forest stands were detected and reported during the monitoring period.

In general, the risk balance is classified as low with a value of 4.92%. (See calculation tool).

The project complies with the BCR recommendation to set aside 20% (see below), even though the risk is low.

16.8 Balance of credits for the market

Following the provisions of BCR V3.2, AFOLU projects must reserve 20% of the period reductions as a BUFFER. In this way, net accounting establishes that an availability of 43,678 Verified Carbon Certificates is generated for the period 2015-2023. The distribution of these is presented in the following table

Table 44. Distribution of removals for the years between 2015 and 2023. In 2023, only 4 months are taken, which corresponds to the cut-off of monitoring period 2.

Removals per year (tCO2eq).			
Year	**Buffer**	**tCO2 Net (CCV)**	**Total**
2015[53]	0	0	0
2016	143	574	717
2017	976	3,902	4,878

[53] For the year 2015, the activities begin in June, which consist of soil preparation, nursery work and others. As identified in the ex-ante projections, in 2015, it is assumed that the project does not generate positive values of carbon removals. Only from 2016 onwards are positive values identified for the implementation of the project.

2018	2,702	10,807	13,509
2019	4,873	19,490	24,363
2020	7,002	28,007	35,009
2021	8,820	35,281	44,102
2022	10,221	40,884	51,105
2023	4,063	16,253	20,316
Total	**38,800**	**155,199**	**193,998**