Monitoring Report 2020-2023

PROYECTO DE CARBONO FORESTAL ORGANIZACIÓN LA PRIMAVERA

Document prepared by Organización La Primavera

Date of issue (*03_17/02/2025*)

Monitoring Report Template (Version 1.1)	
Name of project	*PROYECTO DE CARBONO FORESTAL ORGANIZACIÓN LA PRIMAVERA*
BCR Project ID	*PCR-CO-697-142-001*
Registration date of the project activity	*08/06/2021*
Project holder	*ORGANIZACION LA PRIMAVERA SA*
Contact	*Physical address: Carrera 14 # 78-30 floor 3* *Bogotá, Colombia* *Telephone: +57 601 2579467* *Email: proyectosforestales@proyectosforestales.com* *Website: https://proyectosforestales.com/*

Monitoring Report Template (Version 1.1)	
Version number of the Project Document applicable to this monitoring report	*V03 (17/02/2025)*
Applied methodology	*NTC 6208 of ICONTEC for the record* *Transition to BCR V3.4 (28_06_2024) during the second verification.* *AR-ACM0003. CDM Afforestation and reforestation of lands except wetlands. V2.0*
Project location (Country, Region, City)	*La Primavera Municipality, Vichada Department* *Country Colombia*
Project starting date	*07/09/2012*
Quantification period of GHG reductions/removals	*07/09/2012 to 08/09/2042*
Monitoring period number	*02*
Monitoring period	02/12/2019 to 30/04/2023
Amount of emission reductions or removals achieved by the project in this monitoring period	51,427
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 Project general description

The objective of the forestry project proposal from Organizations La Primavera is to develop a reforestation project with commercial forest species in the municipality of La Primavera in the department of Vichada. In addition to reforestation, the project aims to promote the recovery and improvement of the remaining natural and gallery forests in the project area through passive restoration processes and the capture of atmospheric carbon. This environmental service contributes to the global goal of reducing greenhouse gas emissions and helps boost the local and international carbon market through the commercialization of the service. This is driven by policies such as the carbon tax on the consumption and burning of fossil fuels and the non-taxation of the tax, which companies can obtain when they purchase carbon credits. This allows them to achieve neutrality of the emissions that arise due to their activities and for which they are obliged to pay the tax.

The project proposal also aims to develop actions to protect ecosystems and areas of special ecological interest, which for years had been dedicated to extensive grazing and periodic cutting and burning of pastures and savannah areas. These activities have generated a deterioration of soils and ecosystems in the region.

Following the acquisition and subsequent change in ownership of the land, a transition from extensive cattle ranching to commercial reforestation commenced on the properties included in the project. This resulted in the complete cessation of the periodic burning of pastures. Despite the region's considerable agroecological potential, the project anticipates the implementation of measures to enhance land use conditions through sustainable management practices.

The commercial forest species considered for reforestation are *Pinus caribaea* and *Eucalyptus pellita*. The intervention areas will be 519.6 ha of P. caribaea and 27.6 ha of *E. pellita*.

The project initiative has government support and incentives to encourage the forestry sector (Forestry Incentive Certificate, CIF) and is registered with regional and national environmental authorities such as the Colombian Institute of Agriculture (ICA).

For the current monitoring period subject to the verification process, a net anthropogenic removal of 54,598 tCO2 is accounted for, for all the sinks considered (aboveground biomass, belowground, soil organic carbon, shrubs, litter and dead wood on the ground), in 547.3 hectares of commercial forest identified as established at the 2023 cutoff.

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 Forestal carbon project, *Organización La Primavera,* 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.

1.2 Project start date

07/09/2012.

1.3 Project quantification period

The monitoring period to this verification is from *02/12/2019 to 30/04/2023* 4.3 years.

1.4 Project location and project boundaries

The project is located in the municipality of La Primavera, eastern Vichada department from Colombia (Figure 1**¡Error! No se encuentra el origen de la referencia.**), bordering Venezuela. Its distance from the capital of the country, Bogotá, is close to 556 km.

The center points for the location of the plots that are part of the project proposal are shown in the .

Table 1.Center points of the location of the plots that are part of the Organización La Primavera project

Name	Center Point		Eligible Area (ha)
	Latitud	Longitud	
Mikonos I	5° 13’ 09.09”	70° 26’ 58.56”	470.201
Mikonos II	5° 14’ 09.22”	70° 25’ 41.91”	124.69
El Limonar	5° 14’ 29.99”	70° 24’ 32.06”	81.69
Total			***676.582***

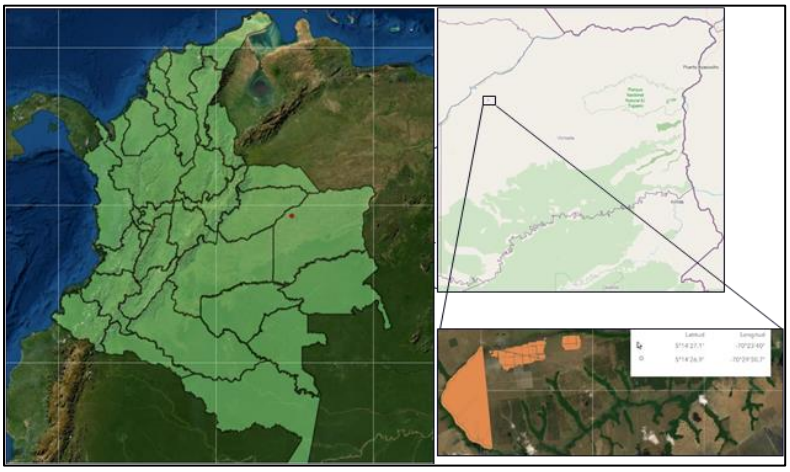

Figure 1. General Location of Forest Initiative Organización La Primavera

1.5 Project Boundaries

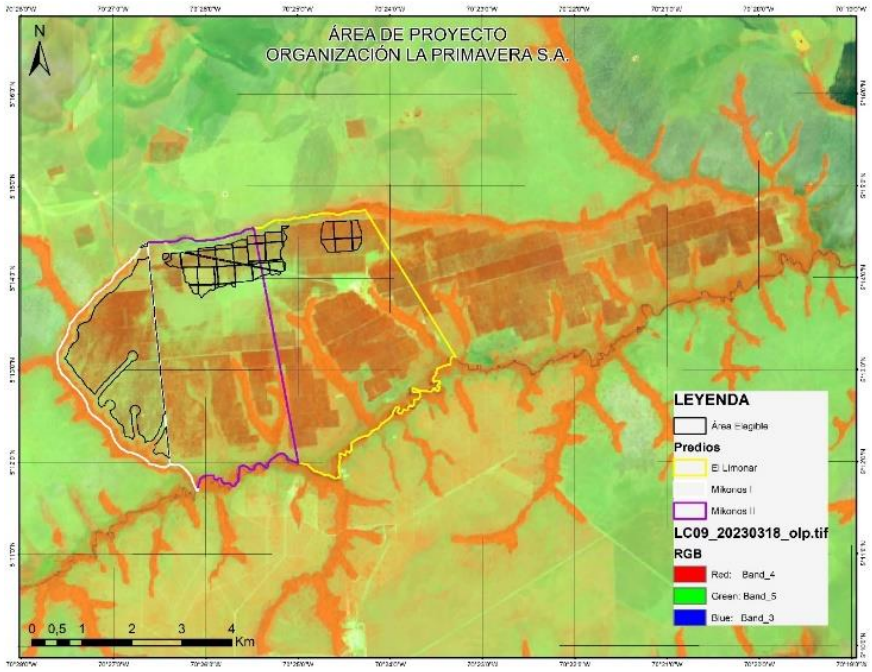

Figure 2. Fields planted under commercial stand models in the Mikonos I, Mikonos II and El Limonar properties

1.6 Summary Description of the Implementation Status of the Project

The project is a commercial forestry model, in abandoned and managed pasture areas, where extensive livestock farming activities were carried out. The initiative is considered

an umbrella project, which, in addition to the Organización La Primavera project, unifies the projects of the Redentoristas and El Dorado Organization, for what is related to the forest establishment and management plan, which is carried out by the same technical entity (Proyectos Forestales).

By 2023, the project has a total of **547.3 ha** established with the species *P. caribaea*, and *E. pellita.* From the established plantations, an accumulated emission reduction is estimated, since the start date of **124,915 tCO2**, of which by 2023, discounting verification 01 of the project (cut-off year 2019), it generates a net value of **51,427** tCO_2 in the period 2019-2023

These plantations have had silvicultural management actions, such as weed control, fire control and prevention, pest control such as ants, as well as maintenance to improve the conditions of the stands, through fertilization, pruning, and thinning.

The project has received support from the government through the forest incentive certificate (CIF) and has permits from the corporation (COPORINOQUIA) for the environmental management measures established by this type of activity in the region.

The project was registered in the PROCLIMA standard (now BIOCARBON Standard) from the beginning (21/04/2021) with the ID PCR-CO-697-142-001. The registration process and the first verification applied the methodological procedure of NTC 6208, accepted by PROCLIMA at that time. They followed the guidelines of the AR-ACM0003 methodology for carbon accounting, in line with the CDM Forest Carbon Initiative, Project for Forestry Restoration in Productive and Biological Corridors in the Eastern Plains of Colombia, promoted by the same technical operator of the current project.

Today Proclima has evolved to BCR Standard, the current project guaranteeing the rights acquired under the initiative's registration with Proclima, reviewed the new versions of the BCR standard, and has demonstrated that it meets the conditions to evolve as well as the standard, to its registration under BCR. This is shown in the compliance with the applicability of the standard (see sections below) and the methodological process contemplated in the AR-ACM0003 and BCR0001[2] V4.0 methodology. And finally, for the current registration, we proceeded to use the methodological tools for risk assessment, tool for assessing compliance with the

[2] According to chapter 3 of BCR0001 V4.0. This Methodology is based on the CDM Methodology: "AR-ACM0003. A/R Large-scale Consolidated Methodology. Afforestation and reforestation of lands except wetlands. Version 02.0 AR and CDM tools applicable to this projects' type.

Sustainable Development Goals, among others, which were not contemplated by Proclima. The results of these adjustments can be reviewed throughout this report and in the annexes.

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

The project is registered following the processes established in the Guide for the formulation, validation, and verification of forestry projects to mitigate climate change ES-I-CC-002 of 2018. And following the methodological processes of AR-ACM0003 Afforestation and reforestation of lands except wetlands. V2.0. For the current monitoring process, the project was adjusted to the requirements of the BioCarbon Registry V 3.3.1 2024. Emphasizing that the construction processes of the baseline in its validation comply with the requirements of the CDM, which is adopted today by the standard.

In the project document registered in the BCR standard with ID PCR-CO-697-142-001, the eligible areas for the project were defined. For this monitoring period, eligibility was reviewed, taking into account the criteria defined in the BCR0001 v4.0 methodology[3], for quantifying GHG removals from afforestation, reforestation and revegetation activities.

a) the areas within the geographical boundaries of the project do not correspond to the category of forest, nor to natural vegetation cover other than forest at the start of the project activities, nor 5 years before the start date. This was demonstrated by the multitemporal analysis, which shows that the project activities have been developed in non-forest areas (see Figure 3 Figure 4 and Figure 5)

[3] https://biocarbonstandard.com/wp-content/uploads/BCR0001_Documento-metodologico-ARR.pdf

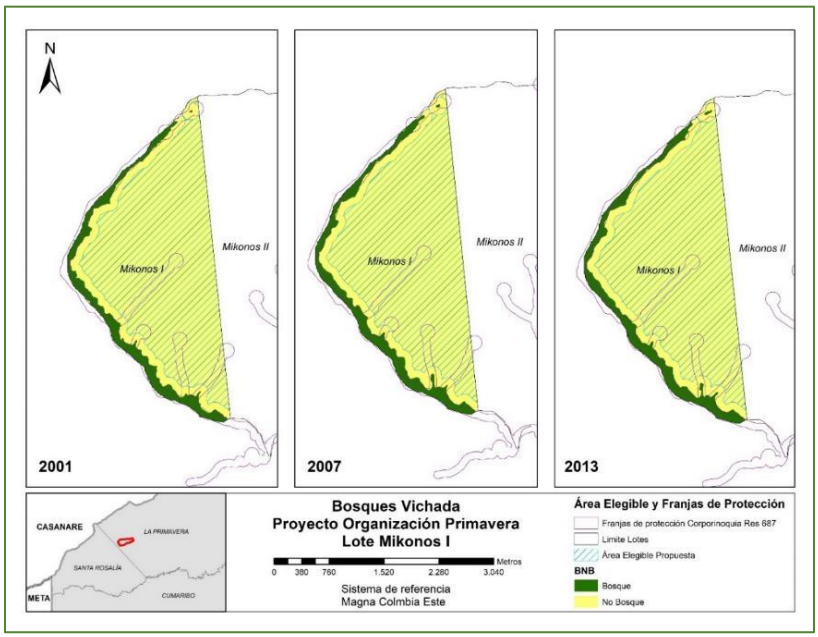

Figure 3. Non-forest maps, to demonstrate the eligibility of the project areas on the Mikonos I property

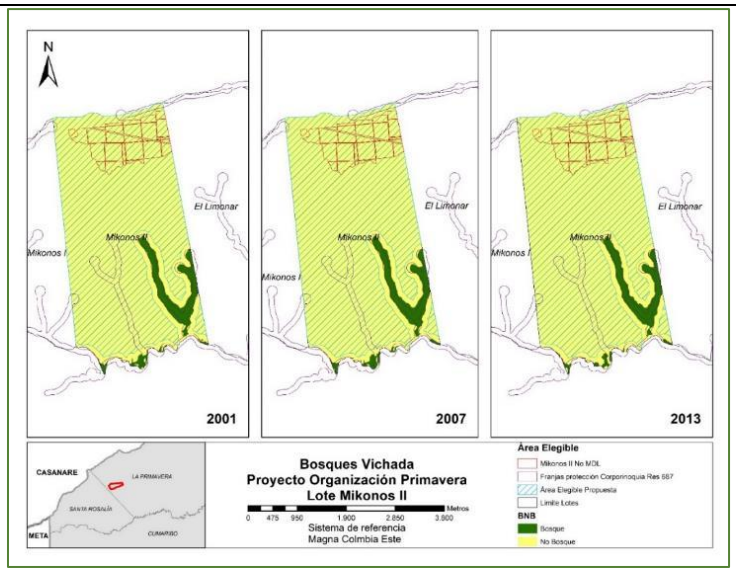

Figure 4. Non-forest maps, to demonstrate the eligibility of the project areas on the Mikonos II property

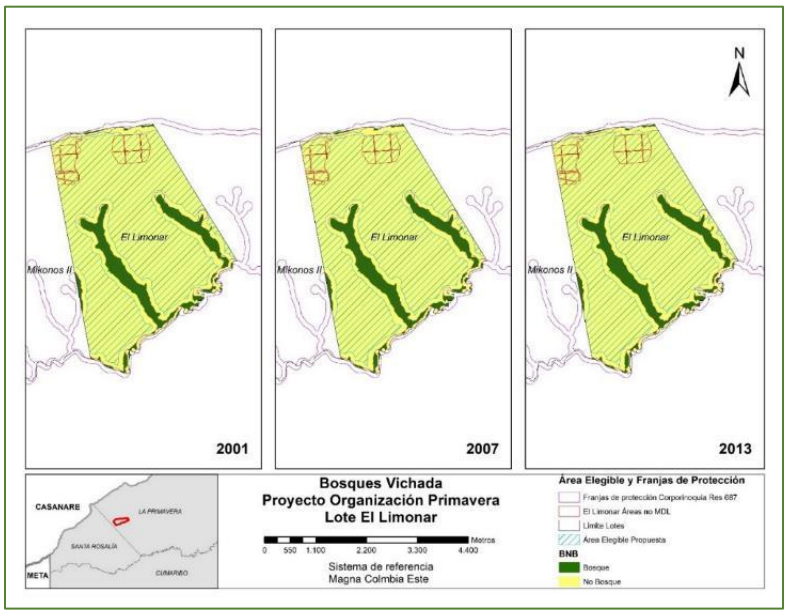

Figure 5. Non-forest maps, to demonstrate the eligibility of the project areas on the El Limonar property

b) the project activities do not generate transformation of natural ecosystems, considering that the land use of the eligible areas corresponds to pastures for extensive livestock farming.
c) project activities do not transform wetland areas, taking into account that they do not overlap with this type of ecosystem.
d) The project does not affect organic soils. The project is being developed on soils degraded by fires and livestock farming.
e) Soil organic matter, leaf litter and dead wood reserves decrease or remain stable, in the absence of the project activities, i.e. relative to the baseline scenario.
f) for the implementation of forest stands, flood irrigation is not used.
g) The project activities do not include planting or management of species reported as invasive. The selection of species for the establishment of forest plantations in the project proposal was carried out based on the evaluation of the biophysical properties of the region and the knowledge of its technological packages[4]. The commercial model uses the species *P. caribaea* and *E. pellita*, suitable for the Colombian Orinoquia.

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

h) the project excluded from the eligible areas the drainage protection strips established by national regulations. Therefore, the effects of drainage are insignificant and GHG emissions other than CO2 can be omitted.
i) there are no alterations to the soil, considering that the soils are degraded due to livestock activities and systematic burning.

3 Registry or participation under other GHG Programs/Registries

The project is not attached to other GHG programs or registries.

An analysis of nearby projects was developed to assess if there were any overlaps and to avoid double counting.

The project was registered on the RENARE platform, showing that it does not overlap with other initiatives. Registration code 1641[5].

A shape file (see annex GIS) is shared with nearby projects to demonstrate that there is no overlap with other initiatives.

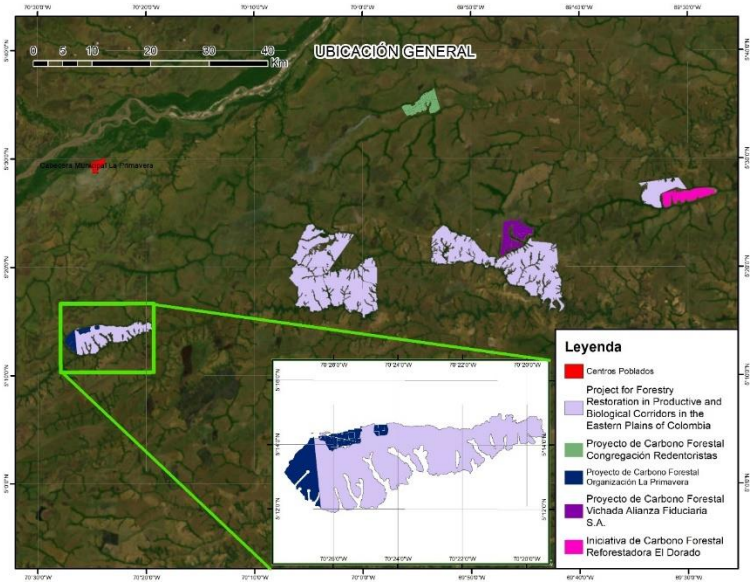

Figure 6. Not Overlapping with other GHG initiatives

[5] http://renare.siac.gov.co/GPY-web/#/gpy/datbasreg/13/1641

4 Contribution to Sustainable Development Goals (SGD)

With 7 years to go until Colombia's 2030 agenda is met to achieve the Sustainable Development Goals, it can be highlighted that the implementation of the project for the 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 2 describes the contributions of the project to the sustainable development indicators.

Table 2. Indicators that have contributed to the Sustainable Development Goals.

GOAL	Contribution
	***12.* Sustainable management and use of natural resources** 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 in the 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.
	New commercial forests have been established in areas that were previously dedicated to extensive and unmanaged livestock farming on degraded soils. These coverages have achieved the removal of significant quantities of CO_2eq during the project implementation period. A cumulative total over the current life of the Project of 124,915 tCO2.
	The burning actions 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.

	The gallery forest areas identified in the baseline persist, and the water circuit areas have increased by the corporation's standards. Likewise, areas are left for natural regeneration. Although areas have been left for passive natural regeneration, this is not documented as new forests for the monitoring period, since the succession process is still very early.
Other transversals	Jobs generated. 339 jobs have been generated and monitored in the period 2020 - 2023 distributed between men (327) and women (12). All of these have had all the conditions of social benefits, training and job security (see Annex_7) Women have been involved in nursery activities, accompaniment in the maintenance of camps, and preparation of food for workers. The following topics have been covered in the training. - Hazards in the workplace - Safety and coexistence rules - Safe handling of chemicals - Differences between poisonous and non-venomous snakes. - Standard Operating Procedure in case of ophidic accident - Good practices to ensure the good use of the water resource. - Wildlife sighting. - Environmental management plan sheets. - Waste management - Forest Fire Prevention The economic income of the personnel has been improved, guaranteeing more regular 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 that previously depended purely on income from livestock activity.

The Biocarbon SDG TOOL (V 1.0) is applied, and its results are presented in Table 3.

Likewise, the annex of the tool can be found in the annex 12_ODS_OLP_2023

Table 3. 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.	A project that contributes to the production of timber raw material for the industry and energy generation.	Commercial forests established with species adapted to the environmental conditions and recommended for the region. GIS and Shapefiles 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 CO2 (tCO2eq.) by trees in proposed stand models	Establish new commercial and natural forests to mitigate the disaster risk caused by fires./ Land use change from pastures and savannas, which are subjected to annual burning, to commercial and natural forests	GIS and Shape file databases and satellite images showing stand establishment and buffer zones for protection.
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).	New commercial and natural forests in areas previously subjected to periodic burning./ Increase in protection strips (101.5 ha) that are not considered for project activities, focusing on the protection of water sources and contributing to passive natural restoration of 129.4 ha in eligible areas./ Hectares of afforested forests that contribute to job creation, under environmental responsibility and the protection of regional strategic ecosystems./ Hectares of new	GIS and Shape file databases and satellite images showing stand establishment and buffer zones for protection.

		commercial and natural forests.	

4.1 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.
Water pollution, including contamination of rivers, lakes, oceans, or aquifers as a result of project-related activities such as emissions, spills, or waste disposal?	☐ Yes ☒ Potentially ☐ No	The containers and disposable materials will be properly disposed of in accordance with the regulations established by Corporinoquia. Hazardous or environmentally harmful materials will be taken to designated facilities where they will be properly destroyed.

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[6])
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

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

		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. (See_Anex_8)
Inadequate monitoring and assessment of biodiversity within the project area, making it Challenging to identify and address changes over time?	☐ Yes ☒ Potentially ☐ No	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. 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.

Labor and Working Conditions

Unsafe working conditions, exposing project stakeholders to potential hazards or accidents before, during and after the implementation of the activities?	☐ Yes ☒ Potentially	Forestry activities entail certain risks to workers' safety. However, one mitigation measure is the application of all regulations related to the implementation of occupational safety, having workers linked to occupational risk services. Provide safety equipment and carry out follow-up and training. The project is periodically supervised in

	☐ No	the implementation of occupational safety actions by third parties such as the labor risk management companies. (ARL, in spanish).

Community health and safety

traffic accidents or road safety hazards associated with increased traffic flow or transportation activities related to the project?	☐ Yes ☒ Potentially ☐ No	All transportation activities involve a risk of accidents, which is mitigated through measures such as setting a maximum speed limit, maintaining critical road sections, and providing staff training on best practices and traffic regulations.
inadequate health infrastructure and services in the project area, leading to challenges in addressing community health needs and emergencies?	☐ Yes ☒ Potentially ☐ No	Unfortunately, the municipal center where the project is developed does not have specialized medical care. However, this is mitigated by ensuring that each worker is enrolled and maintains active coverage in the healthcare system, facilitating administrative processes for any necessary medical transfers. Additionally, an annual health brigade is conducted for all workers to promote preventive healthcare and minimize medical emergencies whenever possible.

The SDS tool can be found in annex_14.

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 800.44.2.12.004), 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 4. Legal requirements for the implementation of the Organización La Primavera Forest Carbon *Project*

Normativity / Legal requirement	**Characteristics**	**Compliance**
Decree 1449 of 1977. Article 3.	Relate actions aimed at protecting water resources. Therefore, it defines measures for the withdrawal and protection areas. Establishing minimum margins of protection which are ratified by corporations in subsequent decrees.	The project defines the retirement areas by following 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, market their products, carry out scientific research, or for the construction of works, must request the respective permit from the Corporation, following the required requirements.	Chapter CIF, (see_Annexes) has served Resolution 0687 of 1997 adopts this decree, which determines the actions by which the forest resource administration regime of the regional autonomous corporation of Orinoquia-Corporinoquia is issued.
RESOLUTION Nº 0687 OF DECEMBER 22, 1997	By which the forest resource administration regime of the regional autonomous corporation of Orinoquia - Corporinoquia is issued.	The project complies with Chapter VIII related to the conditions of commercial forests and plantations and has had the required documents (e.g. establishment and management plan), for the start of activities adjusted to regional standards.
DECREE NUMBER 4296 OF 2004	Regulations for controlling open burning in rural areas.	The project complies with national and regional regulations and does not include in its management practices the burning of waste in soil preparation activities, or the burning of waste derived from maintenance.

Resolution 200.41-11-1130 of June 22, 2011. Update of 0687 of December 22, 1997. And Resolution 50041131571 of November 6, 2013.	By which the forest resource administration regime of the regional autonomous corporation of Orinoquia - Corporinoquia is issued. Corporinoquia, to guide regional productive development, adopts a tool that requires environmental management and technical procedures to develop sustainably the activities that are immersed within agricultural, forestry, and agro-industrial productive projects.	The OLP project has implemented the recommendations of the resolution and its updates, protecting water sources and remaining forests. The project has a registration file (File 800.33.1.10.0019) and monitoring in the Corporation where the monitoring of compliance is detailed. The environmental management policies are adopted and presented to the corporation periodically and their monitoring and follow-ups are recorded and included in the project file folder that resides in the Corporation (see annex_ 8).
Decree 3930 of 2010.	Using which Title I of Law 9 of 1979 is partially regulated, as well as Chapter 11 of Title VI-Part 11I-Book 11 of Decree-Law 2811 of 1974 regarding the uses of water and liquid waste and other provisions are dictated.	The project has the respective requests and approvals for the management of water resources and the potential polluting discharges that are generated. Complies with the due withdrawals for the protection of water sources established in article 40 of said decree (see previous paragraphs). The documents related to said decree rest in file Number 800.44.2.12.004 of the Corporation related to the forestry project. Environmental management plans have been implemented. **See annex 8_Environmental_Commitments**
LAW 139 OF 1994.	By which the Forest Incentive Certificate is created, and other provisions are dictated.	The project complies with the conditions established by said law, meets the requirements, and presents the documentation to access the CIF, having positive approval.
Document National Council of Economic and Social Policy (Conpes) 3827 of 2015.	Distribution of resources for the forestry incentive certificate for commercial purposes (CIF for reforestation) - validity 2015.	The project proposal, in compliance with Conpes 3827, demonstrates the suitability of the territory for the distribution of resources Validity 2012, for projects that begin this year, with prior approval of the compliance suitability. Furthermore, the selected species are within those required in Section III, related to suitable forest species Forest species that have technical supports that demonstrate

		export potential, among others such as Acacia (*Acacia mangium),* Melina (*Gmelina arbórea),* ***pine*** (patula, ***caribbean****, tecunumanii, oocarpa, maximinoii*), ***Eucalyptus*** (E. ***pellita****, tereticornis*) and Teak (*Tectona grandis*), Rubber (*Hevea brasiliensis)* and 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 which allocated the resources under the procedures described and defined before decree 2448 of 2012.
Resolution 1447 of 2018. RENARE	By which the monitoring, reporting, and verification system of mitigation actions at the national level referred to in Article 175 of Law 1753 of 2015 is regulated, and other provisions are dictated.	This resolution establishes the registration times for initiatives before RENARE. In compliance, the project initiative submitted formal registration to the Ministry of Environment and Sustainable Development in 2019. See the 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[7]) For the year 2021, the project achieved registration in RENARE with ID: 1641

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,

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

regulations for projects providing environmental services related to carbon change. For this reason, the project has delegated the Geographic Information System Unit, the **Carbon Business Unit** and the **Legal Department of the Forestry Projects Unit** and directly responsible to OLP 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[8].
- 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: 800.33.1.10.0019, 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[9], 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

The Proyecto Forestal Organización La Primavera is aligned with the strategies proposed in the National Climate Change Policy[10], that seek to shape effective policy to influence decision-making to advance towards sustainable, climate-resilient and low-carbon development.

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

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

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[11], 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	The project activities that add efforts related to line 7 of the National Climate Change Policy are associated with the protection and non-intervention of 101.47 (19% eligible area that corresponds to 13% of the total area of the

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

margins, as well as restoration of degraded areas within farms	property) hectares ((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 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[12], 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 Organización La Primavera, demonstrating its commitment to contributing to GHG mitigation, also carries out actions related to climate change

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

adaptation, derived from the implementation of project activities, adding to the lines of action of the National Climate Change Policy.

The table 6 describes the actions carried out by the project, through the implementation of activities to contribute to climate change adaptation.

Table 6. Project actions that contribute to adaptation to climate change

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 Table 5.
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 Gavilan, 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[13]
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)[14] [15].

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

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[16]
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 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.

[16] https://globalcarbontrace.io/storage/PCR-CO-630/initiatives/PCR-CO-630-142-001/Documento%20de%20proyecto.pdf

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	Organización La Primavera S.A (OLP)
Contact Person	Jesus Rivera
Position	General Director
Adress	Carrera 14 # 78 - 30 Floor 3. Bogotá DC, Colombia
Phone Number	(+57) 601 257-9467
e-mail	jesusrivera@proyectosforestales.com

7.2 Land Tenure

The Mikonos I, Mikonos II and El Limonar properties are registered under public instruments of the municipality of Puerto Carreño (Vichada) with the following real estate registration numbers.

Table 7. List of real estate license plates detailing the ownership of Organización La Primavera properties

Property	Register
Mikonos I	540-1954
Mikonos II	540-1952
El Limonar	540-1951

As established in these documents, governance and the area under control are in coordination with the Organización La Primavera. The legal ownership documents are confidential in nature and are presented in Annex 9 (Ownership to the auditing and certifying entities of the project).

Considering that the ownership of the land is demonstrated by legal documents (Annex 9_Legal Documents), within the properties, commercial forestry activities can be carried out and benefits can be obtained from the sale of the environmental service of carbon

capture, thanks to the planted and regenerated areas (see management plans presented to the CIF), in addition to what is recorded in the registry of the Colombian Agricultural Institute (ICA). The legal documents and forestry records show that the La Primavera Organization is the direct beneficiary of the income from the forestry activity and the sale of the Environmental Aspects capture service.

7.3 Responsible for the mitigation project

Table 8. Contact Information of project managers

Jesus Rivera	General Director of the Forest Carbon Project 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 km2, 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 km2 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.

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 7); which end up becoming limiting factors for agricultural development due to excesses or deficits of water.

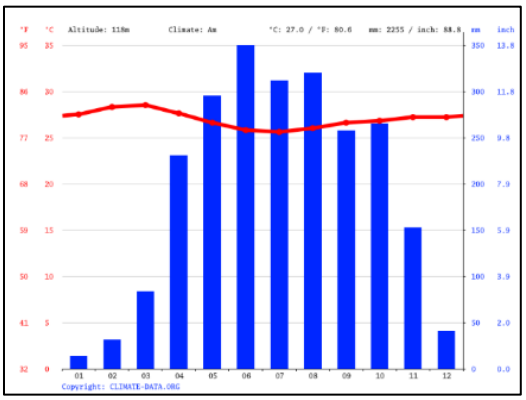

Figure 7. Distribution of precipitation throughout the year in the municipality of La Primavera Vichada. The driest month is January, with 13 mm. Most of the precipitation in the municipality falls in June (months on the horizontal axis), and the average is 336 mm, for an average annual precipitation 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.

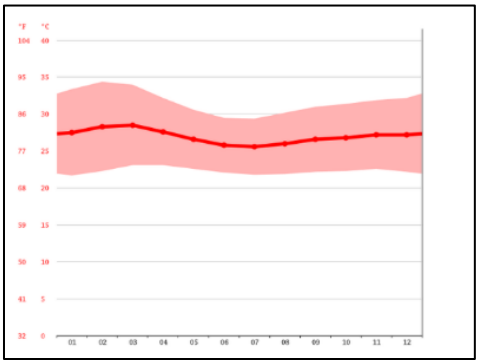

Figure 8. Behavior of the average temperature over a period of one year for the municipality of La Primavera Vichada. Its highest peak is located in March with 28.5 °C and the lowest in July with 25.6 °C, presenting a variation of 2.9 °C. Source: Climate-Data.org

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 corresponds 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, 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 9 and Figure 10)

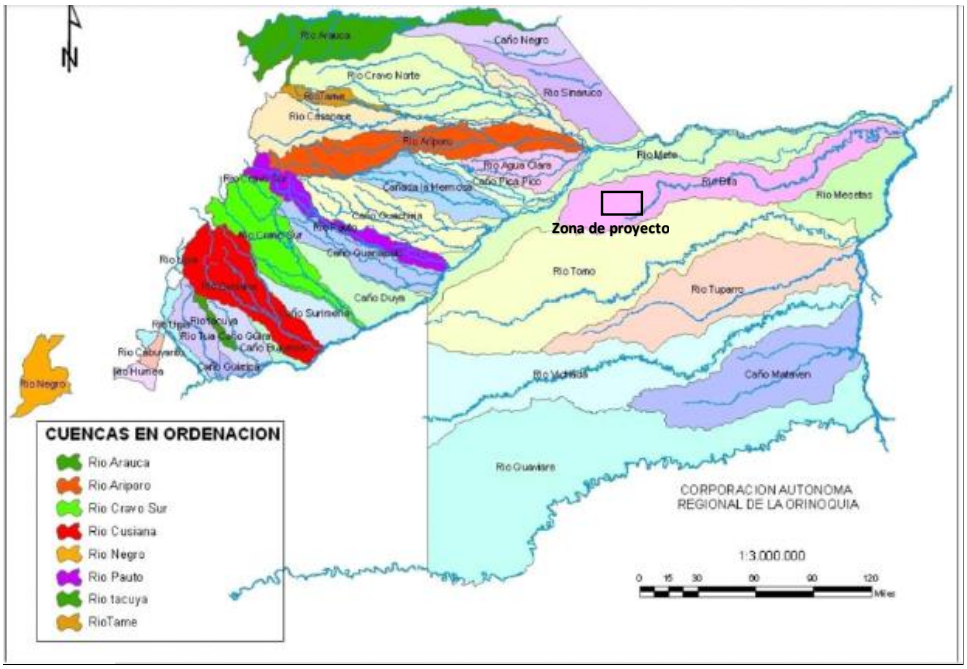

Figure 9. Hydrographic basins of the jurisdiction area of Corporinoquía. Source: CORPORINOQUÍA, 2013. Plan de Gestión Regional Ambiental 2013-2025

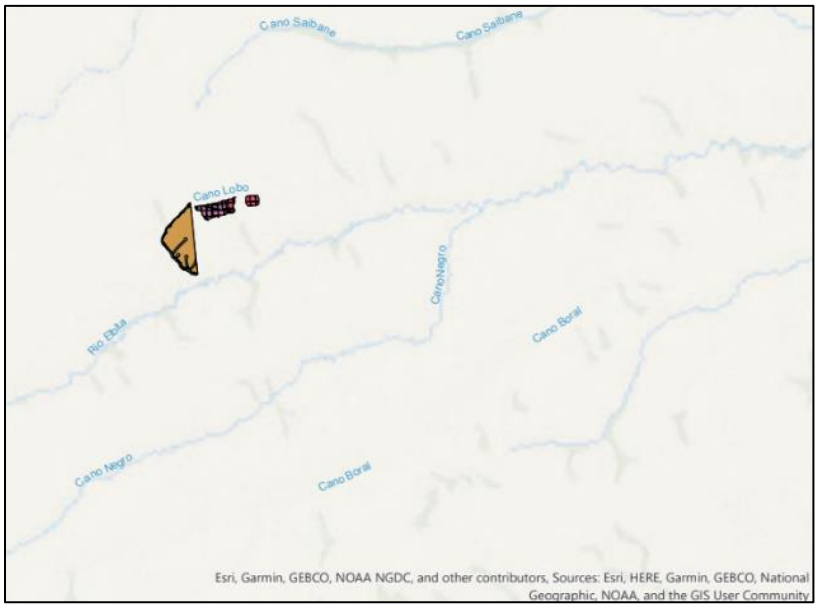

Figure 10. Main rivers and channels around the project area. Source: taken and adapted from geographic data viewer, geological service of Colombia (SGC Servicio Geológico Colombiano).

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 is 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[17]). 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 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 11 shows the density of the Vichada water network. (Ecofondo, 2005[18]).

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

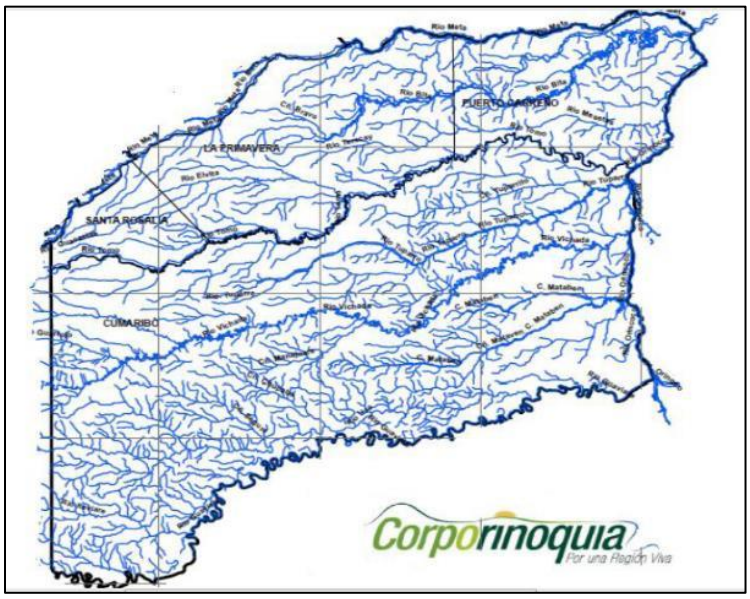

Figure 11. Main water currents of Vichada. Source: CORPORINOQUÍA, 2013. Plan de Gestión Regional Ambiental 2013-2025

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 riverbeds. (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 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 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 soil 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[19].

Table 9. IGAC Soil analysis. (source: 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	

19 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 (%)
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
	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* 10

Table 10. 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 bi-seasonal rainfall regime with 3,000 to 4,000 mm of annual precipitation80. 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:

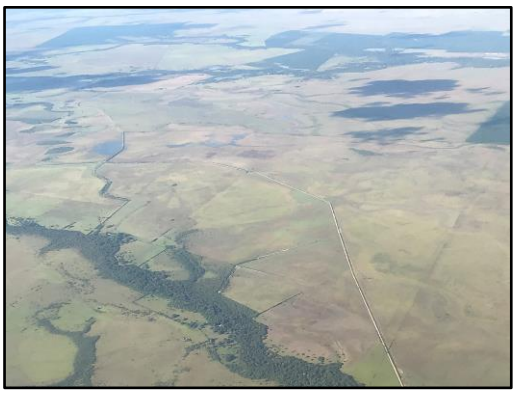

Image 2. Images of the land uses and ecosystems that determine land uses in the Colombian highlands *and in the project area*

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 3,500 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 km2 and densities of 900 to 1,000 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[20]).

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 grown 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[21].

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

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

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[22].

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.

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.

[22] Banco de Occidente, Op Cit.

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[23].

Wetland areas

For the eligible areas of the Organización la Primavera Project, the information is superimposed with the zoned areas of permanent wetlands for Colombia, prepared by the Ministerio del Medio Ambiente y Desarrollo Sostenible[24]. As a result of the 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 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).

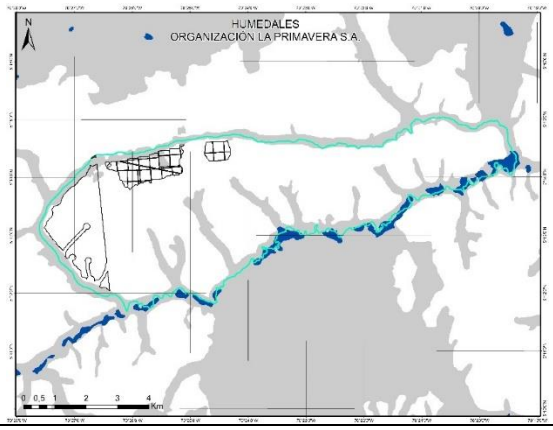

Figure 12. Eligible areas and areas determined as permanent wetlands in the project region

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.

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

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 11)

Table 11. 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 (hec)	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 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 grass 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 24,500 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[25], Bernal *et al.* 2016[26]). 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 26,000 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[27]).

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[28]).

[25] 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,

26 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.

27 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.

[28] 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.

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[29]).

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 13, 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.

[29] 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.

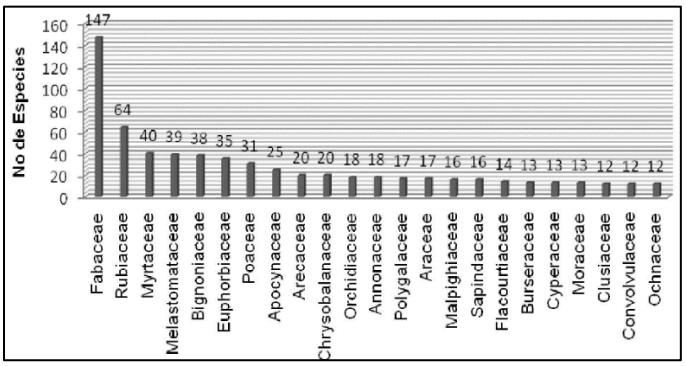

Figure 13. Registry of families with more than 10 species reported in the Orinoqués Anden

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 sheets, gallery forests and bushes, even on the edges of the morichales. In Figure 14, 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).

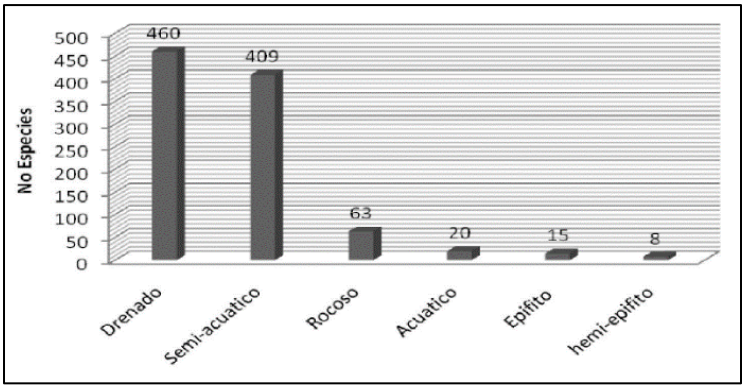

Figure 14. Number of flora species by growth environment in the Anden Orinoqués in Vichada, Colombia

Of the flora species found, 845 are of importance for the diet of wildlife, such as birds, mammals, fish and reptiles (Figure 15).

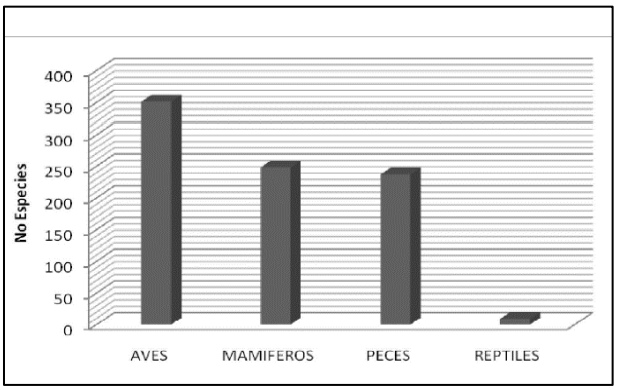

Figure 15. Flora species associated with fauna feeding in the Orinoqués Andén

Likewise, a study carried out by Mosquera *et al*., 2017[30] 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* (Lentibulariaceae), *Polygala microspora* (Polygalaceae) y *Borreria pygmaea* (Rubiaceae) (Table 12).

Table 12. 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

[30] 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.

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[31] 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. 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 *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,

[31] 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.

particularly the pisingos (*genus Dendocygna*), which present massive local migrations from the plains to the foothills, which add to the transcontinental migrations. (Defler & Ródriguez[32]).

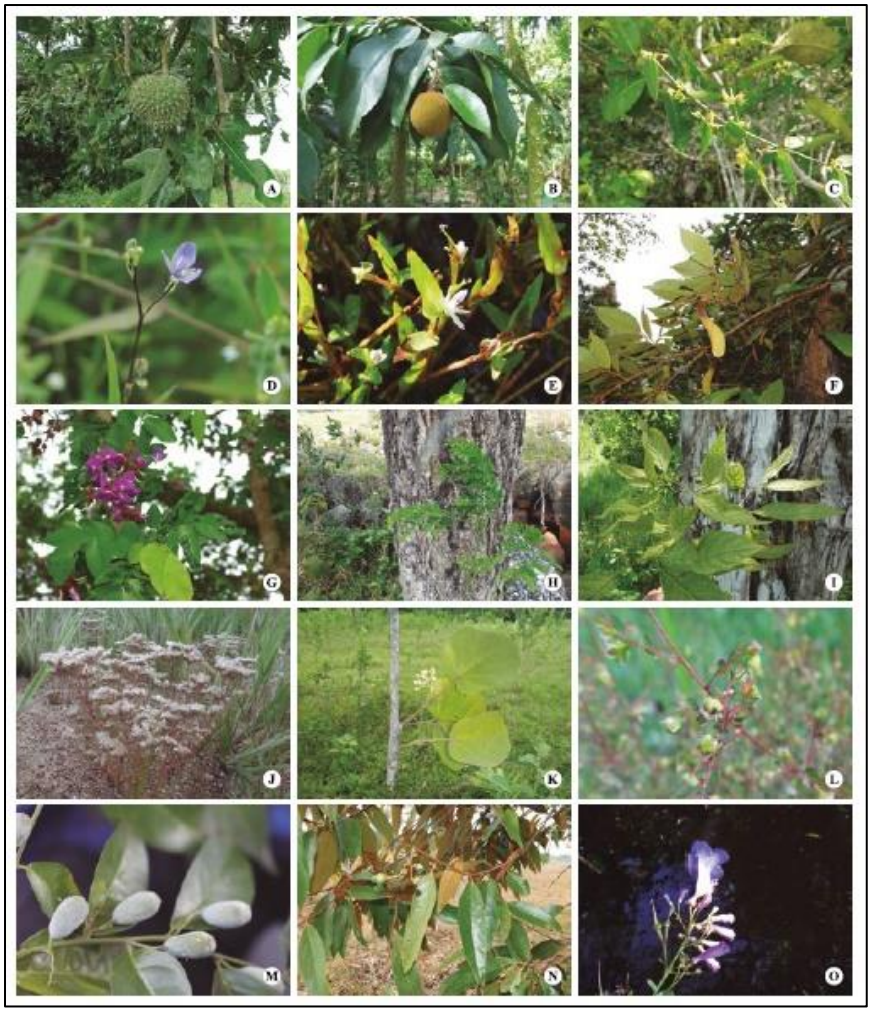

Image 5. Photographs of the new records for the vascular flora of Colombia, collected in Orinoquía, department of Arauca. ***A)*** *D. riberensis,* ***B)*** *T. duckei,* ***C)*** *T. medinae,* ***D)*** *M. burchellii,* ***E)*** *Murdannia aff. M. triquetra,* ***F)*** *M. tovarense,* ***G)*** *M. crucisrubierae,* ***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.*

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

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 bird species have been reported out of the 1,889 reported for Colombia (Donegan et al. 2011), which corresponds to about 40% of the total species in the country. It is estimated that approximately half of the birds reported for the Orinoquia are found in the department of Vichada (Image 7). According to Acevedo-Charry et al. (2014), 368 species have some type of record in this department, while the Biodiversity Information System of Colombia (SiB Colombia 2015) contains records of specimens of 350 bird species for Vichada, represented in the biological collections of the country, of which the majority 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 presumed that there are many more records, but there are gaps in knowledge regarding 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.

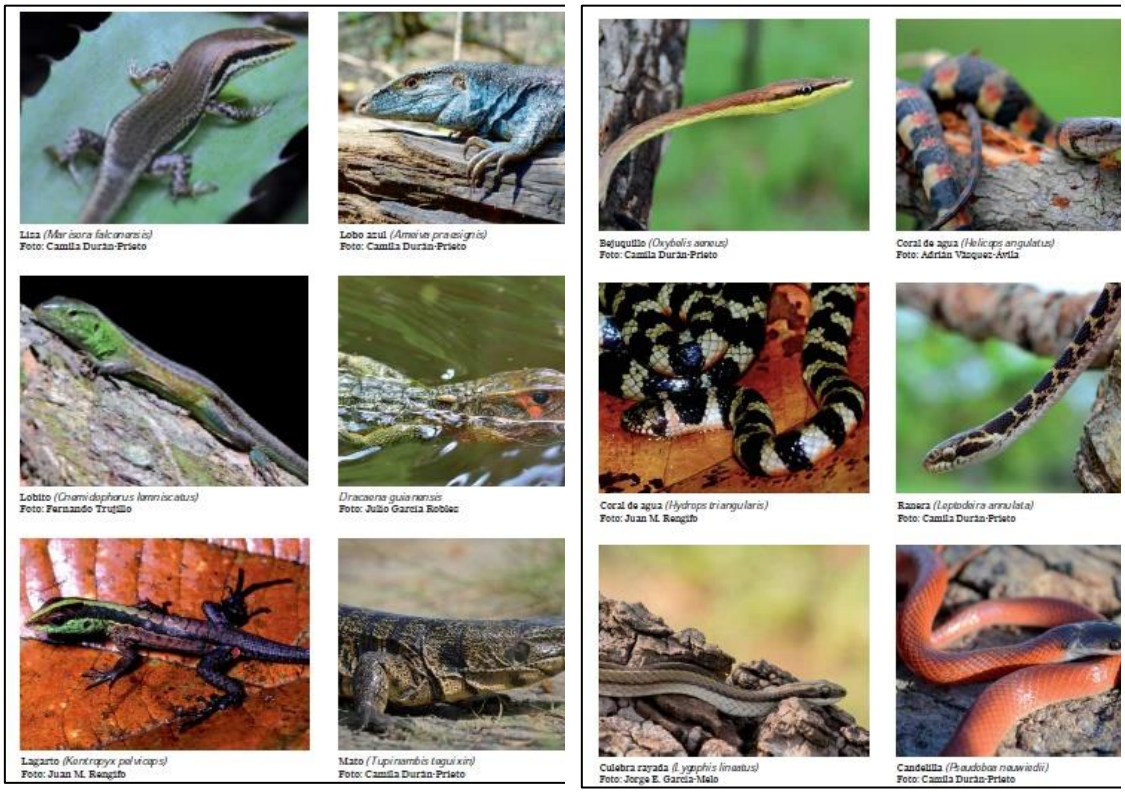

Image 8. Photographic record of some species of amphibians and reptiles of the Orinoquia Region

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).

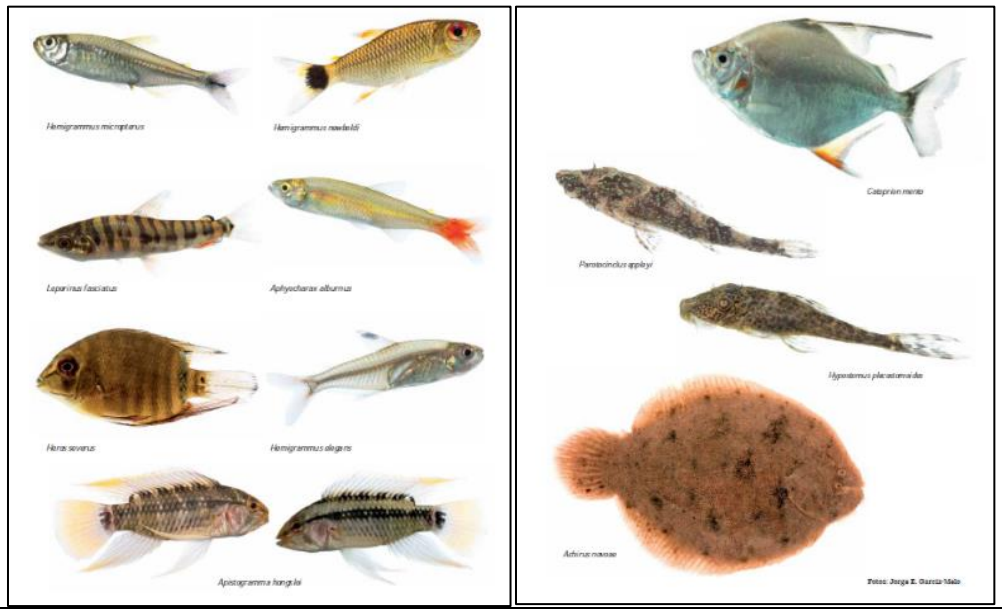

Image 9. Photographic record of some species of fish in the Region

Endangered Species

The chigüiro (*Hydrochaeris hydrochaeris*) is an important rodent in the area and is threatened as a result 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).

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.

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,[34] 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.

The Table 13, shows the list of species reported as threatened in the Eastern Plains Region and the Transitions of the Colombian Amazon.

Table 13. 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	

[34] https://omacha.org/

Scientific Name	Common Name	Category
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*

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. The implementation of the management plans has been verified by the corporation through visits to the project, as evidenced in order 600.6.22.0483 of 2022, which orders the control and monitoring of environmental measures on the project premises.

Image 11. Signs used in the projects for proper waste management and disposal. The oil and fuel handling areas are isolated and have channels for collection in case of any type of spill.

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 12. Signs referring to wildlife conservation.

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 16).

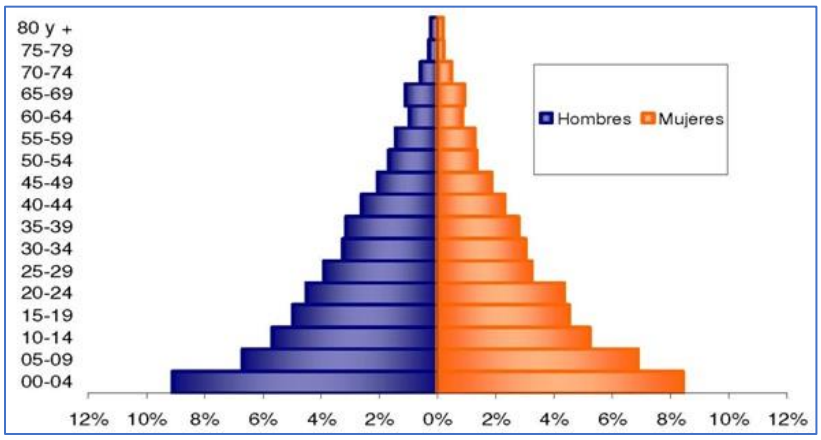

Figure 16. Population distribution years prior to the start of project activities. Source DANE, 2010. https://www.dane.gov.co/files/censo2005/PERFIL_PDF_CG2005/99000T7T000.PDF

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 14, 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 much 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 14. Age distribution for the department of Vichada, year 2016[35].

Age ranges	>1 old	1-4	5-14	15-44	45-59	>60
Total, by age	2094	8,115	18,554	31,621	8,228	5,090
Percentage (%)	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 15), 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 15. 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**	

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.

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

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 (**¡Error! No se encuentra el origen de la referencia.**Figure 17)

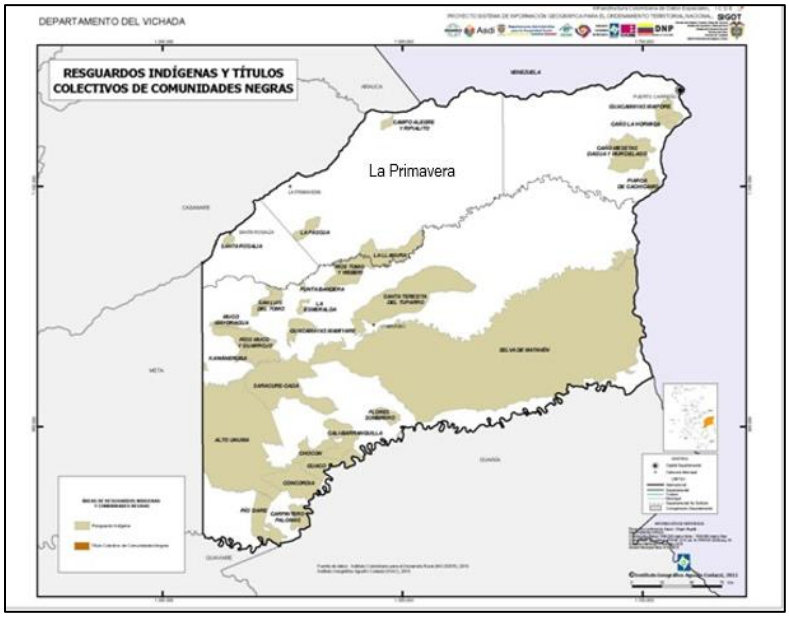

Figure 17. Distribution of the indigenous population in the Department of Vichada. Source: Geographic Information System for Planning and Territorial Ordering – (SIG-OT), 2010)[36].

9.3 Society and economy

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 number of 125,750 head of cattle was estimated. An extensive activity where it

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

is estimated that only 3% of the properties dedicated to livestock farming have implemented pasture improvement[37]. 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[38]) 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 18. Contribution of bovine heads by department to the national inventory (2014). Source: National Agricultural Census 201439.

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

[38] 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

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

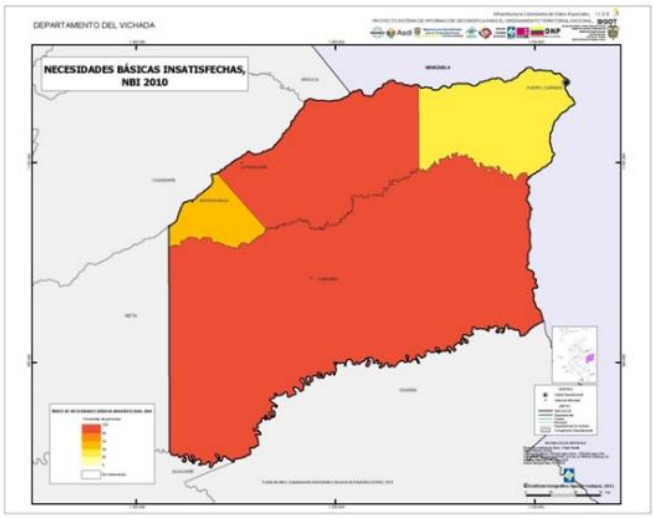

Figure 19. Unsatisfied basic needs department of Vichada year 2010: Source: https://sigot.igac.gov.co/sites/sigot.igac.gov.co/files/sigot/Mapas%20Tematicos/Departamentales/Vichada/Vichada_NBI_2005_V2_2012_01_18.pdf

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 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.

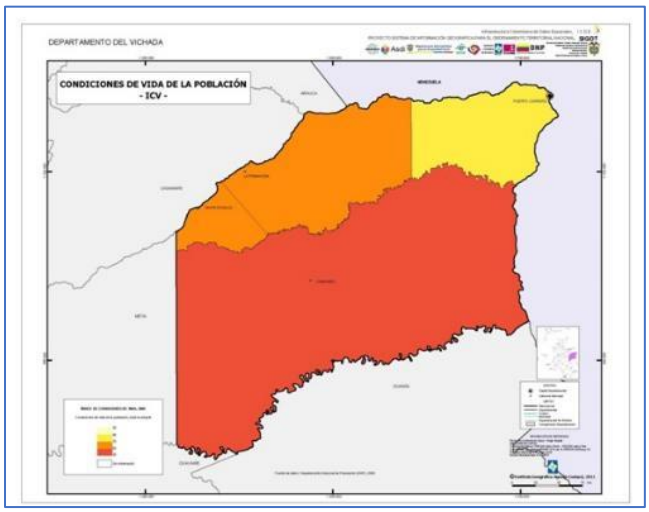

Figure 20. Living conditions of the population of Vichada. In yellow the best conditions and in red and their transitions the worst living conditions[41]

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 339 monthly jobs have been generated between men and women.

41 https://sigot.igac.gov.co/sites/sigot.igac.gov.co/files/sigot/Mapas%20Tematicos/Departamentales/Vichada/Vichada_ICV_Total_V2_2012_01_18.pdf

Table 16. Number of jobs for the monitoring period 2019-2023

Year	Women	Man	Total, Monthly jobs
2020	0	24	24
2021	0	112	112
2022	12	170	182
2023	0	21	21
Total general	**12**	**327**	**339**

Among the sources of income of the population in the municipality is 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.

As a result, there is no evidence of any negative impact on the local population or the cultural and social aspects of the area. Supporting evidence for this evidence can be found in the annexes: *3_Capacitaciones, 9_Documentos_legales, 14_no_impacts, and 7_Componente_social_empleos.*

9.6 Identification of ethnic communities

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.

In terms of social aspects, the project is in the Altillanura Colombiana, where there is a low human population and a lack of labor for agricultural activities. The forestry project has contributed to the training and qualification of the population in alternative labor activities other than extensive cattle farming.

Step 2. As a complement, the Ministry of the Interior in resolution No. 000000156 of October 19, 2011, the year prior to the start of activities, provides certification of the NO presence of black or indigenous communities in the area of direct influence of the project.

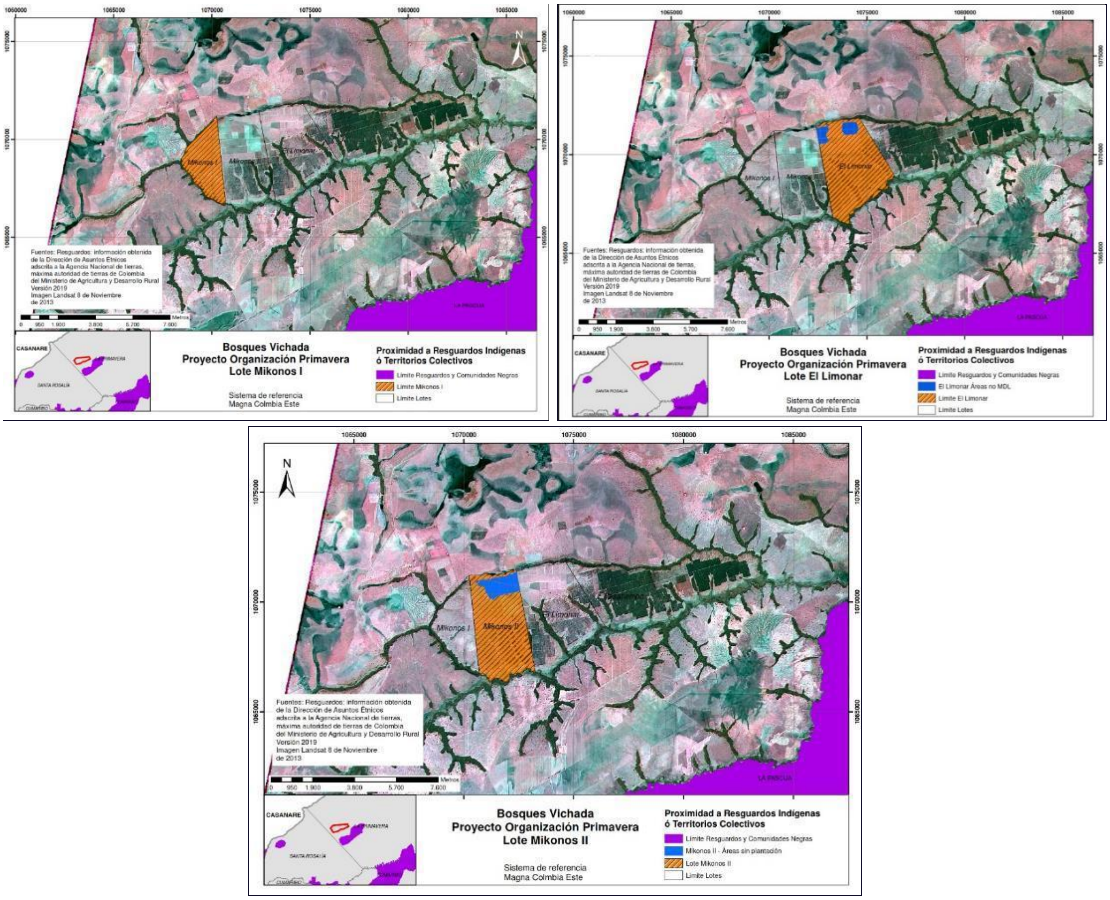

Figure 21. Location of the project centers and proximity to ethnic communities.

As seen in Figure 21, The project and its area of influence do not overlap with indigenous reservation areas or black communities and is certified by the Ministry of the Interior and meets the requirements established for the promotion of forestry activities. In this way, it is evident that no negative impacts are generated on vulnerable population groups.

10 Stakeholders' Consultation

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 Organización La Primavera.

11 REDD+ Safeguards

N.A

12 Special categories related to co-benefits

N.A.

13 Grouped Projects

N.A.

14 Implementation of the project

14.1 Implementation status of the project

The project currently has 547.3 ha of established commercial stands. Distributed in two species:

- *Eucalyptus pellita*: 27.63 ha
- *Pinus caribaea*: 519.65 ha

With this verification, two monitoring periods of the carbon component are completed, the current one corresponding to the years 2020-2023, that is, 12 years have passed since the beginning of the activities.

Regarding the silvicultural management of the stands, for the current period, what is related to fertilization plating and weed control stands out, and an aspect of utmost importance for the region is the maintenance of firebreak rounds, which has reduced the risk of fires or their spread to or from plantations. Table 17 summarizes the silvicultural management actions developed during the monitoring period (see anexx_10_manejo_forestal)

Table 17. List of silvicultural activities in the monitoring period. The activities for the stands planted in each period are listed.

			Planting year lot			
		Activity	**2011**	**2012**	**2013**	**2014**
Activity Year (2020-2023)		Firebreak corridors_2020	44	8	4	32
		Firebreak corridors_2021	44	8	4	32
		Firebreak corridors_2022	44	8	4	32
		Firebreak corridors_2023	44	8	4	32
		Ant Control_2020	44	8	4	32
		Ant Control_2021	44	8	4	32
		Ant Control_2022	44	8	4	32
		Ant Control_2023	44	8	4	32
		Pruning 2020	0	0	1	0
		Pruning 2021	0	0	1	0
		Clean base trunk	0	0	0	1
		Fertilization 2020	0	0	0	1
		Fertilization 2021	0	0	1	0
		Fertilization 2022	0	0	0	1
		Weed control_2021	0	3	0	0
		Forest Thinning_2021	0	75	0	0

Maintenance of firebreak corridors

Pruning and weed control

Control of ants and pathogens.

Image 13. Images of forest management activities in the forest

14.2 Revision of monitoring plan

N.A. The project continues to follow the same monitoring plan that was validated. Therefore, it has not been modified.

14.3 Request for deviation applied to this monitoring period

N.A.

14.4 Notification or request of approval of changes

N.A.

15 Monitoring system

15.1 Description of the monitoring plan

For the implementation of the Forest Carbon project Organization La Primavera, the methodology used has established a series of procedures to ensure clear accounting of the greenhouse gases that would be mitigated, in this case the CO_2 captured and fixed in the growing forest cover. Therefore, once the project has been approved, monitoring includes the evaluation of the state of the forest stands on the ground and the spatial monitoring of the areas through the use of cartography.

15.1.1 Project boundary monitoring

Spatial Analysis

Figure 22. Process flow for area quantification

Identification of study area

Spatial analysis begins with the identification of the study area. In this case, joint analyses were carried out for four nuclei that are part of the forest carbon initiative, considered as a regional umbrella project. Each nucleus shares aspects related to forest management by having the same technical assistance as the La Primavera forest nucleus. The nuclei that are part of the Forest Carbon Initiative have developed their own project documents and monitoring reports separately, but with unified analyses for the four, to facilitate and standardize processes.

In this way, the project area is defined as the properties that make up each of the projects developed in the municipality of La Primavera, Vichada, Colombia (Figure 23).

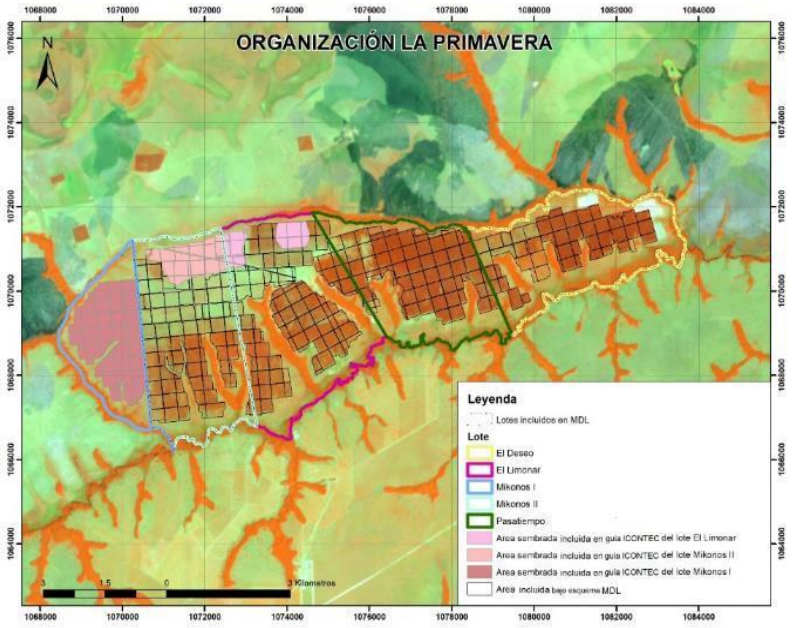

Figure 23. General location of the project Farms planted under commercial stand models on the properties Mikonos I, Mikonos II y El Limonar

The baseline as described in the project record is characterized by clean, weedy pastures. See *Figure 24*, *Figure 25* and *Figure 26*

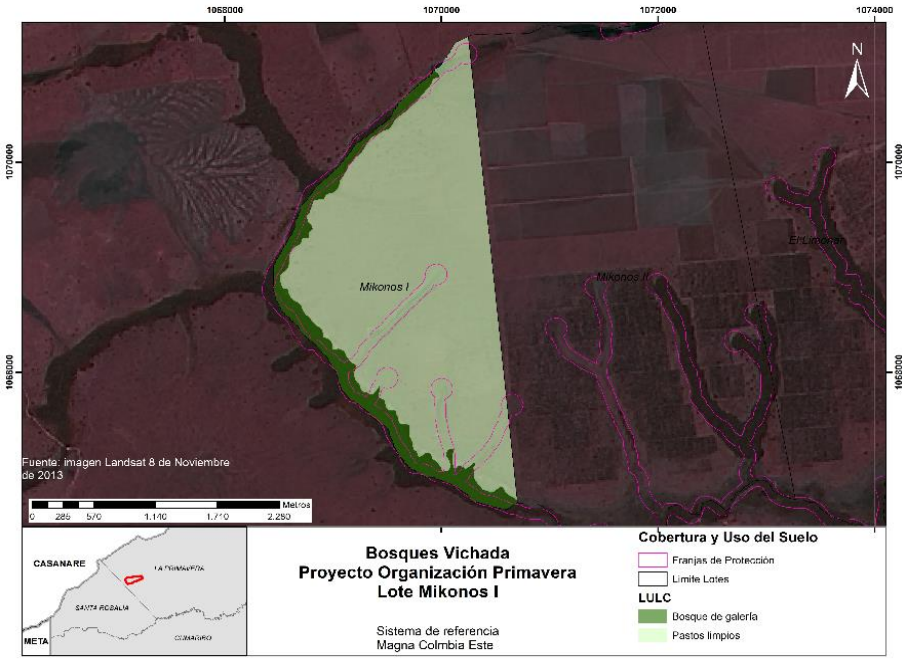

Figure 24. Type of coverage in the baseline of the El Mikonos II area project. Clean pastures predominate in eligible areas

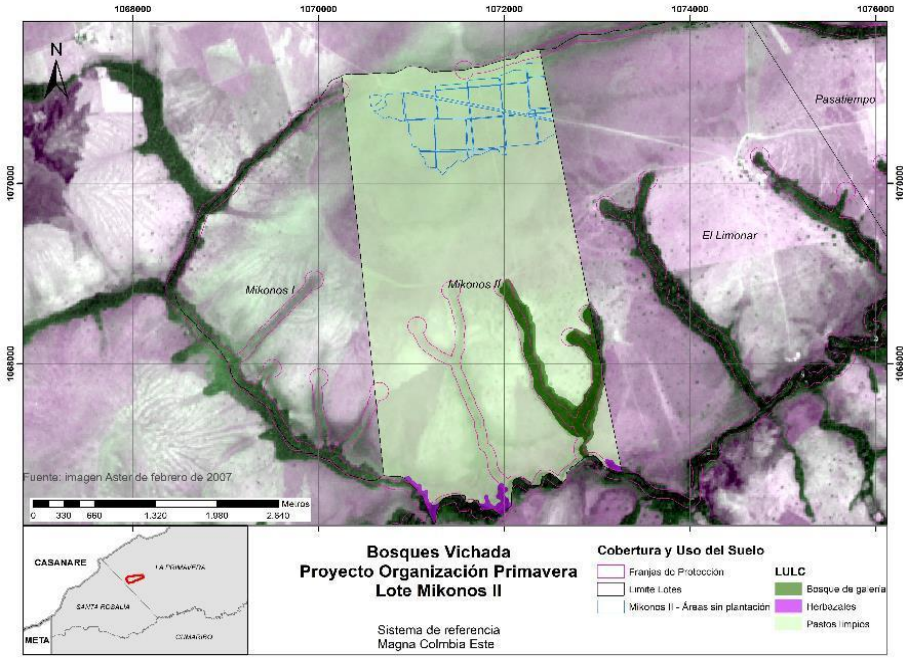

Figure 25. Type of coverage in the baseline of the El Mikonos II area project. Clean pastures predominate in eligible areas

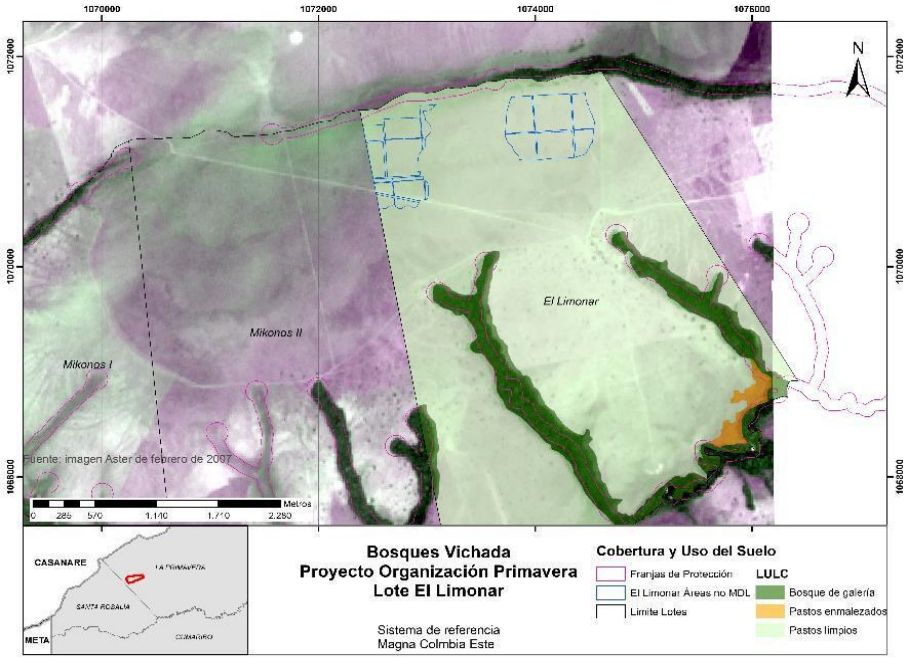

Figure 26. Type of coverage in the baseline of the El Limonar area project. Clean pastures predominate in eligible areas

Field Monitoring

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 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 CO2 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.

Forest Management Monitoring

These activities undoubtedly also affect the greenhouse gas balances that are to be mitigated, given that poor standing 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, sewing 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 against two types of stands:

Commercial stand model: composed of a 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.

Data/Parameters:	$A_{PLOT,}$
Data unit:	ha
Description:	Sampled plot area; Strata area
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*
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:	***APLOT,i***
Data unit:	ha
Description:	The total area of the sampling plots in Strata i
Data source:	Field measurement. 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	Hot control is applied, that is, directly when sampling is carried out, with the same measurement equipment. Reference equipment is properly stored in the office.
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
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 biomasses 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
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 m2 (Figure 27) 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.

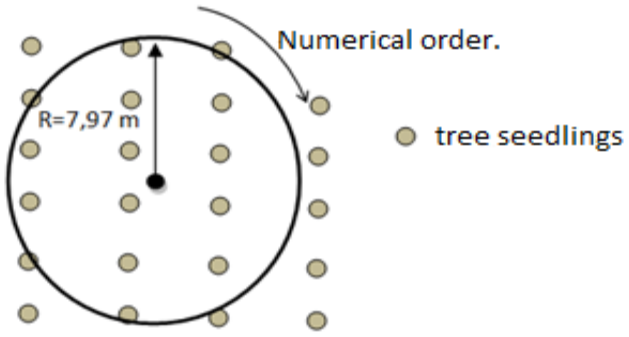

Figure 27. Scheme of the temporary survival monitoring plot.

15.1.3 *Monitoring of the forest management*

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 dendrometric variables will be followed to estimate the volumetric increases in each stand. This information will serve as an input to validate the volumetric equations by species, or to reformulate new equations that allow the volume to be modelled 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 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 content

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 colors 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 criter, 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[42]:

Steps:

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

Parameters:

A: Total project area; ha

i: Strata

Ai: Area of each Strata *i*; ha

AP: Monitoring plot area; ha

st_i: 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 strata i.*

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

$$E_1 = Q_1 * p$$ *(Equation 2 from 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 ($\pm$ 10% of the average)*

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

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 International43.

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 (Figure 28**¡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.

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

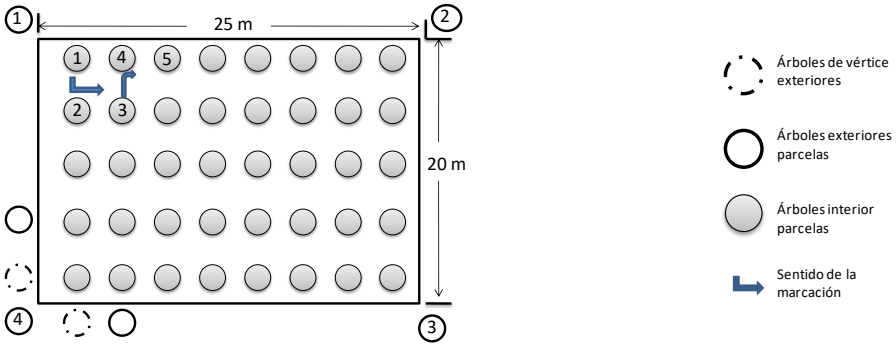

Figure 28. Survey of monitoring plots. The dimensions correspond to 25m x 20m, for an area of 500 m2.

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 coordinates, the center point of the plot is located in the field with 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 (see Figure 28). 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.

The detailed procedures for this purpose are detailed in the field sampling plan protocol.

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 be overseen by 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.
- 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:

$$\text{Error of measurement } (\%) = \frac{Data_1 - Data_2}{Data_2} \cdot 100\%$$

The allowable error should not exceed *5%.*

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:

$$\text{Error of measurement}(\%) = \frac{(Number\ of\ errors\ identified)}{Total\ number} \times 100$$

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.

Safeguarding of information

The data obtained in the field will be kept at least for the subsequent monitoring period. The forms must be scanned and saved in digital formats, along with the digitized files. Likewise, the tracking and monitoring of the other variables must be preserved digitally, in various media such as files in the cloud, hard drives, and USB flash drives. A fixed and secure means will be implemented to archive the information and prevent its loss.

Data and parameters to quantify emissions reduction.

To implement the OLP carbon project, the methodology implemented has established a series of procedures to guarantee a clear accounting of the greenhouse gases that would be mitigated, in this case, the CO2 captured and fixed forest cover that is growing.

Data and complementary information to determine the baseline or reference scenario

Environmental effects

Biodiversity: This monitoring is articulated to the demands developed by the regional autonomous corporation, which within its policies establishes monitoring and control of the impacts that the project activity may generate on the biotic component, especially biodiversity and specifically to the vulnerable species, or Conservation Target Values (VOC). Under this component, the list of species present in the region and their conservation status will be updated based on updated regional studies and complemented by monitoring carried out by the project. For the project and following the environmental requirements of Corporinoquia, the environmental corporation, through file number **800.33.1.10.0019** of the corporation, periodic monitoring is carried out in compliance with the biodiversity component in the areas of influence of the project.

Finally, it is planned to develop processes related to the Quality of information. This provides for the optimization of control and quality of the information collected. The process focuses on a control plan in the collection of information, archiving, verification, and internal audit of the resulting information, guaranteeing the integrity of the data accumulated for each monitoring period and throughout the execution of the proposed project activity.

Social Effects

The social impact of the project is reflected in the generation of jobs, complying with national regulations and provisions for hiring, and training for the qualification of personnel. Likewise, do not affect territories with the presence of ethnic communities.

For this component, monitoring the employment indicators per year becomes the most important, since, as noted in previous paragraphs, the non-presence of ethnic communities in the project areas was demonstrated.

15.2 Variables to monitoring

15.2.1 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***
Data unit	Dimensionless
Description	Root-shoot ratio is appropriate for biomass stock. for species *j*
Source of data used	Table 3A.1.8 of IPCC GPG LULUCF, 2003
Value (s)	**Fact.** / ***P. caribaea*** / ***E. pellita*** Biomass <50tha-1 / 0,46 / 0,45 50-150 tha-1 / 0,32 / 0,35 >150 / 0,23 / 0,2
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 eq. 68 of the methodology AR-AM0004 v.04 and AR-Tool 0014 V.4.2.*

Justification of choice of data or description of measurement methods and procedures applied	Calculation of actual net GHG removals by sinks
Additional comments	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 value from the global study by Cairns *et al.* (1997) is likely to provide a reliable default value.

Data / Parameter	**Root-shoot ratio, *R:S***
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	$\boldsymbol{BDR_{sf}}$

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

15.2.2 Monitored data and parameters

Data / Parameter	***$A_{PLOT,i}$***
Data unit	*ha*
Description	*Sampled plot area; Strata area, Project area*
Measured /Calculated /Default:	*Measured* *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) of monitored parameter	*500 m2*
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Metric lengths of 30 m.
Measuring/ Reading/ Recording frequency.	Each monitoring
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	ha
Description	*Strata area*
Measured /Calculated /Default:	Measured 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	Through remote sensing analysis
Value(s) of monitored parameter	**ESTRATA** / **AREA (ha)** **Low** 146.38 **Steady** 115.91 **Middle** 135.27 **High** 149.73 **Grand Total** **547.3**
Indicate what the data is used for (Baseline/Project/Leak Emissions Calculations)	Estimation of biomass content at Strata level. Project

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Landsat Satellite Images Field surveys concerning the project boundary within which the A/R activity has occurred. site by site
Measuring/ Reading/ Recording frequency	Each verification (minimum every 2 years, maximum 5 years)
Calculation method (If applicable)	Differentiation of spectral response according to biomass content.
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	***n***
Data unit	
Description	Total area of sampling plots in Strata i Total area of sampling plots in Strata i
Measured /Calculated /Default:	Calculated. 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	Field measurement
Value(s) of monitored parameter	**ESTRATA** / **n** **Low** 35 **Steady** 22 **Middle** 37 **High** 23 **Total** 117
Indicate what the data is used for (Baseline/Project/Leak Emissions Calculations)	Determine adjustments to biomass estimates at the Strata level.
Monitoring equipment (type, accuracy class, serial number,	N.A

calibration frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency	Each verification (minimum every 2 years, maximum 5 years)
Calculation method (If applicable)	The sample size is determined by equating.
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 PDD. In each verification process, new measuring tapes will be available to guarantee correct operation and accuracy of measurements.

Data / Parameter	$B_{TREE,l,jp,i}$
Data unit	kg tree^{-1}
Description	Biomass of tree *l* of species *j* in sample plot *p* of stratum *i*;
Measured /Calculated /Default:	Field measurement
Source of data	Field measurement
Value(s) of monitored parameter	N.D
Indicate what the data is used for (Baseline/Project/Leak Emissions Calculations)	Applied in the biomass by tree, where the number of saplings with diameter below the range of diameter applicable to the allometric or volume equations is high.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measuring/ Reading/ Recording frequency	Each verification (minimum every 2 years, maximum 5 years)
Calculation method (If applicable)	N.A
QA/QC procedures applied	The sample size should be sufficient to reduce the statistical variability of sampling. The samples are harvested and properly weighed in a weighing scale. Regarding the Weighing scale, it is

	recommended to use new scales in each verification to reduce precision errors.

Data / Parameter	**DAP**
Data unit	cm or any length unit as specified
Description	Diameter at the breast height of a tree. To determine it, equations (1) and (2) are proposed, DBH could be any diameter or dimension measurement (for example, basal diameter, root neck diameter, basal area, etc.) used as a data source for the model.
Measured /Calculated /Default:	Measured
Source of data	Field measurement in sampling plots
Value(s) of monitored parameter	
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 tape. (-+ 1mm error)
Measuring/ Reading/ Recording frequency	Each verification (minimum every 2 years, maximum 5 years)
Calculation method (if applicable)	direct measurement.
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.

	Monitoring personnel maintain a tape in perfect condition to calibrate the tapes used in the field. This tape is not used in field measurements and is stored at headquarters. Tapes that have calibration problems are replaced with new tapes of the same condition (metallic tape).

Data / Parameter	***H***
Unit	Meters (m)
Description	Tree height
Measured /Calculated /Default:	Measured.
Data Source	Field measurement in sampling plots
Value(s) of the monitored parameter	
Indicate what the data is used for (Baseline/Project/Leak Emissions 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	Random sampling was carried out in more than 10% of the established plots. The same equipment and processes were used to corroborate the proper height measurement. Trees with heights less than 5 meters can be taken with the help of a tape measure. The staff maintains a tape in perfect condition, to calibrate the tapes used in the field. This tape is not used in field measurements and is stored at headquarters. Tapes that have calibration problems are replaced with new tapes of the same condition (metallic tape). Trees with heights greater than 5 meters will be measured with digital hypsometers. The equipment will be checked for calibration before fieldwork.
Comments	Height measurements were taken on all plots in the commercial stands and on all trees in the plots. This

	process was adjusted to what was recommended in the monitoring plan and the PDD since it was suggested to only sample a portion and develop allometric equations to estimate the heights of the unmeasured trees. The field team received additional training for the correct establishment of the plots, this included equipment management, reading, and care. To evaluate biomass in natural regeneration, a specific protocol with defined steps was developed, which was shared with the field team. To verify that the plots had the correct areas, more than 10% of the established plots were remeasured.

Data / Parameter	***T***
Unit	Year
Description	The period between successive carbon storage estimates.
Measured /Calculated /Default:	Calculated
Data Source	Recorded Time
Value(s) of the monitored parameter	4.14 year.
Indicate what the data is used for (Baseline/Project/Leak Emissions Calculations)	Estimate reduced emissions for the verification period.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A.
Measurement/reading/recording frequency	Each monitoring
Calculation method (If applicable)	
QA/QC procedures applied	N.A
Comments	If two of the successive estimates of carbon storage are taken to different points in time in a year t2 and t1 (for example, in the month of April in year t1 and in the month of September in year t2), then, a fraction of value could be assigned to T
Justification of choice of data or description of measurement methods and procedures applied	

Additional comments	

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 areas

The first measure of any spatial analysis is the identification of the study area. In this case, and as the forest carbon initiative is developed, it was determined to carry out joint analyses for three cores that develop the forest carbon initiative, which although they are classified as a regional umbrella project and share aspects related to forestry management since they are covered by the same technical assistance from the La Primavera forest core, decide to develop their own project documents and monitoring reports separately, but with the unified analyses for three projects (Dorado, OLP and Redentoristas, the project is not considered Trust in current monitoring), to simplify processes and generate economies of scale of the carbon project.

In this way, the project area is defined as the properties that make up each of the projects developed in the municipality of La Primavera, Vichada, Colombia.

Figure 29. General location of forest carbon initiatives in the La Primavera

It is worth highlighting that the region has very similar conditions throughout its entire length, characteristics such as heights above mean sea level, low gradient slopes, meandering drainage, relict gallery forests located along the springs, and simple drainage. that progressively feed larger drainages, soil composition, and savanna landscapes and ecosystems; They describe the particularities of the eastern plain of the country. Due to the above, it is expected that the conditions in the areas of the entire core will also be similar, validating the analyses carried out.

To account for removals, it is necessary to apply stratification processes to established stands.

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 is developed through the analysis of satellite images.

This is the first step in which we begin to obtain information from the image; it consists of assigning each pixel in the areas of interest a certain class in the established legend. In this study, a legend was defined based on the strata of development of the vegetation present in the plantations of each property. 4 classes were defined: High Strata, Middle Strata, Steady Strata, and Low Strata; These strata were defined taking into account the state of development of the vegetation, to homogenize the separation criterion between the strata and guarantee consistency in the information.

Once the resulting legend has been defined, the classification is prepared. In this case, the supervised classification technique was used through seeding, and the maximum likelihood algorithm with null class was used as the association algorithm, since due to the conditions in that the information is presented (crops), have a defined spatial association and are differentiated mainly by their spectral response.

The seeding process consists of taking representative samples of each of the classes that make up the legend. These samples must be sections of pure coverage, without mixtures, without the presence of clouds, shadows, or any other factor that modifies the spectral response captured by the sensor present in the satellite camera. Samples must be taken randomly over the entire image, where between each sample the standard deviation does not increase to more than 8 points.

To support the classification, it was decided to create a vegetation index (Figure 30), the NDVI (Normalized Difference Vegetation Index), this index highlights the information of the near-infrared band (at this wavelength, the vegetation presents levels of reflection that help with the analysis of the state of the plants).

Once all the inputs are ready and the seeding has been carried out, the algorithm is run, managing to assign each pixel of the area of interest a respective qualitative value according to the legend prepared.

As in all semi-automated processes, supervised classification may present errors when assigning pixels to each of the classes. This is corrected through the process that consists of a visual review of the entire study area and changing the class of each of the pixels that, at the discretion of the interpreter, must be reclassified.

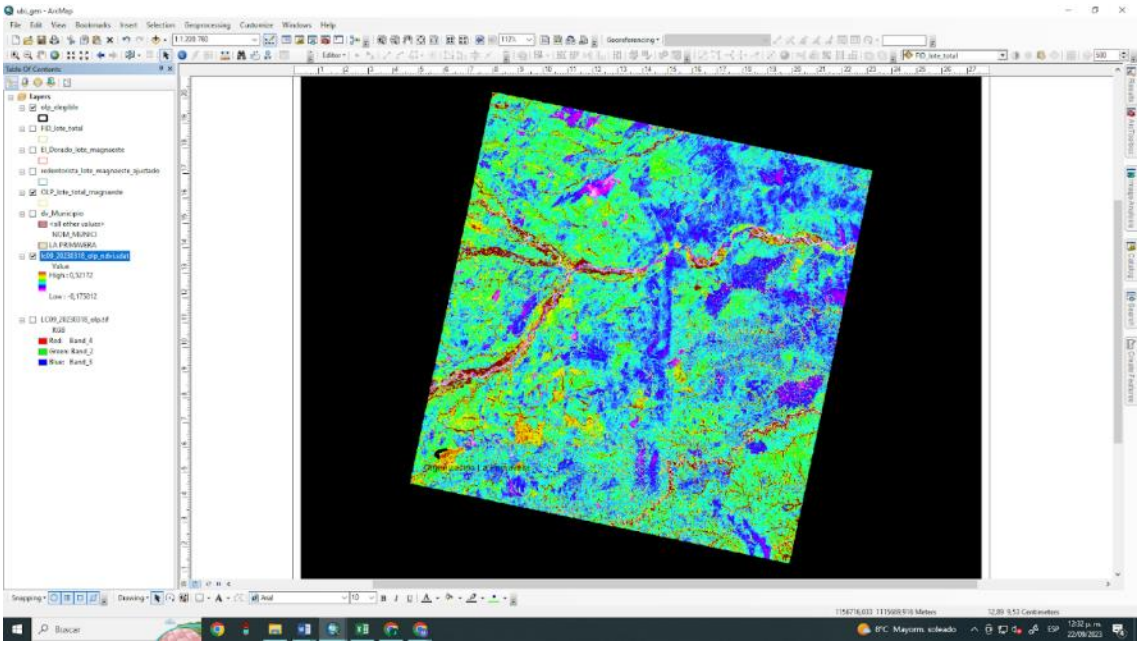

Figure 30. NDVI results

The results of the stratification were the following:

- Low
- Steady
- Middle
- High

These strata can be identified in the following thematic maps for the three nuclei in which the distribution of the sample and the field inventory work were developed in the same way.

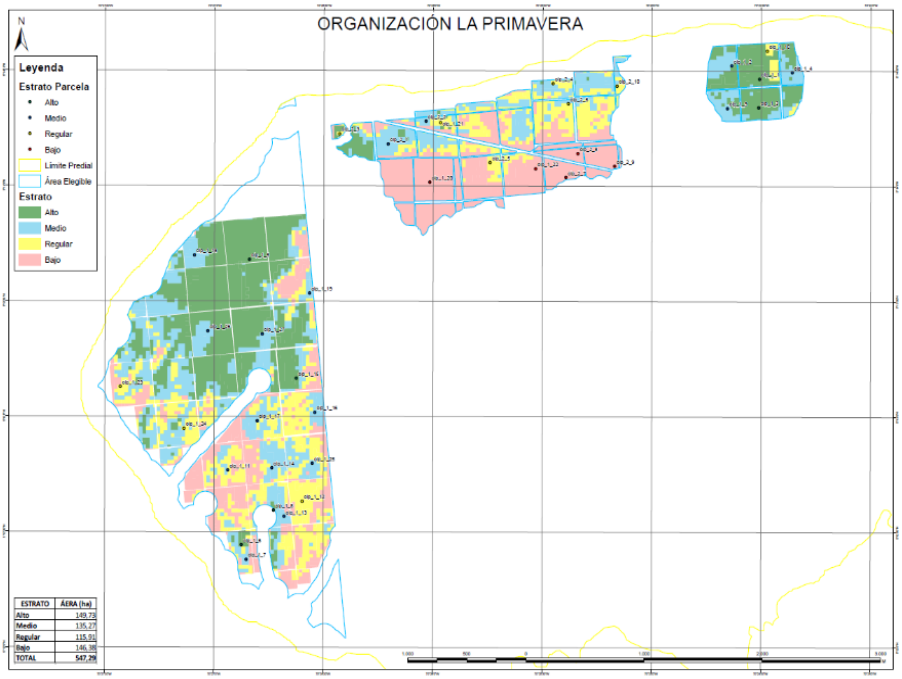

Figure 31. Distribution of plots in the OLP forest nucleus

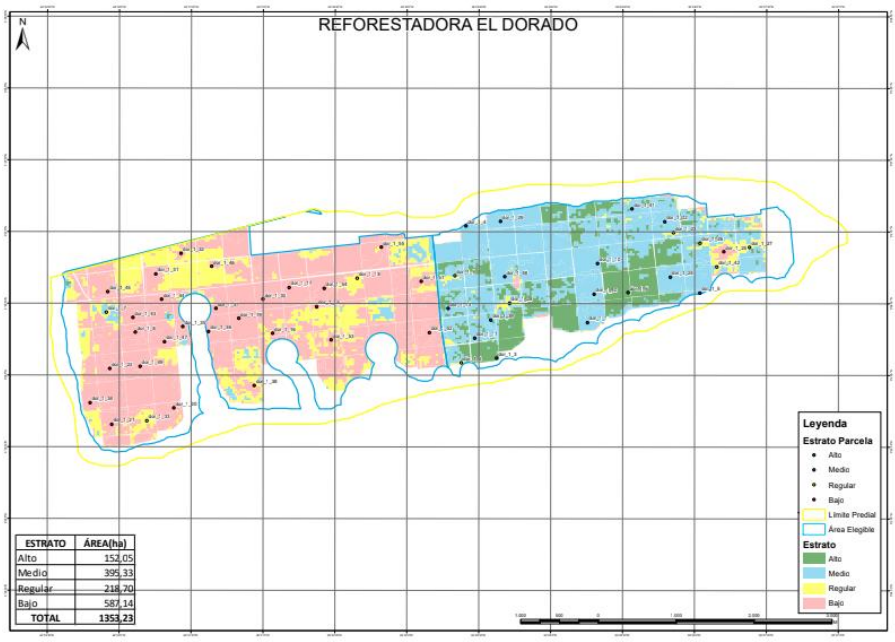

Figure 32. Distribution of plots in the OLP forest nucleus

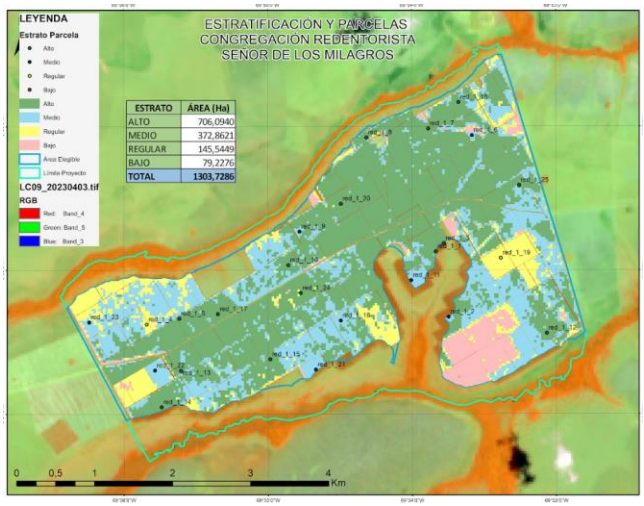

Figure 33. Distribution of plots in the Redentorista forest nucleus.

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. 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 18. Table of results by Strata

El Dorado Forest Project	
ESTRATA	**AREA (ha)**
Low	146,38
Steady	115,91
Middle	135,27
High	149,73
Total	**547,3**

16.2.3 Field inventory results

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

In total, 117 plots were established in the El Dorado, Redentorista, and La Primavera Forest carbon nucleus, distributed in the four strata as follows (Table 19)

Table 19. Sample number inventoried in the sampling of the strata

Strata	Established plots
Low	35
Steady	22
Middle	37
High	23
Total	117

The plots with geographical coordinates are shown in Table 20.

Table 20. Plots in La Primavera Forest nucleus

PARCEL	Strata	N	E
olp_2_7	Low	5° 14' 2.264" N	70° 25' 23.467" W
dor_1_51	Low	5° 26' 39.244" N	69° 29' 54.054" W
olp_2_8	Low	5° 14' 8.467" N	70° 25' 20.226" W
olp_2_9	Low	5° 14' 5.206" N	70° 25' 10.122" W
dor_1_19	Low	5° 26' 23.737" N	69° 31' 10.165" W
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
olp_1_20	Low	5° 14' 0.953" N	70° 26' 0.796" 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
olp_1_22	Low	5° 14' 4,500" N	70° 25' 31,800" 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	Steady	5° 25' 40.853" N	69° 31' 48.440" W
dor_1_27	Steady	5° 26' 53.552" N	69° 27' 37.098" W
dor_1_18	Steady	5° 26' 40.528" N	69° 30' 20.762" W
dor_1_42	Steady	5° 26' 45.323" N	69° 27' 50.729" W
dor_1_7	Steady	5° 26' 26.236" N	69° 32' 5.383" W
olp_1_12	Steady	5° 12' 37.890" N	70° 26' 35.683" W
dor_1_2	Steady	5° 26' 5.198" N	69° 29' 37.287" W
olp_2_6	Steady	5° 14' 21.455" N	70° 25' 22.859" W
olp_2_10	Steady	5° 14' 26.029" N	70° 25' 9.511" W
dor_1_23	Steady	5° 26' 59.629" N	69° 28' 8.837" W
red_1_19	Steady	5° 35' 5.000" N	69° 53' 23.060" W
olp_1_21	Steady	5° 14' 16.454" N	70° 25' 57.859" W
dor_1_28	Steady	5° 26' 30.055" N	69° 29' 17.168" W

PARCEL	Strata	N	E
dor_1_26	Steady	5° 26' 55.260" N	69° 27' 57.714" W
olp_2_5	Steady	5° 14' 6.086" N	70° 25' 44.255" W
dor_1_9	Steady	5° 26' 41.615" N	69° 29' 39.970" W
olp_1_10	Steady	5° 14' 35.198" N	70° 24' 28.286" W
olp_2_3	Steady	5° 14' 13.520" N	70° 26' 25.586" W
red_1_4	Steady	5° 34' 37.350" N	69° 55' 50.550" W
olp_2_4	Steady	5° 14' 26.650" N	70° 25' 27.015" W
olp_1_24	Steady	5° 12' 56.800" N	70° 27' 8.100" W
olp_1_23	Steady	5° 13' 7.700" N	70° 27' 25.600" W
dor_1_29	Middle	5° 27' 4.367" N	69° 29' 20.995" W
red_1_22	Middle	5° 34' 18.170" N	69° 55' 47.140" W
olp_1_16	Middle	5° 13' 1.040" N	70° 26' 32.215" W
dor_1_11	Middle	5° 26' 15.473" N	69° 29' 31.726" W
olp_1_9	Middle	5° 14' 20.266" N	70° 24' 39.195" W
olp_2_2	Middle	5° 14' 16.839" N	70° 26' 1.865" W
olp_1_26	Middle	5° 13' 22.200" N	70° 27' 1,600" W
dor_1_12	Middle	5° 27' 4.211" N	69° 28' 12.468" W
red_1_23	Middle	5° 34' 38.270" N	69° 56' 14.540" W
dor_1_40	Middle	5° 26' 33.887" N	69° 28' 41.897" W
red_1_21	Middle	5° 34' 18.450" N	69° 54' 40.100" W
dor_1_41	Middle	5° 27' 9.594" N	69° 28' 26.131" W
olp_1_19	Middle	5° 13' 32.048" N	70° 26' 33.730" W
dor_1_10	Middle	5° 26' 46.721" N	69° 28' 40.480" W
dor_1_4	Middle	5° 27' 2.424" N	69° 29' 35.393" W
dor_1_48	Middle	5° 26' 41.219" N	69° 29' 19.200" W
olp_2_1	Middle	5° 14' 10.889" N	70° 26' 12.248" W
dor_1_39	Middle	5° 26' 23.049" N	69° 29' 25.022" W
dor_1_24	Middle	5° 26' 41.035" N	69° 28' 10.124" W
dor_1_13	Middle	5° 26' 27.900" N	69° 29' 42.776" W
olp_1_25	Middle	5° 12' 47.800" N	70° 26' 32.900" W
olp_1_17	Middle	5° 12' 58.800" N	70° 26' 48,000" W
olp_1_14	Middle	5° 12' 46.582" N	70° 26' 44,000" W
olp_1_7	Middle	5° 12' 22.771" N	70° 26' 50.986" W
olp_1_2	Middle	5° 14' 31.377" N	70° 24' 38.036" W
olp_1_11	Middle	5° 12' 46,000" N	70° 26' 56.100" W
olp_1_18	Middle	5° 13' 41.900" N	70° 27' 5,300" W
red_1_9	Middle	5° 35' 16.020" N	69° 54' 46.880" W
red_1_11	Middle	5° 34' 55.690" N	69° 54' 0.390" W
olp_1_13	Middle	5° 12' 34,000" N	70° 26' 40.600" W
red_1_6	Middle	5° 35' 56.200" N	69° 53' 35,000" W
red_1_18	Middle	5° 34' 38.890" N	69° 54' 29.740" W
dor_1_5	Middle	5° 26' 34.407" N	69° 27' 57.796" W
dor_1_1	Middle	5° 26' 21.992" N	69° 28' 44.668" W
red_1_2	Middle	5° 34' 40.420" N	69° 53' 44.820" W
olp_1_4	Middle	5° 14' 29.635" N	70° 24' 21.412" W
olp_1_27	Middle	5° 13' 21,400" N	70° 26' 46.700" W
red_1_15	High	5° 34' 22.760" N	69° 54' 59.120" W
olp_1_5	High	5° 13' 40.800" N	70° 26' 50.200" W
red_1_1	High	5° 35' 7.700" N	69° 53' 50.150" W

PARCEL	Strata	N	E
olp_1_15	High	5° 13' 9.900" N	70° 26' 37.300" W
dor_1_3	High	5° 26' 7.140" N	69° 29' 22.590" W
olp_1_1	High	5° 14' 27.920" N	70° 24' 30.396" W
dor_1_6	High	5° 26' 34.623" N	69° 28' 27.795" W
olp_1_3	High	5° 14' 20.449" N	70° 24' 30.595" W
red_1_25	High	5° 35' 35.370" N	69° 53' 15.370" W
red_1_16	High	5° 36' 10.020" N	69° 53' 40.620" W
red_1_24	High	5° 34' 50.400" N	69° 54' 46.366" W
red_1_5	High	5° 34' 39.800" N	69° 55' 37,000" W
red_1_12	High	5° 34' 33.620" N	69° 53' 3.930" W
olp_1_8	High	5° 12' 35.600" N	70° 26' 43,500" W
red_1_13	High	5° 34' 17.990" N	69° 55' 36.300" W
red_1_17	High	5° 34' 41.680" N	69° 55' 20,900" W
red_1_20	High	5° 35' 27.660" N	69° 54' 29.650" W
red_1_10	High	5° 35' 2.040" N	69° 54' 51.520" W
red_1_7	High	5° 35' 58.970" N	69° 53' 53.180" W
olp_1_6	High	5° 12' 26.604" N	70° 26' 52.320" W
red_1_8	High	5° 35' 55.260" N	69° 54' 18.970" W
red_1_14	High	5° 34' 2.830" N	69° 55' 44.390" W
red_1_3	High	5° 35' 11.100" N	69° 53' 46.800" W

Note: The plots monitored in the forestry projects that are part of the La Primavera forestry nucleus are identified as follows: **olp =** Organización La Primavera**, red =** Redentoristas**, dor=** El Dorado.

16.2.4 Carbon Account

Above and belowground carbon estimates

For the estimates of accumulated carbon per hectare, equations available in the literature were used, which were for the species and variety (if possible) of trees considered in the plantation, and following the default values and procedures established by the IPCC. (2003, 2006) when applicable.

Table 21. The equations applied were the following. Taken from IPCC 2003. Tables 4.A.1 and 4.A.3.

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 through destructive sampling in the same plantations.
	Trees range from 0.6 cm to 56 cm DBH.	***BA=0.887+[(10486*DAP^2.84)/(DAP^2.84) +376907)]*** Equation cited by IPCC 2003[44].

[44]IPCC. 2003. Annex 4. Section 4.2. Examples of allometric equations to estimate aboveground and belowground tree biomass.

Eucalyptus. pellita	For all diameters.	***BA=1.22*(DAP^2) *H*0.01*** Equation cited by IPCC 2003.

DBH: Diameter at chest height (1.3 m) above the ground. BA: Biomass (kg), ht: total height of the tree.

The carbon content in the belowground biomass component was estimated following the methodological recommendations of the IPCC 2003, which determines different factors to be applied according to the biomass contents per hectare and for each species. It is important to clarify that only in the 2003 IPCC Good Practice Guides does it make specific reference to what factors to use for root biomass in coniferous plantations and plantations of eucalyptus and other broadleaf species. (Table 22).

Table 22. R values for the species of P. caribaea, A. mangium, and E. pellita according to IPCC 2003. Obtained from IPCC 2003, table 3A.1.8.

Coverage	Reference aerial biomass (tha-1)	R factor. (Root-shoot relationship)
Coniferous Plantations	<50	***0.46***
	50-150	***0.32***
	>150	***0.23***
Eucalyptus and *A. mangium* plantation.	<50	***0.45***
	50-150	***0.35***
	>150	***0.2***

Estimation of sample quantity.

For its estimation, Winrock's CDM A/R Sample Plot Calculator Spreadsheet Tool was used, which applies the equations and statistics to estimate 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 Organización La Primavera project.

Table 23. List of sampling units (plots) established in the forest carbon project initiative Organización La Primavera in La Primavera, Vichada.

Strata	Established plots	Estimated Parcels
Low	35	3
Steady	22	3
Middle	37	3
High	23	5

Total	***117***	***15***

In total, 117 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, although the passive natural regeneration stand model was considered, it will not be quantified due to the low development that has been identified through satellite images, assuming for this Strata and this verification, a conservative position regarding carbon removal derived from this stand or Strata model.

In the current monitoring period, only the plots of the low, regular, and meduim strata that dominated the plantations of the La Primavera project was considered. In this way and according to the previous table, the minimum sample size established by the methodology is met.

To estimate the uncertainty of the calculations, the procedure of 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:

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

Also, the tool in appendix 2 establishes the values to be discounted when the uncertainty in the data exceeds 10%. The result applied to the previous procedures is presented in the following table.

Table 24. Result of carbon estimates (tCO2ha-1) in aboveground and belowground pools by plot and Strata.

Low		Steady		Middle		High	
Parcela Cod	**CO_2 ha^{-1}**	**Parcela Cod**	**CO_2 ha^{-1}**	**Parcela Cod.**	**CO_2 ha^{-1}**	Parcela Cod	**CO_2 ha^{-1}**
DOR_1_14	57,208	DOR_1_18	59,943	DOR_1_1	205,489	DOR_1_3	219,458
DOR_1_15	42,180	DOR_1_2	77,643	DOR_1_10	158,094	DOR_1_6	228,689
DOR_1_16	13,787	DOR_1_23	86,543	DOR_1_11	152,552	OLP_1_1	220,898
DOR_1_17	24,936	DOR_1_26	96,639	DOR_1_12	162,293	OLP_1_15	218,577
DOR_1_19	8,343	DOR_1_27	59,774	DOR_1_13	164,129	OLP_1_3	235,880
DOR_1_20	14,291	DOR_1_28	95,085	DOR_1_24	164,129	OLP_1_5	217,360
DOR_1_21	11,540	DOR_1_33	55,311	DOR_1_29	148,542	OLP_1_6	306,916
DOR_1_22	17,465	DOR_1_42	62,702	DOR_1_39	161,521	OLP_1_8	282,772
DOR_1_25	23,600	DOR_1_7	65,634	DOR_1_4	160,154	RED_1_1	218,129
DOR_1_30	6,637	DOR_1_9	102,963	DOR_1_40	166,331	RED_1_10	302,857
DOR_1_31	21,029	OLP_1_10	104,733	DOR_1_41	154,863	RED_1_12	281,781

Low		Steady		Middle		High	
DOR_1_32	21,899	OLP_1_12	68,630	DOR_1_48	160,470	RED_1_13	283,058
DOR_1_34	12,116	OLP_1_21	93,700	DOR_1_5	204,860	RED_1_14	355,009
DOR_1_35	13,137	OLP_1_23	115,411	OLP_1_11	187,979	RED_1_15	215,574
DOR_1_36	8,771	OLP_1_24	113,855	OLP_1_13	200,072	RED_1_16	259,979
DOR_1_37	15,633	OLP_2_10	85,313	OLP_1_14	177,032	RED_1_17	291,388
DOR_1_38	42,598	OLP_2_3	105,802	OLP_1_16	151,989	RED_1_20	299,626
DOR_1_43	46,577	OLP_2_4	112,052	OLP_1_17	172,647	RED_1_24	266,84
DOR_1_44	45,190	OLP_2_5	102,172	OLP_1_18	189,038	RED_1_25	240,72
DOR_1_45	16,864	OLP_2_6	81,133	OLP_1_19	158,006	RED_1_3	367,85
DOR_1_46	14,034	RED_1_19	93,245	OLP_1_2	180,630	RED_1_5	279,08
DOR_1_47	19,887	RED_1_4	106,993	OLP_1_25	164,940	RED_1_7	305,89
DOR_1_49	9,759			OLP_1_26	161,165	RED_1_8	309,01
DOR_1_50	15,154			OLP_1_27	213,484		
DOR_1_51	4,206			OLP_1_4	210,386		
DOR_1_52	39,965			OLP_1_7	179,793		
DOR_1_53	41,924			OLP_1_9	154,174		
DOR_1_54	35,252			OLP_2_1	160,869		
DOR_1_55	55,005			OLP_2_2	155,443		
DOR_1_8	31,475			RED_1_11	199,372		
OLP_1_20	10,562			RED_1_18	204,410		
OLP_1_22	12,411			RED_1_2	206,252		
OLP_2_7	2,487			RED_1_21	153,537		
OLP_2_8	4,239			RED_1_22	150,656		
OLP_2_9	6,338			RED_1_23	164,047		
				RED_1_6	202,266		
				RED_1_9	204,024		
Low Statistic. *Average*	***21,9***	**Regular Statist.**	**88,42**	**Middle Statist**	***174,747***	**High Statist**	***269,886***
Adjusted[45] Average	***20.13***		***85.577***		**172.41**		**263.49**
Stand Desv	**15,47**		19,38		*21,02*		*44,62*
N	*35*		22		37		*23*

Note: The plots monitored in the forestry projects that are part of the La Primavera forestry nucleus are identified as follows: **olp =** Organización La Primavera**, red =** Redentoristas**, dor=** El Dorado.

Soil organic carbon

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

[45] 40% of the expanded error is discounted, according to Table 3 BCR0001 Quantification of GHG emission reduction. Removal activities. Biomass equations come from areas with similar conditions.

This tool, depending on 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 defined by the following equation.

$$\Delta SOC = \frac{44}{12} \sum A_i * dSOC_{t,i} * 1year$$

$\Delta SOCAL_{,t:}$	Change in soil organic carbon contents 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 Strata of the project ha.
i:	Strata *i*

For this estimation, the tool was used. *Excel* "ARWG30_SOC_Tool_Multizones.xls" that applies the established procedures mentioned in the "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 *dSOC*= 0.8 per hectare year. This value, multiplied by 44/12 results in a change of 2.93333 tCO_2 per year per hectare in the soil carbon sink. The results for the accumulated areas as of 2023 are shown in Table 25.

Table 25. Estimation of accumulated soil organic carbon[46]

[46] The current monitoring period is shown in ochre.

t	Year	Area (ha)	Accumulated area (ha)	CO_2 (t)
0	2012	370,10	370,10	0,00
1	2013	44,30	370,10	1.085,63
2	2014	20,43	414,40	1.215,58
3	2015	112,46	434,83	1.275,51
4	2016	0,00	547,29	1.605,39
5	2017	0,00	547,29	1.605,39
6	2018	0,00	547,29	1.605,39
7	2019	0,00	547,29	1.605,39
8	2020	0,00	547,29	1.605,39
9	2021	0,00	547,29	1.605,39
10	2022	0,00	547,29	1.605,39
11	2023	0,00	547,29	1.605,39
Total				**16.419,87**

Other Sinks

Shrubs.

They were estimated following the methodological recommendations and using the default factors determined by the methodological tools. This component assumes a relationship of aerial biomass content for the types of natural forests present in the project area and related to the areas established for each year of intervention. The balances for this component are shown in Table 26.

Table 26. Carbon content estimates for the project's shrubs sink[47]

Planting ha.	2011	2012	2013	2014	Total
	370.10	44.30	20.43	112.46	547.29
***Shrub Tool Defaults* (tdm ha^{-1})**					
CFS	0.47				
R.S.	0.4				
BDRSF	0.1				
bFOREST	231.7				
$CC_{SHRUB.I}$	0.50				
44/12	3.67				

[47] The current monitoring period is shown in ochre.

$b_{SHRUB,i}$	11,585

Table 27. Shrub carbon balance for the areas established in the project by 2023.

		2011	2012	2013	2014	Total
	ha	370,10	44,30	20,43	112,46	547,29
Year	2012	0				0,0
	2013	905	0			904,5
	2014	905	118	0		1.023,0
	2015	905	118	61	0	1.083,9
	2016	905	118	61	3143	4.227,3
	2017	905	118	61	3143	4.227,3
	2018	905	118	61	3143	4.227,3
	2019	905	118	61	3143	4.227,3
	2020	905	118	61	3143	1.056,8
	2021	905	118	61	3143	1.056,8
	2022	905	118	61	3143	1.056,8
	2023	905	118	61	3143	1.056,8
					Total	24.147,6

Litter

For leaf litter, although in this verification this component was not measured directly, the indirect processes considered by the methodological tool Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities were used. V. 03.1. The estimates are assumed from the results of the carbon content of the trees present in each Strata ($C_{tree,i,t}$), multiplied by a conversion factor, DFLI, which expresses the carbon content present in the leaf litter as a percentage. of the content identified in the biomass of the trees. Although the methodological tool recommends a general factor, it suggests applying other values when these are based on analyses carried out specifically for the project species under similar conditions. For the litter, the factor of 10% was assumed, which is the result of the average values identified in other studies for the species of *Pinus sp in* the tropical region (see annex, Annex_5 Monitoreo carbono/Carbon balances_2011-2023/Supports of the contribution of the litter biomass to the total contents in forest systems in *Pinus sp*).

Table 28. Estimates of carbon removals (tCO2 ha-1) from the litter component in the present monitoring period

DF_{LI}	*10%*	
ESTRATA	**AREA (ha)**	**Leaf litter $C_{LI,t}$ (tCO2)**
Low	146.38	307
Steady	115.91	1,018
Middle	135.27	2,361

High	149.73	4,027
Total	**547.3**	**7,714**[48]

Deadwood

It is estimated from default values recommended by the methodological tool. This tool suggests an expansion factor of 6%, which relates dead wood above ground regarding aerial carbon in each Strata. This average value was multiplied by the areas of each Stratum in the monitored project area.

Estimated deadwood carbon per hectare results are shown in Table 29

Table 29. Estimates of carbon per hectare in the above-ground dead wood biomass component.

DFDW	**AREA (ha)**	**6%**
Strata	547.3	$C_{DW,i,t}$ ha^{-1}
Low	146.38	184
Steady	115.91	611
Middle	135.27	1,417
High	149.73	2,416
Total		**4,628**[49]

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.

[48] From this value, the 4,742.3 tCO_2 obtained from the previous measurement process are subtracted, as they are included in the total reductions reported in t1. These are fully deducted from the result obtained for the current monitoring period t2. Refer to "5_Monitoreo_Carbono_2020-2023/Balance_carbono_2011_2023/Balances Carbono 1a Verificación/ Balances de carbono_2012-2019_V04_May_2021_OLP_Verifi_01"

[49] From this value, the 2,845.4 tCO_2 obtained from the previous measurement process are subtracted, as they are included in the total reductions reported in t1. These are fully deducted from the result obtained for the current monitoring period t2. Refer to "5_Monitoreo_Carbono_2020-2023/Balance_carbono_2011_2023/Balances Carbono 1a Verificación/ Balances de carbono_2012-2019_V04_May_2021_OLP_Verifi_01"

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 BCR, specifically the Tool for carbon removals in projects AR, BCR0001[50].

Since the current monitoring period corresponds to the second measurement process (t_2) carbon, the step is applied *14.1* del Tool:

$$\Delta C_{ARB} = C_{ARB,t2} - C_{ARB,t1} \qquad \text{Eq. 1 of tool.}$$

$$\mu_{\Delta C} = \frac{\sqrt{(\mu_1 x C_{ARB,t1})^2 + (\mu_2 x C_{ARB,t2})^2}}{|\Delta C_{ARB}|} \qquad \text{Eq. 2 of tool.}$$

Where:

ΔC_{ARB}: Change between two points in time *t1* and *t2* in tree carbon stocks. tCO_{2e}

$C_{ARB,t1}$ Tree carbon stock in time t_1, tCO_{2e}

$C_{ARB,t2}$ Tree carbon stock in time t_2, tCO_{2e}

$\mu_{\Delta C}$ Uncertainty in ΔC_{ARB}

$\mu_1, \mu_2,$ Uncertainty in $C_{ARB,t1}, C_{ARB,t2}$ respectively.

According to the above equation:

Table 30. Results of equation 4

ΔC_{ARB}:	$C_{ARB,t1}$	μ_1	$C_{ARB,t2}$	μ_2	$\mu_{\Delta C}$
54.598	73.487	0.07	128.085	0.060	***16,73%***

According to Table 30, uncertainty discount factors, 15 < μ ≤ 2, the discount applied should be 50%.

Updating with the uncertainty discount, the estimates remain:

The total accumulated net removals for the 04/30/2023 cut is estimated at 128.085 tCO_2eq.

These are distributed into four strata for this verification.

[50] Quantifying GHG Emissions Reductions. Removal Activities. V 3.0

Table 31. Relationship between reduced emissions and by Strata for t2 (2019-2023)

Balance							
STRATA	AREA (ha)	*Sinks* (tCO2)					
		tCO_2 Aboveground + belowground biomass (tCO2)	Shrubs CSHRUBS(tCO_2)	Deadwood CDW (tCO_2)	Leaf litter CLI (tCO_2)	COS (tCO_2)	Total (tCO_2)
Low	146.38	2,882	24,148	184	307	16,420	**128,085**
Steady	115.91	9,837		611	1,018		
Middle	135.27	23,243		1,417	2,361		
High	149.73	39,214		2,416	4,027		
Total	547.3	75,176	24,148	4,628	7,714	16,420	

Table 32. Cumulative removals in tons (2011-2023) CO2eq.

Año	Emissions Baseline (tCO2eq)	Project removals (tCO2eq)	Leakage (tCO2eq)	Net removals (tCO2eq)
2023	*0*	**128,085**	*0*	**128,085**
Total	***0***	**128,085**	***0***	**128,085**

The accumulated carbon for the 2020-2023 verification period is determined according to the following equation.

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

Table 33. List of removals in t1 (2011-2019).

Balance t1 OLP 2011-2019 *(t1)*							
Stratum	**Area (ha)**	**tCO2 Biomass bellow + aboveground (tCO2)**	**Shrubs CSHRUBS (tCO2)**	**Dead Wood CDW (tCO2)**	**Litter CLI (tCO2)**	**COS (tCO2)**	**Total (tCO2)**
Low	66.8	434.9	8,478.41	26.1	43.5	9,998.24	**73,487**
Regular	184.7	8.870.2		532.2	887.0		
Medium	293.7	37,682.7		2,261.0	3,768.3		
High	2.2	435.3		26.1	43.5		
General Total	**547.3**	**47,423.04**	**8,478.41**	**2,845.38**	**4,742.30**	**9,998.24**	***73,487***

In this way the removals for the current period are determined by:

$$\Delta C_{ARB} = 128,085 - 73,487$$

$$\Delta C_{ARB\ (2020-2023)} = \mathbf{54,598}\ tCO_2$$

16.3 Leakages

These are related to the displacement of activities carried out within the scope of the project to areas outside of it. The project, as conceived, does not foresee the generation of leakage due to the displacement of activities, as it focuses on a land-use change model in areas dedicated to extensive livestock farming, with very low livestock density per hectare. The project region is characterized by large expanses of plains with native and introduced grasses that are continuously burned for renewal, depleting their fertility and promoting soil degradation.

To prevent leakage, the project implements measures such as monitoring land-use changes through periodic satellite imagery analysis and field inspections, which have confirmed that the forested areas established for commercial purposes, as well as those dedicated to passive and active natural regeneration, have been maintained. Additionally, land-use agreements with landowners and the Ministry of Agriculture (through the CIF) ensure that areas converted to forestry are not reverted to livestock use. Since there are no available areas for pastures, it is not possible to replace livestock during this monitoring period or in the future.

It is estimated that the activity does not generate leakage, as the region has the capacity to support the potential displacement of livestock. Likewise, the project owners do not intervene in all areas of the properties, allowing for livestock rotation areas as the remaining heads are sold. These livestock are not expected to be replaced in the future in the project areas, as confirmed through ongoing monitoring and compliance verification with landowners.

16.4 Net GHG Emission Reductions / Removals

Quantify the net GHG emission reductions and removals, summarizing the key results using the table below.

Table 34. Net GHG emission reductions and removals

Year	***Baseline emissions / removals (tCO_2e)***	***Project emissions / removals (tCO_2e)***	***Leakage emissions (tCO_2e)***	***Net GHG emission reductions / removals (tCO_2e)***

2019 (02-12-2019- 31-12-2019)	0	0	0	0
2020 (01-01-2020- 31-12-2020)	***0***	16,379	***0***	16,379
2021 (01-01-2021- 31-12-2021)	***0***	16,379	***0***	16,379
2022 (01-01-2022- 31-12-2022)	***0***	16,379	***0***	16,379
2023 (01-01-2023- 30-04-2023)	***0***	5,460	***0***	5,460
Total	***0***	**54,598**	***0***	**54,598**

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 54,598 tCO2, discounting verification 01 developed at the cut-off of 2019.

Compared this value with the actual measurements measured at the cut-off of the 2020-2023 period, a difference of **18.8%** below is estimated.

Table 35. Ex ante projections of net removals.

Year	tCO2 Net	Net Ex ante verifications
2012	-7.4	
2013	2,353.3	
2014	6,366.3	
2015	12,620.2	
2016	21,760.1	
2017	33,317.9	
2018	46,998.3	
2019	62,388.6	**62,388**
2020	78,978.7	
2021	96,280.7	
2022	112,306.6	
2023	129,642.9	**67,254**
2024	146,040.5	
2025	160,020.8	
2026	174,876.8	
2027	189,029.6	
2028	202,027.9	

2029	214,655.5	
2030	221,358.0	
2031	227,451.2	
2032	234,389.7	
2033	240,470.6	
2034	248,596.9	
2035	258,907.5	
2036	270,883.4	
2037	284,421.3	
2038	299,037.1	
2039	314,268.3	
2040	328,150.7	
2041	343,291.9	
2042	357,461.3	

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.

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 2020-2023. The distribution of these is presented in the following table

Table 36. Distribution of removals for the years between 2020 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**
2019[51]	0	0	0
2020	3,276	13,104	16,379
2021	3,276	13,104	16,379

[51] For the year 2019, only 29 days of implementation were considered, which is why it was assigned zero for this year, as for the verification 1 of the project, the total year 2019 (including December) was taken into consideration for the vintage assignment.

2022	3,276	13,104	16,379
2023	1,092	4,368	5,460
	10,920	**43,678**	**54,598**