BioCarbon Registry

ORINOCO$_2$

Document prepared by CATARUBEN FOUNDATION

Name of the project	**ORINOCO$_2$**
Project holder	CATARUBEN FOUNDATION
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Project participants	Si
Version	V2.6
Date	December 09, 2024
Project Type	REDD+ ; Activities that avoid land use change of natural savannas
Grouped project	YES

Applied methodology	BCR 0002 V. 4.0 and BCR 0005 Vversion 1.0
Project location (City, Country)	META and VICHADA, COLOMBIA
Starting date	01/10/2018
Quantification period of GHG emissions reduction	01/10/2018-31/12/2027
Estimated total and average annual GHG emission reduction/removals amount	**REDD+ Activities** Total = **803.164** tCO2e Annual average = **86.829** tCO2e/year **Activities that avoid the transformation of natural savannas** Total = **668.414** tCO2e Annual average = **72,261** tCO2e/year
Sustainable Development Goals	6, 13,15
Special category, related to co-benefits	WAX PALM

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1. Project eligibility

1.1. Scope en the BCR standard

In TableTable 1 Compliance with the project scope against the BRC standard can be observed.

Table 1. Scope of the standard

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

1.2. Project Type

Select in TableTable 2 the type of project under which the project activities are developed (Mark with an X).

Table 2. Type of project activities

Activities in the AFOLU sector, different from REDD+	**X**
REDD+ Activities	**X**
Activities in the energy sector	
Activities in the transportation sector	
Activities related to waste management and disposal	

1.3. Project scale

N/A. It does not apply to this type of projects, in accordance with criterion 10.3 “Project scale” of the standard BCR V3.4

2. General description of the project

ORINOCO2, hereinafter referred to as the project, is a climate change mitigation project in the AFOLU sector that seeks to reduce emissions caused by deforestation, forest degradation, and land-use change in the savanna ecosystem within the high plains of the Meta and Vichada departments. Additionally, it generates social and environmental co-benefits, contributes to Sustainable Development Goals (SDGs) 6, 13, and 15, and complies with national safeguards.

In the design and development of the project, Fundación Cataruben acts as the project owner, Ecopetrol as a strategic partner, and the landowners as ecosystem managers or project participants. Cataruben and Ecopetrol are responsible for creating the enabling conditions for the project as well as leading the monitoring, reporting, validation management, verifications, carbon credit commercialization, and distribution of economic benefits. Meanwhile, the landowners execute the necessary activities within the boundaries of each of their properties. This approach ensures effective collaboration between Fundación Cataruben, Ecopetrol, and the landowners, promoting transparency and active participation in implementing climate change mitigation measures. Each party plays a fundamental role in the project's success, working together to achieve emission reduction and ecosystem conservation goals. This synergy between actors allows leveraging the potential of multiple private properties, thus maximizing environmental and social benefits, supporting them in a model of cooperation and shared responsibility that strengthens sustainable ecosystem management and contributes to climate change mitigation.

The project is located in the region known as the Colombian high plains. This area is considered one of the country's main agricultural regions. However, this scenario, which drives Colombia's agricultural development, also represents a challenge in generating low-carbon and socially and environmentally positive production/conservation models.

The main causes of deforestation, forest degradation, and land-use change in the region are the expansion of the agricultural frontier and fires of natural or anthropogenic origin. The main agents are communities and natural events. In this sense, ORINOCO2 implements forest conservation activities and promotes the sustainable use of savannas. Based on this, the project's activities were designed to reduce pressure on forests through management actions that lower the risks of forest fires, as well as sustainable production actions in the savannas that prevent land-use changes. Additionally, economic benefits derived from the sale of carbon certificates are provided as incentives to the project participants, resources that serve for conservation and activity execution, resulting in emission reductions in the project areas, thus closing the project's sustainability cycle.

Given the nature of the project's activities focused on conserving areas of biological importance such as riparian forests and natural savannas, as well as the inclusion of multiple private property

owners, the project includes environmental and social co-benefits aligned with the Wax Palm category of the BCR (BioCarbon Registry) standard. Likewise, the project's activities contribute to Sustainable Development Goals (SDGs) 6 Clean Water and Sanitation, 13 Climate Action, and 15 Life on Land, this is demonstrated by using the SDG tool Developed by BCR, ensuring that the project activities contribute to those SDGs .

Thus, the project will achieve emission reductions, along with generating social and environmental benefits.

2.1. GHG project name

Climate change mitigation project, **ORINOCO$_2$.** From now on in this document, **the project.**

2.2. Objectives

- Reduce deforestation, forest degradation and change in land use in natural savannas on private properties in the departments of Meta and Vichada, through the implementation of conservation, restoration and sustainable land use activities, to generate mitigation results of climate change.
- Generate biodiversity and socioeconomic benefits within the geographic areas of the project.

2.3. Project Activities

In order to initiate the project's activities, a comprehensive analysis of the agents, causes, and drivers of deforestation, forest degradation, and the transformation of natural savanna covers is undertaken as a preliminary step. Subsequently, through the active involvement of the property owners, specific implementation actions are established within the boundaries of each property. These actions are formulated with due consideration given to the property owners' vision for their land and their economic and technical capabilities.

2.3.1. Analysis of causes and agents of deforestation and transformation of natural savanna covers

In accordance with the criteria established in section "11 Causes and Agents of deforestation/degradation" of the BCR 0002 methodology and in the section "9 Drivers that generate changes in land use" of the BCR 0005 methodology, an analysis is conducted to identify the causes and agents of deforestation, forest degradation, and the transformation of natural savannas. For this purpose, the methodology recommended by the United Nations Environment Programme is employed, specifically the reports titled "Drivers of Deforestation and Forest

Degradation" and "Conceptual and methodological guidelines for the characterization of causes and agents of deforestation in Colombia."

These documents offer a series of methodologically and conceptually based guidelines. Their purpose is to ensure that the information collected in the field, as well as information theory, establishes a cohesive framework for analyzing and understanding deforestation and degradation within the project area. As a result, this information can be utilized more effectively in the planning of project activities.

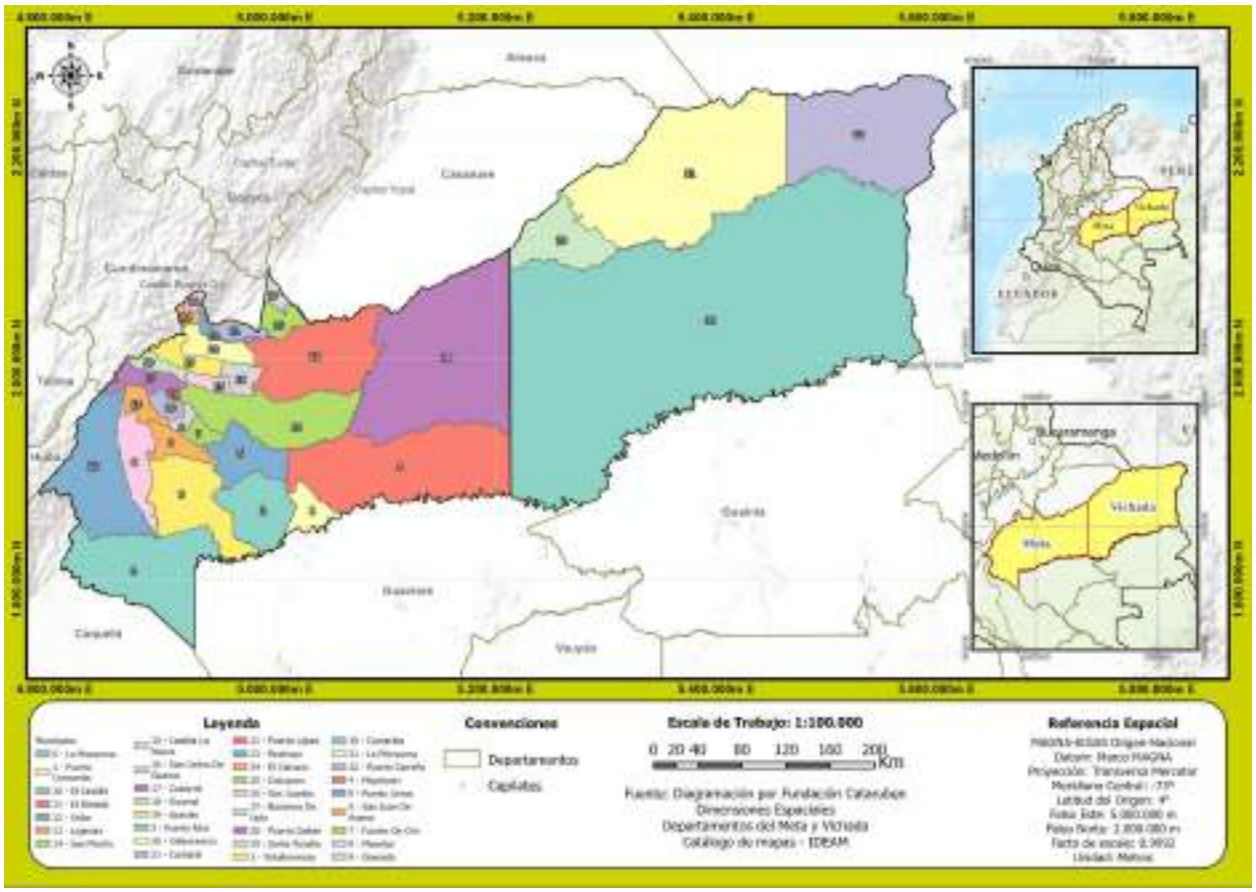
In this sense, in the following sections the contextualization of the spatial and temporal dimensions is carried out to establish the limits of the evaluation, as well as the territorial, sociocultural, economic and historical context. Subsequently, the critical stakeholders, their interests, and motivations are identified. Furthermore, the economic activities leading to the recognition of impacts on the natural environment are examined. The relationships and synergy among the actors are analyzed, and finally, the chain of events resulting in deforestation, degradation, and change in land use is established..

2.3.2. Spatial and temporal dimensions

Within the Orinoquia Region, a formal assessment of the causes and agents of deforestation and the transformation of natural savanna covers is being conducted in the departments of Meta and Vichada. These departments encompass a territorial area of 18,587,700 hectares, which represents approximately 73.08% of the total area of the Orinoquia Region. See Figure 1

This analysis is situated within a temporal framework spanning the years 2009 to 2018. The availability of official data during this period enables the comprehensive identification of the underlying causes and agents of deforestation, forest degradation, and land use change in natural savannas. This comprehensive approach facilitates a deeper understanding of land use changes and their potential trajectories.

Figure 1. Spatial dimensions



Source: IGAC, DANE. Own preparation.

Use: Spatial dimension of the departments of Meta and Vichada within which the project is developed; Context

2.3.2.1. Territorial Context

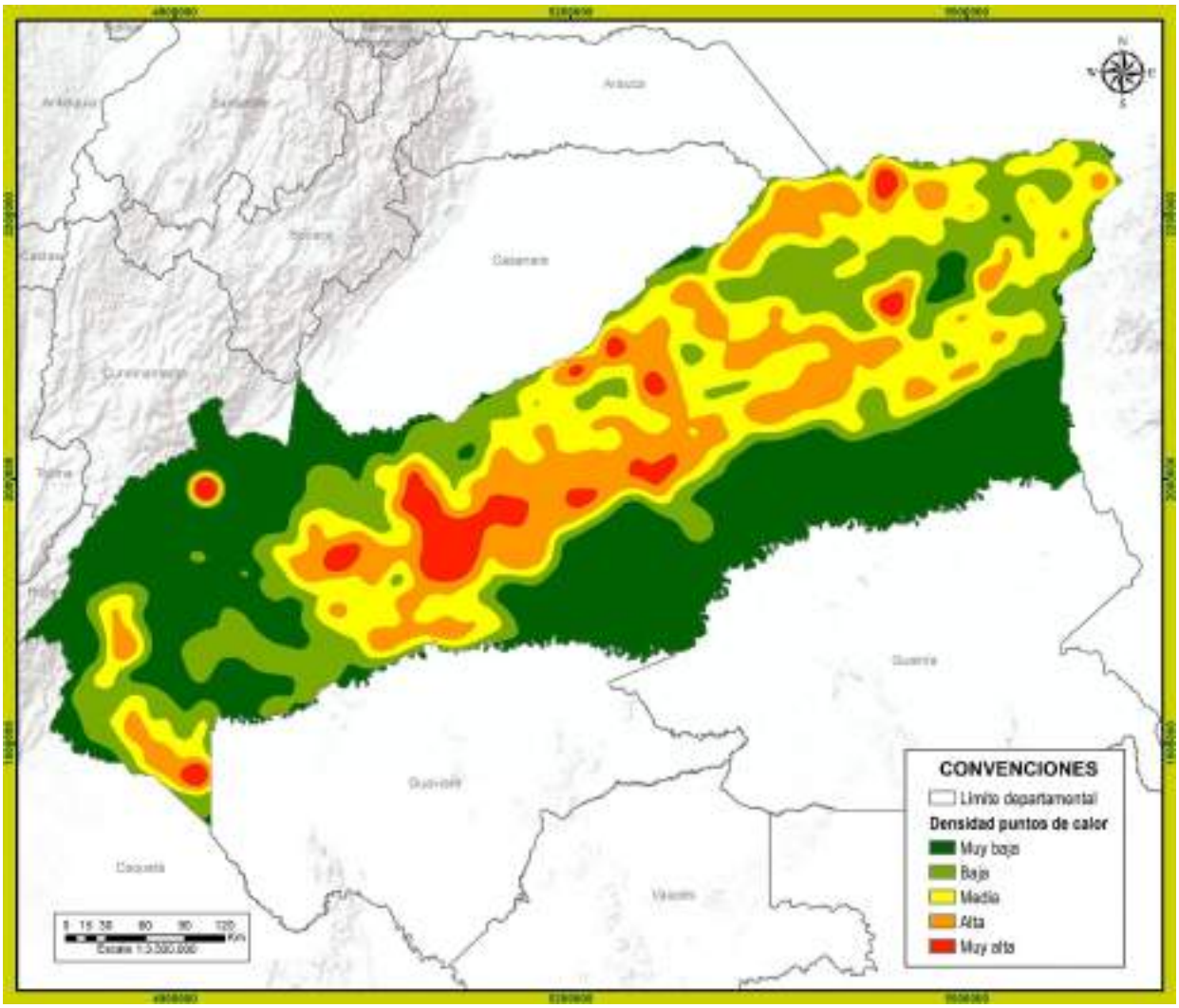
The departments of Meta and Vichada are part of the Llanos Orientales region and are located in the east of the country, being part of the Colombian Orinoquia region. The Department of Vichada is made up of 4 municipalities (Puerto Carreño, Cumaribo, Santa Rosalía and La Primavera), while the department of Meta is distributed in 29 municipalities, mostly rural.

The department of Meta has an area of 85,635 km², representing approximately 7.5% of the national territory. It borders to the north with the department of Cundinamarca and Casanare, separated from the latter by the Upía and Meta rivers. To the east, it borders the department of Vichada, to the south with the department of Caquetá and to the west with the departments of Huila and Cundinamarca (Turismo Meta, 2020).

2.3.2.1.1. Environmental management context

Monitoring of hot spots was carried out through the "System for monitoring heat spots on the surface detected by satellite-IDEAM" for the period 2016–2018. The Figure 2, indicates the density of thermal anomalies for the period, the highest density represented by the color red is found mainly in the municipalities of "San Martín", "Puerto Gaitán" and "Puerto López" in the department of Meta.

Figure 2. Natural cover fire occurrence density, 2016–2018



Source: Monitoring of heat points in Colombia - IDEAM
Own preparation.

2.3.2.1.2. Biophysical context

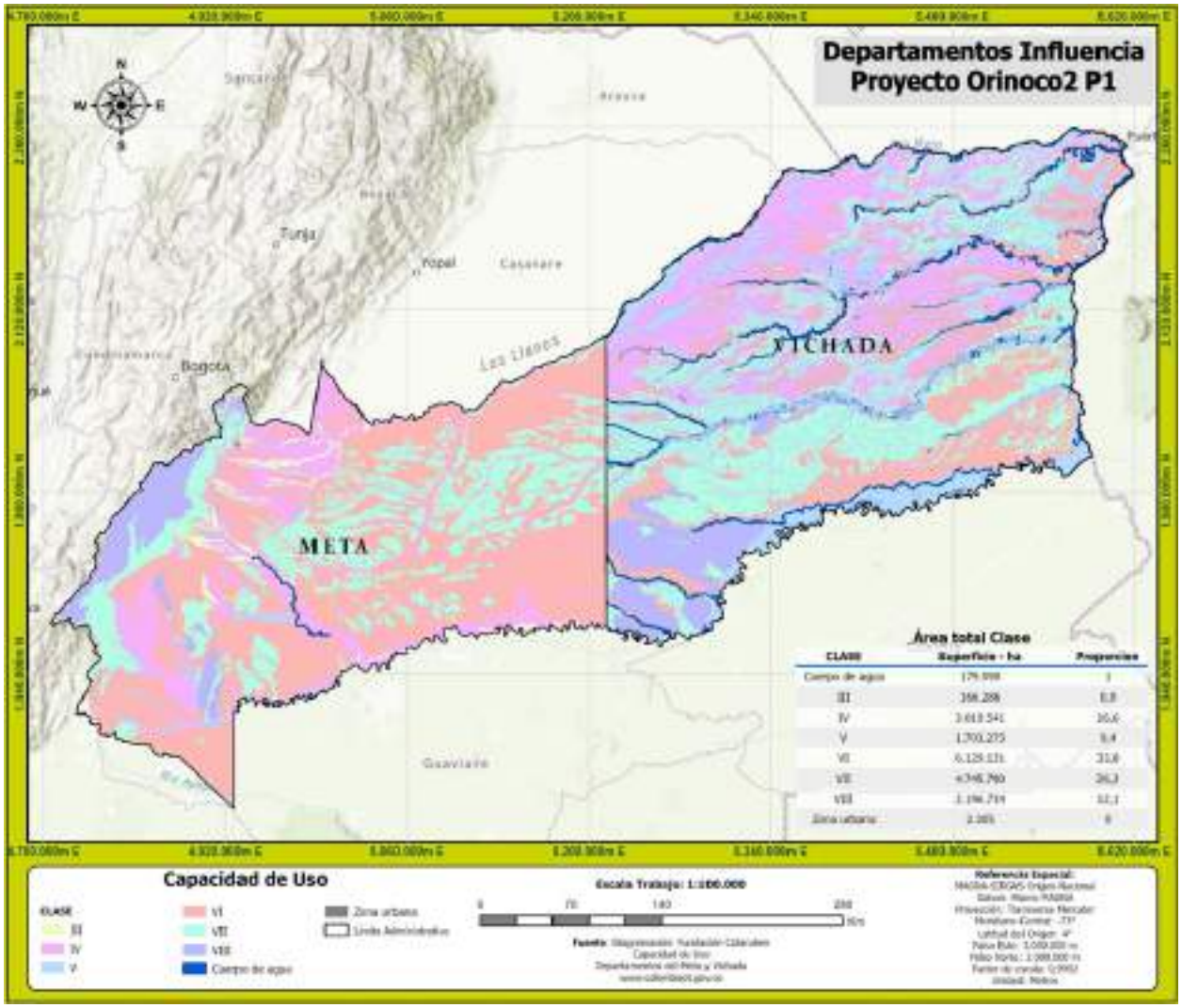
The biophysical environment of a territory comprises a wide range of natural characteristics that influence its landscape, climate, hydrology, and biodiversity. These include everything from geology and topography to vegetation and water resources, which play a crucial role in shaping the ecosystems and in the life of the communities that live in the area.

The description of the territory involves analyzing each of these natural elements in detail and understanding how they interact with each other to create a unique and diverse environment.

Usage Capacity

The land-use potential for the departments of Meta and Vichada was derived from the data available on the Colombia OT platform.(https://www.colombiaot.gov.co/) which is an official space that IGAC has designed to build territory.

figure 3 Land use capacity by class for the departments of Meta and Vichada (IGAC 2014;2017)



Source:https://www.colombiaot.gov.co/.
Own preparation.

The Use capacity - use categories map determines the supply that the biophysical environment offers us, the coverage and use of the current land, this indicates the demand for the land. Thus the figure 3, indicates that 60.0% of the territory is distributed in class VI (33.8%) and Class VII (26.2%). Which are attributed to agroforestry, silvopastoral and agrosilvopastoral system development activities, thus class VII refers to the conservation of primary forests, forestry vocation for the production, conservation and protection of natural resources, for more information review the table 3 description category usability.

Table 3. Description of recommended use by category, Usage capacity.

Class	Recommended Use	
	Meta	**Vichada**
III	The soils are suitable for citrus crops, papaya, African palm, banana, corn, sorghum, vegetables, soybeans, sugarcane and introduced or improved pastures for semi-intensive livestock farming.	
IV	These lands are suitable for annual and perennial crops (cane, sorghum, rice, corn, African palm, fruit trees) and introduced grasses (*brachiaria*) for semi-intensive livestock farming. These soils are suitable for annual crops (rice, sorghum, corn), semi-intensive livestock farming with introduced grasses *(brachiaria,* German) and for multipurpose forestry activity.	Land suitable for some transitional crops resistant to high aluminum saturation (corn, soybeans) and for semi-permanent and permanent crops (cassava, sugar cane, banana, cashew, oil palm and rubber) or agroforestry systems
IN	The suitability of these soils is agrosilvopastoral, for mixed zooculture and for the conservation and protection of natural reserves.	Livestock projects should be carried out for semi-intensive livestock farms with improved pastures. Establishment of short cycle crops (to take advantage of the 6 months of summer) with varieties resistant to high aluminum content.
WE	These soils are suitable for agrosilvopastoral activities: annual, semi-perennial and perennial crops (cassava, corn, cane, banana, beans, vegetables, fruit trees, coffee, cocoa), for extensive livestock farming with introduced grasses (brachiaria, imperial) associated with farming activities. agroforestry (fruit trees, rubber, pine, eucalyptus). The unit has forestry aptitude for conservation, protection and	Development of agroforestry, silvopastoral and agrosilvopastoral systems (with a restricted range of crops). Extensive livestock farming with introduced pastures and appropriate paddock rotation practices that avoid overgrazing.

	production purposes, silvo-pastoral activity is the most appropriate.	
VII	This unit has a forestry vocation for the production, conservation, and protection of natural resources. The sectors with the lowest slope can be dedicated to extensive livestock farming with introduced pastures The unit is suitable for extensive livestock farming associated with agroforestry activities.	Conservation of primary forests. Reforest with timber species in the flattest areas Maintain the existing vegetation and encourage reforestation projects (protector in steeper sectors and producer in gentle slopes). Maintain natural vegetation bodies. Generate reforestation projects (protector-producer). Livestock farming should be excluded from this unit, because the soils have low carrying capacity during the rainy season. Reforestation for protection purposes on slopes and areas with greater slope and erosion. In more favorable areas, grow species resistant to high aluminum saturations and climatic conditions, maintaining balance and sustainability.
VIII	This type of land is not suitable for agriculture and the dominant cover is with bushes and sparse natural grasslands. Its use must be aimed at the conservation and protection of natural resources	Conservation of the fragile ecosystem. Ecological tourism Conserve existing forests to help maintain regional balance The productive capacity of this unit does not allow the implementation of agriculture, due to the severe limitations of humidity, failing which, the use is conservation with native species Allow the development of wildlife and the conservation and recovery of natural resources, especially soils.
Water bodies	Water bodies	Water bodies

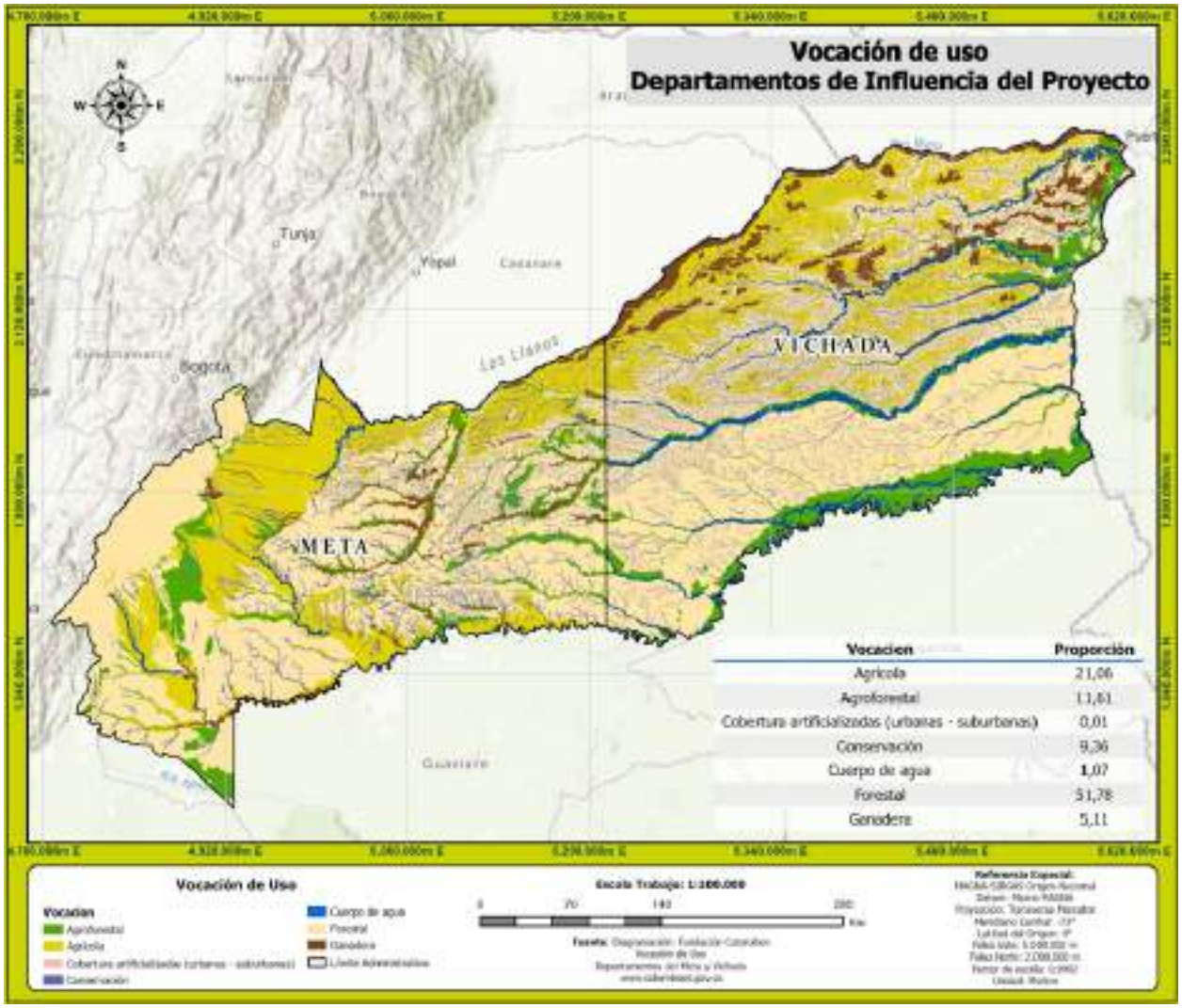
Urban areas	Urban areas	Urban areas

Source:https://www.colombiaot.gov.co/.
Own preparation.

Vocation of Use

The vocation of land use corresponds to "the highest class of use that a unit of land is in its natural capacity to support with sustainability characteristics, evaluated on a biophysical basis..." (IGAC, 2012); As we can see in FigureFigure 4 , the territory is divided into 7 classes of potential uses: agricultural, Agroforestry, artificial covers, Conservation, Forestry, and Livestock. The forestry vocation is the one that occupies the largest area, 9,431,911 hectares, which is equivalent to 51.78% of the entire territory (18,216,155.7 ha). Table 4. Likewise, the use with the smallest number of hectares after conservation is livestock farming with 930,798 (5.11%), except for artificialized coverage. Agricultural and agroforestry uses respectively occupy 21.06% and 11.61% of the territory's surface. Placing them in the potential activities with the highest percentage (after forest use) that can be developed in the region.

Figure 4. Vocation of land use by class for the departments of Meta and Vichada (IGAC 2014;2017)



Source:https://www.colombiaot.gov.co/.
Own preparation.

Table 4. Vocation of land use and proportion in the territory

Vocation	Area – hectares	Proportion (%)
Agricultural	3.835.454,80	21,06
Agroforestry	2.115.033,30	11,61
Artificialized coverings	2.286,40	0,01
Conservation	1.705.202,80	9,36
Water body	195.468,80	1,07
forestry	9.431.911,30	51,78
Livestock	930.798,30	5,11

Source:https://www.colombiaot.gov.co/.
Own preparation.

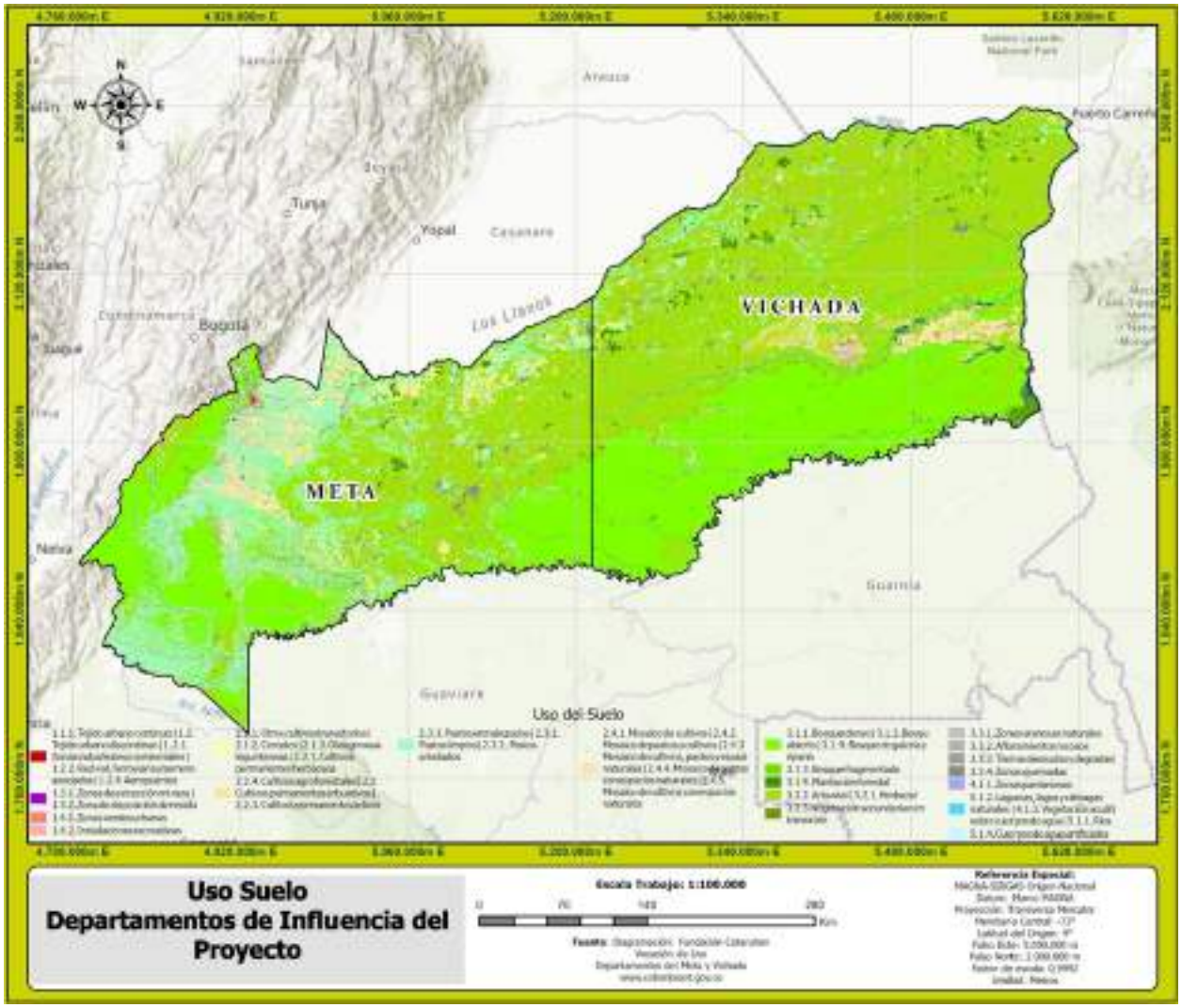
The agricultural vocation encompasses soils that facilitate the implementation of agricultural production systems, accommodating crops with varying life cycles. These soils possess an enhanced capability to sustain semi-intensive and intensive agricultural activities or any other intended use. Conversely, agroforestry vocation pertains to lands whose biophysical characteristics preclude the exclusive pursuit of agricultural activities. As a result, these lands necessitate the integration of agricultural activities within spatial and temporal arrangements. The primary limitations of these lands include steep slopes, excessive or deficient rainfall, erosion, and the presence of high concentrations of salts and aluminum.

The vocation for conservation are all those with biophysical conditions and ecological importance, which fulfill the function of protecting natural resources (IGAC, 2012). The forestry vocation is lands where meteorological conditions, slopes, erosion, soil types, among other things, must be used for forest protection or production purposes. Finally, the Livestock Vocation is characterized by presenting moderate limitations, especially for the development of semi-intensive agriculture, due to its low fertility, the difficulty in root penetration, the presence of stoniness on the surface and the easy puddles and flooding.

Land use and use coverages

Land cover is closely related to its use; in this sense, human activities such as agriculture, urbanization, forest clearing, among others, can change soil cover. In Table 5 We can mention that 75.3% of the territory is found in natural vegetation cover, with 38.9% corresponding to forests and 36.3% savannas. This information is represented through figureFigure 5.

Figure 5. Coverage and land use, departments of Meta and Vichada



Source: Land covers, Corine Land Cover Methodology - http://www.siac.gov.co/catalogo-de-mapas
Own preparation.

table 5. Coverage and land use and proportion in the territory

Legend	Surface H (ha)	Conglomerate Surface	Proportion (%)
1.1.1. Continuous urban fabric	8.572,1	17.989,45	0,1
1.1.2. Discontinuous urban fabric	6.228,4		
1.2.1. Industrial or commercial areas	2.478,6		
1.2.2. Road, railway network and associated land	49,4		
1.2.4. Airports	661,0		
1.3.1. Mining extraction areas	3.386,8	3.408,59	0,0

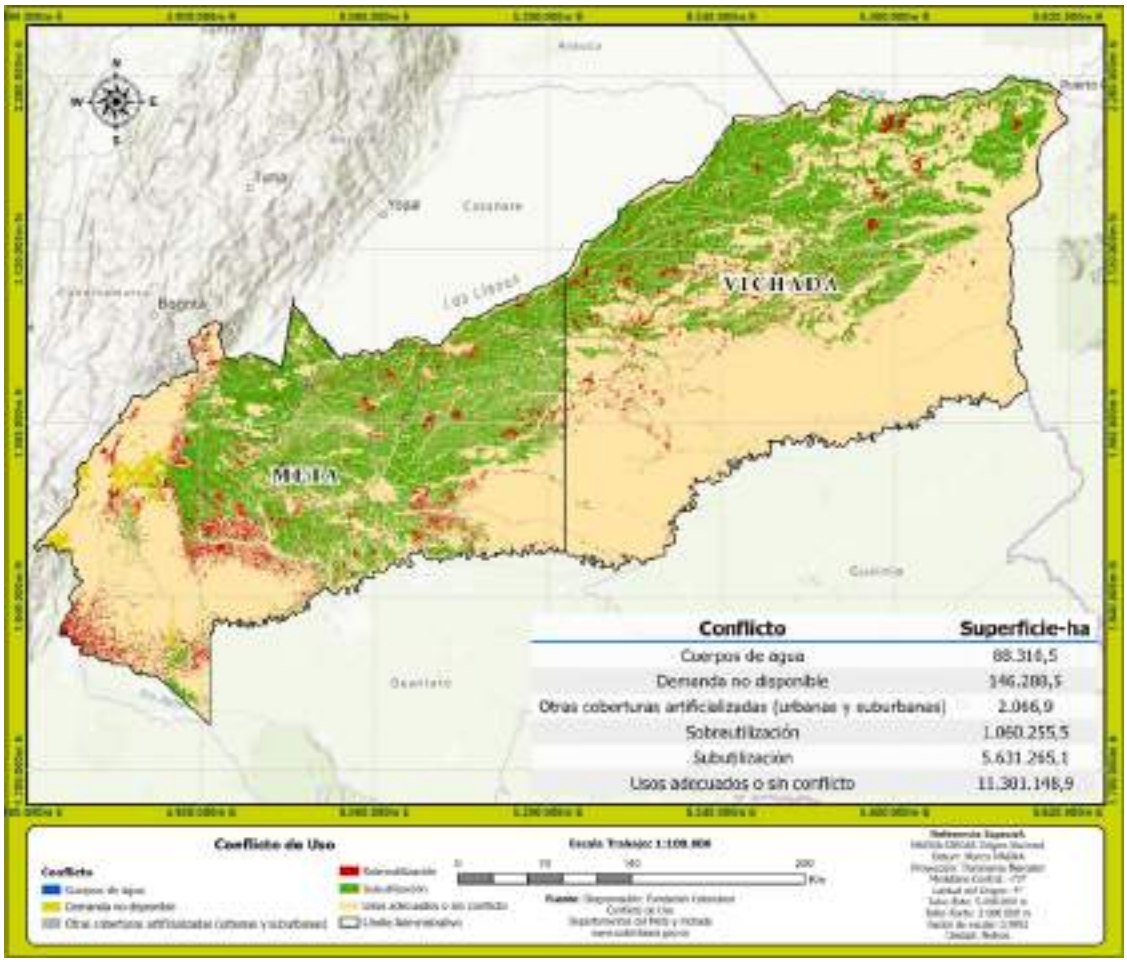
Legend	Surface H (ha)	Conglomerate Surface	Proportion (%)
1.3.2. Waste disposal area	21,8		
1.4.1. Urban green areas	378,1	378,09	0,0
1.4.2. Recreational facilities	1.114,9	1,114.86	0,0
2.1.1. Other transitional crops	17.204,8	120,196.10	0,7
2.1.2. Cereals	85.423,1		
2.1.3. Oilseeds and legumes	10.096,6		
2.2.1. Herbaceous permanent crops	7.471,7		
2.2.2. Permanent shrub crops	737,4	217,806.93	1,2
2.2.3. Permanent tree crops	216.905,9		
2.2.4. Agroforestry crops	163,6		
2.3.1. clean pastures	1.743.125,4	1.822,053.88	10,0
2.3.2. Wooded pastures	15.527,0		
2.3.3. Weeded Pastures	63.401,5		
2.4.1. Crop Mosaic	13.715,4	782,961.69	4,3
2.4.2. Mosaic of pastures and crops	237.066,8		
2.4.3. Mosaic of crops, pastures, and natural spaces	161.748,4		
2.4.4. Pasture mosaic with natural spaces	357.746,8		
2.4.5. Mosaic of crops with natural spaces	12.684,3		
3.1.1. dense forest	5.618.945,3	7.086.625,38	38,9
3.1.2. open forest	8.165,1		
3.1.4. Gallery and riparian forest	1.459.515,0		
3.1.3. Fragmented forest	144.808,8	144,808.85	0,8
3.2.1. Grassland	6.566.620,9	6.621,465.02	36,3
3.2.2. Shrubland	54.844,1		
3.1.5. Forest plantation	172.586,3	172,586.34	0,9
3.2.3. Secondary or transition vegetation	330.475,6	330,475.56	1,8
3.3.1. Natural sandy areas	28.955,7	28,955.71	0,2
3.3.2. rocky outcrops	7.232,5	7,232.49	0,0
3.3.3. Bare and degraded lands	3.861,2	3,861.18	0,0
3.3.4. Burned areas	131.468,8	131,468.84	0,7
4.1.1. swampy areas	59.641,5	59,641.48	0,3
5.1.4. Artificial bodies of water	538,7	538,74	0,0
4.1.3. Aquatic vegetation on bodies of water	226,6	69,851.50	0,4
5.1.1. Rivers	49.203,3		
5.1.2. Natural lagoons, lakes, and swamps	20.421,6		

Source: Land covers, Corine Land Cover Methodology — http://www.siac.gov.co/catalogo-de-mapas
Own preparation.

Land use and use coverage

Conflicts over land use are the result of discrepancies between the use that man makes of the natural environment and that which he should have with the environmental offer (Technical Guide for the formulation of POMCA, 2014). That is, the different types of soil that make up the territory are not used in accordance with their vocation.

Figure 6 Conflicts of use, departments of Meta and Vichada



Source:https://www.colombiaot.gov.co/.
Own preparation.

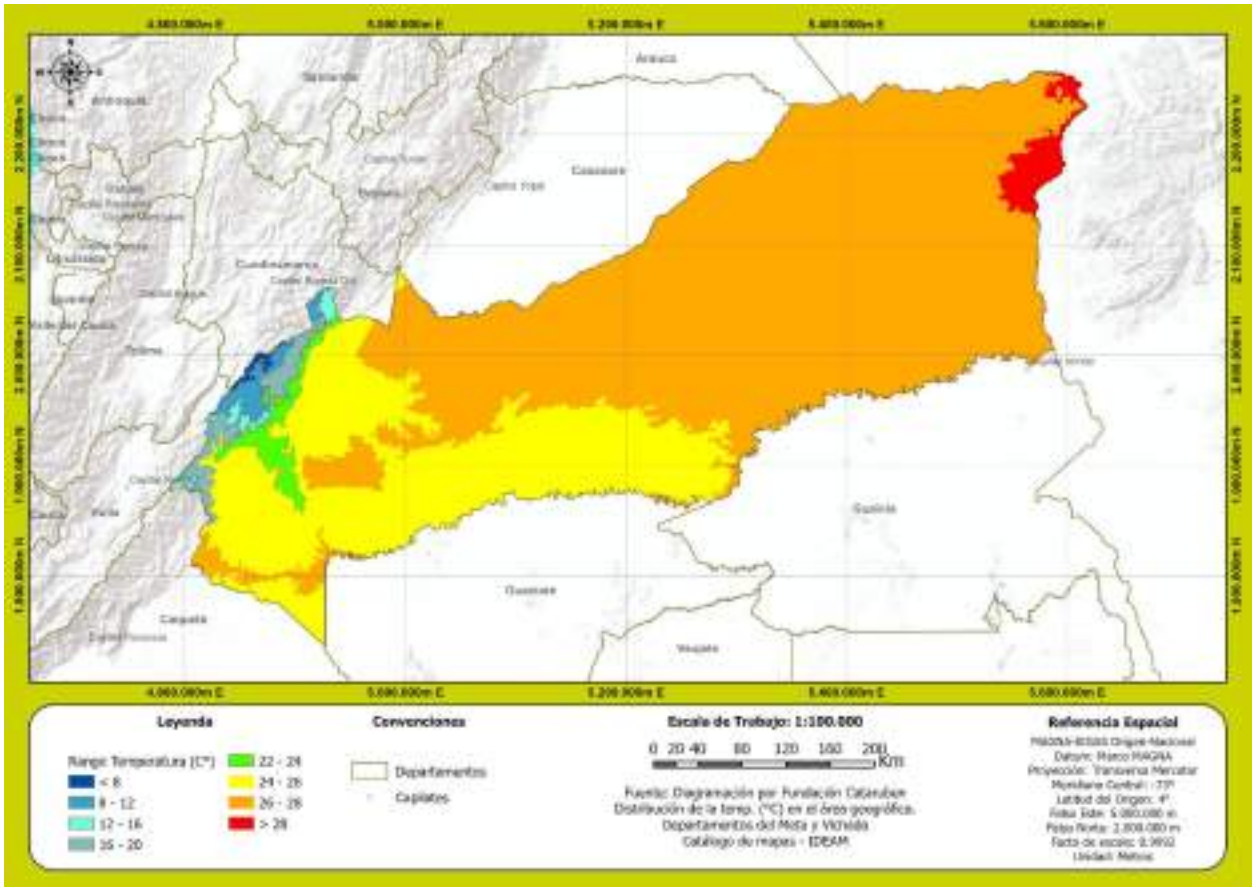
30.9% of the territory is in conflict of use due to underutilization. That is, where the use capacity of the dominant land corresponds to a lower level of intensity of use, if compared to the vocation of main use or compatible use. While 5.8% are in conflict due to overuse, a qualification given to lands where the current dominant use is more intense compared to the main use vocation

assigned to the land. Finally, 62.0% are without conflict or adequate land use, which refers to the correspondence between the land use capacity and the main use vocation.

Temperature

The departments of Meta and Vichada have a wide temperature distribution, which is directly associated with the climate classification (Figure 7), typical of the different ecosystems (Figure 8) that converge in the territory. Temperatures reach their highest levels in the northeastern region of the department of Vichada, exceeding 28 °C, while in the northwest portion of the department of Meta, temperatures drop to 8 °C.

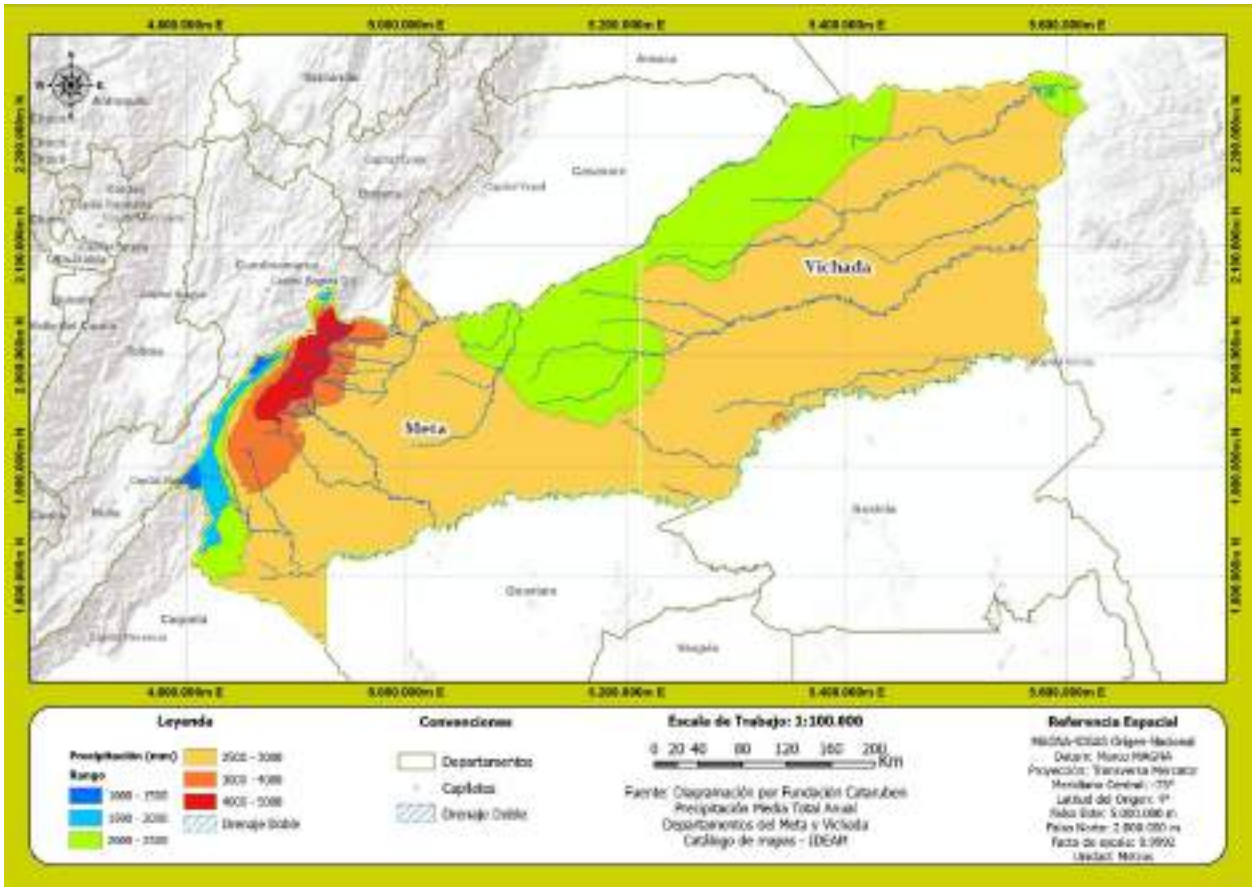
Figure 7. Temperature distribution in the geographic area of the project (°C)



Source: Map catalog - IDEAM
Own preparation.

FigureFigure 8, determines the average annual precipitation of the departments of Meta and Vichada, in which the project is developed. The existence of rainfall records ranging from 1000 mm/year to 5000 mm/year (Northwest of the department of Meta) is determined.

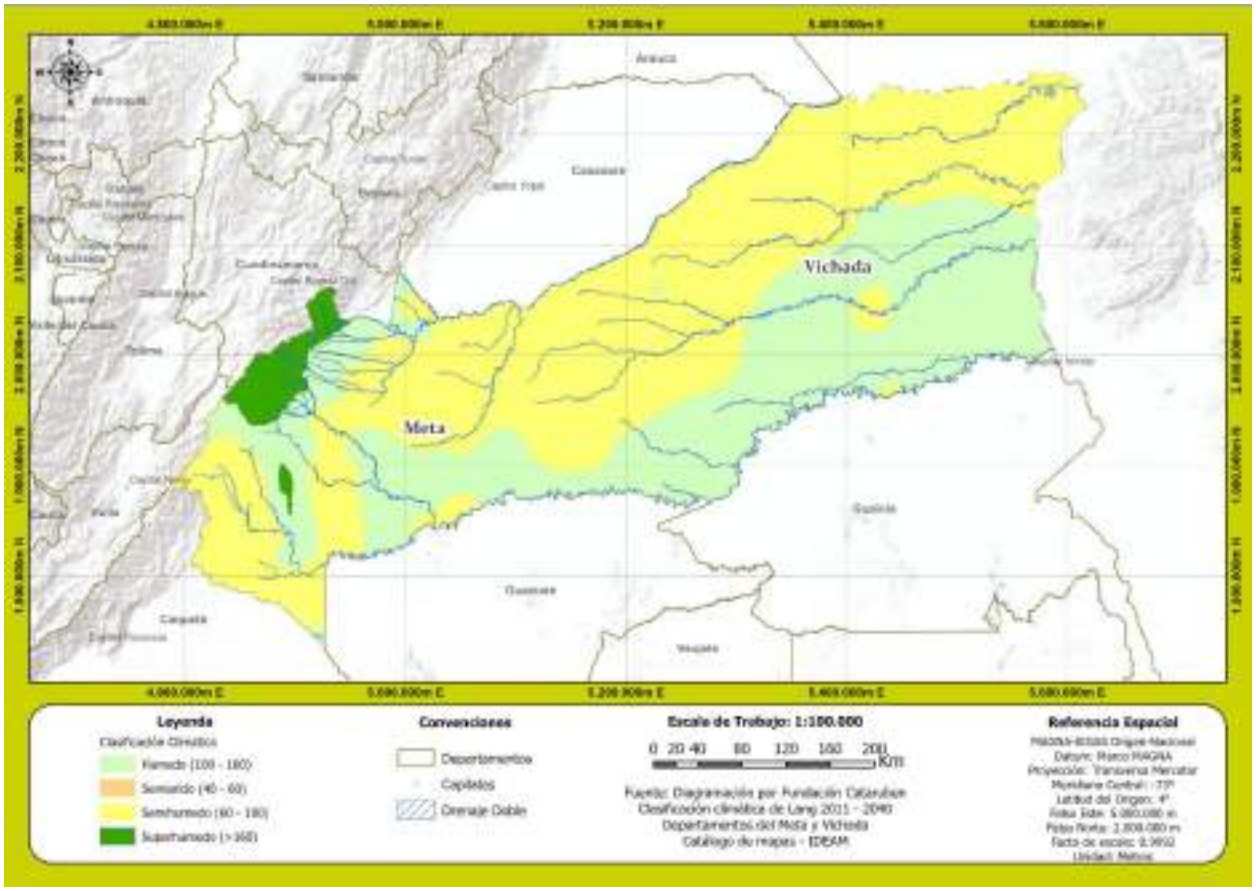
Figure 8. Average Total Annual Precipitation (° Celsius) 1981–2010



Source: [Map catalog - IDEAM]
Elaboration Own

Lang's classification employs the average annual temperature, measured in degrees Celsius (°C), and the average annual precipitation, expressed in millimeters, as input variables. These parameters are interconnected through the ratio of precipitation to temperature, known as the Lang Factor, which serves as an indicator of humidity conditions. This factor yields four distinct categories within the departments of Meta and Vichada: Semi-arid, Semi-humid, Humid, and Hyper-humid. The Semi-humid and Humid categories are the most prevalent. (Figure 9).

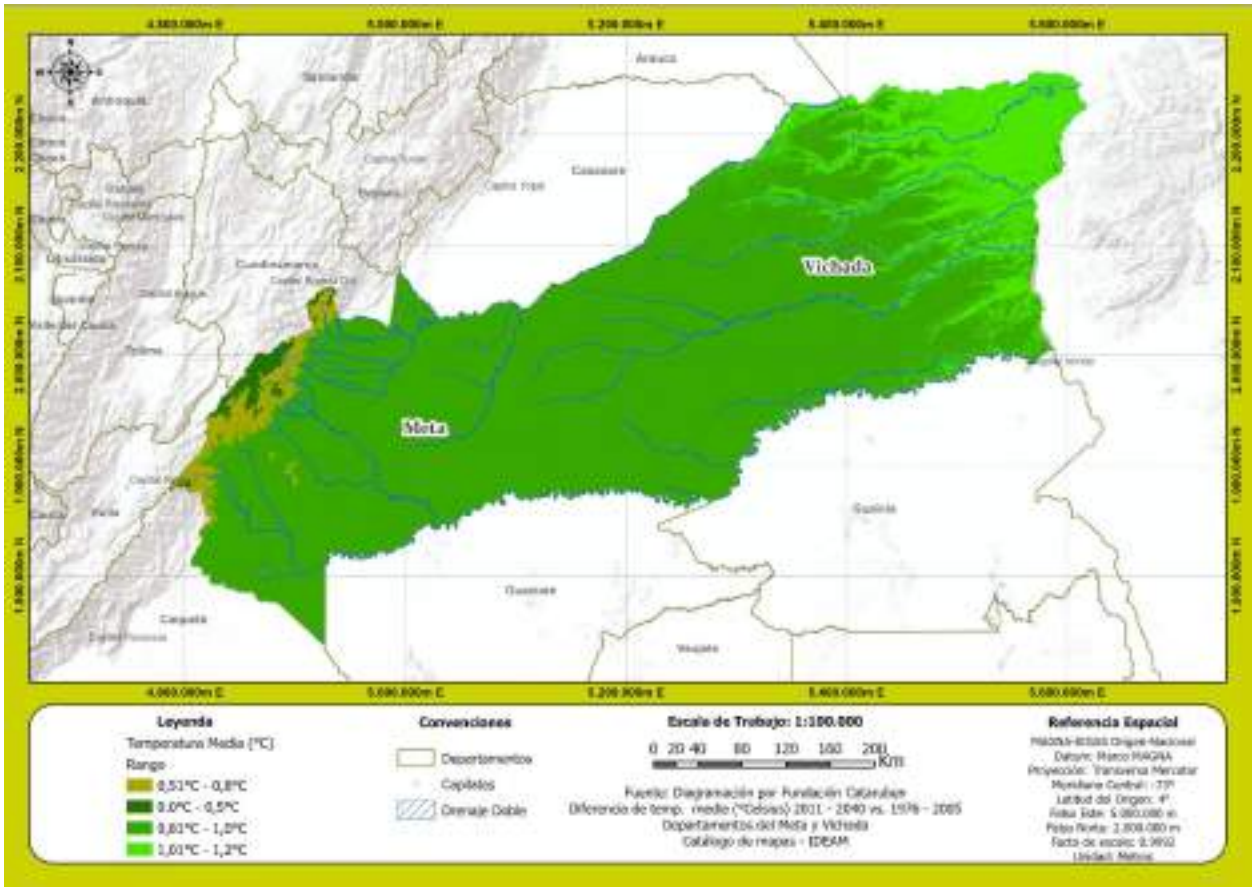
Figure 9. Lang Climate Classification 2011 - 2040



Source: Map catalog - IDEAM
Own preparation.

The Figure 10, determines the distribution of temperature changes expressed in ° Celsius for the 2011–2040 projection compared to the changes reported in 1976–2005. In this sense, the East of the department of Vichada would have an average temperature difference between 1.01 and 1.2 °C, while the rest of the territory ranges between 0.81–1 °C. Except for the northwest of the Meta department, where its variation could be 0.0–0.5 °C.

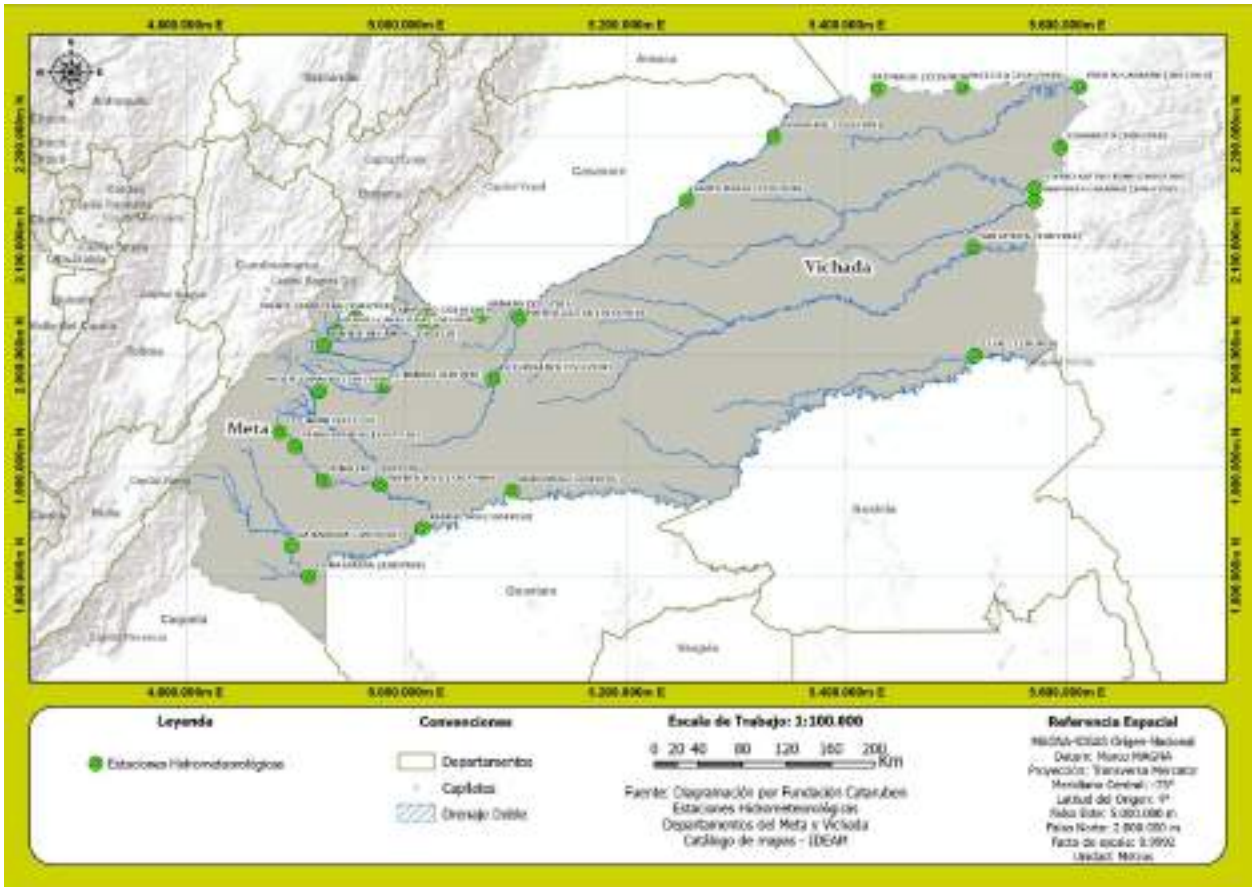
Figure 10. Average temperature difference (° Celsius) 2011–2040 vs. 1976–2005



Source: Map catalog - IDEAM
Own preparation.

Currently, there are 37 climatic stations on the territory, of which 8.0% (3 stations) are Hydrometeorological Stations and 91.0% (34 stations) are Hydrological stations. These stations record data on weather conditions, especially rain, temperature and/or humidity through instruments such as the rain gauge, pluviograph and psychrometer, respectively. The distribution is represented in the Figure 11.

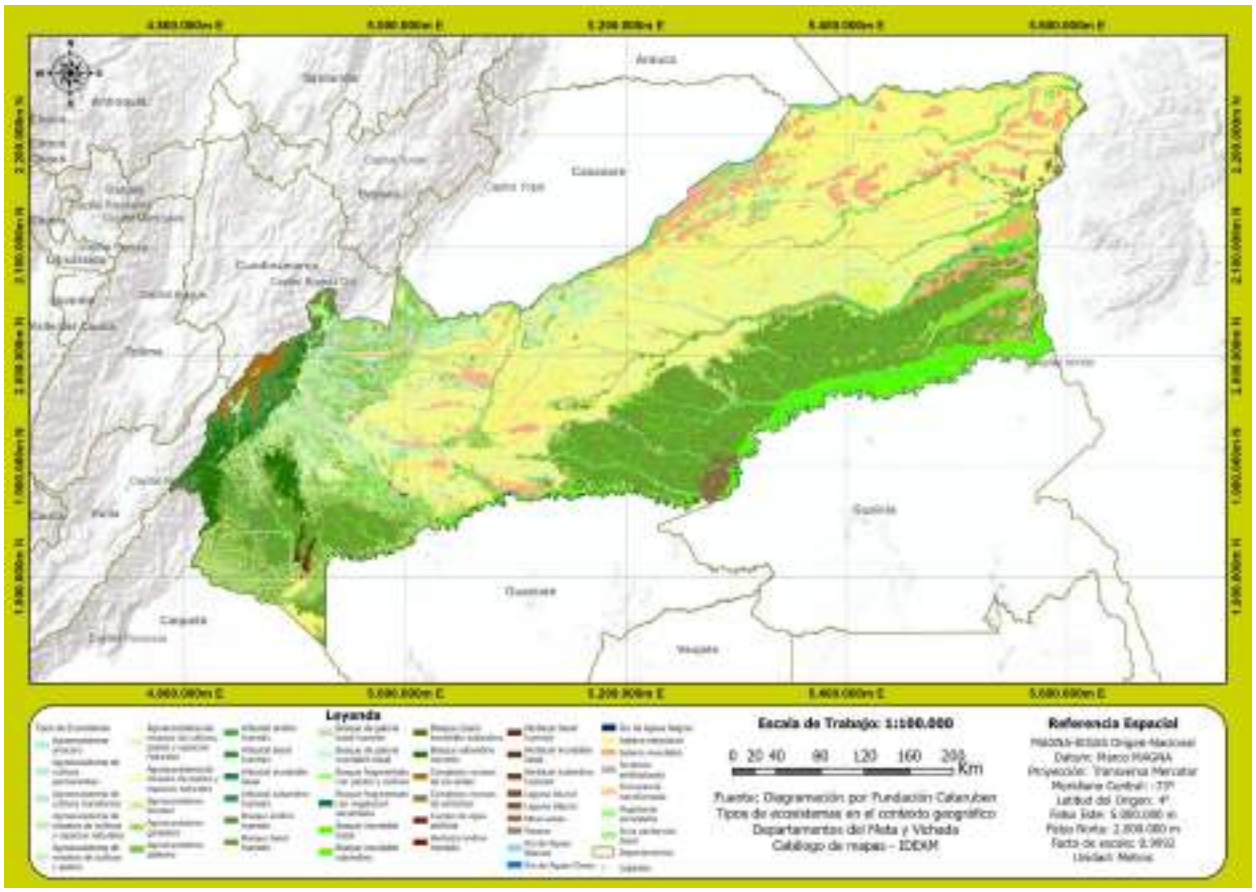
Figure 11. Hydrometeorological Stations



Source: Map catalog - IDEAM
Elaboration Own

Due to the great variety of environmental conditions, there is a diverse number of strategic ecosystems in the region of analysis, which include flooded grassland ecosystems, flooded gallery forests, flooded shrublands, and clear, white and black water rivers. The distribution of ecosystems is found in the Figure 12.

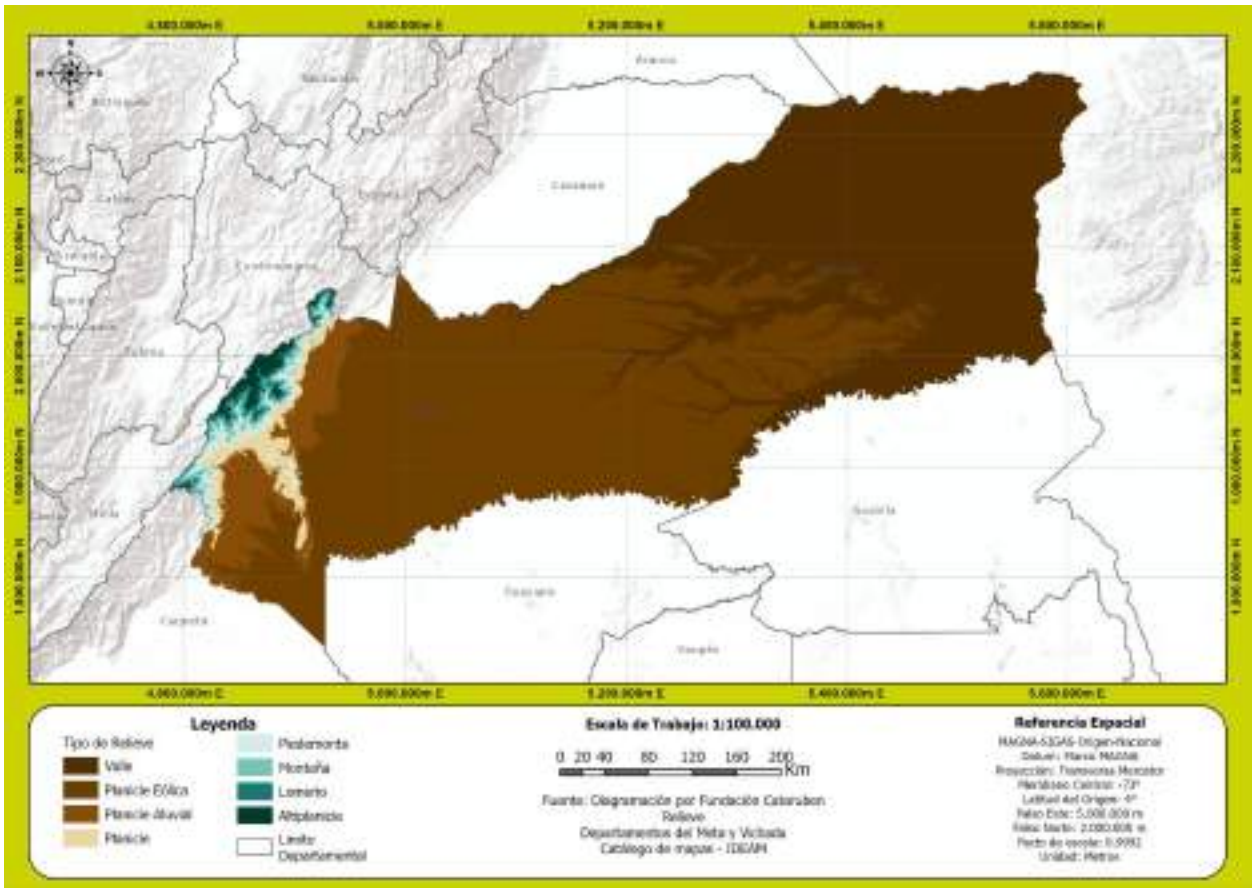
Figure 12. Types of ecosystems in geographical context



Source: Map of Continental, Marine and Coastal ecosystems of Colombia, IDEAM (2017)
Elaboration Own

While for the presence of the various forms that the earth's crust has, the types of relief that dominate the territory are the aeolian and alluvial plains (Figure 13).

Figure 13. Relieve

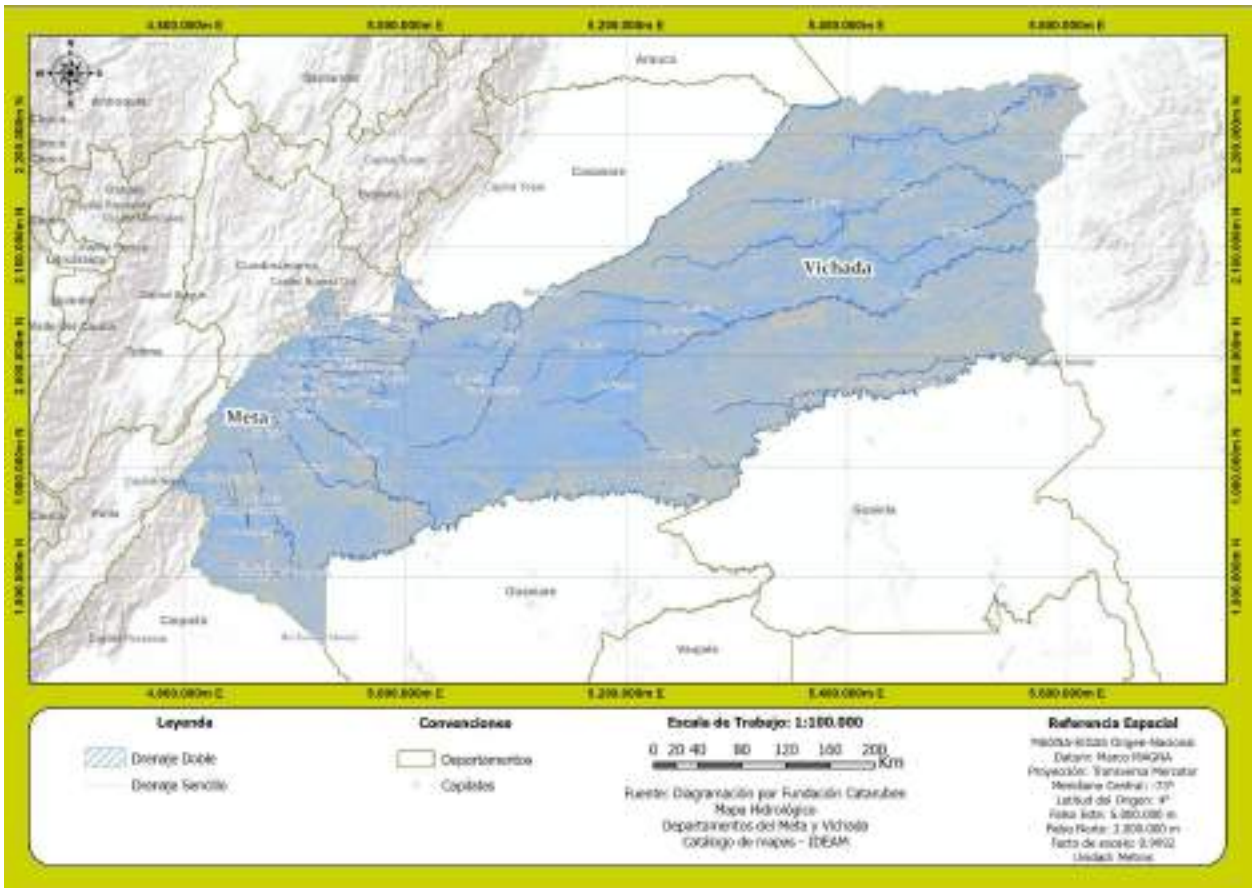


Source: Open data Cartography and geography, IGAC

Elaboration Own

The Figure 14, represents the entire drainage system present on the spatial dimension where the carbon project is developed. The most representative drainages are the Orinoco, Meta, Vichada, Guaviare, El Bita, San Vicente, Humea rivers, among others.

Figure 14. Hydrological Map



Source: Open data Cartography and geography. IGAC
Elaboration Own

2.3.2.2. Context social

The department of Vichada, located in the Orinoquia region, stands out for being one of the largest territories in Colombia, with an area of 100,242 km². Three population groups stand out in the territory, indigenous, llaneros and settlers, according to the National Cultural Information System. The indigenous communities of Guahibos are present in the department of Vichada, Sicuani, Piapoco, Cubeo, Puinave, Amorua and Saliva, who contribute to the cultural wealth of the area. Furthermore, the SINIC highlights that the Guahibos indigenous group has a significant presence in this area, being one of the most prominent, and its origins date back to the time of the conquest (SINIC 2023)[1].

The department of Vichada is divided into four municipalities: Puerto Carreño, La Primavera, Santa Rosalía and Cumaribo, the latter being recognized as the largest municipality in the entire national territory (National University of Colombia, 2013). The department of Vichada is located at the mouth of the Meta River in the Orinoco. The area is mainly characterized by its extensive plains, although it also has hills such as Mataveni, Mono and Vichada (National University of Colombia, 2013).[2].

In relation to the level of poverty in the department of Vichada. According to the DANE Agricultural Census in 2014, it is highlighted that the department occupies second place in the Multidimensional Poverty Index (MPI) adjusted for the population residing in rural areas. dispersed censused by department, with a percentage of 80.6%. The first place is occupied by La Guajira, with a percentage of 84.6%. Subsequently, in the Municipal Multidimensional Poverty Technical Report published by DANE 2018, the municipality of Cumaribo presents a high poverty incidence rate of 91.4%, occupying second place after Uribia (La Guajira), which registers an incidence rate of poverty of 92.2%.

Regarding the lack of access to health services, according to the DANE analysis in 2014. Regarding households in the dispersed rural area censused by the department, it is observed that Vichada occupies second place with a percentage of 17.4% of health deprivation. After La Guajira, which presents a percentage of 27.4%. According to the 2014 DANE report, it is noted that in the department of Vichada, in terms of the distribution of homes with inadequate material in the floors in the dispersed rural area censused by department, it occupies second place. It has a percentage of 68.7%.

[1] National Cultural Information System. (n.d.). *National Culture Information System*. Retrieved Junio 21, 2023, from https://www.sinic.gov.co/SINIC/ColombiaCultural/ColCulturalBusca.aspx?AREID=3&SECID=8&IdDep=99&COLTEM=216

[2] National university of Colombia. (2013, May). *Orinoquía Region Characterization*. Retrieved Junio 22, 2023, from https://www.humanas.unal.edu.co/observapazyconflicto/files/4614/3144/5526/caracterizacion_de_la_orinoquia.pdf

The department of Vichada faces major deficiencies in terms of land connectivity. 80.92% of intermunicipal and national roads are in their natural state, with few paved roads that are only passable during summer. In addition, the department has the presence of three airports in the municipalities of Santa Rosalía, La Primavera and Puerto Carreño, but it is important to highlight that there are no land transportation terminals in any of the municipalities. During the rainy season, the river system becomes the main means of transportation used to connect between municipalities and departments. The river ports are located in the municipalities of Santa Rosalía and La Primavera (Nakusa 2015)[3].

The department of Meta, located in the Orinoquia region, extends across 85,635 km2 and includes 29 municipalities. Its capital is the municipality of Villavicencio. It limits to the north with the departments of Cundinamarca and Vichada, to the south with Caquetá and Guaviare, to the east with Guaviare, and to the west with Huila and Bogotá. The main economic sources are the exploitation of hydrocarbons, extensive livestock farming and agriculture, where crops such as African palm, rice, cocoa, and traditional crops stand out (National Federation of Departments, 2019)[4].

The department of Meta stands out for its low poverty rates. In 2015, it was positioned as the fourth department with the smallest population living in poverty. According to the study carried out by Martinez and Delgado in 2017, approximately 21.8% of the population was below the monetary poverty line in that year. The department of Meta has various means of access that contribute to its connectivity and transportation system. The Vanguardia airport stands out, which plays a crucial role in connectivity between the Orinoquia region and the Amazon. Likewise, there is the Apiay airport, belonging to the Colombian Air Force (Martínez & Delgado, 2017)[5].
River transportation develops along the Meta River, with 18 ports distributed over approximately 730 km between the municipalities of Puerto López and Cabuyaro. The transport and river communication system in the department of Meta plays a fundamental role in the mobility of the region. It not only provides an important avenue for the exchange of goods, but also fosters connection both within the region's municipalities and with other neighboring territories. Finally, it is highlighted that the department of Meta has limited road infrastructure in terms of primary roads. Responsibility for the primary network lies with the national government. However, most of

[3] Nakusa Red Regional Tourist. (n.d.). *PROJECT FNT-07-2014 "STRUCTURING OF THE SPORTS FISHING TOURISM PRODUCT FOR THE DEPARTMENT OF VICHADA" FIN REPORT*. Retrieved Junio 23, 2023, from https://fontur.com.co/sites/default/files/2020-12/DISENO_DE_PRODUCTO_TURISTICO_PESCA_DEPORTIVA_VICHADA.PDF
[4] National Federation of Departments. (2019, December 20). *Goal - Sustainable Development Route*. Retrieved Junio 21, 2023, from https://fnd.org.co/docs/subdirecciones/fortalecimiento-territorial/cartillas/Meta.pdf
[5] Martínez, A., & Delgado, M. (2017, September 15). *Study on the impact of oil activity in the producing regions of Colombia*. Retrieved Junio 26, 2023, from https://www.repository.fedesarrollo.org.co/bitstream/handle/11445/3509/Repor_Septiembre_2017_Martinez_y_Delgado_Meta.pdf?sequence=3&isAllowed=y

these roads show a fair or poor state in terms of maintenance and conservation.n (Martinez & Delgado, 2017)[6].

Finally, the highland plain region presents notable social deficiencies. According to Grain and his collaborators, 67% of the population in this region experiences unmet basic needs. It is important to highlight that in territories such as La Primavera (Vichada), the figures exceed 80% of the affected population. Furthermore, in Cumaribo (Vichada) a percentage of 50% is observed and in Santa Rosalía (Vichada) 70%. These data reveal a complex situation in terms of social well-being in the highland region.

2.3.2.2.1. Demographic context

The demographic analysis focused exclusively on population growth obtained from the projections published by DANE, which were based on the 2005 and 2018 censuses. The information was collected for each municipality and is presented in a table that shows the total population. of each one for the years 2009 and 2018, as well as the percentage of population variation in each municipality. Population growth was selected as an analysis variable based on the objective of the study, which focused on the evaluation of demographic trends in each municipality during the analyzed time period.

In Table 6 The total population figures corresponding to the years 2009 and 2017 are presented, as well as the percentage of change for each of the municipalities in the study area.

Table 6. Analysis of population data for the years 2009 and 2017

Department	Municipality	Total 2009	Total 2017	Change (%)
Meta	La Macarena	20077	26129	30%
Meta	Puerto Gaitán	31310	40428	29%
Vichada	Cumaribo	54899	70339	28%
Meta	Castilla la Nueva	11011	13928	26%
Meta	Barranca de Upía	4954	6264	26%
Meta	San Carlos de Guaroa	9699	12064	24%
Meta	Cabuyaro	4847	5949	23%
Meta	Fuente de Oro	9803	11916	22%
Meta	Acacías	71399	86156	21%

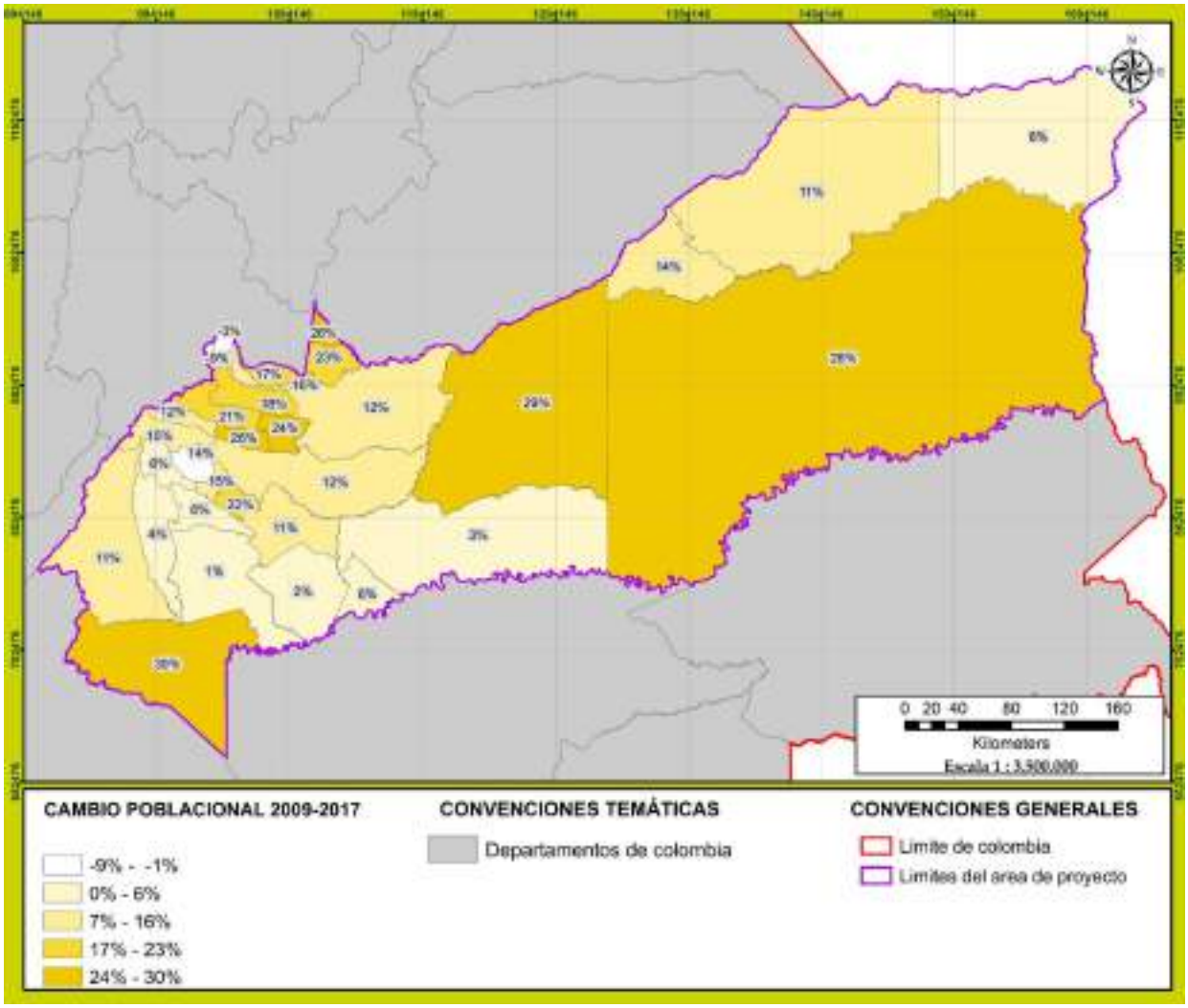
[6] Martínez, A., & Delgado, M. (2017, September 15). *Study on the impact of oil activity in the producing regions of Colombia*. Retrieved Junio 26, 2023, from https://www.repository.fedesarrollo.org.co/bitstream/handle/11445/3509/Repor_Septiembre_2017_Martinez_y_Delgado_Meta.pdf?sequence=3&isAllowed=y

Department	Municipality	Total 2009	Total 2017	Change (%)
Meta	Villavicencio	443635	521700	18%
Meta	Cumaral	19307	22501	17%
Meta	Restrepo	15454	17895	16%
Meta	Granada	58928	67735	15%
Meta	Cubarral	5969	6859	15%
Vichada	Santa Rosalía	3538	4028	14%
Meta	El Dorado	3372	3829	14%
Meta	Puerto López	26725	30016	12%
Meta	San Martín	23549	26431	12%
Meta	Guamal	12392	13853	12%
Vichada	La Primavera	9025	10046	11%
Meta	Uribe	8290	9176	11%
Meta	Puerto Lleras	9372	10360	11%
Meta	Lejanías	10695	11389	6%
Meta	San Juan de Arama	8565	9111	6%
Meta	Puerto Concordia	7898	8362	6%
Vichada	Puerto Carreño	19529	20646	6%
Meta	Mesetas	10735	11113	4%
Meta	Mapiripán	6811	6986	3%
Meta	Puerto Rico	12744	13033	2%
Meta	Vistahermosa	17501	17688	1%
Meta	El Castillo	8038	7994	-1%
Meta	San Juanito	1344	1310	-3%
Meta	El Calvario	1939	1768	-9%

Source: Dane (2018)

Below is a map illustrating the distribution based on percent population change.

Figure 15. Percentage of population change 2009-2017



Source: DANE
Own elaboration.

During the analysis period, it was observed that the majority of municipalities experienced an augmentation in their population. The municipality with the most substantial increment was La Macarena in the department of Meta, exhibiting a growth rate of 30%. This was followed by Puerto Gaitán within the same department, showcasing a growth rate of 29%, and Cumaribo in the department of Vichada, which experienced a growth rate of 28%.

Conversely, some municipalities experienced a population decline. The municipality of El Calvario in the department of Meta had the most significant decrease, with a 9% reduction in its population. San Juanito, also in the department of Meta, experienced a 3% decrease, and El Castillo, in the same department, saw a 1% decrease.

Likewise, according to other reports found, according to the census carried out by DANE in 2015, the total population of the Vichada department was 66,917 inhabitants. Of that total, 51% of the population was concentrated in the municipality of Cumaribo, while 24% resided in the municipality of Puerto Carreño (National University of Colombia, 2013). Additionally, the Fiscal Viability Report of the Departments of the Ministry of Finance and Public Credit, which cites DANE, estimates that in 2018 the population in the department of Vichada was 77,276 inhabitants. Of that total, 45.6% reside in urban areas and 54.4% are in rural areas. Additionally, the report highlights that the department of Vichada has 32 indigenous reservations, and represents a total of 33,838 people. Finally, the previously mentioned report highlights that 54% of the population is in the age group between 19 and 59 years of age (Ministry of Finance Colombia, 2019)[7].

While in the department of Meta, according to the Information and Statistics Office of the Administrative Department of Departmental Planning of Meta, a notable demographic trend is observed. According to the DANE 2005-2020 projection, the population in 2008 was 867,534 inhabitants, while in 2016 it reached 981,726 inhabitants, which represents an increase of 144,192 inhabitants during that period (Gobernación del Meta, 2020)[8]. Furthermore, according to the Report of Joint DANE Regional Economic, in 2014, the population of the department of Meta was estimated at 943 thousand people, with 77.7% of working age. The report also highlights that a greater number of women were registered, with a total of 233 thousand, compared to men, who totaled 217 thousand (DANE, 2014).

2.3.2.3. Economic context

The department of Meta, according to DANE statistics and reports[9], stands out as one of the territories that contribute the most to the national GDP. According to this entity, the Meta economy experienced significant growth in 2012 and 2013, with an increase of 7.6% and 10.3%, respectively. These results positioned Meta in third place of the departments with the highest economic growth in 2012. These achievements are mainly due to the oil industry and the construction sector.

DANE also highlights that in 2013, the Mining and Quarrying industry recorded notable oil production, reaching 186.1 million barrels, which represents 70.3% of the department's total GDP.

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[7] Ministry of Finance Colombia. (2019, June). *Vichada Department*. Retrieved Junio 21, 2023, from https://www.urf.gov.co/webcenter/ShowProperty?nodeId=%2FConexionContent%2FWCC_CLUSTER-121821%2F%2FidcPrimaryFile&revision=latestreleased

[8] Governance of Meta. (2016). *Social and Economic Development Plan "The META, Land of Opportunities. Inclusion - Reconciliation - Equity 2016-2019"*. Retrieved Junio 30, 2023, from https://www.asamblea-meta.gov.co/proyectos-de-ordenanzas/ordenanza-902-de-2016

[9] DANE. (2015, November). *Regional Economic Situation Report*. Retrieved Junio 23, 2023, from https://www.dane.gov.co/files/icer/2014/ICER_Meta2014.pdf

In second place is the construction sector, with a share of 6.6%. The branch of agriculture, livestock, hunting, forestry, and fishing occupied fourth position, contributing 5.5% to the GDP.

In the department of Meta, agriculture stands out for various crops, according to the Ministry of Agriculture and Rural Development. Among them are oil palm, technical corn and mechanized rice. According to the figures of this entity, in 2016, 221,090 hectares of oil palm, 79,150 hectares of technical corn and 77,335 hectares of mechanized rice were planted. In particular, the oil palm sector continued to lead the main crops in 2017, with a planted area of 231,826 hectares, according to data from the Ministry of Agriculture (MinAgricultura, 2018)[10].

In 2012, according to DANE data, land use in the department of Meta was distributed as follows: the livestock sector occupied a total of 4,783,086 hectares, followed by the agricultural sector with 221,592 hectares. The third occupation in terms of land use corresponds to the forest area, which represented a total of 235,823 hectares (DANE, 2012).

The analysis of land use in the department of Vichada, based on DANE data, reveals that the livestock sector occupies the first position in terms of occupation, followed by the forest area and, in third place, is the agricultural sector. According to the DANE report corresponding to the year 2016, the livestock sector registered an occupation of 4,199,801 hectares, while in 2018 this figure increased to 4,637,846 hectares, which represents an increase of 438,045 hectares during that period of time. (DANE, 2020)[11].

In 2016, the government promulgated Law 1776, which established the ZIDRES (Zones of Interest for Rural, Economic and Social Development)[12]. The main objective of this law was to promote the development of livestock, agricultural and other related sectors in special territories with characteristics such as low population density and limited infrastructure. With this legislation, the national government sought to promote investment in specific areas of the country, providing benefits and economic facilities to investors. In this sense, the highland region became a strategic point to carry out this project.

Additionally, in the department of Vichada you can see relevant data on both permanent and temporary crops. According to DANE, in 2017 The planting of 1,262 hectares of oil palm was recorded in this department, while in 2018 the figure increased to 2,221 hectares of oil palm.

[10] Ministry of Agriculture and Rural Development. (2018). *Main Crops by Planted Area in 2017*. Retrieved Junio 26, 2023, from https://agronet.gov.co/Documents/META_2017.pdf

[11] DANE. (2020, January 31). *Technical Bulletin Municipal Multidimensional Poverty Measure*. Retrieved Junio 23, 2023, from https://www.dane.gov.co/files/investigaciones/condiciones_vida/pobreza/2018/informacion-censal/bt-censal-pobreza-municipal-2018.pdf

[12] Tacha , V. , Strong , A. , Martinez , J. H. , Cande , F. , & Mateus , L. (2016). *The Zones of Interest for Rural, Economic and Social Development (ZIDRES) against the Colombian countryside*. Retrieved Junio 28, 2023, from https://semillas.org.co/apc-aa-files/5d99b14191c59782eab3da99d8f95126/informe-zidres_1.pdf

Regarding transitional crops, the presence of yellow corn stands out, which occupied an area of 1,206 hectares planted in 2016.

Finally, Grain and his collaborators point out that the highland region, which includes the departments of Meta and Vichada, is characterized by having an economy focused on oil extraction and the development of extensive livestock farming. According to the authors, in this area of the country there are more than 30,000 hectares with a mining exploitation license and applications have been submitted for more than one million additional hectares.

Furthermore, the authors point out that the occupation of land in this territory is associated with activities such as livestock farming, forestry exploitation, rubber plantations and rice cultivation. These activities have contributed to the configuration of the productive landscape of the region, but they also pose challenges in terms of environmental sustainability and conservation of natural resources.

As mentioned above, both the departments of Vichada and Meta have focused their economic development on agricultural activities, highlighting oil palm, soybean and rice crops, as well as extensive livestock farming and hydrocarbon exploitation. Consequently, development plans have focused on promoting and strengthening these departments through the development of agricultural and livestock projects.

In the Social and Economic Development Plan, "El META, Land of Opportunities. Inclusion — Reconciliation — Equity 2016-2019", programs have been implemented that seek to promote the development of the region. One of them is Program 1: El Campo, Opportunity for Peace, which aims to improve agricultural practices and strengthen marketing. In addition, Subprogram 4: Agro-industry has been established, with the purpose of modernizing production, and Subprogram 7: Agricultural Modernization, which seeks to establish public policies for agricultural, forestry, fishing and agro-industrial development in this area of the country, promoting adoption of sustainable and competitive agricultural systems (Gobernación del Meta, 2016).

The department has historically had an economy based on livestock, which is why the Social and Economic Development Plan "El META, Land of Opportunities. Inclusion — Reconciliation — Equity 2016-2019" recognizes the importance of taking actions in this sector. Subprogram 6: Livestock Improvement focuses on promoting and promoting the modernization of the livestock sector, with the aim of increasing its competitiveness and sustainability. This will be achieved through the implementation of good livestock practices, genetic improvement and other relevant aspects for the development of the sector (Gobernación del Meta, 2016).

During the period 2020-2023, the Department of Meta's Development Plan, guided by the motto "Let's Make Meta Great," was conceived as a comprehensive framework aimed at revitalizing and reinforcing the rural areas in all their productive dimensions. This orientation is clearly reflected in the structuring of the fundamental pillars outlined in chapter 2 of the plan, titled "Pillars of the Development Plan Let's Make Meta Great." Notably, Pillar 1 stands out: "Development of the countryside for the shared prosperity of all," thereby indicating that the department's economic growth strategy will predominantly focus on the agricultural sector.

Likewise, in chapter 3, which addresses the dimensions of development, emphasis is placed on Dimension 1: "Let's Make the Productive Goal Great", where the strengthening of the agricultural sector and rural development is highlighted. This strengthening is carried out through the consolidation of agricultural, agro-industrial and agro-tourism production chains, with the primary objective of increasing productivity and competitiveness in the markets.

Additionally, the importance of the commerce, industry, and tourism sector is highlighted, through program 1: "Productivity and Competitiveness of Companies in the Department of Meta." This program emphasizes the need to implement actions to promote the sustainable development of tourism, diversify the tourism offer through the creation of new routes and tourism development plans. It also aims to strengthen local entrepreneurs and promote Meta as a tourist destination of interest both nationally and internationally. (Meta Government, 2020).

In the Development Plan "Let's Build Vichada 2016-2019" of the department of Vichada, it establishes in strategic axis 2: Productive and sustainable Vichada, Objective 8: Manage and implement productive projects that promote sustainable agricultural growth and guarantee rural development. These actions highlight the importance of this territory in the development of the rural sector. According to DANE data from 2012, 22,261 hectares were cultivated in Vichada, obtaining crops of products such as cocoa, manual dry rice, traditional corn, among others (Gobernación del Vichada, 2016).

The Development Plan "Let's Build Vichada 2016-2019" also highlights the importance of strengthening the agricultural sector through different programs. Firstly, section A: Program for mechanization, automation, and development of technologies applied to agricultural development, aims to promote the use of appropriate technology and machinery to improve productivity in the sector. On the other hand, section D: Agricultural technical assistance program, seeks to provide technical support to farmers and ranchers to optimize their practices and obtain better results. In addition, section I: Agribusiness adaptation program, focuses on creating spaces for the transformation of agricultural products, promoting the creation of added value. These actions have the purpose of promoting and strengthening the development of crops

in the short, medium and long term, as well as improving agricultural technical assistance and facilitating the transformation of agricultural products (Gobernación del Vichada, 2016).

The Departmental Development Plan of Vichada for the period 2020-2023, "Work for all Vichada", established as a primary goal to transform this department into a productive, competitive and constantly evolving territory. This vision is clearly expressed in Strategic Line 3: "Responsible Economic Growth", which defines five programs and fifteen specific subprograms.

In this context, Program 1: "The Future is in the Field" stands out for its focus on strengthening small and medium-sized agricultural producers, in order to promote the development of their economic activities and improve their marketing capabilities. Likewise, Program 4: "Productive and Competitive Vichada", emphasizes promoting associativity between the productive units of the territory, providing technical assistance to various sectors to enhance their growth. In parallel, actions were established to promote the cultural and natural attractions of the department, materialized in the "Tourism for Vichada" Subprogram. This initiative was visualized with the main objective of promoting tourism as an engine of economic development, highlighting the unique natural and cultural resources that Vichada offers (Gobernación del Vichada, 2020).

2.3.2.3.1. *Road Context*

The departments of Meta and Vichada in Colombia have a road network that includes main and secondary roads that connect these regions with other departments and important urban centers. Here are some of the main roads that connect Meta and Vichada:

National Route 40: Known as the Troncal del Llano, this highway is one of the main routes that connects Meta and Vichada with the country's capital, Bogotá. It runs through a large part of the departments of Meta and Vichada and is crucial for the transportation of agricultural and livestock products to other markets.

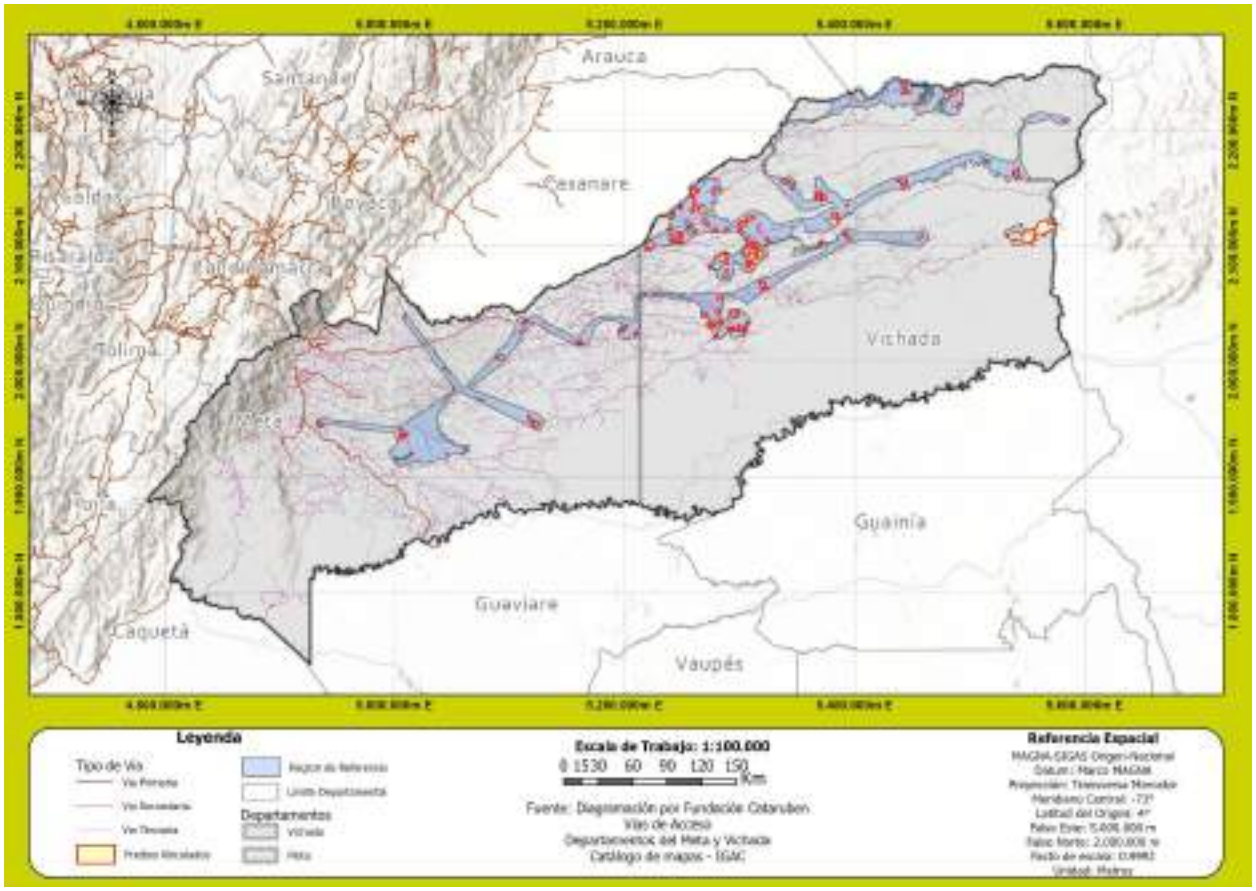
National Route 65: Also called the Cusiana Highway, this road connects Meta and Vichada with the department of Casanare. It is essential for the region's oil industry, as it passes through areas with significant oil deposits.

National Route 66: Known as the Carare Highway, this road connects Meta and Vichada with the department of Casanare and the city of Yopal. It is an important route for transporting cargo and passengers between these regions.

Secondary roads and rural roads: In addition to the main roads, there are a series of secondary roads and rural roads that connect local communities, agricultural areas and remote areas in the departments of Meta and Vichada. These roads are essential for access to rural areas and local mobility.

These are some of the main roads that connect Meta and Vichada, providing vital infrastructure for the economic and social development of the region as shown in the figure 16

Figure 16 Distribution of the roads.



Source: Nationals Roads (https://www.colombiaenmapas.gov.co/), Secondary Roads (https://www.colombiaot.gov.co/) Own preparation.

2.3.2.4. Context historic

The department of Meta and Vichada have maintained a deep cultural and historical connection since the times of the conquest. Its extensive and virgin natural savannas, shared by both territories, have led to extensive livestock farming, always being the main engine of social and economic development in this region. Furthermore, both departments share a close relationship in terms of land ownership and the economic processes that have developed in these areas of the country in recent years.

In relation to the cultural aspect, both the department of Vichada and the department of Meta share various cultural manifestations that are closely linked to the llanero identity. Both regions strive to preserve the valuable llanero intangible cultural heritage, which has been bequeathed by the indigenous peoples originating from this territory and is deeply rooted in its history.

Important festivals are held in the department of Vichada that stand out for their cultural relevance. Among them are the International Corrido Llanero Tournament, the "El Curito" International Festival and Folkloric Reign, the "El Cachicamo de Oro" Festival, the Indigenous Cultural Festival, the Cumare Festival and the "La Palometa de Oro" International Children's Festival.". These events contribute significantly to the promotion and preservation of the cultural identity of the department. Furthermore, it is relevant to highlight that the Departmental Assembly of Vichada, through Ordinance No. 8 of July 10, 2012, made Vichadense Identity Day official. This project aims to promote and disseminate the cultural wealth and identity of the department. (Vichada Government, 2020)[13].

The Meta department is a standout among the territories of the Orinoquia region due to its prominence in cultural and tourism promotion. Various acclaimed events are hosted in this area, captivating attention and bolstering the growth of the industry. Noteworthy among these events are the International Joropo Tournament in Villavicencio, the World Coleo Meeting in Villavicencio, the World Women's Cowgirl Competition in Villavicencio, the Festival of Return in Acacías, the World Cowgirl Meeting in Cumaral, and the Festival Cachama International in Puerto Gaitán. These events provide an invaluable opportunity to showcase and celebrate the cultural and touristic riches of the department. Additionally, the Meta department boasts a broad and diversified range of cultural training programs. These programs encompass various disciplines and artistic expressions, reflecting the region's commitment to fostering and promoting culture in all its manifestations.

2.3.3. Key Actors, Interests, and Motivations

Following a comprehensive database search exercise involving regional organizations and additional efforts by the Project Owner to identify key actors, a database of actors within the territory was created. While this database may not encompass all actors, it includes a substantial number of references that support the economic data described within the context and accurately represents the reality of the territory where the project is being developed. ANNEX 4.1.1. Actors of Interest. Which is summarized by type of actor in the Table 7

Table 7. Summary Actors

[13] Vichada Government. (n.d.). *Cultural Aspects of the Department of Vichada*. http://www.vichada.gov.co. Retrieved Junio 30, 2023, from http://www.vichada.gov.co/cultura/aspectos-culturales-del-departamento-de-vichada

Department	Actor Type	Productive Chain To Which It Belongs	
Meta	Private companies (associated with production chains)	Cacao	3
		Forestry (including rubber)	6
		Cattle raising	18
		Cashew	1
		Other	23
		Palm oil	10
	Non-Profit Entities - ESAL	Rice	2
		Cacao	12
		Forestry (including rubber)	1
		Cattle raising	66
		Other	53
		Palma africana	1
	Individual producer	Palm oilRice	16
		Forestry (including rubber)	3
		Cattle raising	18
		Cashew	1
		Other	9
Vichada	Private companies (associated with production chains)	Cacao	0
		Forestry (including rubber)	0
		Cattle raising	1
		Cashew	8
		Other	0
		Palm oil	2
	Non-Profit Entities - ESAL	Rice	2
		Forestry (including rubber)	2
		Cattle raising	21
		Cashew	5

Department	Actor Type	Productive Chain To Which It Belongs	
		Other	20
	Individual Producer	Cacao	1
		Forestry (including rubber)	26
		Cashew	8
Sum Total			**339**

Source:

The actors that directly influence deforestation, forest degradation and change in land use of natural savannas in the region are the producers, whether individual, collective, agro-industrial companies, expanding settled rural population and producers for self-consumption-subsistence (Table 8).

Table 8. Interests and motivations of the Actors

Key Actor	Type of Impact and Coverage That Impacts	Interests and Motivations
Livestock Producers	Direct because it leads to the expansion of the agricultural frontier in natural savannas and forests.	The interests are related to the generation of stable income and the agricultural tradition that has been transmitted from generation to generation. Among the main motivations is to develop an economic activity that ensures family sustenance, taking advantage of the available conditions and resources. Incentive programs and government support in the form of financial and technical assistance, along with the availability of credit and financing. Another significant motivation is to preserve the livestock culture, the idea of leaving a legacy for future generations and maintaining the property as a family asset.
Oil palm Producers	Direct because it leads to the expansion of the agricultural frontier, mainly in natural savannas.	One of the main interests is income generation, since palm oil is a highly demanded crop in the food and personal care products industry nationally and internationally. Additionally, palm cultivation is considered a long-term investment, since this crop can be profitable and appreciate in value over time.

Key Actor	Type of Impact and Coverage That Impacts	Interests and Motivations
		The motivation behind African palm cultivation focuses on economic sustainability and local development. Palm oil production can generate employment in the region, contributing to local economic growth and community well-being. In addition, access to government support programs and access to credit and financing.
Corn Producers	Direct because it leads to the expansion of the agricultural frontier in natural savannas	Among the main interests is the generation of food intended for self-consumption and to guarantee the food security of their families and community. This strategy makes it possible to reduce costs related to the purchase of food in the market and, consequently, improve the domestic economy. The motivations for growing corn focus on food sustainability and the preservation of local agricultural traditions. The owners are driven by the need to ensure a constant supply of food. Likewise, the preservation of the traditions and cultural identity of the community represent cultural and social motivations that influence their decisions.
rice producers	Direct because it leads to the expansion of the agricultural frontier in natural savannas	The main interests behind the establishment of rice crops are income generation and profitability of the crop. Since rice is a food widely consumed in Colombia and having a constant demand in the local market, makes it a potential source of income. Furthermore, growing rice can be a long-term investment as its production can be profitable. The motivations for establishing rice crops are based on economic sustainability and food security. This crop can generate employment in the region, which boosts local development and community well-being. It can also be an opportunity to access government support programs and access credit and financing.
Cocoa Producers	Direct because it leads to the expansion of the agricultural frontier in natural savannas and forests.	The main interests lie in the generation of income and the profitability of the crop. Cocoa is a highly demanded product in the chocolate and cocoa products industry, making it an attractive source of income for rural owners. Additionally, the agroforestry arrangements under which cocoa crops are established represent a long-term investment, since due to the commercialization of timber and others.

Key Actor	Type of Impact and Coverage That Impacts	Interests and Motivations
		The motivations focus on economic sustainability and the promotion of local development. Cocoa offers the opportunity to generate employment in the region, which contributes to local economic growth and community well-being. Sometimes the establishment and transformation of cocoa is supported by local, national, and even international governments.
Cashew Producers	Direct because it leads to the expansion of the agricultural frontier, mainly in natural savannas.	The interests for the establishment of cashew crops are based on the income generation and profitability offered by the crop. Cashew is a source of nuts that has significant economic value in the nut industry and cashew oil production. This makes it an attractive source of income, taking into account the demand of the national and international market. The motivations focus on economic sustainability and local development. This crop offers the opportunity to generate employment in the region, which contributes to local economic growth and the well-being of the community.
Expanding settled rural population	Direct because it leads to the degradation of ecosystems	One of the main interests of expansion into rural areas focuses on the search for economic opportunities. Expansion into rural areas can offer the possibility of diversifying activities and sources of income. The motivations center on economic growth and the desire to take advantage of the opportunities offered by the region. The expansion can generate employment in the rural area, which contributes to the economic development and well-being of the community.
Agricultural producers with traditional crops for self-consumption	Direct because it leads to the degradation of ecosystems	The primary interest in establishing traditional crops for self-consumption is with the purpose of guaranteeing the food security of their families and communities. These crops, rooted in local agricultural traditions, allow them to access fresh, nutritious food, reducing dependence on markets and ensuring constant supplies of essential foods. Motivations focus on the maintenance of traditions and worldview that have been maintained over time around the forms of subsistence of these communities. These processes are also related to the lack of knowledge of sustainable practices in the development and management of agricultural crops.

Source: Cataruben.

Each key actor, with interference in the dynamics of change in natural cover, not only has a degree of responsibility and influence, but also a geographical expression that must be characterized and related to the phenomenon of cover change. Below, we detail how the production behavior of the different actors has been during the period 2009-2018, according to the availability of official data within the municipalities that are part of the departments of Meta and Vichada.

2.3.4. Economic Activities and their Importance

Activities that directly cause land use change must be characterized in terms of the spatial patterns associated with their presence. In this sense, official data on agricultural production in the departments of Meta and Vichada in two different time periods are presented. Subsequently, a coverage transformation map between these two periods is presented.

2.3.4.1. Livestock Producers

In the departments of Meta and Vichada, the livestock sector, especially cattle farming, occupies a relevant position in the regional economy. According to the data published by the ICA, in the 2018 Cattle Census, the livestock herd reached a figure of 2,203,373 heads of cattle, compared to the 1,226,760 reported in the 2013 National Agricultural Census. It is observed an increase of 79.6%, in the period 2013-2018, and an annual growth rate of 15.9%. Table 8 presents the livestock data by department and municipality for the years 2013 and 2018, as well as the calculation of the change rate.

Table 9. Analysis of livestock data for the years 2013 and 2018

Department	Municipality	Total 2013	Total 2018	Change (%)
Meta	La Macarena	4317	148249	601,9
Meta	Puerto Lleras	7462	126328	- 5,7
Meta	Cumaral	4277	58453	721,0
Meta	Lejanías	1345	17474	328,5
Meta	Villavicencio	9853	103572	- 38,1
Meta	Cabuyaro	7006	57516	1.266,7
Meta	Acacías	10386	72900	118,7
Meta	Mapiripán	14336	100621	- 94,7
Meta	San Juan de Arama	11242	78596	417,8
Meta	El Castillo	6420	33245	0,5
Meta	Puerto Concordia	10155	50551	55,1

Department	Municipality	Total 2013	Total 2018	Change (%)
Meta	Castilla La Nueva	12022	51513	48,8
Meta	Puerto López	47673	193616	- 59,5
Meta	Puerto Gaitán	39566	144123	3.334,1
Meta	Puerto Rico	24911	78038	6,7
Vichada	Cumaribo	24659	53931	1.199,2
Meta	Uribe	32616	52221	601,9
Meta	Fuente de Oro	20056	31107	- 35,8
Meta	Granada	12524	18639	- 3,1
Meta	Vistahermosa	84271	122561	397,8
Meta	Restrepo	27771	34249	264,3
Meta	San Martín	141657	172246	1.593,0
Vichada	La Primavera	126666	135208	306,1
Vichada	Santa Rosalía	40608	41644	213,3
Meta	El Dorado	9773	9821	23,3
Vichada	Puerto Carreño	24816	24037	- 51,2
Meta	Barranca de Upía	22734	21442	599,1
Meta	Mesetas	130806	84015	- 97,8
Meta	Cubarral	25958	16071	21,6
Meta	San Carlos de Guaroa	96616	47150	2,6
Meta	Guamal	46486	18829	60,1
Meta	El Calvario	69616	3676	951,2
Meta	San Juanito	78156	1731	45,4

Source: ICA (2013, 2018)[14]

The data presented in the previous table show a significant variation in the number of livestock in the municipalities of La Macarena, Puerto Lleras and Cumaral, with an increase of 3,334%, 1,593% and 1,267% respectively between the years 2013 and 2018. On the other hand, the municipalities of Guamal, El Calvario and San Juanito have experienced a decrease in the number of cattle, with drops of 59%, 95% and 98% respectively.

[14] **(2020).** *Bovine Census of Colombia 2018.* Data recovered from the portal: https://www.ica.gov.co/areas/pecuaria/servicios/epidemiologia-veterinaria/censos-2016/censo-2018

2.3.4.2. *Oil palm producers*

Oil palm cultivation is one of the main ones in the study area, with a cultivated area of 247,751 hectares in 2018. The significant growth of the cultivated area stands out, given its increase of 121% compared to 2009 data (112,008 hectares).

Table 10. Analysis of oil palm data for the years 2009 and 2018

Department	Municipality	Total 2009	Total 2018	Change (%)
Meta	San Martín	14561,40	14571,00	9,60
Meta	Acacías	13000,00	20718,82	7718,82
Meta	Puerto Concordia	2157,24	9785,00	7627,76
Meta	Vistahermosa	2247,13	9857,50	7610,37
Meta	Mapiripán	89,89	7560,00	7470,11
Meta	Barranca de Upía	6931,95	14372,08	7440,14
Meta	Fuente de Oro	3040,00	3772,95	732,95
Meta	San Juan de Arama	3415,64	9648,59	6232,95
Vichada	La Primavera	0,00	6000,00	6000,00
Meta	Cumaral	6407,00	11365,84	4958,84
Vichada	Cumaribo	0,00	400,00	400,00
Meta	Castilla la Nueva	9000,00	12181,00	3181,00
Meta	Puerto Gaitán	6000,00	34470,44	28470,44
Meta	Villavicencio	539,31	773,00	233,69
Meta	Guamal	0,00	2123,59	2123,59
Meta	Granada	600,00	804,31	204,31
Vichada	Santa Rosalía	0,00	2009,00	2009,00
Meta	San Carlos de Guaroa	30000,00	46535,09	16535,09
Meta	Restrepo	460,21	619,00	158,79
Meta	Puerto López	1693,44	3222,46	1529,03
Meta	Puerto Lleras	3145,98	4551,00	1405,02
Meta	Cabuyaro	7644,00	20360,54	12716,54
Meta	Puerto Rico	1075,00	12050,03	10975,03
Meta	Cubarral	0,00	0,00	0,00
Meta	El Calvario	0,00	0,00	0,00
Meta	El Castillo	0,00	0,00	0,00
Meta	El Dorado	0,00	0,00	0,00

Department	Municipality	Total 2009	Total 2018	Change (%)
Meta	La Macarena	0,00	0,00	0,00
Meta	Lejanías	0,00	0,00	0,00
Meta	Mesetas	0,00	0,00	0,00
Vichada	Puerto Carreño	0,00	0,00	0,00
Meta	San Juanito	0,00	0,00	0,00
Meta	Uribe	0,00	0,00	0,00

Source: MADR (2009, 2018)[15].

2.3.4.3. Corn Producers

Corn is one of the main crops in the study area. In 2009, it occupied a cultivated area of 24,299 hectares, but in 2018, this figure increased to 76,018 hectares, representing a growth of 213%.

Table 11. Analysis of corn crop data for the years 2009 and 2018

Department	Municipality	Total 2009	Total 2018	Change (%)
Meta	Puerto Gaitán	3850,00	49500,00	45650,00
Vichada	Cumaribo	206,00	4551,80	4345,80
Meta	Puerto López	3201,00	7359,72	4158,72
Meta	Villavicencio	255,00	2116,20	1861,20
Meta	Fuente de Oro	621,00	2400,00	1779,00
Meta	Granada	2791,00	3885,00	1094,00
Meta	Uribe	0,00	750,00	750,00
Meta	El Castillo	555,00	958,25	403,25
Meta	Cumaral	70,00	362,25	292,25
Meta	Cabuyaro	78,00	304,23	226,23
Meta	San Carlos de Guaroa	17,00	122,56	105,56
Meta	Castilla La Nueva	0,00	87,32	87,32
Meta	Puerto Concordia	490,00	550,00	60,00
Meta	San Martín	0,00	35,00	35,00
Meta	El Dorado	47,00	67,00	20,00
Vichada	La Primavera	78,00	70,00	-8,00

[15] **MADRID (2020).** *Municipal agricultural evaluations*. Data recovered from the portal: https://www.agronet.gov.co/estadistica/paginas/home.aspx?cod=59

Department	Municipality	Total 2009	Total 2018	Change (%)
Meta	El Calvario	100,00	82,45	-17,55
Vichada	Santa Rosalía	64,00	33,00	-31,00
Meta	Acacías	40,00	0,00	-40,00
Meta	Barranca de Upía	500,00	450,00	-50,00
Meta	Cubarral	72,00	0,00	-72,00
Meta	Guamal	120,00	2,00	-118,00
Meta	Restrepo	140,00	5,00	-135,00
Meta	San Juanito	160,00	0,00	-160,00
Meta	Puerto Rico	240,00	71,34	-168,66
Vichada	Puerto Carreño	400,00	155,00	-245,00
Meta	Puerto Lleras	1379,00	1100,00	-279,00
Meta	Mapiripán	300,00	0,00	-300,00
Meta	La Macarena	1150,00	400,00	-750,00
Meta	Lejanías	1010,00	0,00	-1010,00
Meta	Mesetas	1300,00	0,00	-1300,00
Meta	San Juan de Arama	1700,00	200,00	-1500,00
Meta	Vistahermosa	3365,00	400,00	-2965,00

Source: MADR (2009, 2018)[16].

2.3.4.4. Rice Producers

In the study area, the crop occupies a significant portion compared to other crops, with an area of 52,518 hectares in 2018. However, compared to the area planted in 2009 (109,578 hectares), a reduction of 52% is evident. .

Table 12. Analysis of rice cultivation data for the years 2009 and 2018

Department	Municipality	Total 2009	Total 2018	Change (%)
Meta	Puerto Gaitán	2339,00	7547,00	5208,00
Meta	Puerto Lleras	1195,00	2162,00	967,00
Meta	Vistahermosa	1253,00	1517,00	264,00
Meta	La Macarena	0,00	202,25	202,25
Meta	Mapiripán	0,00	100,00	100,00

[16] **MADRID (2020).** *Municipal agricultural evaluations.* Data recovered from the portal: https://www.agronet.gov.co/estadistica/paginas/home.aspx?cod=59

Department	Municipality	Total 2009	Total 2018	Change (%)
Meta	Uribe	0,00	86,84	86,84
Vichada	Cumaribo	26,00	51,55	25,55
Meta	El Castillo	453,00	471,00	18,00
Meta	Mesetas	0,00	15,34	15,34
Meta	Cubarral	0,00	0,00	0,00
Meta	El Calvario	0,00	0,00	0,00
Meta	El Dorado	0,00	0,00	0,00
Vichada	La Primavera	0,00	0,00	0,00
Vichada	Puerto Carreño	0,00	0,00	0,00
Meta	San Juanito	0,00	0,00	0,00
Vichada	Santa Rosalía	0,00	0,00	0,00
Meta	Guamal	4,00	0,00	-4,00
Meta	Barranca de Upía	128,00	0,00	-128,00
Meta	Lejanías	236,00	104,00	-132,00
Meta	San Juan de Arama	631,00	336,50	-294,50
Meta	Restrepo	2275,00	1267,00	-1008,00
Meta	Puerto Concordia	1700,00	395,50	-1304,50
Meta	Acacías	1902,00	514,00	-1388,00
Meta	Fuente de Oro	11017,00	9348,30	-1668,70
Meta	Granada	4658,00	2909,00	-1749,00
Meta	Puerto Rico	2910,00	759,00	-2151,00
Meta	San Martín	3119,00	367,50	-2751,50
Meta	Cumaral	6688,00	3324,00	-3364,00
Meta	Castilla La Nueva	5347,00	703,50	-4643,50
Meta	San Carlos de Guaroa	7339,00	1489,00	-5850,00
Meta	Villavicencio	18408,00	6650,00	-11758,00
Meta	Cabuyaro	17364,00	5251,00	-12113,00
Meta	Puerto López	20586,00	6947,50	-13638,50

Source: MADR (2009, 2018)[17].

[17] **MADRID (2020).** *Municipal agricultural evaluations.* Data recovered from the portal: https://www.agronet.gov.co/estadistica/paginas/home.aspx?cod=59

2.3.5. Direct and indirect impact

Each cause and agent has a differential impact on natural vegetation, and this impact can be evaluated qualitatively or quantitatively. Quantitative impact estimates can be made through spatial analysis that determines the relationship between the identified cause and the calculated change in land use. In this sense, a transformation analysis of the coverage of natural savannas and forests is carried out during the period from 2009 to 2018 in Colombia. The information used for this analysis was obtained from the Colombia Land Cover Classification (CLCC) database provided by IDEAM, which contains information on land covers and uses in Colombia.

To carry out the analysis, a spatial evaluation of the types of coverage is carried out with the purpose of categorizing them as broader and more relevant to the study. These categories include savannas, forests, agricultural areas, artificial areas, and other natural areas. The following table presents the types of coverage and their corresponding classification category.

Table 13. Categorization of coverage units in Indicators

Category	Classification
Forest	311 Dense Forest 3111 High Dense Forest 31111 High Dense Forest of terra firm 31112 Dense High Flood Forest 311121 Dense High Flood Heterogeneous Forest 311122 Tall dense mangroves 311123 Palms 3112 Low Dense Forest 31121 Dense Lowland Forest of terra firm 31122 Dense Low Flood Forest 312 Open Forest 3121 High Open Forest 31211 Tierra Firm High Open Forest 31212 Floodable High Open Forest 3122 Low Open Forest 31221 Low Terra Firm Open Forest 31222 Low Flood Open Forest

Category	Classification
Sheet	321 Grassland 3211 Dense grassland 32111 Dense Terra Firm Grassland 321111 Dense Non-Forest Firm Land Grassland 321112 Dense Firm Land Grassland Wooded 321113 Dense Firm Land Grassland with Shrubs 32112 Dense Floodplain Grassland 321121 Dense floodplain grassland not wooded 321122 Dense Floodplain Wooded Grassland 321123 Arracachal 321124 Helechal 3212 Open Grassland 32121 Open Sandy Grassland 32122 Rocky Open Grassland 322 Shrubland 3221 Dense shrubland 32211 Tall Dense Shrubland 32212 Low Dense Shrubland 3222 Open bush 32221 Open Sclerophyllous Shrub 32222 Open Mesophyllous Shrub

Category	Classification
Agricultural area	211 Other temporary crops 212 Cereals 2121 Rice 2122 Corn 2125 Wheat 221 Herbaceous Permanent Crops 2211 Other Permanent Herbaceous Crops 222 Permanent Shrub Crops 2221 Other Permanent Shrub Crops 2232 Oil palm 2233 Citrus 2234 Mango 224 Agroforestry Crops 2241 Pastures and Trees Planted 225 Confined Crops 241 Crop Mosaic 242 Mosaic of Pastures and Crops 243 Mosaic of Crops, Pastures, and Natural Spaces 2431 Mosaic of crops, pastures, and natural tree spaces 2432 Mosaic of crops, pastures, and bushy natural spaces 2433 Mosaic of crops, pastures and herbaceous natural spaces 2434 Mosaic of crops, pastures, and other natural spaces 2435 Mosaic of crops, pastures, and secondary vegetation 244 Mosaic of Pastures with Natural Spaces 2441 Mosaic of Pastures with natural tree spaces 2442 Mosaic of Pastures with natural bushy spaces 2443 Mosaic of Pastures with natural herbaceous spaces 2444 Mosaic of Pastures with other natural spaces 2445 Mosaic of grasses with secondary vegetation 245 Mosaic of Crops and Natural Spaces 2451 Mosaic of Crops and natural tree spaces 2452 Mosaic of Crops and bushy natural spaces 2453 Mosaic of Herbaceous Crops and Natural Spaces 2454 Mosaic of Crops and other natural spaces 2455 Mosaic of crops and secondary vegetation

Category	Classification
Artificial area	111 Continuous urban fabric 112 Discontinuous urban fabric 121 Industrial or Commercial Zones 1211 Industrial Zones 1212 Commercial Areas 1221 Road Network and Associated Territories 12211 Red Vial 12212 Land associated with the road network 124 Airports 1241 Airport with Associated Infrastructure 1242 Airport without Associated Infrastructure 125 Hydraulic Works 131 Mining Extraction Zones 1311 Other Mining Exploitations 1312 Hydrocarbon Exploitation 1313 Coal Exploitation 1315 Exploitation of Construction Materials 132 Waste Disposal Areas 1322 Waste dumps 1323 Landfills 1324 Landfill 141 Urban Green Zones 1411 Other Urban Green Areas 1412 Parks Cemeteries 1413 Botanical Gardens 1415 Urban Parks 1416 Rounds of Water Bodies in Urban Areas 142 Recreational Facilities 1421 Cultural Areas 513 Channels 514 Artificial Water Bodies 5141 Reservoirs 5142 Oxidation Lagoons
Other natural areas	323 Secondary or transition vegetation 3231 High Secondary Vegetation 3232 Low Secondary Vegetation 313 Fragmented Forest 331 Natural Sand Areas 3311 Beaches 3312 sands 332 Rock outcrops 411 Marshy Areas 413 Aquatic Vegetation Over Bodies of Water 511 Rivers 512 Natural Lagoons, Lakes and Swamps

Source: National Natural Parks (2021)[18]. Monitoring of land covers in the areas of national natural parks. Version 5, Annex 7. Categorization of Coverage Units in Indicators.
Elaboration Own

[18] https://www.parquesnacionales.gov.co/wp-content/uploads/2023/07/amspnn_mt_01_-monitoreo-de-coberturas-de-la-tierra-en-las-areas-de-parques-nacionales-naturales_v_5.pdf

Once the data was classified, coverage categories for each year were compared to identify areas that experienced significant changes. This made it possible to determine the areas of gain or loss of savannas and forests.

Once the covers have been reclassified and the multi-temporal analysis has been carried out, the areas that in 2009 were classified as natural covers (forests and natural savannas) and that were subsequently transformed into covers for agricultural use are quantified.

Table 14. Multi-temporal analysis of change from 2009 savanna cover to 2018 agricultural use.

Department	Category	savanna 2009 (Ha)	Transformed For Agricultural Use 2009–2018 (Ha)
Meta	Savanna	2.540.116,5	425.314,1
	Forest	3.222.463,3	271.184,5
Vichada	Savanna	4.756.874,2	346.200,2
	Forest	4.363.153,5	48.191,2

Source: Own Preparation.

2.3.6. Relationships and Synergies

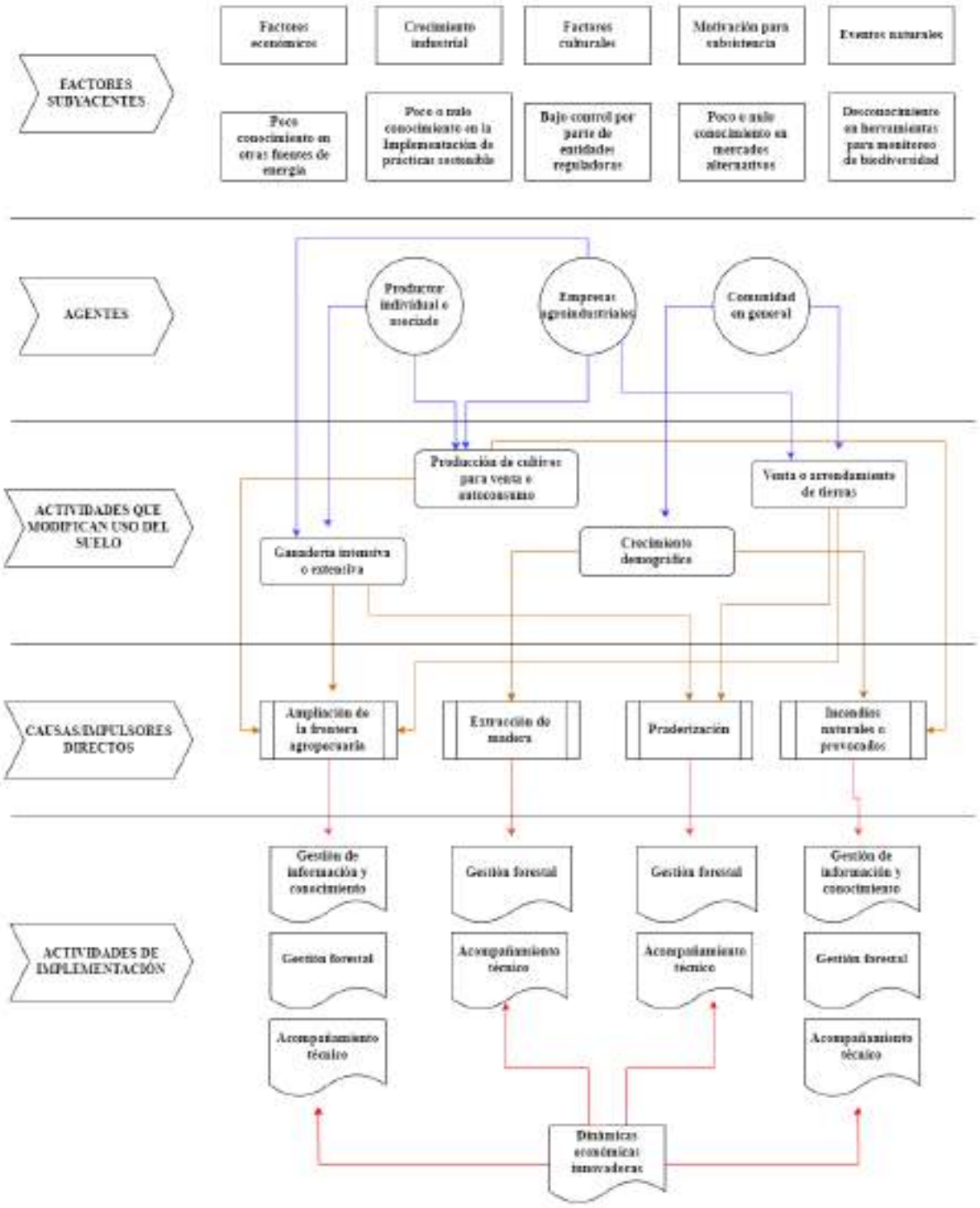
The expansion of the agricultural frontier and forest fires are clearly the main causes that drive deforestation, forest degradation, and changes in the use of natural savannas. The diverse agents involved in these activities range from large agro-industries, individual or associated producers, to the expanding rural population and owners engaged in subsistence activities.

Generally, economic interests motivate all these agents, often leading to the unsustainable exploitation of natural resources. Moreover, the lack of knowledge regarding the sustainable management of natural resources further exacerbates the situation.

Conversely, forest fires, both natural and anthropogenic, are directly related to the absence of actions designed to prevent and mitigate their adverse effects. These fires cause significant damage to ecosystems and compromise the integrity of biodiversity.

Below, a figure is presented that identifies and relates the interactions between the key agents with the sociocultural and economic dynamics, which facilitate the change in land use, giving way to deforestation and degradation. This graph takes into account the underlying factors or drivers, and finally, the relationship with the design of the project activities.

Figure 17. Relationships and synergies between key actors and the socioeconomic and cultural context.



2.3.7. Chain of Events

The analysis of chains of events seeks to identify the relationships between main groups of agents and causes, to try to explain the sequence of events that usually leads to the loss of natural cover in a particular area.

For each activity that causes the loss of natural cover, a causal chain of at least 3 links was identified. This causal chain is made up of a differential sequence of events or conditions that result in the occupation of the territory, as follows:

a) Identification of each of the activities that generate loss or degradation of forest and loss of natural cover. If possible, these should be grouped according to the most common direct causes of change;

b) ID of the agents associated with the actions and direct causes of deforestation, forest degradation and change in established savanna cover;

c) Identification of the underlying causes that promote or facilitate the decisions of agents to carry out actions resulting in forest loss, forest degradation and loss of natural cover.

In this way, in the study area different agents were identified that, motivated mainly by economic, cultural factors and misinformation in different areas, carry out activities that directly trigger deforestation and forest degradation. According to the economic and social dynamics of the study area, three (3) agents are identified that make the decision to convert natural forests to other covers and uses, defined as: 1) individual or associated producers, 2) agro-industrial companies and 3) Settled community.

In accordance with what is described in sections 2.3.2 and 2.3.3 of this document, these agents, in their economic or subsistence activities, generate drivers of deforestation that have been grouped into four (4) direct causes: 1) expansion of the agricultural frontier, 2) grassland, 3) wood extraction and 4) natural or provoked fires.

The expansion of the agricultural frontier is mainly the result of the modification of land use to increase areas destined for livestock farming or the production of traditional or industrial crops. This is largely for sale and to a lesser extent for self-consumption. It is imperative to mention that the expansion of the area depends on the purpose and the technology to be implemented. Now, grassland is a direct driver related to the conversion of forests to grasslands for the increase in livestock activity. However, this activity not only has a productive purpose, it is also enhanced by

other factors related to hoarding and titling of land, thus increasing expectations of ownership and appreciation.

Regarding the extraction of wood, mostly for self-consumption, this activity is carried out most of the time in a disorderly and uncontrolled manner, being used as a source of fuel, construction materials, food, and other ecosystem services. It is important to highlight that this selective logging produces the fragmentation of the forest, which subsequently allows access to the agents of deforestation and the drivers already previously identified.

Finally, natural and cultural factors have a considerable impact on the causing of forest fires. The first factor given the high temperatures that occur in the study area with dry and prolonged periods, and finally, anthropogenic activities related to agricultural management practices. These include weed and pest control, and the expansion of crops and pastures for livestock, which can generate greater risk of fires.

Table 15. Chain of events analysis

Underlying causes/drivers	Agents	Activities that generate loss of coverage.	Direct Causes
Production interests and motivations for the generation of wealth.	Individual or associated producers	Cattle raising	Expansion of the agricultural frontier Prairieization
Lack of knowledge in alternative markets that encourage conservation.			
Lack of knowledge in the implementation of sustainable practices associated with livestock activity.			
Lack of incentives and conservation policies.			
Production interests and motivations for the generation of wealth	Agro-industrial Companies	African Palm Production	Expansion of the agricultural frontier
Lack of knowledge in alternative markets that encourage conservation.			
Regional development policies and models.			
Production interests and motivations for the generation of wealth	Agro-industrial Companies; Individual or associated producers	rice production	Expansion of the agricultural frontier Forest fires of anthropogenic origin
Lack of knowledge in alternative markets that encourage conservation.			
Regional development policies and models.			
Production interests and motivations for the generation of wealth	Agro-industrial Companies; Individual or	Corn Production	Expansion of the agricultural frontier

Lack of knowledge in alternative markets that encourage conservation. Regional development policies and models.	associated producers		
Production interests and motivations for the generation of wealth Lack of knowledge in alternative markets that encourage conservation. Lack of knowledge of sustainable production practices Absenteeism from the presence of public entities	Community	Population growth	Expansion of the agricultural frontier Forest fires of anthropogenic origin
Interests and motivation for subsistence. Lack of knowledge of alternative markets that encourage conservation Lack of knowledge in sustainable production practices and non-timber forest products. Lack of knowledge of sustainable production practices.	Agro-industrial Companies; Individual or associated producers	Production of traditional crops for self-consumption	Expansion of the agricultural frontier Forest fires of anthropogenic origin
Production interests and motivations for income generation. Lack of knowledge of alternative markets that encourage conservation Lack of knowledge in sustainable production practices and non-timber forest products. Regional development plans.	Individual or associated producers	Cocoa Producers	Expansion of the agricultural frontier
Production interests and motivations for income generation. Lack of knowledge of alternative markets that encourage conservation Lack of knowledge in sustainable production practices and non-timber forest products. Regional development plans.	Individual or associated producers	Cashew Producers	Expansion of the agricultural frontier
Cultural management practices for the establishment of more fertile production areas. Lack of knowledge of alternative markets that encourage conservation Lack of knowledge in sustainable production practices and non-timber forest products.	Community, Individual producers.	Agricultural management practices pest control Expansion of crops and pastures	Forest fires of anthropogenic origin
Lack of knowledge of the dynamics caused by the natural conditions of the ecosystem and the changes caused by the climate crisis.	Natural conditions of the ecosystem, accelerated by climate change.	Forest Fires of Natural Origin	Forest Fires of Natural Origin

Lack of resources to carry out fire prevention activities	Individual or associated producers		
Lack of knowledge in the implementation of actions to prevent forest fires.	Agribusiness		
Lack of knowledge in other sources of energy or materials	Individual producer	Use of wood as a fuel source	Extraction of wood for self-consumption.
Lack of financial income		Use of wood as a construction material	
Population growth			
Industrial growth	Agro-industrial Companies	Sale or lease of property.	Expansion of the Agricultural Frontier Prairieization
Lack of knowledge of alternative markets that encourage conservation	Expanding settled rural population		
Cultural factors	Individual producers		
Economic factors			

Source: Own elaboration.

2.3.8. Intervention Model

After a detailed analysis of causes and agents, together with close collaboration with each of the project participants, their particular interests. The focus of the project activities must be closely related to the generation of economic resources and the promotion of sustainable practices. This involves promoting the use of alternative energy sources, providing training in knowledge and skills for the use of non-timber forest products, promoting sustainable production systems and facilitating access to markets for ecosystem services. These measures seek to diversify income options for the agents involved and reduce dependence on activities that cause changes in the natural cover of forests and savannas.

Finally, the execution of controlled fire management actions is of vital importance to prevent and reduce the negative effects of forest fires. The implementation of preventive measures and adequate management strategies will reduce the frequency and intensity of fires, thus safeguarding the ecosystems present in natural savannas.

In summary, the focus of project activities must be comprehensive and directed towards the sustainable use of natural resources, the generation of knowledge and capabilities, and the prevention and mitigation of forest fires. By adopting this approach, it will be possible not only to conserve and restore natural ecosystems, but also to improve the living conditions of local communities and promote more sustainable and harmonious development with the environment.

In this sense, the activities have been carefully conceived from a change management framework, starting from addressing the underlying causes identified in the analysis. TableTable 16 presents a summary of the analysis of how the activities will generate a desired situation within the limits of the project.

Table 16. Analysis of change triggers.

Type of activity	**Change Chain Analysis**
Project general: Project design, generation of enabling conditions.	The general activities of the project are focused on the development of a business model based on the sustainable management of the project areas, without this implying a change in land use during the project execution period. These activities address various aspects that support the success of specific REDD+ and natural savanna activities, in addition to the generation of economic benefits derived from the conservation of these ecosystems. The General activities of the project are divided into components, as follows: innovative economic dynamics, information and knowledge management, forest management and technical support, and address aspects for: ● Generate economic benefits through the sale of verified carbon credits, which are the result of GHG reductions and/or removals due to the implementation of project activities. In this way, the implementation and strengthening of conservation actions and sustainable practices is promoted, as well as improving the degree of satisfaction of their basic needs and improving their well-being. ● Guarantee the conservation of forests, the natural savanna and the implementation of long-term sustainable productive practices through strengthening the technical capacities of the community. ● Strengthen community decision-making and participatory monitoring through the establishment of a governance structure. By involving the community, actions, and goals are sought to be relevant and appropriate to local needs, which improves their effectiveness and relevance, while strengthening transparency. ● Promote the functionality of ecosystems and the construction of social fabric in coordination with other actors of the National System of Conservation Areas (SINAP) present in the area of influence of the project, through the recognition of conservation areas and figures.
REDD+ specific activities	The reduction of greenhouse gas emissions derived from the

	degradation and deforestation of forests is the expected result of REDD+ activities, for which aspects that seek: ● Reduce the risk and intensity of forest fires, through strengthening the community in sustainable fire use management practices and establishing an early warning mechanism for hot spots. This allows owners in the short and medium term to make informed decisions about the management of their properties, taking into account risk factors, in productive, economic, social and environmental terms. ● Reduce pressure on natural resources through the implementation of strategies that guarantee the availability of firewood as a source of energy over time, and reduce exposure to smoke and pollutants. These activities are based on the components of forest management and technical support.
Activities that avoid the change of land use in natural savannas.	Activities designed to prevent land use change in natural savannas seek to guarantee the availability of resources provided by the savannas in the short, medium and long term. This ensures that the owners of the properties can develop sustainable productive practices that provide sustenance to families and generate income. This is achieved through strengthening the capacities of the owners in making informed decisions and sustainable management of the natural savanna. Taking into account their needs, desires, environmental impacts, among others, activities brought together in the components of technical support and forest management.

It is highlighted that these activities not only contribute to the conservation and restoration of natural ecosystems, but also produce a significant improvement in governance. The active participation of independent private owners and consultation with the various participants allows the establishment of a solid decision-making structure, increasing transparency and accountability throughout the process.

In addition, these activities strengthen the monitoring and evaluation of the project, allowing for constant monitoring of progress and results. This, in turn, positively impacts the establishment of additionality, guaranteeing that the actions implemented represent a real and measurable contribution to the reduction of greenhouse gas emissions, which would not have existed in the absence of this project.

Another significant benefit of these activities is the reduction of reversal risk. By actively involving private landowners in the conservation and restoration of their lands with the generation of

economic incentives, a sense of ownership and commitment to the project is created. This decreases the likelihood that actions will be reversed in the future.

In summary, these activities are not only in line with the objectives of conservation and restoration of natural ecosystems, but are also making a significant difference in governance, transparency, monitoring and demonstrating additionality, while reducing the risk of reversals. In the Table 17, by way of general The theory of change sought by the project is summarized, taking into account that it may vary within the framework of adaptive management to the circumstances of each period.

Table 17**.** Summary of expected change

Intervention	**Short Term Changes (0-5 Years)**	**Medium-Term Changes (6-20 Years)**	**Long Term Changes (20 or More Years)**
Private property owners enter the climate change mitigation project to carry out natural ecosystem conservation activities. Framed in the three-part model designed by Cataruben.	Since the owners voluntarily decide to improve forest and natural savanna management in favor of conservation, emissions from deforestation, degradation, and change of land use in natural savannas. A governance model is established among the project participants (Ecopetrol, Cataruben and Owners) to be executed and followed. Under adaptive management according to the circumstances of the development of this type of project. The owners acquire information about alternative markets to the traditional ones, which contributes to changing the management perspectives of their properties.	The effective entry of economic resources strengthens credibility in forms of sustainable management of ecosystems, and improves the conditions for the execution of project activities, especially those related to restoration and conservation actions. Co-benefits. The execution of the Governance model strengthens the execution of activities over time.	A change is achieved in the structural management of the project areas, strengthening sustainable development in the communities. Deforestation, forest degradation and land use change in natural savannas decrease and initiate positive rates of forest regeneration.

2.3.8.1. Design of Project Activities

The Project Activities have been carefully designed to address and respond to the identified causes and agents.

Forest fires, wood extraction, prairie development and the expansion of the agricultural frontier stand out as the main causes behind the degradation of ecosystems. In this context, the agents

involved in these destructive activities are mainly the owners of the properties and the natural conditions of the ecosystem that favor the spread of fires.

The identification of the underlying causes has been essential to understand the factors that motivate landowners to degrade the ecosystem or give up their lands for the expansion of the agricultural frontier. Among the main underlying causes is the lack of incentives for the conservation and/or restoration of natural ecosystems, the low income of the owners, the lack of knowledge in alternative regulated markets, among other cultural factors and demographic growth factors, driving us to make decisions that result in the degradation of natural resources.

Consequently, the activities are designed to address the causes and thus carry out an intervention that generates a measurable impact on the reduction of emissions. In the Table 18 it shows the relationship of the activities designed and implemented with the direct and indirect causes or drivers of deforestation

Table 18. Relationship between implementation activities and the direct and indirect causes or drivers of deforestation

Components	Deployment activity	Direct drivers / Direct causes	Indirect impulses / Underlying causes
Innovative economic dynamics	Improved income of owners generated by the sale of carbon credits	Expansion of the agricultural frontier	Production interests and motivations for income generation. Lack of knowledge in alternative markets that encourage conservation. Cultural factors.
		Wood extraction	
		Prairieization	
		Natural or arson fires	
Information and knowledge management	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	Expansion of the agricultural frontier	Lack of knowledge in sustainable production practices Industrial growth. Lack of knowledge of alternative markets that encourage conservation.
		Natural or arson fires	

Innovative economic dynamics	Alliance management that financially allows generating the enabling conditions for the validation and first verification of the project	Expansion of the agricultural frontier	Production interests and motivations for income generation. Lack of knowledge in alternative markets that encourage conservation. Cultural factors.
		Wood extraction	
		Prairieization	
		Natural or arson fires	
Forest Management	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally	Expansion of the agricultural frontier	Production interests and motivations for income generation. Lack of knowledge in alternative markets that encourage conservation. Cultural factors. Absenteeism from the presence of public entities.
		Wood extraction	
		Prairieization	
		Natural or arson fires	
Forest Management	Promote the delimitation and signaling in strategic ecosystems and natural protection areas	Expansion of the agricultural frontier	Cultural factors. Lack of knowledge in sustainable production practices. Economic factors.
		Wood extraction	
		Prairieization	
		Natural or arson fires	
Forest Management	Promote the recognition of conservation areas and figures for the sustainable management of ecosystems	Expansion of the agricultural frontier	Cultural factors. Lack of knowledge in sustainable production practices. Economic factors. Lack of knowledge in alternative markets that encourage conservation.
		Wood extraction	
		Prairieization	
		Natural or arson fires	
Technical support	Develop a Quality, Efficient Use and Savings of Water in Homes Program (PUEAA), linked in the initiative	Conservation and preservation strategy	Lack of knowledge in sustainable production practices

Forest Management	Implementation of sustainable fire use management practices for the prevention of forest fires	Natural or arson fires	Lack of knowledge of the dynamics caused by the natural conditions of the ecosystem and the changes caused by the climate crisis.
			Lack of resources to carry out fire prevention activities
			Lack of knowledge in the implementation of actions to prevent forest fires.
Technical support	Monitoring of hot spots as an early warning mechanism	Natural or arson fires	Lack of resources to carry out fire prevention activities
Forest Management	Promotion of the establishment of eco-efficient stoves and wood energy banks	Natural or arson fires	Lack of knowledge of alternative markets that encourage conservation
Technical support	Implementation of landscape management tools in savannas	Expansion of the agricultural frontier	Lack of knowledge of sustainable production practices.
Forest Management	Implementation of sustainable productive practices in natural savannas	Expansion of the Agricultural frontier.	Lack of knowledge of sustainable production practices.
Technical support	Identification and monitoring of HCVs present in the project area	Conservation and preservation strategy	Lack of knowledge of tools for biodiversity monitoring
Technical support	Monitoring the presence of globally threatened species and taking actions to conserve them	Conservation and preservation strategy	Lack of knowledge of tools for biodiversity monitoring
Forest Management	Restoration actions in degraded ecosystems	Conservation and preservation strategy	Lack of knowledge of tools for biodiversity monitoring
Information and knowledge management	Strengthening access and management of financial goods and services with a focus that achieves gender equity	Cultural factors. Economic factors	Cultural factors. Economic factors

In this way, the proposed implementation activities strategically address both the direct and indirect drivers of deforestation. These interventions not only address the visible symptoms of the problem, such as logging or agricultural expansion, but also focus on transforming the economic, social and knowledge dynamics that perpetuate deforestation.

Focus on direct drivers:

To mitigate the expansion of the agricultural frontier, the activities propose to promote and implement efficient land use practices, which allow for improved productivity without the need to expand agricultural areas. This is essential, since the conversion of forests into agricultural land is one of the main drivers of deforestation in Colombia. To achieve this, it is essential to establish the baseline of the property, using tools such as property planning.

Regarding timber extraction, sustainable forest management and the creation of incentives for forest conservation offer viable alternatives. By improving the management of natural resources and providing economic incentives, pressure on forests can be reduced and their sustainable use ensured. An example of this is the importance of promoting dendroenergy banks, the use of eco-efficient stoves and land planning.

To counteract grassland degradation and fires (both natural and man-made), activities also include ecosystem rehabilitation and the introduction of more resilient fire management practices that maintain ecological balance and prevent soil degradation.

Focus on indirect drivers:

At a structural level, activities respond to underlying factors such as a lack of knowledge of sustainable practices. Strengthening technical capacities and knowledge management, through training and technical assistance programs, provide landowners with the necessary tools to adopt less destructive productive practices.

In addition, activities focused on innovative economic dynamics seek to change traditional economic incentives that encourage agricultural expansion. Projects that promote sustainable economic alternatives, such as ecotourism or biodiversity conservation, allow income to be diversified without resorting to deforestation, thus contributing to the economic stability of rural communities.

Final conclusion: The proposed implementation activities provide a comprehensive approach to addressing deforestation, attacking both its immediate causes and the deeper factors that perpetuate it. By combining strategies that improve productive practices with the creation of economic incentives and the strengthening of local knowledge, the relationship of communities with forest ecosystems can be changed. This not only has the potential to reduce deforestation in

the short term, but also promotes long-term sustainability, contributing to economic development, biodiversity conservation and adaptation to climate change.

Based on the information described above, the project activities are detailed below:

Table 19. Design of project activities

Activity ID	R1
Component	Innovative economic dynamics
Description	Improving the income of landowners generated by the sale of carbon credits obtained in the forest ecosystem
Aplicated metodoloy	BCR 0002
Relationship with direct or underlying cause	Related to the interests and motivations of production for the generation of income, also involving the lack of knowledge in alternative markets that encourage conservation. From the generation of certificates generated from the project activities, they can continue to develop, and the project participants feel that it is a financial incentive.
Compliance with the interests of rural communities.	Activity of great interest on the part of the project participants, since it represents the possibility of increasing average income and the availability of resources to carry out conservation, restoration and sustainable production activities.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 2.1.2. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of

	adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for planning and coordinating the monitoring, reporting and verification stages, as well as the commercialization of verified carbon certificates and transfer of economic benefits to project participants. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the activities established in the project, and guarantee the conservation of the different strategic ecosystems present in their territories. So as toast the information necessary to rcarry out the transfer of economic resources transparently. **Ecopetrol:** Technical and financial ally that allows consolidating the enabling conditions to ensure the generation of economic benefits, which facilitate the execution of project activities.
Implementation timeline	From the date of commercialization of the carbon certificates

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measurement	Responsible for measurement
Percentage increase in average income derived from the sale of verified carbon credits	Impact	25%	Percentage increase in average income	Cataruben Foundation
Percentage of owners with improved income from the sale of verified carbon credits	Impact	100%	Percentage of homeowners with improved income	Cataruben Foundation

Id	R2
Component	Forest Management
Description	Implementation of sustainable fire use management practices for the prevention of forest fires
Aplicated metodoloy	BCR 0002

Relationship with direct or underlying cause	Forest fires are a direct cause that generates deforestation and forest degradation. In this area of the national territory these phenomena are very common, sometimes they are generated by natural causes or human intervention. Therefore, this activity has the focus of promoting sustainable practices, aimed at the conservation of strategic ecosystems, through the implementation and adequate management of fire.
Compliance with the interests of rural communities.	The project participants have interests in preventing forest fires, given the motivations oriented towards the social, environmental and economic benefits that the preservation of these strategic ecosystems entails; However, many owners do not have the necessary knowledge or resources to implement prevention activities.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for promoting and training landowners in sustainable methods and practices for managing the use of fire. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, and implement targeted actions in the implementation of sustainable practices to prevent, control and mitigate fires.
Implementation timeline	Permanently from the project start date

Indicators to Report the Progress of the Activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**

Number of properties that implement sustainable practices to prevent forest fires	Result	75	Number of properties	Cataruben Foundation

Id	R3
Component	Technical support
Description	Monitoring of forest area under conservation within the project boundaries
Aplicated metodoloy	BCR 0002
Relationship with direct or underlying cause	This activity is related to the prevention and management of fires through early warning mechanisms in eligible areas, for which digital tools will be used to contribute to the tracking and monitoring of the properties linked to the project. The purpose of these actions is to identify heat points through GIS tools and generate timely communication to the owners regarding these eventualities, initially confirming whether they correspond to the presence of fire on their properties or thermal anomalies.
Compliance with the interests of rural communities.	The project participants have interests in this activity since it allows them to have an early warning mechanism and thus be able to prevent and manage possible forest fires. They consider monitoring hot spots and the respective early warnings a positive strategy. Since it contributes significantly to the safeguarding and protection of the strategic ecosystems present on its properties.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities, and benefits of all parties involved. (See 1.1. Linkage contracts).

	At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This is in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for monitoring hot spots as an early warning mechanism **Project Participants:** They are the owners of the properties and are responsible for reporting any anomaly related to forest fires, as well as attending and responding to alerts generated by Cataruben.
Implementation timeline	Permanently, from the beginning of the project start date

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Number of monitoring	Impact	35	Number of monitoring	Cataruben Foundation

Id	R4
Component	Forest Management
Description	Promotion of the establishment of eco-efficient stoves and wood energy banks
Aplicated metodoloy	BCR 0002
Relationship with direct or underlying cause	This activity is directly oriented towards the protection of forests, and at the same time proposes mechanisms that allow the generation of energy sustainably. Additionally, this activity is projected to provide tools that provide beneficiaries with a better quality of life.
Compliance with the interests of rural communities.	Lack of knowledge in other sources of energy or materials, plus the lack of economic income, causes forests to degrade due to the pressure exerted on them, especially on the properties of owners who carry out subsistence activities. Therefore, promoting establishment of wood energy banks and eco-efficient stoves reduces the

	degradation of forests and contributes to improving the health of the community.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This is in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for promoting and training on the establishment of eco-efficient stoves and wood energy banks **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, and promote the establishment of eco-efficient stoves and wood energy banks on their properties.
Implementation timeline	From the start date of the project.

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measurement	Measurement Manager
Number of properties implementing dendroenergy banks	Impact	10	Number of properties implementing dendroenergy banks	Cataruben Foundation
Number of properties with eco-efficient stoves	Impact	20	Number of properties with eco-efficient stoves	Cataruben Foundation

ID	R5
Component	Forest Management

Description	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally.
Aplicated metodoloy	BCR 0002
Relationship with direct or underlying cause	This project, which brings together multiple private owners, requires a governance framework that guides and ensures long-term sustainability and mechanisms to establish procedures and tools, the relationships between the three parts of the project. This enables and sustains an alternative market that encourages conservation, restoration and sustainable production and directly impacts the reduction of deforestation, forest degradation and change in land uses in natural savannas.
Compliance with the interests of rural communities.	The project participants are interested in achieving, thanks to the efforts of the Cataruben Foundation, a project governance model that ensures that the activities they develop can continue to be carried out in the long term.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities, and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This is in the context of adaptive management in the face of the particular conditions of each period..
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** organization responsible for designing, promoting, implementing and monitoring the governance table, where it ensures participation and continuous improvement of the activities proposed in this tool. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the governance table, providing feedback, suggesting and ensuring the representation of the ecosystem managers.
Implementation timeline	From the start date of the project.

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Number of operational governance instances with effective participation of key actors	Impact	34	Number of participation spaces	Economic benefits - Cataruben Foundation

Id	R6
Component	Forest Management
Description	Promote the delimitation and signaling in strategic ecosystems and natural protection areas
Aplicated metodoloy	BCR 0002
Relationship with direct or underlying cause	Promoting delimitation and signaling actions in the strategic ecosystems present in the properties linked to the project will positively impact the protection and safeguarding of natural resources, which will contribute to the governance and protection of natural areas. Which is related to the protection of forests and environmental balance.
Compliance with the interests of rural communities.	This activity is of interest to some property owners, as it strengthens property planning and governance structures and guarantees the sustainability of the strategic ecosystems present on their properties.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This is in the context of adaptive management in the face of the particular conditions of each period.

Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for promoting, training, and strengthening issues of delimitation and signaling in strategic ecosystems and natural protection areas. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, as well as implement methods and tools for signaling and delimiting areas of biological importance.
Implementation Schedule	From the project start date.

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Properties with strategic ecosystems identified, delimited and signposted	Product	20	Number of properties with strategic ecosystems identified, delimited and signposted	Cataruben Foundation

Id	R7
Component	Forest Management
Description	Promote the recognition of conservation areas and figures for the sustainable management of ecosystems.
Aplicated metodoloy	BCR 0002
Relationship with direct or underlying cause	Achieving the recognition of conservation areas and figures such as civil society natural reserves is an activity that directly impacts the planning of properties based on conservation, restoration and sustainable productive development. Which directly reduces the uncontrolled expansion of the agricultural frontier, reduces deforestation and forest degradation.
Compliance with the interests of rural communities.	This activity is of interest to some property owners, as it strengthens the potential economic, social and environmental benefits derived from conservation and sustainable production.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full

	consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This is in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for training owners in the recognition of conservation areas and figures such as civil society natural reserves. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, and with clear and transparent information, proceed to make the free decision to declare their property as a civil society natural reserve.
Implementation timeline	From the start date of the project, with a frequency of every five (05) years.

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measurement	Measurement Manager
Number of properties with declared conservation areas and/or figures	Impact	10	Number of properties with declared conservation areas and/or figures	Cataruben Foundation

Id	R8
Component	Information and knowledge management
Description	Plan to strengthen the community's technical capacities for sustainable forest management and conservation of strategic ecosystem services, fire management to prevent forest fires, and sustainable production systems and landscape management tools.
Aplicated metodoloy	BCR 0002

Relationship with direct or underlying cause	Due to the lack of knowledge of alternative markets, production practices and non-timber products that promote conservation and efficient use of natural resources, a training plan is proposed that promotes environmental education for owners. This plan seeks to raise awareness and build criteria that support continuity in the protection of ecosystems. In this order of ideas, training aimed at contributing to good water quality is a fundamental piece and an instrument that seeks to mitigate the limitations of the water resource and promote sustainable actions on its use. This approach not only strengthens the social fabric, but also serves as a barrier against possible unsustainable activities that could compromise natural resources.
Compliance with the interests of rural communities.	This activity is aligned with the interests of the project participants, as indicated by the socialization processes and signing of agreements carried out. It is oriented towards access to technical knowledge and the incentive for the development of economic, social and cultural activities appropriate for generating sustainable income.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period..
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for designing and planning the training plan to strengthen the capabilities of the Project Participants. In addition to acting as facilitators and speakers of the training. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, attending

	the scheduled sessions and participating in discussions and activities both in person and remotely.
Implementation timeline	Starting from the 2nd year of the project start date and until the 19th year.

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Progress in the execution of the Training Plan aimed at strengthening the community's capacities in ecosystem services and conservation of strategic ecosystems	Product	100%	Percentage	Cataruben Foundation
General training plan in Biodiversity	Product	10%	Percentage of completion	Cataruben Foundation

Activity ID	S1
Component	Innovative economic dynamics
Description	Improving the income of landowners generated by the sale of carbon credits obtained from the natural savannah ecosystem
Aplicated metodoloy	BCR 0005
Relationship with direct or underlying cause	Related to the interests and motivations of production for the generation of income, also involving the lack of knowledge in alternative markets that encourage conservation. From the generation of certificates generated from the project activities, they can continue to develop, and the project participants feel that it is a financial incentive.
Compliance with the interests of rural communities.	Activity of great interest on the part of the project participants, since it represents the possibility of increasing average income and the availability of resources to carry out conservation, restoration and sustainable production activities.
Consultation mechanism for the identification of	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1.

objectives and the definition of activities	Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 2.1.2. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for planning and coordinating the monitoring, reporting and verification stages, as well as the commercialization of verified carbon certificates and transfer of economic benefits to project participants. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the activities established in the project, and guarantee the conservation of the different strategic ecosystems present in their territories. So as toast the information necessary to rcarry out the transfer of economic resources transparently. **Ecopetrol:** Technical and financial ally that allows consolidating the enabling conditions to ensure the generation of economic benefits, which facilitate the execution of project activities.
Implementation timeline	From the date of commercialization of the carbon certificates

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measurement	Responsible for measurement
Percentage increase in average income derived from the sale of verified carbon credits	Impact	25%	Percentage increase in average income	Cataruben Foundation
Percentage of owners with	Impact	100%	Percentage of homeowners with	Cataruben Foundation

improved income from the sale of verified carbon credits			improved income	

Id	S2
Component	Technical support
Description	Implementation of landscape management tools in savannas
Aplicated metodoloy	BCR 0005
Relationship with direct or underlying cause	Production interests and motivations for income generation. Lack of knowledge of alternative markets that encourage conservation, Lack of knowledge of sustainable production practices and non-timber forest products.
Compliance with the interests of rural communities.	The project participants are interested in generating sustainable production models in the savannas by producing and conserving, to the extent that they have economic, technical, and knowledge incentives that the project can provide.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This is in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for promoting and training in the implementation of landscape management tools in savannas to ecosystem managers. **Project Participants:** They are the owners of the properties and

	their responsibility is to actively participate in the training, as well as promote the implementation of landscape management tools in savannas, providing evidence and sharing experiences with the Cataruben Foundation.
Implementation timeline	From the fourth year of the project

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Number of properties that implement Landscape Management Tools in natural savannas	Result	103	Number of properties	Cataruben Foundation

Id	S3
Component	Dinámicas económicas innovadoras
Description	Implementation of sustainable productive practices in natural savannas
Aplicated metodoloy	BCR 0005
Relationship with direct or underlying cause	This activity is related to the development of the productive motivations developed by the participants in the respective properties. Through these actions, we initially seek to transfer the necessary knowledge about the implementation of good sustainable production practices in natural savannas. These activities are not only focused on the conservation and mitigation of environmental impacts, but in parallel contribute significantly to Sustainable Development Goal (SDG) number 6. Specifically, to Target 6.1, which seeks to ensure the availability and sustainable management of water. For everyone, as well as with Indicator 6.1.1. Sand projects that the owners of properties linked to the project adopt sustainable productive strategies and practices that contribute to the strengthening and protection of the ecosystems present in these territories. This activity achieves to empower homeowners with the skills necessary to make informed decisions through effective property planning.

Compliance with the interests of rural communities.	This activity is of great interest to project participants, since it allows them to strengthen their knowledge in the sustainable management of their productive activities. The owners consider favorably the adoption of implementing sustainable productive practices in natural savannas, to the extent that these actions will allow them to strengthen the protection of the different ecosystems present on their properties. At the same time, they will be able to obtain incentives for conserving and developing economic activities aligned with conservation.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities, and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for training and promoting the implementation of sustainable productive practices in natural savannas **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, as well as voluntarily implement sustainable productive practices according to the productive and economic projection.
Timeline Of implementation	Permanently, from the project start date

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Responsible for measurement**

Number of properties that implement sustainable production practices or conservation, soil management and conservation actions	Result	103	Number of properties	Cataruben Foundation

Id	S4
Component	Innovative economic dynamics
Description	Management alliance that financially allows generating the enabling conditions for the validation and first verification of the project
Aplicated metodoloy	BCR 0005
Relationship with direct or underlying cause	This project, which brings together multiple private owners, requires a great financial and technical effort to ensure long-term sustainability and the mechanisms to establish procedures and tools for monitoring, reporting, and verification. Which enables an alternative market that encourages conservation, restoration and sustainable production and directly impacts the reduction of deforestation, forest degradation and change in land uses in natural savannas.
Compliance with the interests of rural communities.	The project participants are interested in the financing of the creation of the enabling conditions for the monitoring, reporting, and verification system of the activities they develop. This is so that they can continue to be carried out in the long term, thanks to the efforts of the Cataruben Foundation.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities, and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners. They can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.

Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for planning and coordinating the monitoring, reporting and verification stages, as well as the commercialization of verified carbon certificates and transfer of economic benefits to project participants. **Project Participants:** They are the owners of the properties and their responsibility is to actively implement actions aimed at reducing GHG, reducing deforestation and reducing degradation, as well as submitting the necessary evidence for the monitoring plan. **Ecopetrol:** Technical and financial ally that allows consolidating the enabling conditions to ensure the generation of economic benefits, which facilitate the execution of project activities.
Implementation timeline	From the date of commercialization of the carbon certificates

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measurement	Measurement Manager
Alliance or formalized agreement	Product	1	Agreement	Cataruben Foundation

Id	S5
Component	Information and knowledge management
Description	Plan to strengthen the community's technical capacities for the management of natural savannas and the conservation of strategic ecosystem services, fire management to prevent forest fires, sustainable production systems and landscape management tools.
Aplicated metodoloy	BCR 0005
Relationship with direct or underlying cause	Due to the lack of knowledge of alternative markets, production practices and non-timber products that promote conservation and efficient use of natural resources, a training plan is proposed that promotes environmental education for owners. This plan seeks to raise awareness and build criteria that support continuity in the protection of ecosystems. In this order of ideas, training aimed at contributing to good water quality is a fundamental piece and an instrument that seeks to mitigate the limitations of the water

	resource and promote sustainable actions on its use. This approach not only strengthens the social fabric, but also serves as a barrier against possible unsustainable activities that could compromise natural resources.
Compliance with the interests of rural communities.	This activity is aligned with the interests of the project participants, as indicated by the socialization processes and signing of agreements carried out. It is oriented towards access to technical knowledge and the incentive for the development of economic, social and cultural activities appropriate for generating sustainable income.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period..
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for designing and planning the training plan to strengthen the capabilities of the Project Participants. In addition to acting as facilitators and speakers of the training. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, attending the scheduled sessions and participating in discussions and activities both in person and remotely.
Implementation timeline	Starting from the 2nd year of the project start date and until the 19th year.
Indicators to report the progress of the activity	

Name	Type	Meta	Unit of measurement	Measurement Manager
Progress in the execution of the Training Plan aimed at strengthening the community's capacities in ecosystem services and conservation of strategic ecosystems	Product	100%	Percentage	Cataruben Foundation

Id	B1
Component	Technical support
Description	ID and monitoring of HCVs present in the project area
Aplicated metodoloy	Cobenefits (BCR 0002 y BCR 0005)
Relationship with direct or underlying cause	This activity seeks to identify the High Conservation Values present in the territory. For the development of this activity, monitoring will be carried out through GIS analysis. These actions seek to identify those strategic conservation ecosystems.
Compliance with the interests of rural communities.	The project participants are interested in being able to identify those HCVs present on their properties and jointly generate protection actions on those areas and ecosystems.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners in be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This is in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the	**Cataruben Foundation:** Organization responsible for designing and

actors participating in the implementation of the activity	implementing the methodology for the identification and monitoring of HCVs present in the project area **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the identification and monitoring of AVC present in the project area
Implementation timeline	From the project start date

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measurement	Measurement Manager
Recognized High Conservation Values	Product	8	AVC presence report	Cataruben Foundation

Id	B2
Component	Technical support
Description	Monitoring the presence of globally threatened species and taking actions to conserve them
Aplicated metodoloy	Cobenefits (BCR 0002 y BCR 0005)
Relationship with direct or underlying cause	This activity is aimed at developing actions to identify, monitor, evaluate and develop strategies that contribute to the conservation of these threatened species, which seeks to strengthen the biodiversity and balance of the ecosystems present in the project areas.
Compliance with the interests of rural communities.	The participants of the project are interested in developing conservation actions on their properties, given that their motivations are oriented towards developing sustainable activities, such as tourism and around this practice, carrying out activities such as fauna and flora watching. It emerges as one of the main motivations on the part of scientists, ornithologists, and travelers is to be able to identify threatened species and contribute to their conservation.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full

	consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This is in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for designing and implementing the methodology for monitoring the presence of globally threatened species and taking actions to conserve them **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in monitoring the presence of globally threatened species and they take actions to preserve them.
Implementation timeline	From the start date of the project.

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measurement	Measurement Manager
Participatory monitoring of wildlife to detect threatened species within the project area	Product	8	Monitoring report on species in some threatened state	Cataruben Foundation

Id	B3
Component	Technical support
Description	Restoration actions in degraded ecosystems
Aplicated metodoloy	Cobenefits (BCR 0002 y BCR 0005)
Relationship with direct or underlying cause	This activity is aimed at providing support to those ecosystems that have suffered alterations as a result of forest clearing and forest fires. The purpose is to generate the recovery of these ecosystems and contribute to the strengthening of biodiversity.

Compliance with the interests of rural communities.	The project participants are interested in developing recovery and restoration actions on their properties, given that they understand that these actions allow the recovery of biodiversity. They also improve the quality of both water and soil, and strengthen the economic benefits derived from conservation. Additionally, they consider this activity important in mitigating climate change.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for promoting and training in restoration actions in degraded ecosystems. **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, and implement restoration actions in degraded ecosystems.
Implementation timeline	From the start date of the project.

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measurement	Measurement Manager
Total reports documenting restoration activities implemented by property managers	Product	40	Advance monitoring reports of the number of restoration activities	Cataruben Foundation

Id	B4

Component	Technical support
Description	General training plan in Biodiversity
Aplicated metodoloy	Cobenefits (BCR 0002 y BCR 0005)
Relationship with direct or underlying cause	A biodiversity training program can strengthen carbon projects by raising awareness of the importance of conserving key ecosystems, promoting sustainable practices, and improving monitoring of flora and fauna. By understanding the relationship between biodiversity and carbon sequestration, participants can adopt regenerative practices that preserve and restore natural habitats, making projects more resilient and effective in reducing emissions. This contributes to both biodiversity conservation and meeting carbon sequestration goals.
Compliance with the interests of rural communities.	This activity is aligned with the interests of the project participants, as indicated by the socialization processes and signing of agreements carried out. It is oriented towards access to technical knowledge and the incentive for the development of economic, social and cultural activities appropriate for generating sustainable income.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	Cataruben Foundation: Organization responsible for designing and planning the training plan to strengthen the capabilities of the Project Participants. In addition to acting as facilitators and speakers of the training. Project Participants: They are the owners of the properties and their responsibility is to actively participate in the training, attending the scheduled sessions and participating in discussions and activities

	both in person and remotely. Starting from the 2nd year of the project start date and until the 19th year.
Implementation timeline	From the start date of the project.

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Property with active restoration initiatives	Product	17	Monitoring reports of Number of restoration activities implemented	Cataruben Foundation

Id	EG1
Component	Information and knowledge management
Description	Strengthening access and management of financial goods and services with a focus on gender equity
Relationship with direct or underlying cause	This activity is focused on generating knowledge transfer to project participants regarding access and management of assets, which allows project participants to use appropriate mechanisms and tools for the management and development of finances derived from conservation processes. .
Compliance with the interests of rural communities.	Some participants express interest in strengthening their capacities in tools aimed at managing their finances, which contributes to the strengthening and access to financial goods and services.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of conservation objectives and activities for the project was carried out (See 6.1.4.1.1. Initial meetings). Manifestation of the will of the owners to be part of a climate change conservation and mitigation project (See 2.1.1 Letters of intent). Agreements signed by the owners where full consent to be linked to the project is expressed, stating the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built participatively with the owners (See 6.5.1.2.2. Property Implementation Plans). These plans not only serve as a monitoring

	tool between Cataruben and the owners. They can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity	**Cataruben Foundation:** Organization responsible for training on access and management of financial goods and services with a focus on gender equality **Project Participants:** They are the owners of the properties and their responsibility is to actively participate in the training, attending the scheduled sessions and participating in discussions and activities both in person and remotely.
Implementation timeline	From the first verification (year 5 of the project)

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Responsible for measurement**
Training developed to strengthen access and management of financial goods and services	Product	10	Number of trainings	Cataruben Foundation

Source: Own elaboration

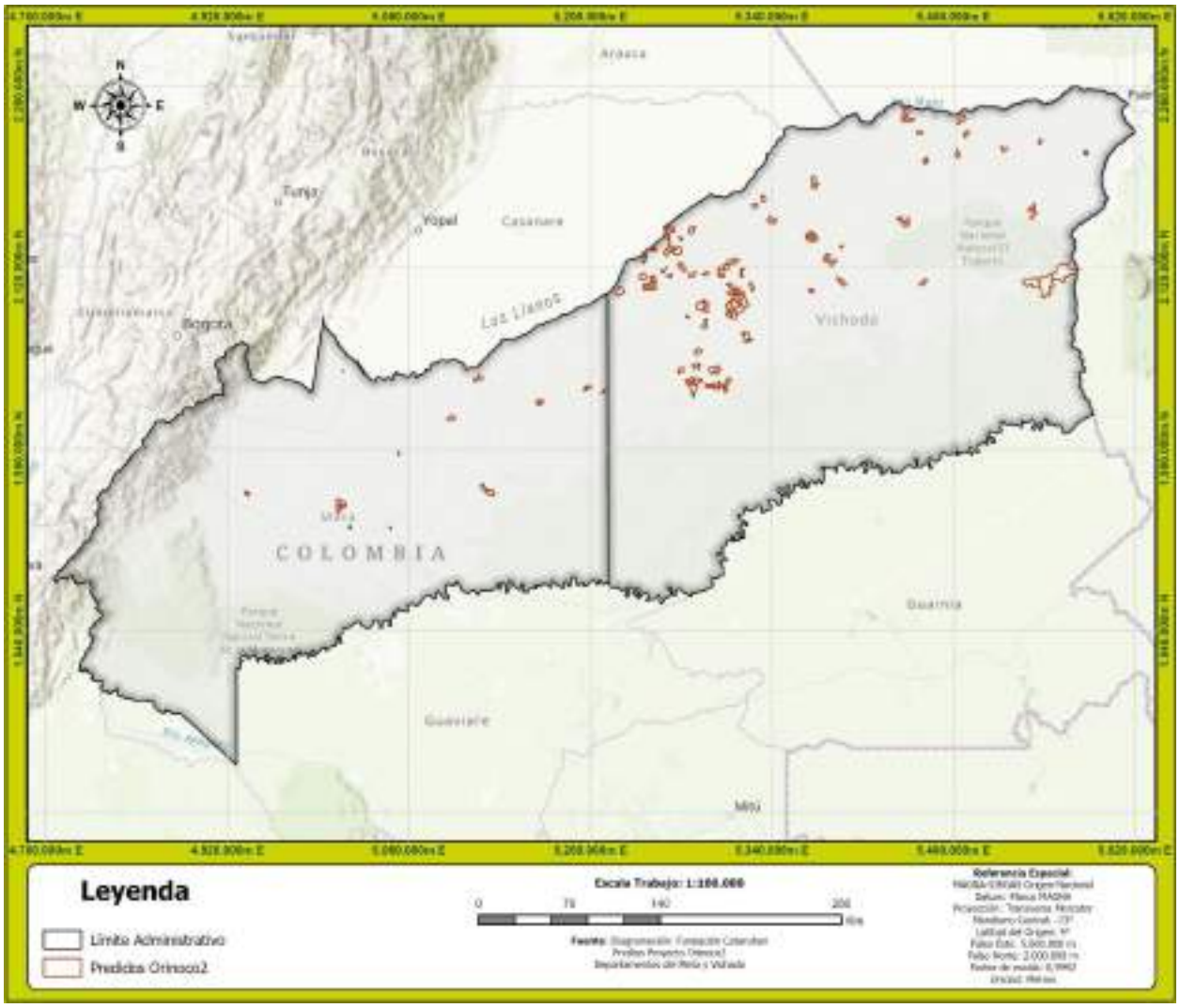
The activities proposed and stipulated above are designed to meet the reporting and monitoring standards required by the BCR0002 and BCR0005 methodologies. Each of the activities has an independent report, accompanied by clear and specific indicators, and an appropriate evaluation frequency is established to ensure rigorous monitoring of its effectiveness in controlling deforestation and land use changes in the savannas. The monitoring plan, with the established indicators and monitoring frequencies, are listed in the Monitoring Plan: Monitoring Plan of project activities.

It is essential to highlight that the ID assigned to each activity and component provides clarity about its focus. This allows us to identify whether the activity is generally oriented towards the development of a conservation project for the natural ecosystems of the Colombian Orinoquía, or if it is specifically aligned with a particular methodology, such as REDD+ or those focused on the preservation of savannas. This differentiation facilitates the monitoring and evaluation of actions, ensuring that each intervention responds to the established objectives and the corresponding conservation needs.

2.4. Project localization

The Project is located in the Colombian Orinoquia biome, the Llanos Ecoregion according to the WWF, and the Orinoco highland region of the departments of Meta and Vichada. (Figure 18)

Figure 18. Project localization



Source: Own elaboration

In the Table 20 the location by municipality and sidewalk of each of the properties that are part of the project is listed.

Table 20. Properties linked to the project

Item	Department	Municipality	Property
1	Vichada	La Primavera	La Reforma
2	Vichada	La Primavera	El Morichal
3	Vichada	Santa Rosalía	Tierra Santa
4	Vichada	Cumaribo	La Conquista
5	Vichada	Santa Rosalía	El Amparo
6	Vichada	Cumaribo	Muzolandia
7	Vichada	Cumaribo	Santa Ana
8	Vichada	Cumaribo	Santa Paula
9	Vichada	Cumaribo	La Hermita
10	Vichada	Puerto Carreño	Lote El Ocarro
11	Vichada	La Primavera	Lote Cacay
12	Vichada	La Primavera	Boral
13	Vichada	Santa Rosalía	Saigon
14	Vichada	La Primavera	La Cristalina
15	Vichada	Santa Rosalía	Palma Seca
16	Vichada	Santa Rosalía	La Pradera
17	Vichada	Santa Rosalía	Samaria
18	Vichada	Santa Rosalía	La Pradera
19	Vichada	Santa Rosalía	La Chumascada
20	Vichada	Santa Rosalía	Miami
21	Vichada	Santa Rosalía	Simaru
22	Vichada	Santa Rosalía	Costa Rica
23	Vichada	Santa Rosalía	Tamanaco
24	Vichada	La Primavera	Venus
25	Vichada	Santa Rosalía	Villa Carolina
26	Vichada	Cumaribo	Bellavista
27	Vichada	Cumaribo	Cawinanay
28	Vichada	Cumaribo	Dos Diamantes
29	Vichada	La Primavera	El Venado
30	Meta	Puerto Gaitán	Lote Tres Cielos Lote 2
31	Vichada	Cumaribo	Waykiky
32	Vichada	La Primavera	Los Deseos San Andres
33	Vichada	Santa Rosalía	El Manguito

Item	Department	Municipality	Property
34	Vichada	La Primavera	Lote 1
35	Vichada	Santa Rosalía	Mata Negra
36	Vichada	Santa Rosalía	El Milagro
37	Vichada	Santa Rosalía	Puerto Dabeiba
38	Vichada	La Primavera	Lote 13
39	Vichada	Santa Rosalía	Costa Rica
40	Vichada	Cumaribo	Capijirito
41	Vichada	La Primavera	La Macarena
42	Vichada	La Primavera	La Esmeralda
43	Vichada	La Primavera	Los Cocos
44	Vichada	La Primavera	Los Laureles
45	Vichada	La Primavera	Mi Conuco
46	Vichada	Cumaribo	La Bohemia
47	Vichada	Cumaribo	Yaguarama
48	Vichada	La Primavera	Lote 2
49	Vichada	Cumaribo	Los Claveles
50	Vichada	La Primavera	La Mariposa
51	Vichada	La Primavera	La Gaviota
52	Vichada	Puerto Carreño	Cayure
53	Vichada	Santa Rosalía	Bet-El
54	Vichada	Puerto Carreño	La Soledad
55	Vichada	Cumaribo	Chaqueva
56	Meta	Mapiripan	Finca El Retiro
57	Vichada	Puerto Carreño	El Zafiro
58	Vichada	Puerto Vichada	Vista Hermosa
59	Vichada	La Primavera	Rnsc Matapalito
60	Vichada	Cumaribo	Constitución
61	Vichada	La Primavera	Los Alcornocos
62	Vichada	La Primavera	Predio El Chaparral
63	Meta	Puerto Lopez	Hacienda Nuevo Mururito
64	Vichada	La Primavera	El Convento
65	Vichada	La Primavera	Los Algarrobos
66	Vichada	Santa Rosalía	Finca Las Brisas

Item	Department	Municipality	Property
67	Vichada	Santa Rosalía	Las Gaviotas
68	Vichada	Santa Rosalía	Control Reserva
69	Vichada	Santa Rosalía	El Control
70	Vichada	Santa Rosalía	La Orquidea
71	Vichada	Puerto Carreño	Luisyana I
72	Vichada	Cumaribo	Providencia
73	Vichada	La Primavera	Matalarga
74	Vichada	La Primavera	El Jobal
75	Vichada	Santa Rosalía	Lote (Fundación La Esperanza)
76	Vichada	La Primavera	Laguna Grande
77	Vichada	La Primavera	El Progreso
78	Vichada	La Primavera	Villa Lorena
79	Vichada	La Primavera	La Sierra
80	Vichada	La Primavera	La Conquista
81	Vichada	La Primavera	Los Huerfanitos
82	Vichada	La Primavera	Brisas Del Lolo
83	Vichada	La Primavera	La Milagrosa
84	Vichada	Puerto Carreño	Maracana V
85	Vichada	Puerto Carreño	Matazul
86	Vichada	Primavera	El Rincón De Mata Azul
87	Vichada	La Primavera	Guaimarito
88	Meta	Puerto Gaitán	La Palmita
89	Meta	Puerto Gaitán	La Tigra
90	Vichada	Puerto Carreño	La Herradura
91	Vichada	Puerto Carreño	Las Palmas
92	Vichada	La Primavera	La Laguna
93	Vichada	Puerto Carreño	El Gran Marco Polo
94	Vichada	Puerto Carreño	Mata Mojada
95	Vichada	La Primavera	El Sinaí
96	Vichada	Primavera	Las Delicias
97	Vichada	La Primavera	La Fortuna
98	Vichada	Puerto Carreño	La Provincia
99	Vichada	Cumaribo	El Caney

Item	Department	Municipality	Property
100	Vichada	Puerto Carreño	Las Guacamayas
101	Meta	Puerto Gaitán	La Esperanza
102	Vichada	Cumaribo	Oropel
103	Vichada	Cumaribo	Yacare
104	Meta	Puerto Gaitán	Finca El Olimpo
105	Vichada	Puerto Carreño	El Capricho
106	Meta	San Martin	Veracruz III
107	Meta	San Martin	Veracruz II
108	Meta	Puerto Lopez	El Boquerón
109	Meta	Puerto Lopez	plantación El Cedral
110	Vichada	La Primavera	La Victoria
111	Vichada	Cumaribo	La Loma
112	Vichada	Cumaribo	La Alegría
113	Vichada	Cumaribo	La Alegría 2
114	Vichada	Cumaribo	La Empresita
115	Vichada	Cumaribo	Victoria
116	Vichada	La Primavera	Congrial
117	Vichada	Santa Rosalía	Lagunitas
118	Vichada	La Primavera	Turuli
119	Vichada	Primavera	Versalles
120	Vichada	Santa Rosalía	La Giralda Valle De Luna
121	Vichada	Santa Rosalía	Buenos Aires
122	Vichada	Puerto Carreño	Lote El Cachicamo
123	Vichada	Puerto Carreño	Los Venados
124	Vichada	La Primavera	Los Ángeles
125	Vichada	La Primavera	La Laguna
126	Meta	Puerto Gaitán	Finca Lucitania
127	Vichada	Cumaribo	Brisas Del Tomo
128	Vichada	La Primavera	Arco Iris
129	Meta	San Martín	La Flor
130	Meta	Barranca De Upía	Cachipay
131	Meta	San Martín	Las Brisas
132	Meta	San Martín	Finca Samanes

Item	Department	Municipality	Property
133	Meta	San Martín	Finca Samanes 2
134	Meta	San Martín	La Gran Conquista
135	Meta	San Martín	La Castellana
136	Vichada	La Primavera	Angosturas
137	Vichada	La Primavera	Lucitania
138	Vichada	Cumaribo	El Machimbre
139	Vichada	Cumaribo	El Edén
140	Vichada	Cumaribo	El Yarumo
141	Vichada	Cumaribo	Valle Verde
142	Vichada	Puerto Carreño	Puerto Rico
143	Meta	Puerto Gaitán	La Esperanza
144	Meta	Puerto Gaitán	Buenavista
145	Vichada	Puerto Carreño	El Algarrobo
146	Vichada	La Primavera	Finca El Regreso

Source: Own elaboration

2.5. Additional Information about the GHG Project

Given that the project includes the implementation of REDD+ activities and activities that avoid land use change in natural savannas, it is important to define the relevance of the combined use of BCR0002 and BCR0005 methodologies and ensure that the two interventions are additional for each area.

table 21 shows the analysis aimed at evaluating the relevance and feasibility of combining BCR002 and BCR005 methodologies in the same scenario of the Orinoco2 project, which is aimed at mitigating climate change through the conservation of natural savannas and forests in the Colombian Orinoco region.

Table 21 Analysis of the pertinence of the combined use of BC0002 and BCR0005 methodologies.

Parameter	BCR 0002	BCR 0005	Analysis	Evidence
Intervention area	Forested Areas Susceptible to deforestation/forest degradation	Natural savannah areas	The methodologies have totally different areas of intervention.	Section 2.5.1.1. REDD+ eligible areas.

				3.6.1.2 *Eligible Areas natural savannas*
Causes and agents	The result of the analysis of causes and agents shows that the owners and natural conditions (fires of natural origin) are the main agents. While economic or subsistence interests are the main causes.	The result of the analysis of causes and agents shows that the owners are the main agents of land use change. While economic or subsistence interests are the main causes. In summary, the landscape is transformed due to lack of knowledge and underlying economic and natural causes.	The agents are and their interests are similar but the areas affected are different. Therefore, an intervention on the causes and agents is required but with particular actions for each type of area. If interventions are only carried out for one area, the other continues its transformation by not carrying out particular interventions.	Section 2.3.1. *Analysis of causes and agents of deforestation and transformation of natural savanna covers.*
Project activities	Specific activities to reduce deforestation and forest degradation. Within the knowledge management activities, particular actions are established with forests, their conservation and restoration.	Specific activities to avoid land use change in natural savannahs. Within the knowledge management activities, particular actions are established with natural savannahs, their conservation and sustainable use.	Taking into account the analysis of causes and agents. Specific activities are considered to be designed for each type of intervention area in accordance with the project areas defined by each methodology. And other activities are also designed that ensure a comprehensive intervention.	2.3.8. *Intervention Model*
Additionality	Additionality analysis is carried out in accordance with the	Additionality analysis is carried out in accordance with the methodology and	Independent additionality analysis for each component that ensures the additionality of the interventions and overall the financial additionality of	3.3. Identification of the Baseline Scenario and Additionality

	methodology and standard.	standard.	the project. That is to say, without the resources received by the two components of the project, the activities that reduce emissions could not be implemented.	
Emissions	It is carried out by monitoring REDD+ eligible areas.	It is carried out by monitoring the eligible natural savanna areas.	Since they are different areas with different interventions, their quantification is independent. Always complying with the applicability criteria of each methodology for each type of area.	Seccion 3. Quantification of GHG emissions reduction
Leakage	Leakage area is established in accordance with the BCR0002 methodological guidelines	Leakage area is established in accordance with the BCR0005 methodological guidelines	The leakage areas for the forest component are totally different from the natural savanna component. They are monitored independently and quantified separately. For its management, risks are addressed in a comprehensive manner, understanding the causes and range of mobility of the agents.	Seccion 3. Quantification of GHG emissions reduction 3.5. Leakage and non-permanence

2.5.1. BCR Methodologies and tools used for project design implementation and monitoring

- Bcr0005 Quantification Of GHG Emissions Reduction version 1.0
- Quantification Of GHG Emission Reductions Redd+ Projects Bcr0002 Version 4.0
- Bcr Tool Sustainable Development Goals (Sdg) Version 1.0
- Bcr Tool To Demonstrate Compliance With The Redd+ Safeguards Version 1.1
- Bcr Tool Avoiding Double Counting (Adc), Version 2.0
- Bcr Tool Monitoring, Reporting And Verification (Mrv), Version 1.0
- Bcr Tool Sustainable Development Safeguards, Version 1.1.

- Bcr Guidelines Baseline And Additionality, Version 1.3
- Bcr Tool Permanence And Risk Management, Version 1.1

3. Quantification of GHG emissions reduction

The project's emissions are quantified based on the monitoring of quantification methodologies. The mitigation results correspond to the sum of the reduction of emissions from REDD+ activities and the reduction of emissions from activities that avoid change of use of the land in natural savannas.

3.1. Quantification methodology

Since project activities seek to reduce emissions from deforestation, forest degradation and land use change of natural savannas, two quantification methodologies are used: BCR 0002 V 4.0 y BCR 0005 V 1.0.

3.1.1. Applicability conditions of the methodologies

In the Table 22 The applicability criteria are described as well as the description of compliance by the project.

Table 22. Compliance with conditions of application of methodologies.

Methodology	Criterion	Description Compliance
BCR 0002	The areas in the geographical boundaries of the project correspond to the forest category according to the national definition of forest for the clean development mechanism (CDM) at the beginning of project activities and 10 years before the project start date:	**Comply.** According to IDEAM, the forest for Colombia corresponds to: "*The land occupied mainly by trees that may contain shrubs, palms, bamboo, grasses and lianas, in which tree cover predominates with a minimum canopy density of 30%, a minimum in situ canopy height of 5 meters at the time of its ID*". Therefore, once the limits of each project area (each property) were defined, an eligibility analysis was carried out in accordance with section 9.1 of the BCR 0002 methodology. The analysis contemplated the period 2008-2018, under which the delimited the areas that have remained as stable forest during the last 10 years prior to the project start date. The detailed description of the procedure to determine eligible areas is described in the Section 3.7.1.1 of this document.

Methodology	Criterion	Description Compliance
	the areas within project boundaries do not correspond to the wetlands category	According to section 7 "Terms and Definitions" of BCR0002, wetlands are defined, based on the Ramsar Convention on Wetlands (Article 1), as: "Wetlands are areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of marine water the depth of which at low tide does not exceed six meters" (Ramsar, 1971). The IPCC defines wetlands as follows: "This category includes areas of peat extraction and land that is covered or saturated with water throughout the year or for part of it (e.g., peatlands) and that is not within the *categories of forest land*, cropland, grassland, or settlements. It includes reservoirs as a managed subdivision and natural rivers and lakes as unmanaged subdivisions." In this sense, it was verified that, according to the IPCC definition of wetlands (above), these areas do not correspond to wetlands but rather to forest lands. Therefore, they are not classified as: 4 (Wetlands), specifically 411 (Swampy Areas), 412 (Peatlands), and 413 (Aquatic Vegetation over Water Bodies), according to the descriptions of the Corine Land Cover categories for Colombia. This is consistent with Article 1 of the Ramsar Convention for Wetland Protection and the IPCC guidelines. The spatial data is located in the REDD+ Geodatabase under the Feature Class "Validation of Eligible Areas." and annex 1.1.2.1.1.3. validation of areas.
	there are no organic soils in the areas within the geographical limits of the project	According to section 7 "Terms and Definitions" of BCR0002, they are soils with organic carbon content equal to or greater than 12%. Organic soils (e.g., peat and manure) have at least 12 to 20

Methodology	Criterion	Description Compliance
		percent organic matter by mass and thrive under poorly drained wetlands conditions. Organic soils are identified based on criteria 1 and 2, or 1 and 3 listed below: 1. Organic horizon thickness is greater than or equal to 10 cm. A horizon of less than 20 cm has 12 percent or more organic carbon when mixed to a depth of 20 cm. 2. Soils that are never saturated with water for more than a few days shall contain more than 20 percent organic carbon by weight (i.e., about 35 percent organic matter). 3. Soils are subject to water saturation episodes and have either: a) At least 12 percent organic carbon by weight (i.e., about 20 percent organic matter) if the soils have no clay; b) At least 18 percent organic carbon by weight (i.e., about 30 percent organic matter) if the soils have 60% or more clay; or c) An intermediate proportional amount of organic carbon for intermediate amounts of Clay. En este sentido dado que las áreas elegibles corresponden a bosques riparios la evaluación para definir suelos orgánicos corresponde a la aplicación del criterio 1 y 3. En este sentido se realizó una revisión de los levantamientos semiestructurados de suelos realizados por el IGAC los cuales son el insumo para realizar los mapas de carbono del suelo en colombia y se comprobó los suelos presentan porcentajes de carbono orgánico del 1,02% hasta 7,64% por lo tanto no corresponden a suelos orgánicos. Fuentes. (Sistema de Información de Suelos de Latinoamerica SISLAC) donde el IGAC colabora activamente alojando la información

Methodology	Criterion	Description Compliance
		correspondiente a los levantamientos semiestructurados de Suelos. Para corroborar la anterior información, se tomaron muestras de suelo en áreas elegibles de bosque para establecer el porcentaje de carbono orgánico. Los resultados de laboratorio establecen valores de promedio de 1.4%. Por lo tanto se comprueba que no los suelos no corresponden a suelos orgánicos. Ver anexo 1.3. Suelos Bosques Orinoco2 P1 , 1.3.1. Resultados Laboratorio_S2023-231.pdf La informacion espacial se encuentra ubicada en la geodatabase REDD+, Feature Dataset Levantamiento Suelo, archivo vectorial "Levantamiento Semiestructurado Suelos IGAC", "Levantamiento suelos REDD".
	The causes of deforestation may include, among others: expansion of the agricultural frontier, mining, wood extraction and expansion of infrastructure.	**Comply.** According to the analysis of causes and agents, the expansion of the agricultural frontier and fires were identified as the main causes of deforestation (See section 2.3 / section 2.3.7).
	The identified causes of forest degradation may include: selective logging, firewood extraction, forest fires, grazing in forest areas, expansion of the agricultural frontier, and illicit crops.	**Comply.** According to the analysis of causes and agents, the causes include the expansion of the agricultural frontier and fires (See section 2.3 / section 2.3.7).
	No reduction in deforestation or degradation is expected to occur in the absence of the project.	**Comply.** The baseline and additionality analysis shows that factors such as the absence of financial incentives for conservation, combined with the economic profitability of other activities and the lack of effective control measures, encourage the continuity of current trends of deforestation and forest degradation. (section 3.3).
	In areas within the project boundaries, carbon stocks in soil organic matter, litter, and dead	**Comply.** According to the baseline scenario, carbon stocks decrease due to the influence of deforestation and/or degradation agents. This

Methodology	Criterion	Description Compliance
	wood may decline or remain stable.	occurs by disrupting the natural cycle of carbon capture and storage, which promotes acceleration in the decomposition of organic matter and the subsequent release of additional carbon into the atmosphere.
	The quantification of GHGs other than CO2 must be included in the quantification caused by forest fires (if applicable) during the monitoring period.	**Comply.** During the monitoring period, the quantification of CH4 and N2O emissions caused by the combustion of woody biomass is contemplated (section 3.2.2). To this end, the monitoring plan includes monitoring the areas within the geographical limits of the project, in order to identify fires in tree covers (section 17.1.1). In the event of events of this type, the calculation of other GHG emissions will be carried out in accordance with the provisions of the Section 17.1.3.4.
BCR0005	The areas within the geographic limits of the project correspond to natural savannas.	**Comply.** In compliance with the criteria of section 7.1.1 of the BCR 0005 methodology, the analysis for the delimitation of eligible areas of the natural savanna ecosystem contemplated the period 2012-2018, where those coverages of were identified in the geographical limits of the project. 3.2.1 Grasslands and 3.2.2. shrublands, which are considered as savannas (section 3.9.1.2).
	The project activities avoid the change of land use in natural savannas.	**Comply.** Project activities prevent land use change in natural savannas by encouraging sustainable practices through production systems that do not imply land use change. In addition, economic incentives for conservation are generated from the commercialization of the project's mitigation results (section 2.3.8.1).
	The project activities include biodiversity conservation actions that integrate preservation, restoration and/or management and sustainable use efforts of the savannas.	**Comply**. The project activities are framed in conservation, restoration and sustainable use actions of the savannas. The section 2.3.8.1 describes in detail the proposed activities.
	The causes of land use changes identified may include, among others: Expansion of the agricultural frontier, mining,	**Comply.** The main cause identified corresponds to the expansion of the agricultural frontier carried out by the main agent, which is the owners of the properties. See section 2.3 / section 2.3.7).

Methodology	Criterion	Description Compliance
	extraction and loss of vegetation cover.	
	It is possible that, in areas within the project boundaries, carbon stocks in soil organic matter, litter, and dead wood may decline or remain stable.	**Comply**. Under the baseline scenario, carbon stocks are expected to decline as a result of the influence of land use change agents, while under the project scenario they are expected to remain stable or increase.
	The amount of nitrogen-fixing species used in the project activities is not significant, so GHG emissions from denitrification can be considered insignificant.	**Comply,** given that the dispersed planting of species in savanna and restoration areas with multiple native species is contemplated, so GHG emissions would not be significant.

Source: Own elaboration

3.1.2. Methodology Deviations

Methodological deviation is not presented.

3.2. Project boundaries, sources and GHGs

The geographic limits of the project are constituted by the eligible areas on which the project activities are developed, that is, the eligible areas of natural forests and natural savannas within the boundaries of each property. The sum of all eligible areas on each property determines the total project area. Other geographic limits of the project correspond to the reference region and the area of leakages. The GHG included corresponds to the analysis of gases controlled by the project based on REDD+ activities and Natural savannas. Finally, the time limits correspond to the historical period, the accreditation period and the monitoring periods of the project.

3.2.1. Spatial limits of the project

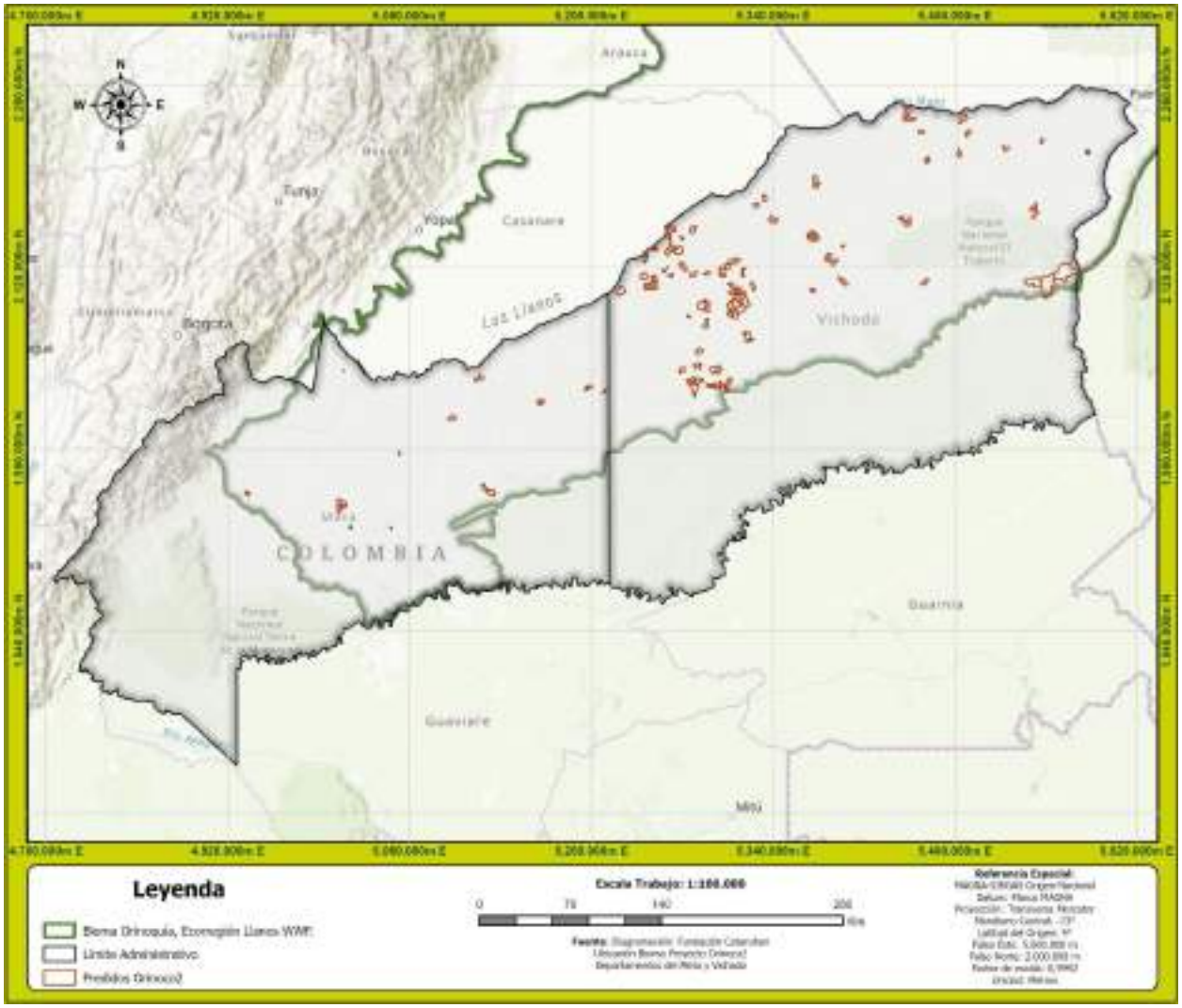
The space limits of the project correspond to the project areas, the reference region and the leakage area as described below.

3.2.1.1. Project area

The project area corresponds to the extensions of natural forests and savannas within the limits of the properties linked to the project. These areas cover an area of 117.253,0 ha distributed in

29.857,0 ha Forest and 87.396,0 ha natural savannas. For more detail, consult the Figure 19, which shows the distribution of the areas included in the project and ensures that the limits of the project are within the savanna biome and Llanos ecoregion according to the WWF classification. Relevant cartographic information is available in component-specific geospatial databases, in the Annex 1.1.1. savannas and 1.1.2. REDD feature dataset "Project Areas"

Figure 19. Distribution of project areas



Source: Own elaboration.

3.2.1.2. Reference Region for Baseline Estimation

By delimiting the reference region for the estimation of land use change in natural savannas as well as deforestation and forest degradation in vegetal and natural covers (grasslands, shrublands,

and forests), which could occur in the project area in the baseline scenario. The reference region is similar to the project area in terms of access, drivers of land use change, land use categories and/or land use change, landscape configurations, environmental and socioeconomic conditions, and local regional context. , as described below.

a. similarity in access: Both the project areas and the reference region are usually located in places where there is developed road infrastructure or in the process of development. This means that both areas have a network of roads or paths that facilitate human access to different parts of the territory. The presence of the mesh influences deforestation and transformation of coverage similarly; through these, access to natural areas is facilitated for activities such as livestock, agriculture, among others, which result in changes in coverage and loss of natural space. In the section 2.3.2.3.1. Road Context, the context develops. The Cartographic information is found in the layer: Annex 1.Emissions/1.1.Gdb/1.1.1.sabanas and 1.1.2.REDD. Feature Dataset Biophysical Surroundings/Vias.shp.

b. Drivers of change: Both the project areas and the reference region share similar characteristics in terms of their biophysical environment, such as climate, relief, soil type and availability of water resources. These environmental conditions influence drivers of change, such as deforestation, soil degradation and loss of biodiversity. Socioeconomic pressures, such as population growth, demand for natural resources, and the expansion of the agricultural frontier, may be similar in the project areas and in the reference region. The information is available in Annex 1.Ediciones/1.1.Gdb/1.1.1.sabanas and 1.1.2.REDD. Feature Dataset DriversChange/Aptitud.shp.

c. land uses: The reference region and the project areas share similar geographical and environmental characteristics, such as land use, 75.3% of the territory is located in natural vegetation covers, intended for agroforestry, silvopastoral and conservation systems. of primary forest. In it, item 2.3.2.1.2. Biophysics context, the characteristics of land uses, capacity for use, vocation for use and land cover are described. The Cartographic information is found in Layer: Annex 1.Emissions/1.1.Gdb/1.1.1.sabanas and 1.1.2.REDD. Feature Dataset Biophysical Surroundings/Vocation Usage.shp, Usage Capacity.shp, Usage Conflict.shp, Usage Coverages.shp.

d. land use category: The reference region and the project areas share similar geographical and environmental characteristics, such as soil type, 60% of the territory is destined for agroforestry, silvopastoral systems and primary forest conservation. In it, 2.3.2.1.2. Biophysics context, the characteristics of the capacity-categories of land uses are mentioned. It is also described in categories of use.

e. categories of land and/or change in land use: 30.9% of the territory is in conflict due to underused, while 5.8% is in conflict due to overuse. In it, item 2.3.2.1.2. biophysics context,

describes land use categories and land use conflict. The cartographic information is found in the Item 1.Emissions/1.1.Gdb/1.1.1.sabanas and 1.1.2.REDD. Feature Dataset Biophysical Surroundings/Capacity Usage.shp, Conflict of usage.shp, coverages of usage.shp.

f. Landscape configuration: Both the project areas and the reference region have a flat topography. Similar environmental conditions influence the distribution of vegetation, as well as the characteristics of the distribution and composition of the coverage, as well as the types of ecosystems. Additionally, the presence of conservation figures such as the different categories of RUNAP trigger an environment conducive to the generation of biological corridors and key habitats for wildlife. This is approached from the perspective of the types of ecosystems that are present in the territory. For which, the one of the different ecosystems that are present in the territory.

g. environmental conditions: The project areas and the reference region experience similar climatic conditions, such as precipitation, temperature, and seasonality. These climatic factors influence the distribution of vegetation, life cycles of species and availability of natural resources. The environmental conditions are described in the item 2.3.2.1.2. Biophysic context, which describes the distribution of temperature, average temperature, precipitation, climate classification, types of ecosystems, relief, hydrometeorological stations, drainage. The Cartographic information is found in Item 1.Emissions/1.1.Gdb/1.1.1.sabanas and 1.1.2.REDD. Feature Dataset EntornoBiofisico/temperatura.shp, average temperature.shp, precipitation.shp, climatic classification.shp, ecosystem types.shp, relief.shp, hydrometeorological stations.shp, drainages.shp.

h. socioeconomic conditions: The reference region experiences predominant economic conditions in the project areas, it usually reflects conditions of livestock and silvopastoral systems, agriculture, The economic conditions are described in the items 2.3.2.2. Social context and 2.3.2.3. Economic context

i. regional context: What is described in the previous items demonstrates that there is cartographic coherence and a correlation between the different factors found in the reference region as well as in the project areas. The fact of sharing similarity in environmental and geographical conditions establishes a uniformity of conditions for the development of agricultural and livestock activities related to the expansion of the agricultural frontier. The information is included in the 2.3.2.1. Territorial context.

Moreover, in accordance with criterion 9.2 of the BCR 0002 methodology and criterion 7.1.3 of the BCR 0005 methodology, a reference region was established to estimate the baseline of the REDD component of the project and another for the component of natural savanna that meets the criteria outlined in the Table 23.

Table 23. Criteria for establishing the reference region.

Methodology	Criterion	Description Compliance
BCR 0002	a. The reference region must include the project area	**Comply.** The reference region includes the **100 %** of the project area, 1.Emissions/1.1.Gdb/1.1.2. REDD+/Feature dataset Project area. Figura 20.1 Criterion A. Establishment of the Reference Region. All corresponding geographic information is stored in the REDD+ geodatabase, specifically in the Feature Dataset "Project Area," "Leakage Area," and "Reference Region," with vector data identified under the same names.
	b. The reference region must be larger than the project area. The size of the reference area must be in accordance with the mobility of the agents who may have access to the project area. The reference area should be limited to 10 times the project area.	The forest area within the reference region is 217,936 hectares, while the eligible forest area within the project area is 29,857 hectares. The total area of the reference region, including forest and non-forest land, is 1'672,931 hectares, and the area within property boundaries is 169,145 hectares.
	c. The geographic boundaries of the reference region that do not overlap with the project areas and the project area must represent similarity of at least 80% in terms of the following physical variables: precipitation, temperature, vegetation strata, soils, slopes, access roads.	**Comply. Analysis of Similarity:** To determine the percentage of similarity between the reference region and the project areas, the Similarity Search tool was used. This spatial tool identifies which entities are more or less similar to one or more entities based on their attributes. The geographic information comes from official data-generating organizations, mainly IDEAM and IGAC, for the required physical variables according to the methodology. From the reference region, the project areas are extracted, and physical variables are determined for both the reference region (excluding the project areas) and the project areas. After processing the data, they are entered into the Similarity Search tool, which compares the variables in the reference region with those in the project areas. The results, shown in table 23.1, indicate that 92.5% of the physical conditions in the reference region are coherent and similar to the project areas. This confirms that the project areas are optimally aligned with the characteristics of the reference region.

<table>
<tr><th>Methodology</th><th>Criterion</th><th>Description Compliance</th></tr>
<tr><td></td><td></td><td>Tabla 23.1. Summary Similarity Physics Variables
<table><tr><th>Physical variables</th><th>Percentage Similarity</th></tr><tr><td>Vegetation strata</td><td>98,14 %</td></tr><tr><td>Soils</td><td>84,0 %</td></tr><tr><td>Slope</td><td>100,0 %</td></tr><tr><td>Temperature</td><td>86,6 %</td></tr><tr><td>Precipitation</td><td>86,6 %</td></tr><tr><td>Roads</td><td>100,0 %</td></tr><tr><td>Total</td><td>92,5 %</td></tr></table>Source: Cataruben Foundation.

The corresponding information is described in Technical Annex 1.1.2.5. "Similarity Analysis," where the document and the database are stored. Additionally, a package for ArcGIS Pro is attached, containing the geographic information used.</td></tr>
<tr><td></td><td>d. Socioeconomic and land use conditions, as well as applicable legislation and policies related to land use, must be similar to the project areas and must be consistent with the reference region.</td><td>Comply. The project areas are located within the reference region and fall within the departments of Meta and Vichada, which share a similar socioeconomic and land-use context. See section 2.3.2.1, Territorial Context, 2.3.2.2, Social Context 2.3.2.4, Historic Context 2.3.2.1, Territorial Context and 5.4 Land Tenure. They also exhibit comparable physical environmental conditions and private land tenure, and do not include special management areas see literals c, e, and h of this table.</td></tr>
<tr><td></td><td>e. The existing differences between the forms of land tenure or legal status between the project area and the reference region should not affect the causes and agents of deforestation and degradation or</td><td>The reference region only includes areas of private property, which is the same form of tenure as the project area.

It explicitly excludes collectively-owned areas, such as Indigenous Reserves, Community Councils of Black Communities, and Peasant Reserves, as well as special management areas, including zones</td></tr>
</table>

Methodology	Criterion	Description Compliance
	the trends of deforestation and degradation;	registered in RUNAP or Ramsar sites. Detailed information on this delineation is available in the REDD+ geodatabase within the "Restricted Access" Features Dataset. The cartographic information is found in the following route 1.Emisiones/1.1.Gdb/1.1.2. REDD+/Feature dataset. Additionally, the land tenure feature dataset should be consulted where the informality of the land related to the municipal resource informality index obtained from SIPRA is displayed.
	f. The agents and determinants of deforestation/degradation, identified in the reference region, can access the project area.	**Comply.** The reference region and the project areas are located within the same WWF ecoregion "sabanas de los Llanos" and share the same biome (ORINOQUÍA). Both areas comprise exclusively private properties. In addition, specific criteria were applied to define the non-accessible forest, following the IDEAM guidelines in Annex 1 of the NREF.[19] These criteria consider slopes greater than 15° and accessibility, determined by the distance to land roads, with a buffer of 15 km from the roads according to the official IGAC cartography at a scale of 1:100,000. The cartographic information is found in the following route 1.Emisiones/1.1.Gdb/1.1.2. REDD+/Feature datase Orinoquia Biome.shp, Sabanas Ecoregion.shp. To visualize compliance, simply visualize the Orinoquia biome, the ecoregion savannas and the reference region located in the Reference feature dataset. While the non-accessible forest.shp is located in the Restricted Access Feature class.
	g. The project area is of interest to the agents identified in the previous criterion.	**Comply.** The land tenure conditions are similar in the reference region as in the project areas, this provides ease for identified agents to carry out deforestation/degradation actions in the forest. In addition, the soil, climate, and land cover conditions are similar throughout the territory. It should be noted that mobility and the road network

[19] https://redd.unfccc.int/files/31122019_anexo_circunstancias_nref_nal_v7.pdf

Methodology	Criterion	Description Compliance
		are a favorable condition for entering the project areas. The cartographic information is found in the following route 1.Emisiones/1.1.Gdb/1.1.2. REDD+/Feature dataset Biophysical Environment, where the corresponding shapefiles are found with the access routes to the territory, edaphoclimatic conditions, land cover.
	h. the reference region should not include special management areas nor areas contained within the geographic boundaries of other GHG projects;	**Comply.** In the reference region, the exclusion of all special management areas is carried out. Geographic information is stored in the geodatabase respectively, Feature Dataset RReferencia y and restricted access.
	i.the reference region must exclude restricted access areas to the agents and drivers of deforestation and degradation	**Comply.** Areas in which agents have restricted access are excluded, according to the criteria of slope and proximity to the roads. (Criteria used by IDEAM to define non-accessible forest within Annex 1 of the NREF: adjustment for national conditions[20]). Additionally, RUNAP conservation areas and Collective territories (Legalized Indigenous Reservations, Black Communities, Peasant Reserve Zones) and Ramsar Bita are excluded. The cartographic information is found in the following route 1.Emisiones/1.1.Gdb/1.1.2. REDD+/Feature dataset Restricted access, where the vector information of the collective territories and natural spaces is found.
	j. The reference region must include the leakage area.	**Comply.** The reference region includes leakage areas. Geographic information is stored in the geodatabase respective Feature Dataset Area leakage, while the information of the reference region is found in Featurea Dataset RReference. See figure 20.
BCR0005	a. The reference region and the project area are part of the same ecoregion	**Comply.** The reference region and the project areas are located in the Orinoquia biome and the ecoregion (PLAINS savannas) according to the

[20] https://redd.unfccc.int/files/31122019_anexo_circunstancias_nref_nal_v7.pdf

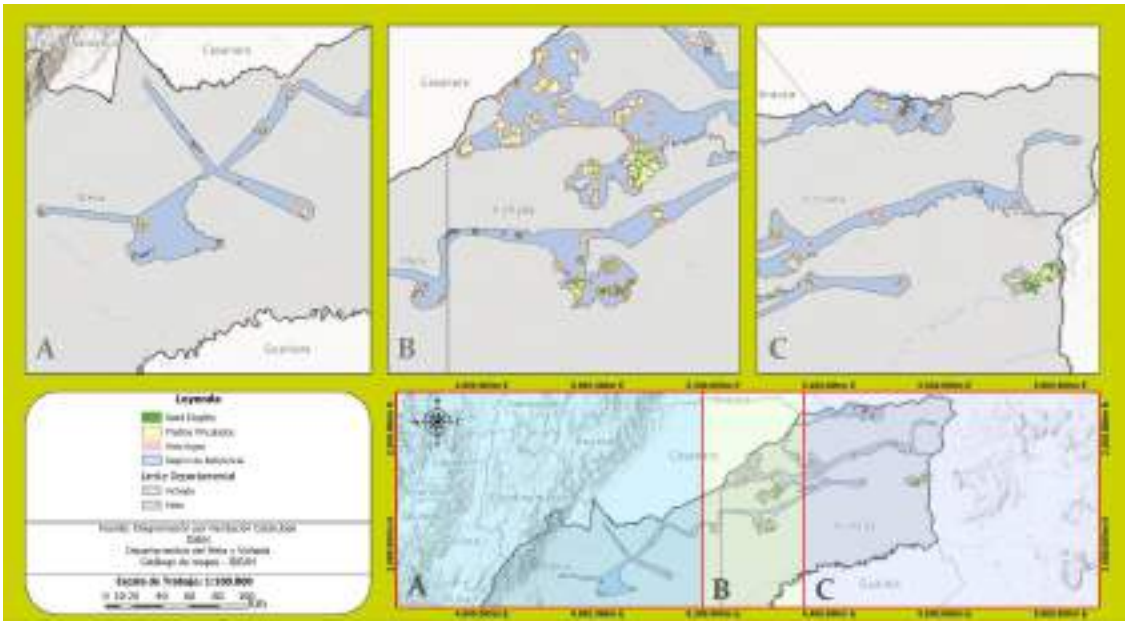
Methodology	Criterion	Description Compliance
		WWF ecoregion map. Complying with the geographical coherence requested by the criterion. The cartographic information is found in the following route 1.Emissions/1.1.Gdb/1.1.1. sabanas/Feature datase Biome Ecoregion, Where you will find Ecoregion sabanas.shp, Biome Orinoquia.shp and World Grassland Types.shp. To visualize compliance, it is enough to visualize the Orinoquia biome, the savannas ecoregion and the reference region located in the Reference feature database.
	b. The drivers that generate changes in land use, identified in the reference region, can access the project area	**Comply.** Given that the project areas, like the reference region, include private property owners with similar interests in generating subsistence economic resources within regulated markets. 1.Emissions/1.1.Gdb/1.1.1. sabanas/Feature datase Drivers of change. Vector information corresponding to the aptitudes of the soil, as well as the access routes to the territory.
	c. The project area is of interest to the agents identified in literal b, above;	**Comply.** Land tenure conditions are similar in the reference region as in the project areas, that is, private tenures. 1.Emissions/1.1.Gdb/1.1.1. sabanas/Feature datase Biophysical Environment.
	d. The figures of land tenure and land use rights in the reference region are similar to the project areas.	**Comply.** Land tenure conditions are similar in the region, it only includes areas of private properties, whose land tenure is similar to that of the project areas. (Ownership, Possession, Tenure). Collective properties are excluded. The cartographic information is found in the following route 1.Emissions/1.1.Gdb/1.1.1. savannasFeature dataset land tenure where the informality of the land is visualized related to the municipal resource informality index obtained from SIPRA.

Source: Cataruben Foundation.

From the assurance of compliance with the criteria for delimitation, the reference region was determined for each of the components (Figure 20). The cartographic information is found in the

Feature Dataset “Reference” located in the Geodatabase Orinoco2_Sabana and Orinoco2_REDD+ annexed to this document.

Figure 20. Reference region for baseline estimation.



Source: Cataruben Foundation.

The purpose of Figure 20 is to demonstrate that the BRC0002 project areas (eligible area and leakage area) are fully included within the reference region.

The triptych of maps (A, B, and C) provides a detailed visualization of different sections of the reference region, using a more appropriate scale for easier interpretation.

All corresponding geographic information is stored in the REDD+ geodatabase, specifically in the Feature Dataset "Project Area," "Leakage Area," and "Reference Region," with vector data identified under the same names.

3.2.1.3. Leakage Area

The project areas are located within the limits of each private property, therefore it would not be expected that these actions move emissions outside their limits, given that the main agent is the owners with their decisions and management. However, a leakage area was established that was determined in accordance with the criteria established by the BCR 0002 and BCR 0005 methodologies, as follows:

For BCR0002 methodology

- (a) all areas in the forest that are a range of mobility of the agents identified
- (b) the leakage area is geographically distinct from the project area, with no overlap;
- (c) the leakage area excludes areas of restricted access to deforestation and forest degradation agents
- (d) whether the leakage area overlaps with other GHG project areas, the impact of project activities on deforestation drivers and measures to manage them should be analyzed.

For BCR0005 methodology

Areas corresponding to the categories of herbaceous and shrublands, in the savanna biome, to which activities that generate land use changes may be displaced to, beyond the project holder's control. That is, the areas to which the agents that generate land-use change may be displaced as a consequence of project activities.

The leakage was delimited on the basis of the following criteria:

- a) all areas of herbaceous and shrubland that are within the mobility range of the agents identified
- b) exclude areas of restricted access to agents that generate changes in land use.

In order to establish the limits of the leakage areas for both activities (BCR0002 and BCR0005 Activities), a spatial proximity analysis was carried out, commonly known as close neighbors, which allows determining the distribution of deforestation and the transformation of coverage in the territory.

The inputs used to determine the mobility of agents for BCR0002 included data from Global Forest Watch Deforestation (2005–2017), socioeconomic and demographic context, and a spatial similarity analysis (land use capability, land use potential, land cover, land use, soil use, temperature, precipitation, climate classification, relief, strategic ecosystems, hydrology, and access roads).

For BCR0005, the mobility of agents was determined based on economic and social factors such as the land market, agricultural frontier expansion, the presence of agro-industrial companies, family farming, livestock farming, and proximity to populated centers. Physical factors were also considered, including land use potential, land use, access roads, slope, and the transformation of natural vegetation covers in the project baseline using Corine Land Cover.

The leakage area for both activities (BCR0005 and BCR0002) was defined by evaluating different distance ranges (buffers from the property boundary) using a spatial proximity analysis (nearest neighbors), complemented by the Tukey statistical test (1.1.5 Leakage Analysis). This analysis included multiple distances: 400, 500, 1000, 1200, and 1500 meters, to determine if there were

significant differences in the mobility of transformation agents between savannas and forests. The results of the Tukey test indicated no significant differences among the evaluated distance ranges. Meanwhile, the spatial analysis conducted with the Average Nearest Neighbor tool in ArcGIS Pro provided crucial complementary information. This tool assessed the spatial distribution of agents and determined the type of pattern—random, clustered, or dispersed—based on distances between them.

The analysis using the Average Nearest Neighbor tool indicated that the spatial distribution of agents follows a dispersed pattern. The average distance between neighbors is approximately 1000 meters. This suggests that, despite the general dispersion, there is a typical or average distance of 1000 meters that captures relevant spatial interactions between transformation agents 1.1.5. Leak Analysis.

As a result of this evaluation, a buffer area or belt of 1000 meters from the boundary of each property has been established. This ensures that the leakage areas are geographically distinct from the project areas and that no overlap exists. Furthermore, exclusions have been made within the leakage area, removing restricted-access zones and those with different land tenure regimes. Since the agents are private landowners, areas belonging to collective communities and special management zones, such as those registered in the RUNAP, have also been excluded.

The monitored areas are clearly defined and are exclusively limited to forest or natural savanna areas that were previously identified.

The spatial proximity analysis determined that the leakage area corresponds to *86,0 %* in compared to the REDD + project areas, while for Savanna they correspond to 88,0 *% compared to Elegible Savannas areas*. The cartographic information for each component is found in its respective Geodatabase\Area leakage.

Monitoring will be carried out for the Forests and natural savannas areas through Digital Processing of Satellite Images — PDI periodically with annual reports on coverage changes. For Forest, monitoring will be carried out through the non-forest forest map generated by the SMB&C. In addition to relying on supervised classifications using the Google Earth Engine process engine, where forest samples will be taken that will be used to represent the spectral signature of the forest and represent a map of it. To calculate the precision and uncertainty of the classifications, the AcaTAmA Plugin will be used.

While for monitoring the savannas will be carried out through the Visual interpretation method, also called PIAO using the satellite images with the best spatial resolution available for free, (Twin Sentinel 2A, Sentinel 2B, spatial resolution 10 m×10 m). In areas that are difficult to identify, high resolution images were used as long as they are available from the Maxar constellation. To

calculate the precision and uncertainty of the model, used the method of cross matrix or cross validation what daring a result of 93.6% reliability in the data.

3.2.2. Carbon reservoirs and GHG sources

Emission sources and associated GHGs were selected taking into account the guidelines of the BCR 0002 V4.0 (section 8) and BCR0005 V1.0 (section 7.2) methodologies, and the internal procedure *FC-GOP-23 Inventory design procedure for monitoring biomass growth, section 7.1.* Therefore, based on the characteristics of the project areas and activities, in the **Tables 24 and 25**, the identified GHG reservoirs and sources are described. For its part, in the section 3.7.3 The procedures to determine the GHG baseline are detailed in accordance with the identified FSRs.

Table 24. Reservoirs and sources component Forests.

Type	Source or Reservoir	GEI	Including (YES/NO/ Optional)	Justification
Reservoir	Above ground biomass	CO_2	YES	The change in the carbon content in this deposit is significant according to the IPCC and is highly affected by the loss of natural cover, change in land use and increase in temperature (FAO. 2017, Kauffman et al. 2016). . In addition, The loss of forest cover and release of CO2 can have a considerable impact on the global C balance (Brown et al., 1996). In this way, it is considered a relevant reservoir for the quantification of emissions in the baseline scenario and monitoring of the project.
Reservoir	belowground biomass	CO_2	YES	The change in carbon content in this deposit is significant according to the IPCC and can be significantly affected by changes in land use (Kauffman et al. 2016). In addition, there is official information applicable to the project.
Reservoir	Dead wood and leaf litter	CO_2	YES	The carbon content is expected to decrease in the baseline scenario. However, according to the availability of official data applicable to the project, only the dead wood reservoir is considered for estimating emissions.
Reservoir	Soil Organic Carbon	CO_2	YES	The change in the carbon content in this deposit is significant according to the IPCC, being susceptible to considerable carbon losses in the baseline scenario. Therefore, its inclusion

				in REDD+ projects is recommended (Yepes et. al, 2011). In addition, there is official information applicable to the project.
Source	Combustion of woody biomass	CO_2	NO	According to the BCR 0002 V3.1 methodology, CO emissions due to the combustion of woody biomass are not quantified.
		CH_4	YES	In the event of fire events in the tree component (combustion of woody biomass) during the monitoring period, the affected area will be identified and the CH emissions will be quantified.
		N_2O	YES	In the event of fire events in the tree component (combustion of woody biomass) during the monitoring period, the affected area will be identified and the CH emissions will be quantified.

Table 25. Reservoirs and sources component savannas

Type	Source or Reservoir	GEI	Including (YES/NO/ Optional)	Justification
Reservoir	Above ground biomass	CO_2	YES	The change in carbon content in this deposit is significant according to the IPCC and is highly affected by the loss of natural cover, change in land use and increase in temperature (Bond-Lamberty et al., 2018, FAO . 2017, Kauffman et al. Therefore, it is considered relevant for the quantification of GHG emissions in the scenario with and without the project.
Reservoir	belowground biomass	CO_2	YES	The change in carbon content in this deposit is significant according to the IPCC.
Reservoir	Soil Organic Carbon	CO_2	YES	It is considered, as it is one of the main carbon reservoirs in savanna ecosystems, and it can also be highly affected by the loss of natural cover, change in land use and increase in temperature (Bond-Lamberty et al., FAO. 2017 , Kauffman et al.

Reservoir	Necromass and Leaf Litter	CO_2	NO	Conservatively excluded. Although the carbon contents in this reservoir may decrease in the baseline scenario, there is no availability of official local or regional data applicable to the project.
Source	Combustion of woody biomass	CO_2	NO	According to the BCR 0002 V4.0 methodology, CO emissions due to the combustion of woody biomass are not quantified.
		CH_4	YES	In the event of fire events in the tree component (combustion of woody biomass) during the monitoring period, the affected area will be identified and the CH emissions will be quantified. Not considered in savanna burning[21].
		N_2O	YES	In the event of fire events in the tree component (combustion of woody biomass) during the monitoring period, the affected area will be identified and the CH emissions will be quantified.

Source: Cataruben Foundation

3.2.3. Time limits and analysis periods

Project deadlines correspond to the periods during which GHG emissions reductions are quantified. Quantification periods are defined in section 11.5 of the BCR Standard V3.4

In this sense, the time limits and analysis periods of the project are defined in accordance with the criteria established for REDD+ projects and AFOLU Sector projects described in section 11.5 of the BCR V3.4 Standard. So:

A. Historical period of deforestation: Period used to determine deforestation in the reference region and leakage area (see section 3.7.3.1.1) .

B. Historical period of changes in land use: Period used to determine land use change in natural savannas (See section 3.7.3.1.3)

[21] Non-woody aboveground biomass is generally burned or decomposed within the same year of its production and is therefore considered in equilibrium with CO2 uptake, plant respiration and annual decomposition. IPCC, *Grasslands*, in *Guidelines for Greenhouse Gas Inventories*. 2006, IPCC. p. 1-49.

C. **Project start date:** Date on which the intention of landowners to reduce deforestation, forest degradation and land use change in natural savannas began. As well as the beginning of the structuring of landowner implementation plans focused on reducing the risk of forest fires and conserving natural ecosystems (see section 3.2.3.1)

D. **Duration of the GHG project:** It corresponds to the number of years that the project activities will be maintained, from its start date. 40 years are established, thus complying with the criteria established for REDD+ projects and AFOLU Sector projects described in section 11.5 of the BCR V3.4 Standard

E. **Quantification periods:** Renewable quantification periods are established with a maximum duration of 10 years from the start date of the project.

F. **Monitoring Periods:** They are monitoring periods planned during the execution of the project within the quantification period. As a result of the monitoring, monitoring reports are prepared in each monitored period. An initial monitoring period of 4.25 years is established and subsequently every 2 years.(see section 17)

G. **Validation and/o verifications:** Established periods for carrying out validation and verification and subsequent validations and verifications. The project is validated in 2024, simultaneously the monitoring period is verified from the start date of the project until December 31, 2022. Followed by a verification in 2025 of the 2023-2024 monitoring period, and thereafter every two years.

3.2.3.1. Project Start Date

The project has a start date of October 1, 2018, where group activities begin to generate emissions reductions in the project areas. As detailed in the letters of intent sent by project participants during 2018. (2.1. PROPERTY DOCUMENTS).

The project areas correspond to the qualified areas within private properties, where the owner is the primary agent of the transformation and the main agent of conservation and protection of the forests against forest fires. Consequently, the intention to preserve and incorporate part of a mitigation project is an essential step to generate the intended change by the project. This intention, along with the construction of property implementation plans (See Property Implementation Plans) and with the practical actions that begin after this letter of intent mark the beginning of the execution of the project.

3.2.3.2. quantification period of GHG emissions reduction/removal

As stipulated in Section 11.5 of the BCR Standard, given that the project encompasses REDD+ actions and activities explicitly designed to mitigate land use change in natural savannas, a

quantification period of 9.25 years is established from the project's start date. This period will be subject to renewal to align with the overall duration of the GHG project.

3.2.3.3. Monitoring periods

In accordance with the monitoring plan, project emissions will be monitored annually in order to request the issuance of verified carbon certificates (CCV).

3.3. Identification of the Baseline Scenario and Additionality

The analysis is carried out in accordance with the criteria established in the numerals 10 of the BCR 0002 methodology and 8 of the BCR 0002 methodology. Complying with what is indicated in the baseline and additionality tool V.1.3[22]

3.3.1. Step 0. Preliminary screening based on the starting date of the project activities

3.3.1.1. Evidence that the starting date

The project has a start date of October 1, 2018, where group activities begin to generate emissions reductions in the project areas. As detailed in the letters of intent sent by project participants during 2018. (2.1. PROPERTY DOCUMENTS).

The project areas correspond to the qualified areas within private properties, where the owner is the primary agent of the transformation and the main agent of conservation and protection of the forests against forest fires. Consequently, the intention to preserve and incorporate part of a mitigation project is an essential step to generate the intended change by the project. This intention, along with the construction of property implementation plans (See Property Implementation Plans) and with the practical actions that begin after this letter of intent mark the beginning of the execution of the project.

3.3.1.2. Impact of the sale of the CCVs

The project, with the certification and registration process, reduces the impact of the barriers identified for the implementations of activities.

The project manages GHG reductions by avoiding deforestation and degradation of forest areas and the transformation of savannas, efforts that translate into verified carbon certificates (CCV), its commercialization becomes a valuable source of investment resources that promote the implementation of project activities, essential to address the practices and factors that pose a threat to the forests and savannas of the region.

[22] https://biocarbonregistry.com/tools/additionality.pdf

To make possible the delivery of economic benefits to owners that make possible the non-transformation of the ecosystems and their conservation in the project area, we initially start with a financial analysis, taking into account the project monitoring period (investment initial requirement of the project) and the period of quantification of GHG reductions (action window). Thus achieving a financial projection from the year 2018 to the year 2027 with respect to the verification and certification processes and from 2023 to 2027 period The project receives income from the sale of carbon certificates. This analysis is carried out through the financial model tool, in which macroeconomic projections, investment items, costs and expenses are detailed, as well as the CCV inventory is projected according to the quantification analysis and therefore the income they generate. Therefore, which then determines results through financial indicators, such as the income statement and cash flow, which represent the economic performance of the project during its life cycle, evidencing positive financial behavior for the participants of the financing project. Thus the ecosystem conservation activities, as well as for the sustainability of the project, with a positive net financial projection. That is, once the total expenses have been projected with respect to the total income during the execution period. It can then be concluded that there is sufficient liquidity and solvency to provide continuity and sustainability to the development of this project.

The above is supported by the estimated financial model for the project, based on the investment period and future monitoring of the project, especially in the financial indicators tabs. (ANNEX 5.1. Financial Model)

Finally, the project establishes guidelines regarding carbon rights and ownership through a contractual relationship with the owners. In order to regulate the obligations and distribution of economic benefits generated by the project. In this sense, 70% of the resources are granted to the owners of the properties for the implementation of conservation and climate change mitigation activities. And 30% is administered by the Cataruben Foundation to direct, execute and manage the project in aspects technical, financial, scientific, commercial, administrative, operational and monitoring and reporting processes during the accreditation period.

In summary, the benefits derived from the project associated with the reduction of GHG emissions translate into direct economic income for the project participants, which ensure the continuity of the actions that achieve the reduction of deforestation.

3.3.2. Step 1. Identification of land use alternatives

Land use alternatives are identified based on an analysis of potential activities and how these are consistent with related regulations and legislation. Taking into account the conditions of the project area and the reference region,relevant national and/or regional policies and circumstances, such as historical land uses, practices and economic trends. The following activities and scenarios were identified.

Table 26. *Step 1a. Identify credible alternative land use scenarios to the proposed project activities*

Scenario	BCR0002 Activities	BCR0002 Activities
Continuation of the pre-project land use scenario	This alternative corresponds to the scenario of deforestation, forest degradation. This is because the owners seek natural resources for subsistence, the satisfaction of their basic needs. This alternative establishes that the scenario within the project areas corresponds to the trends that occur in the reference region (which includes the project areas), regarding the increase in deforestation and forest degradation	This alternative corresponds to the scenario of transformation of the natural savannas. Although a portion of these natural areas remain conserved, this scenario is credible and probable for the areas. This is because the owners seek natural savanna land for subsistence, and also seek to maximize their financial profits per hectare of land by carrying out economic activities, generally agriculture. This alternative establishes that the scenario within the project areas corresponds to the trends that occur in the reference region (which includes the project areas), regarding the expansion of the agricultural frontier and transformation of natural savannas. Within this type of alternative, the most probable ones according to the analysis of causes and agents in the reference region correspond to: - Corn crops - Rice Crops - Clean Pasture Crops
Reduction of deforestation and forest degradation within the project boundary carried out without being registered as a BCR project activity.	This alternative highlights the active and voluntary participation of the property owners in the control of activities that cause deforestation, and forest degradation present on their properties.	N/A

	Through environmental awareness and a vision of sustainable development, property owners take specific measures to prevent the expansion of the agricultural frontier, prevent forest fires and reduce the extraction of wood.	
Reduction change land use in the Natural Savana within the project boundary, performed without being registered as the BCR project activity	N/A	This alternative highlights the active and voluntary participation of the property owners in activities that reduce the transformation of the natural savannas present on their properties. The establishment of new agricultural systems that do not damage the natural cover of savannas.

The outcome of the List of credible alternative land use scenarios that would have occurred on the land within the project activity boundary of the BCR0002 is.

- Continuation of the pre-project land use scenario
- Reduction of deforestation and forest degradation within the project boundary carried out without being registered as a BCR project activity.

And the outcome of the List of credible alternative land use scenarios that would have occurred on the land within the project activity boundary of the BCR0005 is:

- Continuation of the pre-project land use scenario
- Reduction change land use in the Natural Savana within the project boundary, performed without being registered as the BCR project activity

The following table shows an analysis of the consistency of the alternatives with the relevant regulations.

Table 27 *Step 1.b Consistency of credible alternative land use scenarios with enforced mandatory applicable laws and regulations*

Scenario	Actividades BCR0002	Actividades BCR0005
Continuation of the pre-project scenario In forest land	Regarding forest areas in the Colombian Orinoco, national legislation establishes clear restrictions on land use change, protecting these ecosystems due to their environmental importance. Law 99 of 1993, which created the Ministry of the Environment, establishes that natural forest areas must be preserved and that land use changes for agricultural, livestock, or infrastructure activities are prohibited, except in exceptional circumstances and with the express authorization of the competent environmental authorities. Decree 1791 of 1996, which regulates the use of forests in Colombia, reinforces this protection by stipulating that natural forests are subject to a sustainable management regime. This means that forested areas may only be intervened under a controlled use scheme and for specific purposes such as conservation, restoration, or sustainable use of forest products. In this context, land use changes in forest areas to convert them into agricultural or urban zones are explicitly prohibited without an approved forest management plan and the corresponding environmental license. In the case of REDD+ areas, although deforestation and forest degradation do not comply with current regulations, the population established in the project area and in the reference region develops them extensively and habitually, as evidenced in the analysis of causes and agents. Likewise, forest fires are commonly of natural or anthropogenic origin. This is called unplanned deforestation and degradation. As evidence that in Colombia there is this phenomenon of deforestation and unplanned degradation, the Government of Colombia, through the Ministry of Environment and Sustainable Development, presents to the country	

	"Forests Territories of Life" Integral Strategy to Control Deforestation and Forest Management, as a cross-sectoral policy instrument that involves the co-responsibility of the different sectors of the Colombian State, with the purpose of halting deforestation and forest degradation, addressing the complexity of the causes that generate it, based on the recognition of the strategic significance of these ecosystems for the country, for their socio-cultural, economic and environmental importance, for their potential as a development option in the framework of the peace building process, and for their contribution to the mitigation and adaptation to climate change. For all of the above, it is assumed that this scenario can be maintained over time and constitute a probable scenario	
Reduction of deforestation and forest degradation within the project boundary carried out without being registered as a BCR project activity.	Regarding forest areas in the Colombian Orinoco, national legislation establishes clear restrictions on land use change, protecting these ecosystems due to their environmental importance. Law 99 of 1993, which created the Ministry of the Environment, establishes that natural forest areas must be preserved and that land use changes for agricultural, livestock, or infrastructure activities are prohibited, except in exceptional circumstances and with the express authorization of the competent environmental authorities. Decree 1791 of 1996, which regulates the use of forests in Colombia, reinforces this protection by stipulating that natural forests are subject to a sustainable management regime. This means that forested areas may only be intervened under a controlled use scheme and for specific purposes such as conservation, restoration, or sustainable use of forest products. In this context, land use changes in forest areas to convert them into agricultural or urban zones are explicitly prohibited without an approved forest	

	management plan and the corresponding environmental license.	
Continuation of the pre-project scenario in savannas natural land		In savanna areas it is consistent and aligned with all laws, statutes, regulatory frameworks or policies. It represents a typical state of many lands in the high plains of the departments of Meta and Vichada prior to conversion to agricultural land use, where vegetation is conserved to some degree. The Orinoquia presents a favorable scenario for implementing sustainable agricultural programs, since the private land area is located mainly within the agricultural frontier, which makes the conversion of natural savanna viable. In addition, this historical conversion could be accelerated according to national policies that define the highlands as a Colombian agricultural pantry. First, Decree 2369 of 2010, which regulates Law 1152 of 2007 (Rural Development Statute), establishes that the National Government may plan and manage land use in agricultural frontier areas, which includes the Orinoco. This decree recognizes the need to promote agricultural production in underutilized or unexploited areas, as long as the principles of environmental sustainability are respected. In addition, the National Development Plan (Law 1955 of 2019) promotes the expansion of the agricultural frontier in a controlled manner in the Orinoco, encouraging agroindustrial activities under a framework of conservation and sustainable development. On the other hand, Resolution 128 of the Ministry of Agriculture and Rural Development defines the criteria for the expansion of the agricultural frontier, where the change of land use from non-forest areas to agricultural, livestock

		and commercial forestry activities is allowed, as long as natural reserve zones are not violated and special management areas are respected. This regulation confirms that land use change is permitted in certain areas of the Orinoco, but it must follow sustainability and conservation guidelines that limit deforestation and the impact on strategic ecosystems. These regulations show that, under current conditions, land use change is legally permitted in the Orinoco, which reinforces the additionality of mitigation projects that seek to conserve or restore areas susceptible to being transformed for agricultural activities. For all of the above, it is assumed that this scenario can be maintained over time and constitute a probable scenario
Reduction change land use in the Natural Savana within the project boundary, performed without being registered as the BCR project activity		In Colombia's Orinoco region, natural savannas are recognized as strategic ecosystems that must be managed under conservation and sustainable use principles. Law 99 of 1993, which establishes Colombia's environmental framework, mentions that savanna ecosystems must be managed in a way that guarantees their conservation and sustainable use. This implies that any intervention in these areas must be carefully planned and oriented towards the preservation of their biodiversity and ecosystem services, especially in relation to water regulation and carbon storage. Decree 2372 of 2010, which regulates areas for the protection and sustainable use of biodiversity in Colombia, establishes that savannas, although susceptible to intervention for productive activities, must be managed under management plans that ensure their long-term sustainability. This decree highlights the importance of

		integrating productive activities such as cattle ranching and agroforestry with practices that avoid soil degradation and biodiversity loss in the savannas. Thus, changes in land use are permitted in these areas, as long as sustainable management practices are applied that do not compromise the structure and function of the ecosystem. On the other hand, Law 1930 of 2018, which promotes the integral and sustainable management of strategic ecosystems, also includes guidelines for the use of natural savannas. This law highlights that the development of activities in these territories must be oriented towards conservation, ecological restoration and rational use of natural resources. Agricultural activities in the savannas must incorporate measures to reduce pressure on soils and maintain vegetation cover, promoting systems such as sylvopasture that balance production with ecosystem conservation. In summary, the regulations allow for the sustainable use of natural savannas, provided that management strategies are applied to ensure their conservation and the maintenance of their ecological functions. Finally, the areas within the project located in the Ramsar site of the Bita River are zoned for agricultural production or natural threats.

The outcome of the List of credible alternative land use scenarios that are in compliance with mandatory legislation and regulations taking into account their enforcement in the region or country for the BCR0002 is.

- Continuation of the pre-project land use scenario
- Reduction of deforestation and forest degradation within the project boundary carried out without being registered as a BCR project activity.

The outcome of the List of credible alternative land use scenarios that are in compliance with mandatory legislation and regulations taking into account their enforcement in the region or country for the BCR0005 is.

- Continuation of the pre-project land use scenario
- Reduction change land use in the Natural Savana within the project boundary, performed without being registered as the BCR project activity

3.3.3. *Step 2. Barrier analysis*

This step serves to identify barriers and to assess which of the land use scenarios identified in the sub-step 1b are not prevented by these barriers.

Table 28 Step 2a. Barrier analysis BCR0002

Scenario	Reduction of deforestation and forest degradation within the project boundary carried out without being registered as a BCR project activity.
Barrier	Investment barriers

Debt financing is not available

One of the main barriers to implementing climate change mitigation projects to reduce deforestation and forest degradation is the low access to Colombia's financial markets to obtain leverage, which represents few opportunities for their implementation. This is due to the fact that environmental sector projects behave differently than projects of the sector agricultural, manufacturing, livestock or of hydrocarbons. To support the above, it is necessary to evaluate the main means in the search for resources for climate change mitigation projects. These are of public or private origin and which, especially for GHG projects, suggest a critical role in their scope.

To this end, it is important to note that public entities do not represent stable, governable and direct financing for the implementation of GHG project activities. This is because of the institutional weakness partly caused by the deficit in the country's balance of payments. As evidenced by the reports on the behavior of Colombia's balance of payments published quarterly by the Banco de La República (Banco de la República de Colombia, 2021)[23]; and the lack of political will that is represented in the citizen's vision by the high index of institutional distrust, as stated in the methodology and protection of the Social Capital Barometer (BARCAS) in its fourth and last study carried out.[24], which shows that 79.6% of those surveyed have little or no confidence in the national government (CONTRIAL, 2017); However, the

[23] Bank of the Republic of Colombia. (2021, 09 01). *Report on the behavior of Colombia's balance of payments*. REPORT ON THE BEHAVIOR OF THE BALANCE OF PAYMENTS OF COLOMBIA. Retrieved 04 19, 2023, from https://www.banrep.gov.co/es/informe-comportamiento-balanza-pagos-colombia

[24] The Social Capital Barometer (Barcas) is a measurement that identifies where there is Social Capital and what its level is in Colombia.

Colombian government through the Ministry of Environment and Sustainable Development and the Ministry of Finance have implemented different programs and mechanisms, such as PSA (Payment for Environmental Services Program) to manage and encourage conservation and restoration actions of various strategic ecosystems, where the beneficiary can become a creditor of the resource directly or indirectly, in cash or in kind, however, this program does not guarantee the direction of these exclusive resources for the reduction of greenhouse gas emissions, the commercialization of carbon certificates and compensation for the carbon footprint of natural and legal persons; and such as the national carbon tax, which, although it responds to the need to "have economic instruments to encourage compliance with greenhouse gas (GHG) mitigation goals at the national level" (Ministry of the Environment and Sustainable Development, 2022)[25] , there only 30% of the resources obtained are allocated for conservation areas and strategies, of which 25% are for the management of coastal erosion where the project reference area is not included and the other 5% to strengthen the National System of Protected Areas, which does not ensure the availability and possibility of access to this financing for the properties of the linked Ecosystem Managers and does not determine tools that ensure and monitor the correct allocation of money and implementation of actions in cases concrete.

Likewise, financing strategies specifically for forestry activities "appropriate for sustainable forest management are not evident at the national level, because existing local resources cannot be applied to the management of native forests, due to a lack of mechanisms." of operation such as a bank or forestry fund", (United Nations Development Program & Viteri, 2010)[26], as reflected in the forestry sector analysis document in the context of adaptation and mitigation to change in the land use sector, soil change and forestry (forestry) in Ecuador, but which to a large extent reflects the Latin American context and It is not far from the national reality.

Therefore, under this perception there is a low management of resources, allies, and ecosystem managers. On the other hand, private funding sources mean having a strong financial and administrative muscle for both the organization implementing the project and the owners of the land that belongs to it. This compels potential implementers of greenhouse gas (GHG) REDD+ projects who fail to comply with the requirement for financial backing to refrain from engaging in environmentally beneficial actions. This forces the project implementer to sectorize the community, benefiting it for its economic capacity but not for the environmental impact that it mitigates. In addition, the conservation activities carried out by the owners of these properties to guarantee the reduction and/or removal of CO_2 emissions and protection of the biodiversity they host, does not allow them to have a cash flow, so it does not represent a future profit and therefore a profitability with which they can economically sustain their properties only for the implementation of these actions, since it does not represent an income but an outflow of money, i.e.,

[25] Ministry of Environment and Sustainable Development (Ed.). (2022). *ABC DECREE 926 OF 2017* [National Carbon Tax and Non-Casual Carbon Neutrality Tax Treatment FAQ]. Frequently asked questions about the national carbon tax and non-causation tax treatment for carbon neutrality. Retrieved 06 09, 2023, from https://www.minambiente.gov.co/wp-content/uploads/2022/01/ABC_DECRETO_926_de_2017.pdf

[26] United Nations Development Program & Viteri, A. (2010, August). *ANALYSIS DOCUMENT OF THE FOREST SECTOR IN THE CONTEXT OF ADAPTATION AND MITIGATION TO CLIMATE CHANGE OF THE LAND USE, LAND CHANGE, AND FORESTRY (FORESTRY) SECTOR IN ECUADOR.* 05_ecuador_nip_forestry_mitigation-libre.pdf. Retrieved 2022, from https://d1wqtxts1xzle7.cloudfront.net/30236413/05_ecuador_nip_forestry_mitigation-libre.pdf?1390881517=&response-content-disposition=inline%3B+filename%3DSECTOR_FORESTAL_EN_EL_CONTEXTO_DE_ADAPT.pdf&Expires=1686360152&Signature=CuXdabS9eN0NgF2QaAvrUWHYEAuon

there is no internal rate of return, which reduces the possibility of financial leverage with an external party. Due to the above, the alternative is left open to implement other types of activities other than those of GHG projects that represent profitability in search of finding governance in their finances.

Lack of access to credit

Even though in Colombia there are special lines of credit with interest rate subsidies demanded by the government and aimed at agricultural sustainability and green businesses, their financing does not frame the fulfillment of GHG project activities such as REDD+, nor does it frame the characteristics of all the linked properties that do not exercise productive activities in parallel to preservation, so that the protection of biodiversity in these ecosystems does not prevail over productivity indicators and economic profitability forecasts. In addition, because financial entities seek to reduce the risk of their financial capital, they do not support applications that do not demonstrate sufficient solidity to respond to the medium and long-term collection obligation, even when there are subsidiary rates, thus avoiding a sinister portfolio. Therefore, they seek figures to support the loan, such as co-debtor, credit history, gross equity, cash flow, financial projections based on modeling, documents of title, among others, which in most cases are not available to the owner of the property.

On the other hand, the increase in usury percentages in Colombia has had an increase of up to 58.8% in the microcredit interest rate for the first quarter of 2023, with respect to the Current Banking interest stipulated by the Financial Superintendence in the resolution. 1968 of 2022 multiplied by 1.5, reducing the ranges of financial sustainability for the borrower in the short term; Likewise, ignorance of a correct financial evaluation can lead to poor debt decisions and therefore not provide sustainability to the owners who wish to finance their conservation activities.

It is evident that there is discrimination in accessing credit due to the systemic barriers present within the banking system. Furthermore, the time, conditions, and behavior of the projects in terms of operability and guarantee in the permanence of the areas subject to conservation impede the implementation of the conservation activities from an economic standpoint. This is despite the fact that this requires a significant increase in income to ensure the conservation of the ecosystems and biodiversity that reside there. Additionally, banking represents a high index of institutional distrust among Colombians, with a percentage of 69.6% according to the latest BARCAS report. (CONTRIAL, 2017). This indicates that citizens are unable to access these financial products and services due to a general negative perception of this type of supply.

Barrier	**Institutional barriers**

Lack of enforcement of land-use-related legislation

Although deforestation and forest degradation are not allowed in the region, according to the analysis of changes in land use, in the period 2009-2018, 271,184.5 hectares of forest have been lost in the

department of Meta and 48,191.2 hectares in the department of Vichada. See section 2.3.5. Direct and Indirect impact.

This shows that even if regulations exist, the event of deforestation and forest degradation occurs and cannot be controlled by state institutions.

As evidence that in Colombia there is this phenomenon of deforestation and unplanned degradation, the Government of Colombia, through the Ministry of Environment and Sustainable Development, presents to the country "Forests Territories of Life" Integral Strategy to Control Deforestation and Forest Management, as a cross-sectoral policy instrument that involves the co-responsibility of the different sectors of the Colombian State, with the purpose of halting deforestation and forest degradation, addressing the complexity of the causes that generate it, based on the recognition of the strategic significance of these ecosystems for the country, for their socio-cultural, economic and environmental importance, for their potential as a development option in the framework of the peace building process, and for their contribution to the mitigation and adaptation to climate change.

Barrier	**Barriers due to local ecological conditions**

Catastrophic natural and / or human-induced events

Due to natural conditions in the highlands of the Orinoquia, forest fires are a major barrier to maintaining intact forest areas.[27]

To corroborate the risk, the Monitoring of hot spots was carried out through the "System for monitoring heat spots on the surface detected by satellite-IDEAM" for the period 2016–2018.

Barrier	**Barriers due to social conditions**

Widespread illegal practices (illegal grazing, and logging)

Although deforestation and forest degradation are not allowed in the region, according to the analysis of changes in land use, in the period 2009-2018, 271,184.5 hectares of forest have been lost in the department of Meta and 48,191.2 hectares in the department of Vichada. See section 2.3.5. Direct and Indirect impact.

Likewise, the transformation of natural savannas to anthropic uses in the department of Meta amounts to 425,314.1 hectares and 346,200.2 hectares in the department of Vichada. See section 2.3.5. Direct and Indirect impact

Lack of organization of local communities

The Orinoquía region is characterized by being a heterogeneous territory both in its geography and in its cultural wealth. And taking this into account, the communities present in the area of influence of the

[27] Fire threatens the diversity and structure of tropical gallery forests. https://doi.org/10.1002/ecs2.3347

project, that is, the departments of Vichada and Meta, combine the presence of indigenous population or communities, Afro-descendants and Creole llaneros or native llaneros (Piñeros, 2019)[28]. The latter represent the target population for the projects as they are, and this is so, because they imply a private acquisition of land legitimized by the documentation they possess.

According to the organization of these families, groups of families (mostly settlers) or companies that can demonstrate rights over certain territories, organizational strategies in the territory promoted by the national government are highlighted. The first to take into account is CONPES 3797: Policy for the comprehensive development of the Orinoquía: Altillanura - Phase I (2014) which resulted within the provisions of the National Development Plan 2010-2014: Prosperity for all. Document that focused on an analysis of the Orinoco highlands, addressing its social, cultural, geographical and economic aspects. The data obtained from this analysis raised alarm bells due to the evident mismanagement of the public sector, which meant indifference regarding the administration of public and natural resources, the environmental fragility of the territory and social stability. Aspects, which, of course, are closely linked to the direct sustainability and growth of the region's productive practices. Among the primary objectives of this CONPES was to create the economic and social conditions to enable egalitarian and inclusive development, which would level the balance in order to achieve sustainable development.

However, CONPES is not the only tool identified that would aim at the organization of the territory and its inhabitants. Additionally, a second strategy is the Orinoquia Master Plan between the years 2014 and 2018, which was supported by a strategy for the region called "Environment, agriculture and human development: Growth and well-being for the Llanos" of the PND 2014-2018[29]. This document was drafted using as the main input the information provided during the presentation of the regional dialogues that were intended to configure it.

Particularly, the aforementioned National Development Plan focused on four crucial aspects for the territory, among which were: sustainable productive development, water resources and environment, infrastructure and logistics, and territorial planning (PND, 2016)[30]. Thus trying to create a bridge between legal security and possible investments in the region, which includes tourism, transportation, agriculture, and of course, the environment and water resources.

Likewise, a third strategy occurred in 2017 when the "Comprehensive Regional Climate Change Plan for the Orinoquia" (PRICCO) was established.[31], developed in Arauca, Casanare and of course in Vichada and Meta. Document, which reinforced the urgency of achieving integration between climate change and the possible relationship that management processes and the development of the region have with environmental disasters. Similarly, a fourth is the PND 2018-2022 (National Development Plan), which established twenty goals within the framework of commitments called "pacts for the productivity and equity of the regions" among which can be counted precisely the "Llanos-Orinoquía Region Pact: Connect

[28] Piñeros, R. (2019). The other new llaneros: migration, race and gender in the oil palm labor market in the Colombian Orinoco. Culture and Work, (94), 93-103.
[29] National Development Plan 2014-2018National Planning Departmenthttps://colaboracion.dnp.gov.co › CDT › PND
[30] National Development Plan 2018-2022National Planning Departmenthttps://colaboracion.dnp.gov.co › CDT › Press
[31] The Orinoquia already has a Comprehensive Regional Plan for...Ministry of Environment and Sustainable Developmenthttps://archivo.minambiente.gov.co › index.php › 285...

and enhance the sustainable food supply of the region with the country and the world." Basically, the aforementioned document made evident the relationship of said pact with the pact of productivity, legality, equity for ethnic communities (in the field of opportunities), and of course, environmental, economic and social sustainability (DNP, 2019).

The most logical barrier detected is the lack of a precise and forceful implementation of the strategies and pacts previously summarized, either due to bureaucratic inefficiency or due to corruption itself. However, it is evident the influence they have had in highlighting in the collective imagination of their residents the concern for issues such as: climate change, the conservation of ecosystems, and the relationship between sustainable development and environmental care. That is, there is still a way to go.

Barrier	*Barriers relating to land tenure, ownership, inheritance, and property rights*

Lack of suitable land tenure evidence and documentation to support the security of tenure

In the Colombian Orinoco region, about 46% of the properties are presumed to be informal, which indicates that they meet at least one of the criteria established for their identification. At the departmental level, the department of Vichada is the one with the highest presumption of informality, being in the range of 50% to 75%, while the other three departments are in the range of 25% to 50%.[32]

Table 29 Step 2a. Barrier analysis BCR0005

Scenario	*Reduction change land use in the Natural Savana within the project boundary, performed without being registered as the BCR project activity*
Barrier	Investment barriers

There is no access to capital markets due to the real or perceived risks associated with direct domestic or foreign investment in the country where the project is to be implemented:

In human activity, there is a long list of environmental priorities that require large investments, ranging from the atmosphere (to reduce greenhouse gas emissions) to the local conservation of biological and genetic diversity.However, notwithstanding the above premise, there is a constraint in the execution of

[32] Resumen del diagnóstico de la distribución y tenencia de la tierra rural en la región de la ORINOQUIA https://upra.gov.co/Kit_Territorial/2-%20Informaci%C3%B3n%20por%20Departamentos/ARAUCA/Diagnostico%20distribucion%20tenencia%20tierra%20rural%20Orinoquia%20-%20ARAUCA.pdf

the project with respect to the accessibility of an investment capital market, both at the national and international levels. As an illustration, regarding the General Royalty System for the year 2021, only 8% of the country's resources have been allocated to the operation of the Ministry of Environment and Sustainable Development, while only 10% have been allocated to the Ministry of Agriculture and Rural Development (National Department of Planning, 2022).Consequently, the operational resources allocated to these sectoral ministries distribute revenues among their various government programs, which does not guarantee full access to this type of public investment. Regarding foreign direct investment in 2021, reports from the Bank of the Republic revealed a conspicuous absence of resource allocation for environmental concerns. (Banco de la República de Colombia, 2021). And the quarterly report on foreign direct investment in Colombia in total and by economic activity, (Banco de la República de Colombia, 1996). In the context of national or foreign direct investment, access to capital markets for these types of projects represents a significant level of uncertainty. The current uncertainty can be attributed to a number of factors, including the state of the country's economy, the level of security and political stability, the transformation of soils, and the extraction of raw materials that contribute to climate change.

Conversely, access to the capital market is driven by direct investments in sectors that are environmentally detrimental. These investments are largely made by national and international investors who inject significant financial capital into agricultural activities. The extraction of oil and its derivatives, among other unsustainable practices, is particularly prevalent in protected areas or on private properties with abundant natural resource exploitation, as seen in some instances related to this project. This presents a unique opportunity to open new capital markets and achieve a sustainable economic transition. The goal is to implement GHG projects through carbon credit financing and adapt the use of these ecosystems for sustainable productive and conservation activities within the framework of local economic development. (Vázquez Barquero & CEPAL, 2000)[33].

On the other hand, although today sustainable economic growth has accelerated in the world and with it different ways of allocating funds to investments with environmental benefits, such as thematic bond issues. Especially, green bonds refer to a debt of fixed income for projects that mitigate climate change. It is analyzed that, first, this refers to a debt that, even if it means lower rates, is still a debt that needs collection and that projects like this without participation in the European Union or the European Union carbon market do not It could cancel these portfolios because it does not foresee any other way to raise resources. Second, these types of bonds are not so common, "according to the BVC, Colombia has issued 20 bonds with specific allocation of resources between December 2016, when Bancolombia's first green bond came out (this entity was the second in the market with IFC), until May 2022, with a social bond from Bancóldex" (Capital Inteligente Grupo Bancolombia, 2022); fourth, it represents an underlying portfolio "especially green projects, due to the high specifications in technological matters, making them costly initiatives, which is why for many companies they become financially unviable, consequently, the great challenge is to see how governments leverage the financial part of these projects"; Fifth, since there are no government policies that exponentialize the lung that exists in Colombia, there are no investors

[33] Vázquez Barquero, A., & CEPAL. (2000). *Local economic development and decentralization: approach to a conceptual framework* [DECENTRALIZATION; ECONOMIC DEVELOPMENT ; REGIONAL DEVELOPMENT; REGIONAL ECONOMY; DEVELOPMENT POLICY]. https://repositorio.cepal.org/handle/11362/31392

who go to the capital market to buy issues like those mentioned; and sixth, the standards to define how to access are framed in international norms that become difficult to adapt into national legislation. Finally, the lack of access to capital markets associated with direct foreign and national investment can be analyzed due to ignorance of the existence or not of investment mechanisms interested in working with communities of private properties. These mechanisms aim at the implementation of activities of biodiversity preservation accompanied by the establishment of sustainable production practices, so the above could bias the possibility of accessing market diversification, which also indirectly determines a notable investment barrier.

Barrier	*Barriers related to local tradition*

Laws and customs, market conditions and practices

The Orinoquia region has been prioritized by recent governments and the private sector as the new frontier for agro industrial development1. In recent decades, exotic pastures, and other crops such as rice and soybeans have grown at an accelerated rate2-5. With the growing demand for food and agricultural products, this trend of land use change is expected to continue and intensify in the coming years.

Planning for agroindustrial expansion, while ensuring the maintenance of ecosystem services and biodiversity conservation, is an urgent task for the government, the private sector and the region's inhabitants. This requires understanding recent changes in land use, as well as possible future trajectories and their socio-environmental implications, to inform decision makers. However, public and open access information on agroindustrial expansion is very limited for this region of the country, especially for savanna ecosystems.

In order to understand these change processes, land cover/land use (LULC) maps were generated in 2014 and 2020 by training neural network models to predict land cover/land use from Landsat 8 satellite images, using the 2015 IDEAM land cover map as training data. During the 2014-2020 period, more than 545,000 ha of savannas were transformed to agricultural land cover.

Likewise, the transformation of natural savannas to anthropic uses in the period 2009-2018 in the department of Meta amounts to 425,314.1 hectares and 346,200.2 hectares in the department of Vichada. See section 2.3.5. Direct and Indirect impact

Barrier	*Barriers due to social conditions*

- Widespread illegal practices (e.g. illicit crops, extraction of non-timber products, felling of trees):

There are several illegal practices present in the country that can represent important barriers for this type of ecosystem conservation and restoration projects, but one of the most representative is illicit

crops. And Colombia, for more than 40 years, has held the sad honor of being one of the main coca leaf producers on the planet, this, according to data provided by the Illicit Crops Monitoring System (SIMCI, 2021).

In particular, the Orinoquia region, because it represents a border area and one of constant change in both ownership and land use, is a territory with a relative density of this type of crops. The departments of Meta, Meta, and Vichada are the most representative. Now, the obvious consequence of the implementation of these crops (coca and marijuana) results in direct consequences for natural ecosystems, such as deforestation. And in turn, it is closely related to poverty in rural areas, the armed conflict and little or no interest in the conservation of the animal and plant species of the territory.

Despite the above, in the eastern plains, and for several years now, a constant process of agroindustrial strengthening has been developed that has meant the gradual adoption of legal alternatives for agricultural production. This, as a response from the National Government, by providing options to families that depended economically on these crops. An example is the commitment to cocoa, introduced as a gateway to legality for the most remote farmers of the eastern plains.

According to data from the monitoring of territories affected by illicit crops (2020), carried out by the United Nations Office on Drugs and Crime (UNODC)[34]. Coca crops and their subsequent transition to cocaine have shown a progressive decrease in Orinoquía. Accordingly, in 2005, reported around 9,709 hectares of these crops, but already in 2020 the surprising sum of 121 hectares was cultivated. Thus showing a decrease of 99%, which means that since 2018 the territories included in the eastern plains contain less than 0.5% of the cocaine crops in the entire country.

Lack of organization of local communities

The Orinoquía region is characterized by being a heterogeneous territory both in its geography and in its cultural wealth. And taking this into account, the communities present in the area of influence of the project, that is, the departments of Vichada and Meta, combine the presence of indigenous population or communities, Afro-descendants and Creole llaneros or native llaneros (Piñeros, 2019)[35]. The latter represent the target population for the projects as they are, and this is so, because they imply a private acquisition of land legitimized by the documentation they possess.

According to the organization of these families, groups of families (mostly settlers) or companies that can demonstrate rights over certain territories, organizational strategies in the territory promoted by the national government are highlighted. The first to take into account is CONPES 3797: Policy for the comprehensive development of the Orinoquía: Altillanura - Phase I (2014) which resulted within the provisions of the National Development Plan 2010-2014: Prosperity for all. Document that focused on an analysis of the Orinoco highlands, addressing its social, cultural, geographical and economic aspects. The

[34] UNODC. (2020). *Colombia: Monitoring of territories affected by illicit crops 2020.* https://www.unodc.org/documents/crop-monitoring/Colombia/Colombia_Monitoreo_de_territorios_afectados_por_cultivos_ilicitos_2020.pdf

[35] Piñeros, R. (2019). The other new llaneros: migration, race and gender in the oil palm labor market in the Colombian Orinoco. Culture and Work, (94), 93-103.

data obtained from this analysis raised alarm bells due to the evident mismanagement of the public sector, which meant indifference regarding the administration of public and natural resources, the environmental fragility of the territory and social stability. Aspects, which, of course, are closely linked to the direct sustainability and growth of the region's productive practices. Among the primary objectives of this CONPES was to create the economic and social conditions to enable egalitarian and inclusive development, which would level the balance in order to achieve sustainable development.

However, CONPES is not the only tool identified that would aim at the organization of the territory and its inhabitants. Additionally, a second strategy is the Orinoquia Master Plan between the years 2014 and 2018, which was supported by a strategy for the region called "Environment, agriculture and human development: Growth and well-being for the Llanos" of the PND 2014-2018[36]. This document was drafted using as the main input the information provided during the presentation of the regional dialogues that were intended to configure it.

Particularly, the aforementioned National Development Plan focused on four crucial aspects for the territory, among which were: sustainable productive development, water resources and environment, infrastructure and logistics, and territorial planning (PND, 2016)[37]. Thus trying to create a bridge between legal security and possible investments in the region, which includes tourism, transportation, agriculture, and of course, the environment and water resources.

Likewise, a third strategy occurred in 2017 when the "Comprehensive Regional Climate Change Plan for the Orinoquia" (PRICCO) was established.[38], developed in Arauca, Casanare and of course in Vichada and Meta. Document, which reinforced the urgency of achieving integration between climate change and the possible relationship that management processes and the development of the region have with environmental disasters. Similarly, a fourth is the PND 2018-2022 (National Development Plan), which established twenty goals within the framework of commitments called "pacts for the productivity and equity of the regions" among which can be counted precisely the "Llanos-Orinoquía Region Pact: Connect and enhance the sustainable food supply of the region with the country and the world." Basically, the aforementioned document made evident the relationship of said pact with the pact of productivity, legality, equity for ethnic communities (in the field of opportunities), and of course, environmental, economic and social sustainability (DNP, 2019).

The most logical barrier detected is the lack of a precise and forceful implementation of the strategies and pacts previously summarized, either due to bureaucratic inefficiency or due to corruption itself. However, it is evident the influence they have had in highlighting in the collective imagination of their residents the concern for issues such as: climate change, the conservation of ecosystems, and the relationship between sustainable development and environmental care. That is, there is still a way to go.

[36] National Development Plan 2014-2018National Planning Departmenthttps://colaboracion.dnp.gov.co › CDT › PND
[37] National Development Plan 2018-2022National Planning Departmenthttps://colaboracion.dnp.gov.co › CDT › Press
[38] The Orinoquia already has a Comprehensive Regional Plan for...Ministry of Environment and Sustainable Developmenthttps://archivo.minambiente.gov.co › index.php › 285...

Barrier	*Barriers relating to land tenure, ownership, inheritance, and property rights*

Lack of suitable land tenure evidence and documentation to support the security of tenure

In the Colombian Orinoco region, about 46% of the properties are presumed to be informal, which indicates that they meet at least one of the criteria established for their identification. At the departmental level, the department of Vichada is the one with the highest presumption of informality, being in the range of 50% to 75%, while the other three departments are in the range of 25% to 50%.[39]

- Lack of land tenure legislation and regulation, adequate to support tenure security:

Inequality in land ownership is a significant problem in Colombia, especially in the departments of Meta and Vichada, where the project is carried out. A minority of citizens have title to their land, while the majority of the population occupy them irregularly. For almost 40 years, the National Government has attempted to implement strategies and agrarian reforms to address this inequality and provide resources that allow the community to access land ownership. However, this process has slowed down, leading to the irregular possession of land that has become common in the territories.

The legal regulation of real estate ownership in Colombia originates from constitutional provisions that initially recognize the fundamental rights to private and collective property with a social purpose, that is, to improve the quality of life of Colombian citizens. In the departments of Vichada and Meta, the right to property has been violated and violated over the years, mainly due to the armed conflict, which has resulted in displacement and a lack of government control over land. This process has been subsequently intervened by competent authorities with repair strategies, which has caused numerous citizens to recover the exercise of ownership and occupation of their land.

In addition to the above, the Colombian Civil Code contains provisions related to the ownership of real estate for both natural and legal persons. This compilation of regulations classifies the ownership of land into ownership, possession and/or tenure, establishing guidelines that guarantee the quality of the rights of each person according to the quality they have in front of the property. It is essential to address this inequality in land ownership and promote the formalization of property to guarantee the legal security of citizens and the

[39] Resumen del diagnóstico de la distribución y tenencia de la tierra rural en la región de la ORINOQUIA https://upra.gov.co/Kit_Territorial/2-%20Informaci%C3%B3n%20por%20Departamentos/ARAUCA/Diagnostico%20distribucion%20tenencia%20tierra%20rural%20Orinoquia%20-%20ARAUCA.pdf

sustainable development of the region. This situation will require continued collaboration between the government, the entities involved, and the local community.

3.3.4. Elimination of land use scenarios that are prevented by the identified barriers

To eliminate land use scenarios that are prevented by any barriers, the following analysis was performed.

Table 30. Barrier Analysis Results

Methodology	Land use alternatives	Barriers	Barrier Type	Result of barrier analysis
BCR0002	*Continuation of the pre-project land use scenario*	NO	-	Taking into account the description of the previously mentioned barriers, compared to the land use scenarios identified in substep 1a, one of the most probable land use alternatives to define the project baseline (different from the project activity). It is the continuation of the previous land use, given that none of the barriers prevent the continuation of the activities that have historically developed in the territory. That is to say a constant degradation. **Result: Continue**
	Reduction of deforestation and forest degradation within the project boundary carried out without being registered as a BCR project activity.	YES	Inversion Social	**Investment:** Without the availability of investment capital, the transition from current productive activities to those that do not affect natural coverage does not occur. **Social:** Considering the economic dependence among the present population groups and that this promotes the development of activities that generate the

				transformation of areas. If the population does not have a financial mechanism that allows counteracting this dependence, it is unlikely that economic alternatives will be developed that offer opportunities of income and mitigate the negative environmental impact. **Results: Eliminate**
	Continuation of the pre-project land scenario	NO	-	Taking into account the description of the previously mentioned barriers, compared to the land use scenarios identified in substep 1a, one of the most probable land use alternatives to define the project baseline (different from the project activity). It is the continuation of the previous land use, given that none of the barriers prevent the continuation of the activities that have historically developed in the territory. That is to say a constant degradation. **Results: Continue**
	Reduction change land use in the Natural Savana within the project boundary, performed without being registered as the BCR project activity	YES	-	This alternative is one of the most probable given the interest of the property owners in generating wealth and income within the framework of a regulated market. This has been demonstrated by the transformation of natural coverage that has historically occurred in the departments of Meta and Vichada. Which advances year after year. Either because the owners invest in the implementation of some extensive cultivation or because they sell the land to agro-industrial companies. **Results: Eliminated**

Source: Cataruben Foundation

List of land use scenarios that are not prevented by any barrier is:

- Continuation of the pre-project land use scenario for BCR0002
- Continuation of the pre-project land use scenario for BCR0002

3.3.5. Sub-step 2c. Determination of baseline scenario

Methodology	Scenarios that are not prevented by any barrier	Baseline Scenario?
BCR0002	Continuation of the pre-project land use scenario	**Yes** Since the list of likely scenarios does not include the implementation of activities to reduce deforestation and forest degradation without being registered as BCR 0002 activity and there is only one scenario that is not prevented by any barrier, then this is considered a baseline scenario.
BCR0005	Continuation of the pre-project land use scenario	**Yes** Since the list of likely scenarios does not include the implementation of activities to reduce deforestation and forest degradation without being registered as BCR 0005 activity and there is only one scenario that is not prevented by any barrier, then this is considered a baseline scenario.

Based on the results for both methodologies, we proceed to step 4 common practice analysis.

3.3.6. Step 4 common practice analysis

The previous steps were complemented with an analysis of the degree of diffusion of the REDD+ activity and activities that prevent land use change in natural savanna in the geographical area of the project, i.e. in the highlands of the Colombian Orinoquia. This test is a credibility check to demonstrate additionality that complements the barrier analysis (Step 2).

3.3.6.1. Step 4 common practice analysis REDD+

Zero Deforestation Agreements: Although initiatives such as Zero Deforestation Agreements exist in sectors such as palm, livestock and cocoa, their implementation is still limited in terms of

coverage and effectiveness. For example, in the livestock sector, only 20% of the market is covered by zero deforestation agreements, and these agreements focus on aspects of production traceability rather than on the effective reduction of deforestation on private land in the highlands. This context shows that zero deforestation agreements on private lands such as those in the project are innovative and are not part of common practices in the region[40].

Forest Fire Prevention and Alternative Energy Use: In the Orinoco, forest fires are a constant threat, but preventive actions are still in early stages of development and are not part of a widely adopted approach to land management practices. Similarly, the use of alternative energy for cooking, such as the replacement of firewood from the forest with cleaner energy, is an emerging activity, but its implementation is limited and not widespread at the level of small farms or private estates.[41]

Forest Governance and Knowledge Management: Forest governance activities on private land in the highlands are scarce. Although there are specific initiatives to strengthen local capacities, knowledge management and the implementation of organized forest governance systems are not common, especially in territories where private ownership predominates. This gap in management and governance reinforces the innovation of the activities proposed in the project.[42]

On the other hand, In the departments of Meta and Vichada there is a significant presence of GHG mitigation projects, totaling 36, which are distributed according to the standards as follows: VERRA (6), COLCX (7), CERCARBONO (6), BIOCARBONO REGISTRY (17) 1.4.4.3.Database. However, none of them are developed on private properties with REDD+ activities and activities that avoid the change in land use of natural savannas. On the contrary, REDD+ initiatives are developed in collective communities (Indigenous Collective Properties) while projects with ARR activities are developed on private properties.

In summary, the project proposes activities that, although mentioned in certain national programs, are not common practices in the region, which strengthens the justification for additionality in the context of climate change mitigation in the "altillanura region".

3.3.6.2. Step 4 common practice analysis Natural Savannas

The analysis of sustainable cattle ranching, tree planting in natural savannas, pasture rotation, and conservation of natural savannas in the Altillanura region of the Meta and Vichada departments shows that these practices are still not common, reinforcing the project's additionality.

Sustainable cattle ranching and pasture rotation: While some model farms have implemented sustainable cattle ranching practices in savannas, such as the Tréquina farm in Arauca, where

[40] https://www.elespectador.com/ambiente/bibo/acuerdos-cero-deforestacion-la-apuesta-por-producir-protegiendo-la-biodiversidad/
[41] https://cerodeforestacioncolombia.co/
[42] https://medioambiente.uexternado.edu.co/politica-de-deforestacion-en-colombia-conpes-4021-de-diciembre-de-2020/

rotational grazing and the use of native forage species are promoted, these practices are not yet widely adopted in the Altillanura region. Many cattle ranching activities in the Orinoquía remain extensive and have negative impacts on soils and biodiversity, contributing to ecosystem degradation[43]

Tree planting in natural savannas: The implementation of silvopastoral systems, which involve planting trees in savannas to improve forest cover and provide shade for cattle, is an emerging practice but not widely implemented in the region. These systems are primarily developed by pilot projects in specific areas, such as the flooded savannas, and are not part of traditional cattle ranching practices in the Altillanura, where extensive ranching continues to dominate[44](

Conservation of natural savannas: Although efforts are being made to conserve savannas through initiatives of cattle ranching reconversion and productive conservation, these activities are not yet the norm in the Altillanura. Integrated conservation with production is a recent approach that has not achieved widespread adoption in the region, where agricultural expansion remains a constant threat to these ecosystems[45]

In conclusion, the proposed activities for natural savanna in the mitigation project are not common in the region, justifying their additionality. Sustainable cattle ranching practices, tree planting, pasture rotation, and savanna conservation are still in the early stages of adoption, reinforcing the project's innovation and impact in the Altillanura region.

In addition, in the departments of Meta and Vichada there is a significant presence of GHG mitigation projects, totaling 36, which are distributed according to the standards as follows: VERRA (6), COLCX (7), CERCARBONO (6), BIOCARBONO REGISTRY (17) 1.4.4.3.Database. However, none of them developed activities to prevent land use change in savanna nature.

On the other hand in section *2.3.4. Economic Activities and their Importance* Shows that the main economic activities in the region correspond to activities that involve land use change of natural savannas lands. As rice, corn, palm or clean pasture crops.

3.3.7. Additional information

Likewise, in compliance with article 37 of resolution 1447 of 2018, an analysis of compliance with the criteria established in the article is carried out.

"Article 37 Criteria for Additionality of Sectoral GHG Mitigation Projects: Those reductions in GHG emissions or removals that the owner of the Sectoral GHG Mitigation project demonstrates that

[43] https://cipav.org.co/sdm_downloads/sabanas-inundables/
[44] https://www.contextoganadero.com/cronica/trequina-un-modelo-de-ganaderia-sostenible-en-sabanas-inundables
[45] https://www.elespectador.com/ambiente/bibo/producir-y-conservar-el-caso-de-la-ganaderia-en-las-sabanas-inundables-de-la-orinoquia/

would not have occurred in the absence of the GHG Mitigation initiative are considered additional. , and that generates a net benefit to the atmosphere with respect to its baseline."

"Likewise, GHG removals are considered additional as a result of the implementation of GHG Removal forestry activities, which are developed in areas other than natural forests and which demonstrate a positive net change in carbon deposits in the development area of the forest activity and the other additionality criteria defined by the Ministry of Environment and Sustainable Development."

- In this sense, it is clarified that Orinoco2 is an emissions' reduction project.

"Reductions in GHG emissions or removals as a result of compensation activities for the biotic component derived from the impacts caused by projects, works, or activities within the framework of environmental licenses, concessions, applications for permits for the sole use of the forestry resource due to change in land use, and the request for definitive removals from national and regional forest reserves are not considered additional."

- In this sense, the project validates with each of the owners of the properties the areas linked to the project are not within any commitment to compensate for the biotic component. In addition, the cartographic base information provided by Ecopetrol was corroborated.. (See Annex 1.Emissions/1.1 .GDB/1.1.1.GDB /feature class/Offsets.)

"Reductions in GHG emissions or removals as a result of presentation and restoration activities in strategic ecosystem areas for which payments for environmental services of GHG reduction and capture are accessed will not be considered additional in accordance with the provisions of Chapter 8. of Title 9 of Part 2 of book 2 of decree 1076 of 2015."

"The reductions or removals of GHG generated from the date of compliance with the legal terms of the compensations mentioned in this article, or the completion of payments for environmental services of GHG reduction and capture, are considered additional."

- Faced with this criterion, it is clarified and evident that none of the areas linked to the project are within a payment scheme for environmental services in the Annex. 1.Emissions/1.1.GDB/1.1.3.Compensation The cartographic information corresponding to the PSA of the department of Meta and Vichada is found.

3.4. Uncertainty management

Under the guidelines of the BCR 0002 (section 13.1) and BCR0005 (section 12) methodologies, "*Uncertainty management is determined by the accuracy of the maps used to estimate activity data, and the application of discounts in emission factors."*

For activity data, an accuracy greater than 90% is required in the maps used. In this context, for the REDD+ component, non-forest forest maps of national origin were used in the reference region. Validation of non-forest forest maps corresponding to the years 2005, 2018 and 2022 was carried out through AcATaMa, a QGIS plugin designed specifically for this purpose (AcATaMa Instructions; Inventory Design Procedure and the validation of a classification model based on field data). This validation process involves a comparison between the results of the forest-non-forest classifications and a set of reference data, ranging from in situ observations to high-resolution images, or failing that, a resolution higher than those used to generate the classification.

For each year evaluated, AcATaMa generated a confusion matrix that facilitates the calculation of various classification evaluation metrics, including Accuracy, which determines the level of precision achieved in the classification of each of the identified coverages. The accuracy results for the forest-non-forest maps were as follows: Lb 2005 (95,0%), 2008 (94%), Lb 2017 (94,0%), 2018 (95%) and 2022 (96%).

The confusion matrix that facilitates the calculation of various classification evaluation metrics, including Accuracy, was also used in the component savannas, especially in the 2022 land cover map, because the 2012 and 2018 inputs (used to determine eligibility) come from the 2012 and 2018 national land cover maps. The interpretation assisted by computer with contrast from with in situ observations and high-resolution images from sensors such as WorldView 2 (Spatial resolution 0.30m/pixel) and Sentinel 2 (Spatial resolution space 10 m/pixel).

On the other hand, for the emission factors The methodologies accept an uncertainty of 10%. In the event that the uncertainty value is greater than 10%, the lower value of the 95% confidence interval should be applied. Thus, in the case of savannas, the uncertainty estimation was carried out according to the formula 15 de la herramienta "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (See Inventory Design Procedure), as indicated below:

$$\mu_{\Delta C} = \frac{t_{VAL}\, x \sqrt{\sum_{i=1}^{M} IN_i^2 x \frac{S_i^2}{n_i}}}{b_{TREE}}$$

Where:

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

t_{VAL} Two-tailed t-student value for a 90% confidence level and degrees of freedom equal to *n-M,* where *n* is the total number of sampling plots within the biomass estimation strata and *M* is the total number of biomass estimation strata

S_i^2 Variance of biomass per hectare in the stratum i; $(t\ d.m.\ ha^{-1})^2$

IN_i Relationship between the area of stratum i and the sum of the areas of the biomass estimation strata (i.e. $IN_i = A_i / A$)

n_i Number of sampling plots in the stratum i

b_{TREE} Average biomass per hectare in the stratum i; $t\ d.m.\ ha^{-1}$

In this sense, the emission factors for natural savannas registered a value of 9%, complying with the required procedures. The detailed calculations and results are presented in Annex 1. Emissions / 1.2. Quantification of emissions /1.2.2 Emission factors / 1.2.2.3 Data analysis / savanna data.

Regarding forests, the emission factors presented at the country's reference level were applied, so the information is in accordance with the national emissions scenario and represents a conservative scenario (Ministry of Environment and Sustainable Development – IDEAM, 2020, 2024).

3.5. Leakage and non-permanence

3.5.1. Leakage

The leakage area was defined as a buffer[46] 1 km away from the edge of the properties and limits of the eligible areas. (see section 3.2.1.3 leakage Area)

The forest, shrub, and grassland areas will be monitored with the objective of quantifying the increase in emissions that could occur outside the project area. These emissions will be subtracted from the project results in accordance with the criteria of the methodologies. The quantification of leakage is detailed in section 3.9. Mitigation results.

On the other hand, for reducing the risk of leakage, the project designed an early warning activity for potential forest fires, as well as a knowledge management plan that educates agents (private landowners) about sustainable management of natural resources and the non-displacement of emissions outside the project areas.

3.5.2. non-permanence

Identified project permanence risks and designed a monitoring plan that includes mitigation measures, monitoring indicators and results, and reporting procedure. Biophysical and socioeconomic risks were assessed including: fires, floods, land tenure disputes, conflicts between project stakeholders, non-ownership of project activities, and governance deficits.

[46] It is an area that surrounds the project reference areas.

These risks are identified and tracked in the monitoring tool. Risk analysis and management

Finally, the monitoring of project activities, through verifications, shall evaluate the permanence of project activities.

3.6. Mitigation results

Below (numerals 3.6.1 to and 3.6.8) It is demonstrated that the mitigation results, obtained as a consequence of the execution of the project activities, are verifiable within the framework of the ISO 14064-3:2019 Standard. In this sense, strict use is made of the guidelines and criteria established in section 13 (reduction of GHG emissions from REDD+ activities) of the BCR 0002 methodology and section 11 Quantification of the reduction of GHG emissions of the BCR 0005 methodology.

3.6.1. Eligible areas within the GHG project boundaries

3.6.1.1. REDD+ eligible areas

The REDD+ eligible areas of the project correspond to the stable forest that is within the limits of the properties for a period of at least ten years prior to the start date of the project (Geodatabase_REDD+\Project_Areas). According to the definition of forest adopted by Colombia and used by the SMByC, namely, land occupied mainly by trees that may contain shrubs, palms, guaduas, grasses and lianas, in which tree cover with a minimum density predominates canopy of 30%. A minimum in situ canopy height of 5 meters at the time of identification and a minimum area of one hectare (IDEAM, 2014)[47]. To identify the forests present on the properties, the classification process was generated through the Google Earth Engine (GEE) platform with images from the Landsat constellation, which has a spatial resolution of 30 meters/pixel, Temporal resolution — revisit time of 16 days.

The forest maps corresponding to the years 2008 and 2018 were generated using collections of images from the Landsat 5, 7 and 8 satellites using the Google Earth Engine (GEE) platform. During the construction of the mosaics, the start date of the project was considered, establishing specific filters for each year. 20 scenes were obtained that make up the mosaic corresponding to the year 2008 (01/01/2008 - 03/30/2008). For the year 2018, 28 scenes that make up the mosaic were acquired. (01/01/2018 - 03/30/2018).

[47] IDEA (2014a). *Monitoring of the area covered by natural forest*. Obtained from IDEAM: http://www.ideam.gov.co/web/ecosistemas/superficie-cubierta-por-bosque-natural?p_p_id=110_INSTANCE_dqBGlv6hKQrD&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_pos=1&p_p_col_count=2&_110_INSTANCE_dqBGlv6hKQrD_struts_action=%2Fdo

The process of searching for information through filters aims to ensure the selection of images free of environmental noise such as clouds or distortions and with minimum percentages of cloudiness. This guarantees obtaining images in optimal conditions, reducing uncertainty in digital processing. If clouds are present, masking is performed to eliminate them including their shadow, thus ensuring a clear representation of the Earth's surface.

Once the different satellite images are obtained, they are merged to create a mosaic on which the analysis will take place. Forest classification using Digital Image Processing — PDI requires training samples/observations to distinguish between forest and non-forest areas. For this, training areas verified through field observations, high resolution images (WorldView 2, Geoeyes, Planet) and visual interpretation.

The Random Forest algorithm[48] It is used to classify forest and non-forest mosaics.[49] from the training samples. Random Forest is a supervised learning technique that generates multiple decision trees (group of observations or random training samples) on a set of training data, the results obtained are combined to obtain a single, more robust model.

Subsequently, with the objective of ensuring the thematic quality of the generated products, a supervised review and adjustment process is implemented through visual interpretation. This process is carried out through the Procedure for Computer-Aided Interpretation (PIAO), complemented by the use of the "Imagery" module of the ArcGIS Pro v3.2 software. These measures are adopted with the aim of improving the results of the classifications obtained in GEE. This comprehensive approach to review and supervised adjustment ensures greater accuracy and reliability in the subject matter of the products, thus contributing to the generation of more robust and reliable data.

Finally, after the review and supervised adjustment, the model is validated for each year using the AcATaMa Plugin in the QGIS software (Geodatabase_REDD+\AcATaMa). Validation through the AcATaMa plugin constitutes a fundamental measure to verify the coherence and accuracy of the classification, reinforcing the integrity of the results obtained during the process. The procedure

3.6.1.2. Eligible Areas natural savannas

To identify the eligible savanna areas, it is demonstrated that the geographical limits of the project correspond to the savanna biome and correspond to the Los Lanos Ecoregion, according to the WWF classification.[50](geodatabase_savannas\Biome_Ecoregion).

[48] *Breiman, L. (2001). Random Forests. Machine Learning, 45, 5-32 https://doi.org/10.1023/A:1010933404324.*
[49] *https://developers.google.com/earth-engine/apidocs/ee-classifier-smilerandomforest*
[50] WWF,2012. Terrestrial Ecoregions of the World. Available at: htpps://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world

To identify the eligible savanna areas, land cover maps from 2012 and 2018 are used, scale 1:100,000, a product of joint inter-institutional work, a process currently led by IDEAM and in which various institutions have participated, such as IGAC and PNN. Consolidated as national cartography.

In accordance with the BCR0005 methodology, the coverages identified as 3.2.1. grasslands and 3.2.2. Shrublands are considered savannas. In this order, the savanna covers for the year 2012 and 2018 are identified. Those areas that have remained in the aforementioned categories at the beginning of the project activity and five years before the start date of the project are considered as eligible areas (geodatabase_sabanas\Project_Area)

3.6.2. Stratification

The project is structure in two components: 1. Natural savanna, 2. Natural forests, according to the methodologies and coverage to be managed for forest and natural savanna, respectively.

3.6.2.1. *REDD+ stratification*

For the quantification period of the project after 2022, the forest will be stratified according to the methodology included in the FREL for the period 2023-2027[51]. An approach based on morphological analysis using Morphological Spatial Pattern Analysis (MSPA) algorithms is used.

o establish the baseline in the reference region, forest layers from 2005 and 2017, of national origin (Forest and Carbon Monitoring System), were used. While for the project areas, maps of the surface covered by natural forest generated through PDE and Google Earth Engine were used. These layers were adjusted to be processed in the MSPA algorithm as follows:

a. **Recoding:** They were recoded so that forest areas will be represented in the first bit and non-forest areas in the second bit.
b. **Data type setting:** The layers were adjusted so that the data type was 4 bits.

The algorithm was executed in the Debian/Ubuntu operating system, through the Guido Toolbox Workbench platform (Guido Toolbox Workbench). The installation was carried out following the instructions available at (Guido Toolbox Workbench Installation Guide). In addition, the resource "GuidoToolbox Workbench: spatial analysis of raster maps for ecological applications" was used (GuidoToolbox_Workbench_Procedure), which describes the procedure to run the software on Linux.

The MSPA algorithm was run with the following parameters:

- **Connectivity:** 8

[51] https://redd.unfccc.int/media/colombia_submission_nref_2023_-_2027_vf.pdf

- **Border width:** 4 pixels (120 meters)
- **Transition:** 1
- **Intext (fondo):** 1

The result was a forest configured in seven morphological categories (Original MSPA Class), which were then post-stratified into two categories (see Table 27):

Table 31. MSPA post stratification

MSPA Original Class	Post stratification
Núcleo	Core Forest
Isla	Edge Forest
Bucle	Edge Forest
Puente	Edge Forest
Perforación	Edge Forest
Borde	Edge Forest
Rama	Edge Forest

Source: Cataruben Foundation, 2024.

In this way, the natural forest or forest area is stratified thanks to the MSPA algorithm in **Core Forest** and **Edge Forest** . The cartographic information is in 1.1.2.1. Geodatabase REDD+ Feature Dataset Reference Region, Project Areas and Leakage Areas. The inputs of national forest 2005 and 2017 and the stratification according to MSPA. 1.1.2.1.1 Stratification_MSPA are included. In each folder you will find the parameters and a folder called bnb_2005_ttb_mspa that contains the stratification.

The accuracy of the MSPA results is directly linked to the precision of the geographic inputs, such as the national natural forest cover maps, which are essential for a detailed analysis of the reference region. In the project areas, forest models were constructed using DIP on Google Earth Engine, achieving accuracies of 94% for 2008, 95% for 2018, and 96% for 2022, ensuring the necessary precision for reliable and accurate analyses.

3.6.2.2. *REDD+ Degradation*

After stratification of the core and edge forest areas, using the spatial analysis algorithm MSPA (Morphological Spatial Pattern Analysis), a multitemporal analysis was carried out both in the

reference region and in the project areas for the period in question, with the objective of quantifying forest degradation. This analysis allowed a precise identification of the areas where the core forest is transformed into edge forest, indicating forest degradation processes. On the other hand, those areas where the core or edge forest changes to the "non-forest" category were identified as deforestation.

The analysis conducted in the reference region allowed projecting the degradation rate in the core forest areas within the project. In this context, it is important to highlight what is described in Annex 1.2.1 Project_Emissions, which presents both the areas eligible for deforestation (30718.3 ha of forest) and the areas of core forest that may be degraded to edge forest (9,166.7 ha).

Although both processes share certain characteristics, the key differentiation lies in the measurement methodology: forest degradation is defined when an area of core forest is transformed into edge forest, but remains classified as "forest" according to the "forest-not forest" maps. In contrast, when forest cover is completely lost, the area is classified as deforestation.

To quantify degradation, when a core forest area is converted to edge, an emission factor of 98,747 tCO2e/ha is applied. If this same area subsequently undergoes deforestation (becomes "non-forest"), the deforestation emission factor for core forests is applied, discounting the value corresponding to the previous degradation (98.747 tCO2e/ha), which would correspond to the emission factor of an edge forest or degraded forest. This distinction is crucial for an accurate accounting of the emissions generated.

3.6.2.3. *Savanna stratification*

The savanna component was not stratified because there are no significant differences between the carbon contents of the Grassland and Shrubland. Every time, the coverage with the greatest presence in the territory is grassland and not shrubs. The cartographic information is on 1.1.1.1.Savannas Geodatabase Feature Dataset Reference Region, Project Areas and Leakage Areas.

3.6.3. Reduction of Emissions/Removals in the Baseline scenario

To determine the emissions' reduction in the baseline scenario, activity data for deforestation, forest degradation, and land use change in natural savannas were first determined. To do this, they followed the guidelines established in the methodological documents BCR 0002 version 4.0, sections 13.3.1 and 13.3.2, and BCR0005 version 1.0, sections 11.2.2 and 11.2.4.

Subsequently, the emission factors were calculated for each component, according to the selected carbon deposits (section 3.2.2) and procedures established in the methodologies BCR 0002, section 13.4, and BCR0005, section 11.3.

Finally, to calculate GHG emissions, resulting from the relationship between the activity data and the defined emission factors, the procedures established in sections 13.5 of the BCR 0002 methodology and 11.4 of BCR0005 were followed.

3.6.3.1. Activity Data

In accordance with the BCR 0002 and BCR0005 methodologies, the activity data correspond to the changes in the forest surface and in the natural cover surface in the geographical and temporal limits of the project.

In accordance with the guidelines of the BCR 0002 methodology, item 13.3 Activity data, non-forest forest maps generated by the Forest & Carbon Monitoring System in the reference region, period 2005–2017, were used. These were stratified through the MSPA algorithm in **Core Forest** and Edge **Forest.** As is it related in 3.7.2 Stratification. The processes carried out in deforestation consisted of determining how many pixels (areas) of Core Forest and Edge Forest became non-forest, while for degradation were the areas of Core Forest that transitioned to Edge Forest.

On the other hand, in accordance with the guidelines of the BCR0005 methodology, item 11.2 Activity data, the national land cover maps were used, period 2012–2018. In relation to the activity data, exclusively the changes that manifest themselves in the savanna vegetation covers (Graslands — Shrublands) identified in 2012, focusing specifically on the transitions they experience towards other anthropic covers for the year 2018.

3.6.3.1.1. Deforestation

To estimate deforestation activity data, the historical average estimation approach was selected. The applied processes are presented below.

- **Annual historical deforestation in the reference region**

The calculation of historical average deforestation was carried out by analyzing the change in forest to non-forest coverage, which occurred in the reference region in the period 2005–2017, using the following equation:

$$CSB_{R,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{R1} - A_{R2}\right)$$

$$CSB_{R,year} = \left(\frac{1}{2017 - 2005}\right) x \left(217936 - 196312\right)$$

$$CSB_{year} = 1,802\ ha/year$$

Where:

CSB_{year}	Annual change in the area covered by forest in the reference region; ha
t_1	Start year of the reference period; year
t_2	Final year of the reference period; year
A_{R1}	Forest area in the reference region, at the initial time; ha
A_{R2}	Forest area in the reference region at the final time; ha

Since, the period 2023-2027 contemplates the stratification of the forest in Core and Edge areas. The analysis was repeated considering this stratification as follows:

For the Core Forest stratum:

$$CSB_{R,Core,\,year} = \left(\frac{1}{2017-2005}\right) x\,(40.229 - 33.112)$$

$$CSB_{R,Core,\,year} = 593,08\ ha/year$$

For the Edge Forest stratum:

$$CSB_{R,Edge,\,year} = \left(\frac{1}{2017-2005}\right) x\,(177.707 - 163.199)$$

$$CSB_{R,Edge,\,year} = 1209 ha/year$$

Subsequently, to estimate the annual historical deforestation in the project area, the following equation was applied:

$$CSB_{A,year} = \left(\frac{CSB_{R,year}}{A_{R1}}\right) x \left(A_{At}\right)$$

$$CSB_{A,year} = \left(\frac{1.802,00}{217936}\right) x (29.857,00)$$

$$CSB_{A,year} = 246.87 \text{ ha/year}$$

Where:

$CSB_{A,year}$	Annual change in the area covered by forest in the project area; ha
$CSB_{R,year}$	Annual change in the area covered by forest in the reference region; ha
A_{R1}	Forest area in the reference region, at the initial time; ha
A_{At}	Forest area in the project area, at time t; ha/year

In accordance with the national reference levels, the adjustment for national circumstances was applied to the $CSB_{A,year}$ for the quantification period calculated from the historical average. According to the most conservative scenario of the logistics model developed for this purpose

(Ministry of Environment and Sustainable Development – IDEAM, 2020; Ministry of Environment and Sustainable Development – IDEAM, 2024).

- **Annual historical deforestation in the leakage area**

The annual historical deforestation in the leakage area was calculated by analyzing the change in forest cover for the period 2005 - 2017, relating the following equation:

$$CSB_{f,year} = (\frac{1}{t_2 - t_1}) \, x \, (A_{1,f} - A_{2,f})$$

$$CSB_{f,year} = (\frac{1}{2017 - 2005}) \, x \, (21617 - 19876)$$

$$CSB_{f,year} = 145,08 ha/\text{year}$$

Where:

$CSB_{f,year}$	Annual change in the area covered by forest in the leakage area; ha
t_1	Start year of the reference period; year
t_2	Final year of the reference period; year
$A_{1,f}$	Forested area of the leakage area at the beginning of the reference period; ha
$A_{2,f}$	Forested area in the leakage area at the end of the reference period; ha

Similarly to the reference region, to project the change in forest cover in the baseline scenario for the period 2023-2027, the analysis was carried out considering the defined strata: core and forest. Presenting the following values:

For the Core forest stratum:

$$CSB_{f\ Core,year} = (\frac{1}{2017 - 2005}) \, x \, (4853 - 4303)$$

$$CSB_{f\ Core,year} = 45,83 \ ha/year$$

For the Edge forest layer:

$$CSB_{f\ Edge,year} = (\frac{1}{2017 - 2005}) \, x \, (16765 - 15573)$$

$$CSB_{f\ Edge,year} = 99,33 \ ha/year$$

In this sense, the rate of loss of forest cover in the reference region and the value of annual change in the leakage area calculated from the historical average. These represent the expected forest loss in the project area and leakage area, respectively, in the baseline scenario.

3.6.3.1.2. Forest Degradation

According to BCR0002 section 13.3.2. Degradation. To define the forest degradation activity data, the project holder shall apply the Methodology adequate and credible for estimating forest degradation, by means of which the changes in aboveground biomass present in different forest cover categories are determined, assigned through a fragmentation analysis.

To define the activity data for degradation, the guidelines of the national reference level proposal - NREF (Ministry of Environment and Sustainable Development — IDEAM, 2024) were followed. After post stratification where only 2 categories are defined: Core Forest and Edge Forest in the Reference Region, project areas and leakage areas, the forest degradation process is carried out which consists of: Determine the core forest areas that transited to Edge Forest.

- **Annual historical degradation in the project area in baseline**

The calculation of the annual historical degradation in the baseline is carried out based on the fragmentation analysis in the period 2005–2017. Likewise, the applied equation is based on what is stipulated by the BCR 0002 methodology for the primary degradation calculation, making an adjustment in the transition between fragmentation classes (core areas passing to edge).

$$DFP_{lb,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{core,lb} - A_{core-edge,lb}\right)$$

Where:

$DFP_{lb,year}$	Historical annual primary degradation at baseline; ha
t_1	Start year of the reference period; year
t_2	Final year of the reference period; year
$A_{core,lb}$	Area of the reference region in core class in the year of the beginning of the reference period; ha
$A_{core-edge,lb}$	Area of the reference region that moves from core to edge in the final year of the reference period; ha

Now, in order to avoid overestimating emissions due to degradation, the value of $A_{core-edge,lb}$ It was defined as the areas in the Core category in t1, minus the areas that went from Core to Edge between periods t1 and t2. As described below:

$$DFP_{lb,year} = \left(\frac{1}{2017-2005}\right)x(40299 - (33563 - 6666))$$

$$DFP_{lb,year} = \left(\frac{1}{2017-2005}\right)x(40299 - 26897)$$

$$DFP_{lb,year} = 555,50\ ha/year$$

In this way, when relating it to the Core Forest area of the project, average annual degradation values are estimated as 555,50 ha.

- **Historical annual degradation in the leakage area**

Similarly, to estimate the historical degradation in the leakage area, the following equation was applied:

$$DFP_{lb,f,year} = \left(\frac{1}{t_2 - t_1}\right)x\left(A_{core,lb,f} - A_{core-edge,lb,f}\right)$$

Where:

$DFP_{lb,f,year}$	Annual primary degradation in the leakage area; ha
t_1	Start year of the reference period; year
t_2	Final year of the reference period; year
$A_{core,lb,f}$	Area of leakage in core class in the year of the beginning of the reference period; ha
$A_{core-edge,lb,f}$	Area of leakage that passes from core to edge in the final year of the reference period; ha

As in the previous section, the value of $A_{Core-edge,lb,f}$ It was defined as the area in the Core category in t1 minus the areas that go from Core to Edge between periods t1 and t2, applying the equation as follows:

$$DFP_{lb,f,year} = \left(\frac{1}{2017-2005}\right)x(4860 - (4853 - 630))$$

$$DFP_{lb,f,year} = \left(\frac{1}{2017-2005}\right)x(4860 - 4.228)$$

$$DFP_{lb,f,year} = 52,5\ ha$$

3.6.3.1.3. Changes in land use in natural savannas

The analysis of change in the area with natural vegetation cover (CSCN) for the estimation of activity data in covers classified as savannas was carried out based on the guidelines established in the BCR 0005 methodology, section 11.2.

The cover change matrix plays a fundamental role in the Biocarbon Standard methodology by providing a comprehensive tool to evaluate and quantify transformations in land use and vegetation. In the context of this standard, the importance of the matrix lies in its ability to accurately and detailed track changes in land cover, allowing a comprehensive assessment of the associated environmental and carbon impacts. This systematic approach facilitates the identification of sustainable practices and the promotion of projects that significantly contribute to climate change mitigation, while promoting biodiversity conservation and sustainable management of natural resources. The coverage change matrix thus becomes a key tool for the effective implementation of positive and sustainable carbon strategies, aligned with the objectives of the Biocarbon Standard.

For the analysis of the coverage change matrix, the main input is the IDEAM Corine land cover for the years 2012 and 2018. Table 32 defined in the reference region area, in order to generate a land use classification for each coverage, as shown in the following table:

Table 32. Land use classes by coverage.

LAND USE BY LAND COVER		
LEGEND	LAND USE	COD
1.1.1. Continuous urban fabric	URBAN	F1
1.1.2. Discontinuous urban fabric	URBAN	
1.2.2. Road, railway network and associated land	INFRASTRUCTURE	F2
1.2.4. Airports	INFRASTRUCTURE	
1.3.1. Mining extraction areas	INFRASTRUCTURE	
2.1.1. Other transitional crops	AGRICULTURAL	F3
2.1.2.1. Rice	AGRICULTURAL	

LAND USE BY LAND COVER		
LEGEND	LAND USE	COD
2.2.1.1. Other permanent herbaceous crops	AGRICULTURAL	
2.2.3.2. oil palm	AGRICULTURAL	
2.3.1. clean pastures	GRAZING	
2.3.2. Wooded pastures	GRAZING	F4
2.3.3. Weeded Pastures	GRAZING	
2.4.1. Crop Mosaic	AGRICULTURAL	
2.4.2. Mosaic of pastures and crops	AGRICULTURAL	
2.4.3. Mosaic of crops, pastures, and natural spaces	AGRICULTURAL	F3
2.4.4. Pasture mosaic with natural spaces	AGRICULTURAL	
2.4.5. Mosaic of crops with natural spaces	AGRICULTURAL	
3.1.1.1.1. Tall dense mainland forest	FORESTAL	
3.1.1.1.2. High dense floodplain forest	FORESTAL	
3.1.1.1.2.1. High dense forest Heterogeneous flood	FORESTAL	
3.1.1.2.1. Dense lowland forest	FORESTAL	
3.1.1.2.2. Dense low floodplain forest	FORESTAL	
3.1.2.1.1. Tall open mainland forest	FORESTAL	
3.1.2.1.2. High floodplain open forest	FORESTAL	F5
3.1.2.2.2. Low open floodplain forest	FORESTAL	
3.1.3. Fragmented forest	FORESTAL	
3.1.3.1. Fragmented forest with pastures and crops	FORESTAL	
3.1.3.2. Fragmented forest with secondary vegetation	FORESTAL	
3.1.4. Gallery and riparian forest	FORESTAL	
3.1.5. Forest plantation	PRODUCTION	F7
3.2.1.1.1. Dense grassland of dry land	SAVANNA	
3.2.1.1.1.1. Dense non-wooded terra firm grassland	SAVANNA	
3.2.1.1.2. Dense floodplain grassland	SAVANNA	
3.2.1.1.2.1. Dense floodable grassland without trees	SAVANNA	
3.2.1.1.2.2. Dense wooded floodplain grassland	SAVANNA	F6
3.2.1.2.1. open sandy grassland	SAVANNA	
3.2.1.2.2. Rocky open grassland	SAVANNA	
3.2.2.1. dense shrubland	SAVANNA	
3.2.2.2. open shrubland	SAVANNA	
3.2.3. Secondary or transition vegetation	RESTORATION	
3.3.1. Natural sandy areas	RESTORATION	F8
3.3.3. Bare and degraded lands	RESTORATION	
3.3.4. Burned areas	RESTORATION	
4.1.1. Marshy Areas	WATER BODIES	F9

LAND USE BY LAND COVER		
LEGEND	LAND USE	COD
4.1.3. Aquatic vegetation on bodies of water	WATER BODIES	
5.1.1. Rivers (50 m)	WATER BODIES	
5.1.2. Natural lagoons, lakes, and swamps	WATER BODIES	

Source: Cataruben Foundation, 2023.

Once the land covers have been classified by each land use code for the years 2012 and 2018 (Table 33), an intersection of both layers is made to determine the change in use in the reference region during that period, as shown below:

Table 33. Matrix of land cover changes and their use

MATRIX OF LAND COVER CHANGES											
Idcl		Initial Coverage/Use Classes (2012), area in hectares									
		I1	I2	I3	I4	I5	I6	I7	I8	I9	TOTAL
Class Finals Coverage (2018)	F1	732	24	59	46	17	70	25	6	2	981
	F2	1	45	0,00	24	7	209	53	0,00	2	341
	F3	228	187	114670	108443	20683	52581	46855	5405	563	349615
	F4	251	148	36523	156389	19959	115008	11988	3737	436	344439
	F5	39	23	202225	33606	612758	122652	4982	14773	4745	995803
	F6	496	1193	112385	287254	183767	2293287	66034	74398	24919	3043733
	F7	0	0	30	250	20	0	0	0	0	300
	F8	4	5	11025	15665	9491	123815	2558	12237	1458	176258
	F9	8	0	3454	678	8209	7968	9	7125	10610	38061
	TOTAL	1759	1625	480371	602355	854911	2715590	132504	117681	42735	3200728

Source: Cataruben Foundation, 2024.

As a result of the analysis of the matrix of coverage changes, it is obtained that 62.8% (3.200.728 Ha) of land cover within the reference region of the Orinoco2 project, has been maintained during the period 2012-2018.

- **Annual historical changes in the reference area**

The calculation of the annual historical change in the reference region for the scenario contemplated the multi-temporal analysis of the coverage classified as savanna in the period 2012–2018, applying the following equation:

$$CSCN_{year} = \left(\frac{1}{t_2 - t_1} ln \frac{A_2}{A_1}\right) x\, A_p$$

$$CSCN_{year} = \left(\frac{1}{2018-2012} ln \frac{2.293.288}{3.046.769}\right) x87.396$$

$$CSCN_{year} = 4.138,22\ ha/\textbf{year}$$

Where:

$CSCN_{year}$	Change in the area with natural vegetation cover in the scenario without project; ha/year
t_1	Start year of the reference period in which the changes are analyzed
t_2	Final year of the reference period in which changes are analyzed
A_1	Area in natural vegetation cover in the reference region at t1; ha
A_2	Area in natural vegetation cover in the reference region at t2; ha
A_p	Eligible project area; ha

In this sense, based on the historical average of changes in land use in the reference region, a natural savanna transformation rate of 4.73% was calculated, which represents an average annual change of 4,181.22 ha in the project area.

- **Annual historical land use changes in the leakage area**

In turn, the annual historical changes in land use in the leakage area are estimated using the following formula, for the period 2012–2018:

$$CSCN_{f,year} = \left(\frac{1}{t_2 - t_1} ln \frac{A_2}{A_1}\right) x\ A_f$$

$$CSCN_{f,year} = \left(\frac{1}{2018-2012} ln \frac{76.577}{84.973}\right) x76.577$$

$$CSCN_{f,year} = 1.327,8\ ha/\text{year}$$

Where:

$CSCN_{f,year}$	Change in the surface with natural vegetation cover in the leakage area, in the scenario without project; ha/year
t_1	Start year of the reference period in which the analysis is carried out
t_2	Final year of the reference period in which the analysis is carried out

A_1 Surface in natural vegetation cover in the leakage area t1; ha

A_2 Surface in natural vegetation cover in the leakage area region in t2; ha

A_f Leakage area; ha

In this sense, the historical transformation rate recorded in the reference region and in the leakage area represents the loss of vegetation cover expected in the scenario without the project.

3.6.3.2. Emission factors

The emission factors for deforestation and forest degradation were defined based on official information calculated by the National Forest Inventory (IFN) for the Orinoquía biome, which was presented at the national reference levels - NREF (Ministry of Environment and Sustainable Development – IDEAM, 2020, 2024). For its part, in natural savannas, own data was used for biomass, and reference data applicable to the project execution area for soil organic carbon (SOC).

3.6.3.2.1. Deforestation

According to the IPCC (2006), in the event of a deforestation event, the loss of carbon contained in the biomass and necromass is expected at the time the conversion occurs. While, for the organic carbon present in the soil (SOC), a gradual loss is assumed over a period of 20 years.

For the project, the emission factors for deforestation were based on the NREF values for the Orinoquía biome, considering technical specifications such as stratification (Ministry of Environment and Sustainable Development – IDEAM, 2020, 2024). The NREF 2020 values were used for the period 2018-2022, and the NREF 2024, currently under evaluation, was used for the period 2023-2027 (Table 34, Table 35 and Table 36).

Table 34 Carbon stored in total biomass and detritus

Period 2018-2022 (NREF 2020)				
Biome/Strata	**Aerial biomass (t/ha)**	**belowground biomass (t/ha)**	**Total biomass (t/ha)**	**Carbon in total biomass (tC/ha)**
Orinoquía (Forest)	85,58	20,90	106,47	50,04
Period 2023-2027 (NREF 2024)				
Biome/Strata	**Total biomass (t/ha)**	**Carbon in total biomass (tC/ha)**	**Carbon in detritus (tC/ha)**	**Total carbon (tC/ha)**
Orinoquía (Core	159,58	75,00	4,74	79,74

Forest)				
Orinoquía (Forest Edge)	104,35	49,04	4,74	53,78

Source: Ministry of Environment and Sustainable Development – IDEAM, 2020, 2024.

Table 35. Soil organic carbon (SOC) by stratum

Period 2018-2022 (NREF 2020)		
Biome/Strata	**COS (tC/ha)**	**COS20 (tC/ha)**
Orinoquía (Forest)	64,51	3,23
Period 2023-2027 (NREF 2024)		
Biome/Strata	**COS (tC/ha)**	**COS20 (tC/ha)**
Orinoquía (Forest)	34,73	1,73

Source: Ministry of Environment and Sustainable Development – IDEAM, 2020, 2024.

Table 36 Deforestation emission factors

Period 2018-2022 (NREF 2020)			
Biome/Strata	**Total carbon (tC/ha)**	**COS20 (tC/ha)**	**Deforestation emission factor (tCO2e/ha)[52]**
Orinoquía (Forest)	50,04	3,23	195,32
Period 2023-2027 (NREF 2024)			
Biome/Strata	**Total carbon (tC/ha)**	**COS20 (tC/ha)**	**Deforestation emission factor (tCO2e/ha)[53]**
Orinoquia (Core Forest)	79,74	1,73	298,76
Orinoquía (Forest Edge)	53,78	1,73	203,58

Source: Ministry of Environment and Sustainable Development – IDEAM, 2020, 2024.

3.6.3.2.2. Degradation

According to the BCR 0002 V4.0 methodology, the emission factor for forest degradation is defined from the difference in the average of the total biomass with respect to the transitions between the

52 The emission factor is calculated by converting the value of total carbon and COS20 in tons of CO2e, multiplying them by the stoichiometric ratio between carbon dioxide (CO_2) and elemental carbon (44/12)

53 The emission factor is calculated by converting the value of total carbon and COS20 in tons of CO2e, multiplying them by the stoichiometric ratio between carbon dioxide (CO_2) and elemental carbon (44/12)

fragmentation classes; that is, the loss of biomass as part of the transition process from one class to another. Given the proposed methodological deviation (section 3.1.2) and the availability of information on biomass content by fragmentation classes, the emission factor was established for the transition between the core class (intact forest) to the edge (degraded forest).

For this, the value of the total biomass loss (ΔBT_{bn-bb}), calculated by the National Forest Inventory (IFN) for the Orinoquía biome (Ministry of Environment and Sustainable Development – IDEAM, 2024). Subsequently, the carbon dioxide equivalent was calculated by multiplying ΔBT_{bn-bb} by the fraction of carbon (0.47) and the constant of the molecular ratio between carbon (C) and carbon dioxide (CO_2). In the Table 37 The emission factor applied to the project is presented:

Table 37. Emission factor for forest degradation.

Transition fragmentation classes	Average difference in total biomass (t/ha)	Difference in carbon content in total biomass (tC/ha)	Degradation emission factor (tCO2e/ha)
Core-Edge	57,30	26,93	98,74

Source: Ministry of Environment and Sustainable Development – IDEAM, 2024

3.6.3.2.3. Emission factor in natural savannas

Given the limited availability of values applicable to the project, the own data was used to define the total biomass emission factor in natural savannas. For this, a field sampling was carried out, taking into account The procedure FC-GPP-22. Cluster sampling procedure for aboveground biomass and soil in grasslands and forests, which in turn is based on the National Forest Inventory of Colombia (Olarte et al. 2021).

In this way, the selection of the number and location of sampling points was carried out according to the FC-GOP-23. Inventory design procedure for biomass growth monitoring, section 7.4. For this, it relates the size or area of each ecosystem and the variation of biomass content, established from reference data for the study region (Orozco et.al 2023). Applying the following equation:

$$n = \frac{S^2}{\frac{-2}{y_{IN}} cve^2 + \frac{S^2}{N}}$$

Where:

n Sample size

S^2 Sample variance

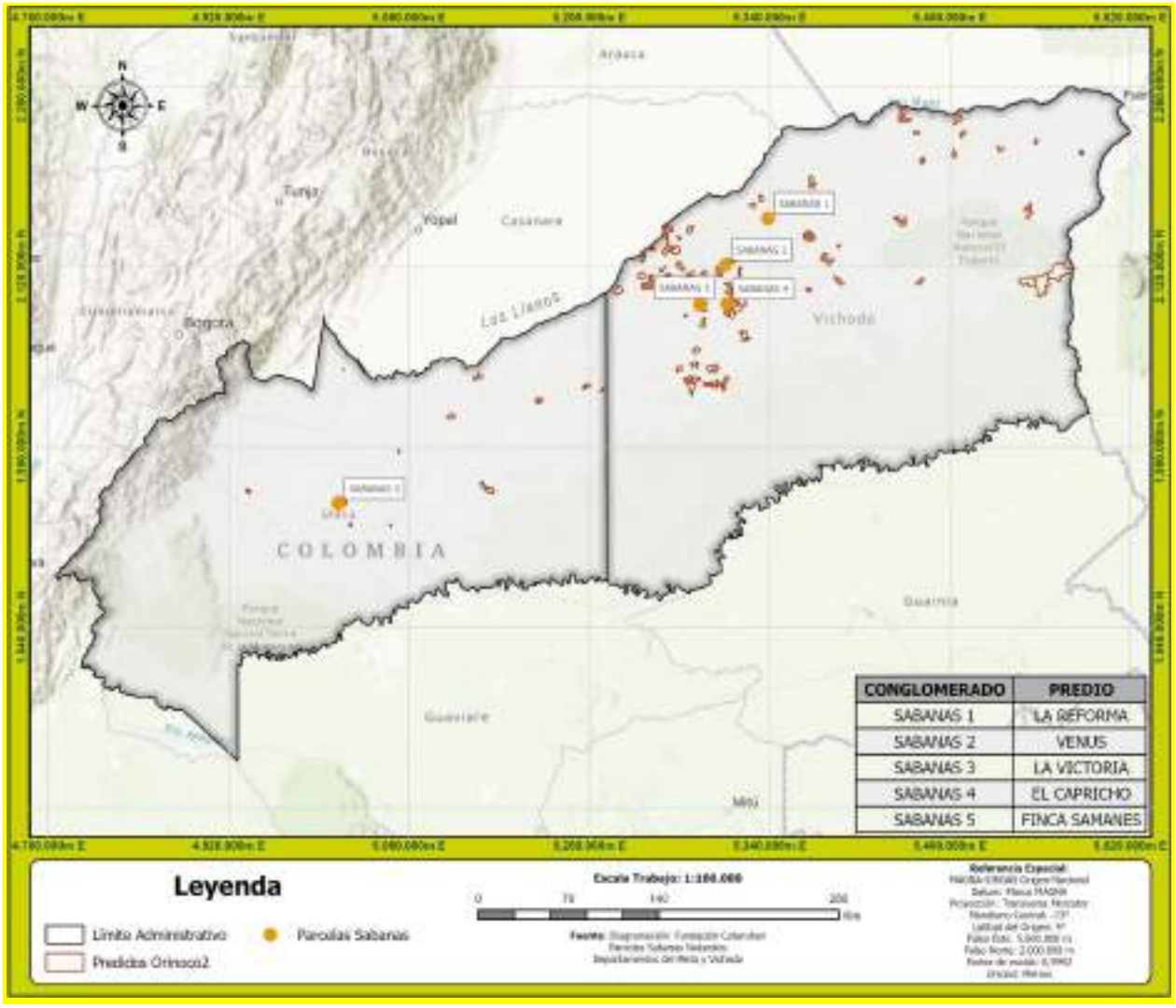
$\bar{y}$ Mean of the guide variable

cve Sample error (%)

N Population size. Total number of sampling points within the project boundaries.

So that, a total of six (6) sampling points for monitoring carbon stocks, which were randomly selected in eligible areas of the properties linked to the project (Figure 21; Table 38). The details of the calculations are found in the Attachment Cluster calculation.

Figure 21. Location of sampling points for the definition of emission factors in savannas.



Source: Cataruben Foundation, 2023.

Table 38. Location of savanna component sampling points.

Component	Id	Department	Municipality	Sidewalk	Property	Length	Latitude
savannas	S1	Vichada	La Primavera	Matiyure	Reform	69°56'44.2"W	05°24' 53,8"N
	S2	Vichada	La Primavera	San Teodoro	Venus	70° 14' 37.1" W	05° 05' 21,3"N
	S3	Vichada	La Primavera	Nazareth	The victory	70° 25' 21.3" W	04° 48' 36,7"N
	S4	Vichada	Cumaribo	Asocortomo	El capricho	70° 13' 57.5" W	04° 49' 2,4"N

Component	Id	Department	Municipality	Sidewalk	Property	Length	Latitude
	S5	Meta	San Martin	Brisas del Camoa	Finca Samanes	72° 56' 59.5" W	03° 25' 49,3" N

Source: Cataruben Foundation, 2023.

Each sampling unit consisted of a 3,535 m cluster² formed by five (5) subplots circulars of 15 m radius (707 m²), arranged in the shape of a cross with a distance of 80 m between the central points, as established in the procedure GPP-22. In savanna ecosystems, no tree or shrub individuals were recorded, so to calculate the biomass content, herbaceous vegetation was collected from 4 quadrants of 1 m x 1 m located 7.5 m from the center of each subplot (Figure 22).

The collected herbaceous vegetation samples were sent to the CIAT Analytical Services laboratory for their respective preparations and dry weight analysis of each sample using the gravimetry technique. The supports for the results delivered by the laboratory can be found in the Annex 1.2.4. Lab results.

The detailed description of the developed procedures is presented in the Data Quality Control Report. For its part, cartographic information is available in 1.1.1.1.Geodatabase sabanas, feature dataset Parcelas, Shapefile Parcelas.

Figure 22. Establishment of clusters: a) and b) delimitation of the cluster; c) and d) harvest of herbaceous vegetation; e) measurement of the fresh weight of herbaceous vegetation and f) reference sample sent to the laboratory.

Source: Cataruben Foundation, 2023

From the information collected in the field. For the calculation of aerial biomass, the dry and wet weight data were related using the following equation: (IDEAM, 2011):

$$BS = \left(\frac{PS_{sample}}{PH_{sample}}\right) * BH$$

Where:

BS	Dry biomass of material harvested in the field
PS_{sample}	Dry weight of the sample taken to the laboratory
PH_{sample}	Wet weight of the sample taken to the laboratory
BH	Biomass or wet weight of all material harvested in the field

For his part, the belowground biomass was estimated from the ratio factor of 1.6, established by default for tropical grasslands by the IPCC (2006). The total biomass emission factor was estimated from the average value of above-ground and belowground biomass, applying the following equation. The results are presented in TableTable 39.

$$CBF_{eq} = BT\ x\ FC\ x\ \frac{44}{12}$$

Where:

CBF_{eq}	Equivalent carbon dioxide contained in the total biomass. tCO2e/ha/year
BT	Total biomass; t/ha
FC	Carbon fraction of dry matter (0.47)
$\frac{44}{12}$	Constant of the molecular ratio between carbon and carbon dioxide

Table 39. Carbon emission factor in total biomass savannas.

Total biomass (t/Ha)	Carbon In BT (tC/ha)	Carbon dioxide equivalent in BT (tCO2e/ha)
3,78	1,78	6,51

Source: Cataruben Foundation, 2023.

Taking into account the principles of the BRC V 3.4 Relevance, Accuracy and Conservative Attitude standard, and also in accordance with the BCR005 methodology section 12.1 Conservative selection of default values. Which states that:

When using default data, the following considerations should be applied when selecting the source of the data:

- Values should be, as far as possible, specific, with a selection from the following data sources (in order of priority, highest first):

1. Local peer-reviewed studies. From areas with climatic and soil conditions similar to those of the project area. This, provided that the more typical small data sets, from local studies, are considered sufficiently reliable;

2.Regional or national forest or GHG inventory for the same ecological zone (i.e., same broad climatic zone and similar soil fertility and depth);

3. International or global forest or GHG inventory, including IPCC literature, for the same ecological zone.

In this regard, the project has found two relevant and accurate studies within the reference region where the project is being developed, which can be used.

Xxx SOC emission factor analysis

Scientific Article	Data	Cumplimiento BCR
Costa, C. Jr., Villegas, D. M., Bastidas, M., Rubio, N. M., Rao, I., and Arango, J. (2022). **Soil carbon stocks and nitrous oxide emissions of pasture systems in Orinoquía region of Colombia: potential for developing land-based greenhouse gas removal projects**. Front. Clim. 4, 916068. Doi: 10.3389/fclim.2022.916068	79.9 tC/ha up to 30 cm.	Adequate data, complies with BCR principles and section 12.1 of BCR0005.
Hyman G, Castro A, Da Silva M, Arango M, Bernal J, Pérez O and Rao IM (2022) **Soil carbon storage potential of acid soils of Colombia's Eastern High Plains**. Front. Sustain. Food Syst. 6:954017. doi: 10.3389/fsufs.2022.954017	65.94 tC/ha up to 40 cm.	Adequate data, complies with BCR principles and section 12.1 of BCR0005.

Finally, in order to be conservative in the calculations, for the soil organic carbon emission factor (COSThe study conducted by Hyman et al. (2022) was taken as COS value. They analyzed the carbon storage potential of soils in the Colombian Orinoco and determined a COS value of 65.94 tC/ha in native savannas at a depth of 0-40 cm. In other words, an emission factor of 12.09 tCO2e/ha is defined for the soil deposit.

Table 40. Emission Factor due to change in land use in savannas.

COS *(tC/ha)*	**COS20** (tC/ha)	**Carbon dioxide equivalent in COS** *(tCO2e/ha)*	**Carbon dioxide equivalent contained in the total biomass** *(tCO2e/ha)*	**Total Carbon Dioxide Equivalent** *(tCO2e/ha)*
65,94	3,30	12,09	6,51	18,60

Source: Cataruben Foundation (2023) and Hyman et al. (2022).

3.6.3.3. GHG emissions in the baseline scenario

GHG emissions correspond to the amount of carbon dioxide (CO_2) to issue, as a result of deforestation and forest degradation events, and land use changes in natural savannas in a no-project scenario. In this way, the procedures applied for its calculation are based on the guidelines of the BCR 0002 methodologies (section 13.5) and BCR 0005 (section 11.4).

3.6.3.3.1. Deforestation

The annual estimate for deforestation in the baseline scenario is estimated taking into account the following equations:

$$EA_{lb,R,year} = (CSB_{R,year} \, x \, TCO_{2eq})$$

Where:

$EA_{lb,R,year}$ Annual emission in the baseline scenario in the reference region; tCO_2/year

$CSB_{R,year}$ Annual historical deforestation in the baseline scenario in the reference region; ha

TCO_{2eq} Total equivalent carbon dioxide; tCO_{2e}/ha.

$$EA_{lb\ A,year} = (CSB_{A,year} \, x \, TCO_{2eq})$$

Where:

$EA_{lb,A,year}$	Annual emission due in the baseline scenario in the project area; tCO_2/year
$CSB_{A,year}$	Historical annual deforestation in the baseline scenario in the area of project; ha
TCO_{2eq}	Carbon dioxide equivalent; tCO_{2e}/ha.

and,

$$EA_{lb,f,year} = (CSB_{f,year} \, x \, TCO_{2eq})$$

Where:

$EA_{lb,f,year}$	Annual emission due in the baseline scenario in the leakage area; tCO_2/year
$CSB_{f,year}$	Historical annual deforestation in the baseline scenario in the leakage area; ha
TCO_{2eq}	Carbon dioxide equivalent; tCO_{2e}/ha.

The details of the annual emissions calculations for the entire quantification period are found in the Annex 1. Emissions / 1.2. Emissions quantification / Annex 1.2.1. Emissions_Project / Sheet 1. Deforestation_LB.

3.6.3.3.2. Degradation

To calculate annual emissions in the baseline scenario, the following equation is used:

$$EA_{d,lb,year} = (DFP_{lb,year} \, x \, DCBT_{DP})$$

Where:

$EA_{d,lb,year}$	Annual emission due to degradation, in the baseline scenario; tCO_2/year
$DFP_{lb,year}$	Historical annual primary degradation in the baseline scenario; ha
$DCBT_{DP}$	Equivalent carbon dioxide contained in the difference in total biomass per hectare in the primary degradation class; tCO_{2e}/ha
$DFS_{lb,year}$	Annual historical secondary degradation in the baseline scenario; ha

$DCBT_{DS}$ Equivalent carbon dioxide contained in the difference in total biomass per hectare in the secondary degradation class; tCO_{2e}/ha

The calculations of annual emissions for the entire quantification period are found in the Annex 1. Emissions / 1.2. Emissions quantification / Annex 1.2.1. Emissions Project / Hoja 2. Degradacion_Forestal_LB.

3.6.3.3.3. Land use change in natural savannas

For the calculation of annual emissions in the scenario without a project for the savannas, the following equation is used:

$$EA_{lb} = CSCN_{lb}\, x \left(CBF_{eq} + COS_{eq}\right)$$

Where:

EA_{lb} Annual issue in the scenario without project; tCO_{2e}/ha/year

$CSCN_{lb}$ Historical changes in the scenario without a project; ha/year

CBF_{eq} Equivalent carbon dioxide contained in the total biomass; tCO_{2e}/ha

COS_{eq} Soil carbon content; tC/ha

The calculations of annual emissions for the entire quantification period are found in the Annex 1. Emissions / 1.2. Emissions quantification / Annex 1.2.1. Emissions Project / Sheet 3. Transformacion_sabanas_LB.

3.6.4. Reduction of Emissions/Removals in the project scenario

To determine the reduction of projected emissions during the execution of the project, the guidelines established in the methodological documents BCR 0002 and BCR0005 were followed. Firstly, the activity data for the project scenario were estimated, in accordance with the guidelines described in sections 13.3.1 and 13.3.2 of the BCR002 methodology, and sections 11.2.3 and 11.2.5 of BCR0005.

Regarding the emission factors, the same values used in the calculation of emissions of the baseline scenario were applied, which are detailed in section 3.7.3.2 of this document.

To calculate GHG emissions, derived from the relationship between the activity data and the defined emission factors, the procedures established in sections 13.5 of the BCR 0002 methodology and 11.4 of BCR0005 were followed.

3.6.4.1. Activity data

Activity data correspond to changes in forest area and natural cover area within the project boundaries. For the project scenario, its estimation was carried out using as a reference the average of the historical changes recorded in the reference region and the leakage area, as well as the projected impact due to the implementation of the project activities. The procedures used for this estimation are detailed below.

3.6.4.1.1. Annual projected deforestation in the project scenario

The annual projected deforestation, in the scenario with REDD+ project, was calculated by applying the following equation:

$$CSB_{project,\,year} = CSB_{lb\,A,year} x(1 - \%DD)$$

Where:

$CSB_{project,\,yea}$	Annual change in the area covered by forest in the scenario with the project; ha
$CSB_{lb\,A,year}$	Annual change in the area covered by forest in the scenario without project; ha
$\%DD$	Projection of the decrease in deforestation due to the implementation of REDD+ activities.

For the quantification period, a 95.65% decrease in deforestation is expected, in accordance with the behavior observed during the first monitoring period and taking into account that the implementation of project activities promotes the conservation of the entire forest cover and seeks to strengthen technical capacities for the sustainable management of the project areas.

On the other hand, the annual projected deforestation in the leakage area in the scenario with the project was estimated from the following equation:

$$CSB_{REDD+project,f\,year} = CSB_{f,lb} x(1 + \%E_f)$$

Where:

$CSB_{REDD+project,f\,year}$	Annual change in the area covered by forest in the leakage area, in the project scenario; ha
$CSB_{f,lb}$	Annual change in the area covered by forest in the leakage area, in the baseline scenario; ha
$\%E_f$	Percent increase in emissions in the leakage area due to the

implementation of REDD+ activities[54].

3.6.4.1.2. Annual projected degradation in the project scenario

The estimate of the projected degradation in the project area was estimated with the following equation:

$$DFP_{REDD+project,\,year} = DFP_{lb} x(1 - \%DFP)$$

Where:

$DFP_{REDD+project,\,ye}$	Annual primary degradation of the project area in the project scenario; ha
DFP_{lb}	Historical annual primary degradation in the scenario without project; ha
$\%DFP$	Projection of decreased degradation due to the implementation of REDD+ activities[55]

Finally, to calculate the projected degradation in the leakage area, the following equations were used:

$$DFP_{f,year} = DFP_{f}\, x\, (1 + \%E_{f})$$

Where:

$DFP_{f,year}$	Annual primary degradation in the leakage area in the scenario with the project; ha
DFP_{lb}	Historical annual primary degradation of the leakage area in the scenario without project; ha
$\%E$	Percent increase in emissions in the leakage area due to the implementation of REDD+ activities[56]

[54] According to the BCR 0002 methodology, the use of a default value of 10% is accepted.

[55] A decrease in degradation is projected in a 99%,according to the behavior observed during the first monitoring period and taking into account that the project activities are aimed at conserving the entire eligible forest area.

[56] According to the BCR 0002 methodology, the use of a default value of 10% is accepted.

3.6.4.1.3. Projection of annual changes of natural savannas in the project scenario

The estimation of the annual changes of savannas areas in the scenario with the project was carried out based on the following equation:

$$CSCN_{Project} = CSCN_{lb} x(1 - \%DC_{project})$$

Where

$CSCN_{project}$	Change in the surface with natural vegetation cover in the scenario with the project; ha/year
$CSCN_{lb}$	Change the surface with vegetation cover in the no project scenario; ha/year
$\%DC_{project}$	Projection of decreased coverage changes due to implementation of project activities.[57]

The estimate of changes in the annual changes in the leakage area in the scenario with the project is calculated as follows:

$$CSCN_{Project,f,year} = CSCN_{f,lb} x(1 - \%E_f)$$

Where

$CSCN_{project,f,yea}$	Change in natural vegetation cover in the leakage area, in the project scenario; ha/year
$CSCN_{f,lb}$	Annual change in the area with vegetation cover in the leakage area, in the baseline scenario; ha/year
$\%E_f$	Percentage of projected increase in emissions in the leakage area due to the implementation of project activities.[58]

3.6.4.2. Annual emission in the project scenario

Annual GHG emissions correspond to the projected amount of CO2 to be emitted, as a result of deforestation and forest degradation events, and changes in land use in natural savannas during the accreditation period, in a scenario without a project. The procedures applied for its calculation are based on the guidelines of the BCR 0002 (section 13.5) and BCR 0005 (section 11.4) methodologies.

[57] Based on the project activities to be implemented and according to the behavior observed during the first monitoring period, the project owner estimates a decrease in 97.02% in changes in land use.
[58] The use of a default value of 10% is accepted by the BCR 0005 methodology.

3.6.4.2.1. Deforestation

The annual emission from deforestation in the scenario with the project is calculated following the equation:

$$EA_{REDD+project,\,year} = (CSB_{REDD+proy}\, x\, TCO_{2eq})$$

Where:

$EA_{REDD+project,\,year}$ Annual emission in the project scenario in the project area; tCO_2/year

$CSB_{REDD+proy}$ Annual change in the area covered by forest in the project area, in the project scenario; ha

CT_{eq} Total carbon dioxide equivalent[59]; tCO_{2e}/ha.

For its part, the annual emission due to deforestation in the leakage area is calculated as follows:

$$EA_{f,project,year} = CSB_{f,project,year}\, x\, TCO_{2eq}$$

Where:

$EA_{f,year}$ Annual emission in the project scenario in the project area; tCO_2/year

$CSB_{f,project,year}$ Annual projected deforestation in the leakage area; ha

TCO_{2eq} Total equivalent carbon dioxide; tCO_{2e}/ha.

The calculation of the estimated annual emissions for the entire quantification period is found in the Annex 1. Emissions / 1.2. Emissions quantification / Annex 1.2.1. Emissions_Project / Sheet 1. Deforestation_LB.

3.6.4.2.2. Forest degradation

In the calculation of annual emission in the project scenario, the following equation is used:

$$EA_{d,REDD+project,year} = (DFP_{REDD+project,\,year}\, x\, DCBT_{DP})$$

Where:

[59] The estimate of GHG emissions contemplates the distinction in emission factors, according to the analysis period (2018-2022 and 2023-2027) and the strata identified for each case.

$EA_{d,REDD+project,year}$ Annual emission in the project scenario; tCO_2/year

$DFP_{REDD+project,\,year}$ Annual historical primary degradation in the project scenario; ha

$DCBT_{DP}$ Equivalent carbon dioxide contained in the difference in total biomass per hectare in the primary degradation class; tCO_{2e}/ha

To calculate the annual emission in the leakage area, the following equation is used:

$$EA_{d,f,\,year} = (DFP_{f,\,year}\, x\, DCBT_{DP})$$

Where:

$EA_{d,f,year}$ Annual emission in the leakage area; tCO_2/year

$DFP_{f,year}$ Annual historical primary degradation in the leakage area; ha

$DCBT_{DP}$ Equivalent carbon dioxide contained in the difference in total biomass per hectare in the primary degradation class; tCO_{2e}/ha

The calculation of the estimated annual emissions for the entire quantification period is found in the Annex 1. Emissions / 1.2. Emissions quantification / Annex 1.2.1. Emissions_Project / Hoja 2. Degradacion_Forestal_LB.

3.6.4.2.3. Land use change in natural savannas

To calculate the annual emission in the scenario with the project, the following equation is used:

$$CSCN_{project,\,year} = CSCN_{project}\, x\, \left(CBF_{eq} + COS_{eq}\right)$$

Where:

$CSCN_{project,}$ Annual emission in the project scenario; tCO_{2e}/ha/year

$CSCN_{project}$ Change in land use in the project scenario; ha/year

CBF_{eq} Equivalent carbon dioxide contained in the total biomass; tCO_{2e}/ha

COS_{eq} Carbon dioxide equivalent contained in soils; tCO_{2e}/ha

Finally, to calculate the annual emission in the leakage area, the following equation is used:

$$E_{f,year} = CSCN_f\, x\, \left(CBF_{eq} + COS_{eq}\right)$$

Where:

$E_{f,year}$ Annual emission in the leakage area; tCO_{2e}/ha/year

$CSCN_f$ Change in land use in the leakage area; ha/year

CBF_{eq} Equivalent carbon dioxide contained in the total biomass; tCO_{2e}/ha

COS_{eq} Carbon dioxide equivalent contained in soils; tCO_{2e}/ha

The calculation of the estimated annual emissions for the entire quantification period is found in the Annex 1. Emissions / 1.2. Emissions quantification / Annex 1.2.1. Emissions_Project / Sheet 3. Transformacion_sabanas_LB .

3.6.4.3. Calculation of Emissions Reduction in the project scenario

The emissions reduction calculation relates the difference between the amount of GHG estimated in the baseline scenario and the projected emissions in the project area and the leakage area. Therefore, the procedures applied to quantify the project's emissions reduction are described below, based on the BCR 0002 (Section 13.6) and BCR 0005 (section 11.5) methodologies.

Once all the formulas have been applied, a summary table of the projected emissions per year is generated, both for forests and savannas. The column of *GHG emissions in the baseline scenario* shows the emissions that would occur in the scenario without the project, according to the historical and regional trend. The column of *emissions in the project scenario* indicates the emissions by the project according to the activities that were designed. The column of *emissions attributable to leakage* correspond to the projection of a 10% increase in historical emissions in the leak belt, due to the implementation of project activities.

Finally, the column of *estimated net GHG reduction*, corresponds to baseline emissions minus project emissions and emissions attributable to leakage. That is, it corresponds to the projection of the reduction of emissions by the project that could be translated into carbon certificates according to the results presented in each of the future monitoring and verification reports.

3.6.4.3.1. Reduction of emissions from REDD+ activities

The reduction in emissions from deforestation and avoided degradation is estimated according to the following equations:

$$RE_{DEF,REDD+proy} = \left(t_2 - t_1\right)x\left(\left(EA_{lb,A,year} - EA_{REDD+project,\,year}\right) - \left(EA_{lb\,f,year} - EA_{f,project,year}\right)\right)$$

Where:

$RE_{DEF,REDD+proy}$	Reduction of emissions from avoided deforestation in the scenario with the project; tCO2e
t_1	Final year of the reference period; year
t_2	Start year of the reference period; year
$EA_{lb,A,year}$	Annual emission from deforestation in the baseline scenario; tCO2e
$EA_{REDD+project,\ yea}$	Annual emission from deforestation in the project area; tCO2e
$EA_{lb\ f,year}$	Annual emission from deforestation in the leakage area in the baseline scenario; tCO2e
$EA_{f,project,year}$	Annual emission in the project scenario in the leakage area; tCO2e/ha

and,

$$RE_{DEG,\ REDD+proy} = (t_2 - t_1)x(EA_{DEG,lb,year} - EA_{SDR,REDD+project,year} - EA_{DEG,f,year})$$

Where:

$RE_{REDD+proy}$	Reduction of emissions due to avoided degradation; tCO_2/year
t_1	Start year of the reference period
t_2	Final year of the reference period
$EA_{DEF/DEG,lb,year}$	Annual emission degradation in the baseline scenario; tCO2e
$EA_{DEF/DEG,REDD+proj,,year}$	Annual degradation emission in the project area; tCO2e
$EA_{DEF/DEG,f,year}$	Annual emission degradation in leakage area; tCO2e

Given that the REDD+ activities component includes the monitoring of emissions from deforestation and forest degradation, Table 41 shows the summary of the sum of GHG emissions and annual reductions of the two activities.

Table 41. Summary of emissions reductions from REDD+ activities

Year	GHG emissions in the baseline scenario (tCO2e)	GHG emissions in the scenario with Project (tCO2e)	GHG emissions attributable to leaks (tCO2e)	Estimated Net GHG Reduction (tCO2e)
2018	18.982,0	705,0	838,0	17.439,0
2019	79.183,0	2.957,0	3.352,0	72.874,0
2020	82.046,0	3.079,0	3.352,0	75.615,0
2021	84.432,0	3.180,0	3.352,0	77.900,0
2022	86.286,0	3.259,0	3.352,0	79.675,0
2023	98.880,0	3.793,0	3.909,0	91.178,0
2024	101.573,0	3.907,0	3.909,0	93.757,0
2025	104.055,0	4.013,0	3.909,0	96.133,0
2026	106.327,0	4.108,0	3.909,0	98.310,0
2027	108.388,0	4.196,0	3.909,0	100.283,0
Total	870.152,0	33.197,0	33.791,0	803.164,0
Annual Average	94.070,5	3.588,9	3.653,1	86.829,0

Source: Cataruben Foundation, 2024.

The application of the equations and step-by-step calculations are found in the Annex 1. Emissions / 1.2. Emissions quantification / Annex 1.2.1. Emissions_Project / *Sheets 1. Deforestation_LB and 2. Forest_Degradation_LB.*

3.6.4.3.2. Reduction of emissions by avoiding land use change in natural savannas

The calculation of the emission reduction due to avoiding changes in land use in natural savannas, in the scenario with the project, is estimated from the following equation:

$$RE_{project} = (t_2 - t_1)\, x\, (EA_{lb} - EA_{project} - EA_f)$$

Where:

$RE_{project}$	Reduction of emissions by avoiding changes in land use in the scenario with the project; tCO2e
t_1	Start year of the reference period; year
t_2	Final year of the reference period; year
EA_{lb}	Annual emission from land use changes in the baseline scenario; tCO_{2e}
$EA_{project}$	Annual emission from changes in land use in the project area; tCO_{2e}

EA_f Annual emission from land use changes in the leakage area; tCO_{2e}

Table 42 shows a summary of greenhouse gas (GHG) emissions calculations and reductions.

Table 42. Summary reduction of emissions from activities that avoid land use change in natural savannas.

Year	GHG emissions in the baseline scenario (tCO2e)	GHG emissions in the scenario with Project (tCO2e)	GHG emissions attributable to leaks (tCO2e)	Estimated Net GHG Reduction (tCO2e)
2018	19.246,0	563,0	618,0	18.065,0
2019	76.982,0	2.251,0	2.470,0	72.261,0
2020	76.982,0	2.251,0	2.470,0	72.261,0
2021	76.982,0	2.251,0	2.470,0	72.261,0
2022	76.982,0	2.251,0	2.470,0	72.261,0
2023	76.982,0	2.251,0	2.470,0	72.261,0
2024	76.982,0	2.251,0	2.470,0	72.261,0
2025	76.982,0	2.251,0	2.470,0	72.261,0
2026	76.982,0	2.251,0	2.470,0	72.261,0
2027	76.982,0	2.251,0	2.470,0	72.261,0
Total	712.084,0	20.822,0	22.848,0	668.414,0
Annual Average	76.982,1	2.251,0	2.470,1	72.261,0

Source: Cataruben Foundation, 2024.

The emission reduction calculations are found in Annex 1. Emissions / 1.2. Emissions quantification / Annex 1.2.1. Emissions_Project / *3. Transformation_sabanas_LB*.

3.6.4.3.3. Total project reductions

The project aims to achieve a reduction of 1.471.578 tCO2e during its first quantification period (2018-2027), of which 54.58% is projected as a result of avoided deforestation and degradation, and the remaining 45.42% is related to avoided transformation in natural savanna areas. (Table 43).

Table 43. Project emissions reduction summary.

Year	GHG emissions in the baseline scenario (tCO2e)	GHG emissions in the scenario with Project (tCO2e)	GHG emissions attributable to leaks (tCO2e)	Estimated Net GHG Reduction (tCO2e)
2018	38.228,0	1.268,0	1.456,0	35.504,0

Year	GHG emissions in the baseline scenario (tCO2e)	GHG emissions in the scenario with Project (tCO2e)	GHG emissions attributable to leaks (tCO2e)	Estimated Net GHG Reduction (tCO2e)
2019	156.165,0	5.208,0	5.822,0	145.135,0
2020	159.028,0	5.330,0	5.822,0	147.876,0
2021	161.414,0	5.431,0	5.822,0	150.161,0
2022	163.268,0	5.510,0	5.822,0	151.936,0
2023	175.862,0	6.044,0	6.379,0	163.439,0
2024	178.555,0	6.158,0	6.379,0	166.018,0
2025	181.037,0	6.264,0	6.379,0	168.394,0
2026	183.309,0	6.359,0	6.379,0	170.571,0
2027	185.370,0	6.447,0	6.379,0	172.544,0
Total	1.582.236,0	54.019,0	56.639,0	1.471.578,0
Annual Average	171.053,0	5.840,0	6.123,0	159.090,0

Source: Cataruben Foundation, 2024.

4. Compliance with Laws, Statutes and Other Regulatory Frameworks

In the process of planning, executing and monitoring the objectives and goals of Orinoco2, a project led by the Cataruben Foundation, an analysis of current national regulations was carried out, since both individuals and legal entities are obliged to respect and comply with the set of rules that regulate individual or community activities within Colombian territory.

This legislation regulates social, environmental, economic and cultural situations, among others. The laws are modified according to the changes that are generated on a daily basis. With this in mind, the information is controlled and updated in a document called <<legal regulations matrix>>(folder 6.5.1.3.1. Safeguard A) his document is created, organized and updated according to the procedure established in the foundation's document management system, called << Procedure GJP-14 Management of Legal Requirements >> (Folder 7. Others/annex 7.1), which establishes parameters for effective compliance within the project areas and its activities.

In addition to complying with applicable legislation, once the eligible areas of the project have been identified, Cataruben carries out the process of requesting determination and opportunity for prior consultation before the Ministry of the Interior. Through this process, the entity is asked to indicate in writing if there are any requests being processed regarding the expansion of the indigenous communities' areas or a definitive overlap with the project's private lands, so as not to intervene in special jurisdiction processes, since the development of Orinoco 2 is only focused on private areas. If this were to happen, such areas would be excluded.

According to all the above, Below are the regulatory provisions that were considered when the project was launched.

Table 44. Normative provisions of the project.

Area	Norm or Law	Characteristics	Compliance
APPLICABLE CLIMATE CHANGE LEGISLATION	Decree 2811 of 1974 — Environmental protection	By which the National Code of Renewable Natural Resources and Environmental Protection is dictated	The Cataruben Foundation, in compliance with Decree 2811 that covers comprehensive environmental management, has adopted a proactive and committed approach to the conservation of natural forest and savanna ecosystems, as an integral part of the ORINOCO2 project, recognizing the fundamental importance of conserving the natural resources present in the areas linked to the project. It is committed to implementing effective measures to preserve biodiversity, soil quality,

Area	Norm or Law	Characteristics	Compliance
			water and other elements that make up local ecosystems.
	Law 164 of 1994 — Climate Change	United Nations Framework Convention on Climate Change Through which the commitment to adopt measures to reduce GHG emissions into the atmosphere is ratified.	The primary objective of the Orinoco2 project is to carry out activities aimed at achieving the goal of reducing deforestation and forest degradation, as well as preventing the transformation of land use in natural savannas. This initiative proposes to achieve a significant reduction of 1,695,656 tons of CO_2 equivalent, during the period 2018-2027. The execution of these activities is aligned with the principles of Law 164 of 1994, reaffirming our commitment to the regulations and standards established for environmental preservation and the sustainable management of natural resources.
	National Policy for the Comprehensive Management of Biodiversity and its ecosystem services of 1996	Prevent and control the accelerated loss and transformation of Biodiversity, as well as to reduce and mitigate the negative effects that this generates on the quality of life.	The implementation of monitoring of globally threatened species and the promotion of actions for their conservation within the framework of the project are concrete manifestations of prevention against the accelerated loss of biodiversity, attributable to the same economic dynamics of the territory.
	Forest Policy-Conpes 2834 of 1996	Its general objective is to achieve the sustainable use of forests, in order to conserve them, consolidate the incorporation of the forestry sector into the national economy and contribute to the improvement of the quality of life of the population.	With the implementation of the Orinoco2 project, conservation activities are carried out on the forest areas identified in each of the private properties formally linked to the project, represented in 33,960.9 hectares, to contribute in joint work to the preservation of these areas and its biodiversity between the project owner and the Ecosystem Manager.
	Law 629 of 2000 - Approval of the Kyoto Protocol in Colombia	Quantification and reduction of greenhouse gases, climate change mitigation strategies	With the implementation of the Orinoco2 project, the aim is to manage the reduction of emissions by 1,695,656 tCO_2e and thus join efforts through the purchase of carbon credits generated by climate change mitigation projects in compliance with law 629 of 2000.

Area	Norm or Law	Characteristics	Compliance
	National Plan for Prevention, Control of Forest Fires and Restoration of Affected Areas of 2002	Strengthen the global response to the threat of climate change by keeping global temperature rise this century well below 2 degrees Celsius above pre-industrial levels, and pursue efforts to further limit temperature rise to 1 .5 degrees Celsius. Furthermore, the agreement aims to increase the capacity of countries to address the effects of climate change and ensure that financing flows are consistent with a low level of greenhouse gas (GHG) emissions and a climate-resilient trajectory.	The implementation of the Orinoco2 project includes key activities aimed at strengthening the knowledge of private property owners. One of the important focuses of this strengthening is focused on the prevention of forest fires that involve (controlled burning practices, firebreaks, adequate waste management), through these actions, we seek to contribute significantly to the protection of forests and savannas preserved within the framework of the project.
	National Climate Change Policy, 2016	Strategies and actions to manage knowledge about climate change and its potential consequences on communities, biodiversity, their ecosystem services and the country's economy.	Within the framework of project execution, strategies are proposed to manage climate change. These include the prevention of forest fires, monitoring of hot spots, implementation of landscape management tools, biodiversity monitoring and restoration actions for degraded ecosystems. All these actions are coherently aligned with the national climate change policy.
	Decree 298 of 2016- National Climate Change System- SISCLIMA.	Establish the National Climate Change System SISCLIMA, in order to coordinate, articulate, formulate, follow up and evaluate policies, regulations, strategies, plans, programs, projects, actions and measures for adaptation to climate change and mitigation of greenhouse gases, whose intersectoral and transversal nature implies the necessary participation and co-responsibility of national, departmental,	The related regulations establish criteria for the management of climate change projects, which allow impact not only on the environment, but also related social and economic aspects with respect to the people who represent the direct actors in its implementation, with an objective in common which is mitigating Greenhouse Gases. The Orinoco2 project aligns with this requirement and contributes to this objective, implementing forest and savanna conservation actions on private properties in the departments of Meta and Vichada.

Area	Norm or Law	Characteristics	Compliance
		municipal or district public entities, as well as private and non-profit entities.	
	Decree 926 of 2017- Carbon Tax	By which the heading of Part 5 is modified and Title 5 is added to Part 5 of Book 1 of Decree 1625 of 2016 Sole Regulatory on Tax Matters and Title 11 of Part 2 of Book 2 of Decree 1076 of 2015 Sole Regulatory System for the Environment and Sustainable Development Sector, to regulate paragraph 3 of article 221 and paragraph 2 of article 222 of Law 1819 of 2016.	The national carbon tax was created by article 221 of law 1819 of 2016 (Structural Tax Reform) in response to the country's need to have economic instruments to encourage compliance with Greenhouse Gas (GHG) mitigation goals.) at the national level. The Orinoco2 project is aligned with this legal requirement, since it seeks to contribute to climate change through 146 private properties where activities will be carried out to contribute to the fulfillment of the objectives of reducing the effects of Greenhouse Gases (GHG).) and thus, open the possibility that all people who must incur the carbon tax can compensate for it according to what is permitted by law.
	Decree 298 of 2016 - National Climate Change System	By which the organization and operation of the National Climate Change System is established and other provisions are dictated	The Orinoco2 project is aligned with what is established by the national climate change system (Sisclima) and guarantees compliance with the national climate change policy through the active and effective participation of civil society.
	Law 1844 of 2017- Paris Agreement	Adopts the Paris agreement in Colombia for all countries that are part of it	In accordance with the goals established for the reduction of emissions, the non-deforestation of 179,212.3 linked hectares contractually to the project, the empowerment of associated communities, the impact on SDG 6 and 15 show a clear alignment with the Paris Agreement.
	Law 1447 of 2018- Monitoring, reporting, and verification system of mitigation actions at the national level	Regulate the Monitoring, Reporting, and Verification System of mitigation actions at the national level, in relation to the Accounting System for the Reduction and Removal of Greenhouse Gas Emissions and the National Registry for the Reduction of Greenhouse Gas Emissions	Orinoco2 is a project that seeks to mitigate the effects of Greenhouse Gas (GHG) emissions through the development of activities to contribute to the objectives and commitments regarding climate change. This joint work is carried out with property owners, private companies and Ecopetrol as a strategic ally, the reference scenario is the compensations measured in tons

Area	Norm or Law	Characteristics	Compliance
		(GEI), which includes the National Registry of Programs and Projects of actions for the Reduction of Emissions due to Deforestation and Forest Degradation in Colombia (REDD+)	of CO2e that would be produced during the monitoring period. The project is aligned with the provisions of Law 1447, given that it is aligned with the guidelines established there regarding REDD initiatives and contributes to the goals and objectives of climate change, this initiative will be registered in RENARE once it comes into operation through from which control is kept of all the information regarding the development of these projects at the national level.
	Law 1931 of 2018 - Climate Change Guidelines	Establishes guidelines, mainly in actions to adapt to climate change, as well as in mitigation of greenhouse gases, with the aim of reducing the vulnerability of the population and the country's ecosystems to its effects and promoting the transition towards a competitive, sustainable economy and low carbon development	Taking into account that the Orinoco2 project vinwhich has 146 propertiesowners of private properties that guarantee the reduction of emissions on their properties, Law 1931 is complied with, which establishes that all natural or legal persons have the responsibility of participating in the management of climate change and developing their own actions to contribute to their management; These owners linked to the Cataruben Foundation carry out adaptation and mitigation actions for greenhouse gas emissions.
	CONPES 3918 of 2018-Strategy for the Implementation of the Sustainable Development Goals (SDG) in Colombia	Consolidate sustainable alternatives for production, conservation, recovery of goods, ecosystem services and improve the management of information on the state and pressures of the resource forestry, for the development of actions aimed at the administration and sustainable management of the country's forests.	The Orinoco2 project complies and is aligned with the guidelines established in the regulatory document of goals against climate change, the environment and the Sustainable Development Goals (SDG) in Colombia. This document, which establishes clear guidelines for the achievement of environmental and development goals, serves as a fundamental reference for our approach and implementation of each of the activities established in the project.

Area	Norm or Law	Characteristics	Compliance
	Law 2169 of 2021 - Carbon Neutrality	Through this standard, minimum goals and measures are established to achieve carbon neutrality, climate resilience and low-carbon development in the country in the short, medium and long term, and other provisions are dictated.	ORINOCO2 during the development of the project activities implemented by the Cataruben Foundation and Ecopetrol as a strategic ally, contributes significantly to the fulfillment of the goal set in Law 2169 throughout the Colombian territory, under which a reduction must be generated by the year 2030. 51% of greenhouse gas emissions caused by different aspects including consumption of fossil fuels, coal mining, electrical energy, etc. These reduction activities must be measured and monitored, for which a system will be established that allows it.
	Resolution 849 of 2022 - Comprehensive Territorial Climate Change Management Plans - PIGCCT	Establish the "Guide for the formulation and implementation of Comprehensive Territorial Climate Change Management Plans – PIGCCT"	Resolution 849 addresses fundamental aspects such as the analysis of climate risk vulnerability, strategies to achieve carbon neutrality in the short, medium and long term, the development of mitigation scenarios, the development of measures and actions to implement in the territory for each of local authorities; The project develops a matrix of social and economic environmental risks to measure and mitigate the impacts caused by the project in the territory, at the same time generating a baseline scenario based on the temporal and spatial history of the Orinoco2 project.
SOFTWARE	Law 2294-2023 NATIONAL DEVELOPMENT PLAN 2022-2026 "COLOMBIA WORLD POWER OF LIFE	Lay the foundations for the country to become a leader in the protection of life through the construction of a new social contract that promotes the overcoming of historical injustices and exclusions, the non-repetition of conflict, the change in our relationship with the environment and a productive transformation based on knowledge and in harmony with nature. This	During the first monitoring period (2018-2022), the Orinoco2 Project has implemented activities in accordance with the special protection and territorial planning figures established. These actions have been fundamental to advance our conservation and sustainability objectives. However, in order to remain aligned with the most recent standards and evolutions in territorial planning

Area	Norm or Law	Characteristics	Compliance
		process must lead to total peace, understood as the search for an opportunity so that we can all live a dignified life, based on justice; that is, in a culture of peace that recognizes the sublime value of life in all its forms and that guarantees the care of the common home.	guidelines, the project has decided to consider reviewing updates to the monitoring reports. These updates will focus mainly on the changes or modifications of the municipal Development Plans and the Action Plan of the CAR (Regional Autonomous Corporation), thus guaranteeing that our activities remain consistent with current policies and regulations, thus the Orinoco2 project reaffirms its commitment to environmental management
	Forest Policy Territory of Life 2019	Comprehensive Deforestation Control and Forest Management Strategy, as a cross-sectoral policy instrument that involves the co-responsibility of the different sectors of the Colombian State, with the purpose of stopping deforestation and forest degradation, addressing the complexity of the causes that They generate it, starting from recognizing the strategic significance of these ecosystems for the country, for their sociocultural, economic and environmental importance, for their potential as a development option within the framework of the peace-building process, and for their contribution to the mitigation and adaptation to climate change.	Orinoco2 is aligned with the forest territories of life strategy, they already share the general objective of contributing to the sustainable development and preservation of natural forests, in addition to strengthening the knowledge of the owners of the properties linked to Orinoco2, on forest governance, environmentally sustainable activities, in order to conserve the existing ecosystems in each property and join efforts in the mitigation of Greenhouse Gases (GHG)

Area	Norm or Law	Characteristics	Compliance
	Colombia Nationally Determined Contribution (NDC) Update - 2020	The NDC incorporates three components: i) Greenhouse Gas (GHG) mitigation, ii) adaptation to climate change, and iii) means of implementation as an instrumental component of policies and actions for low-carbon, climate-adapted and resilient development. .	The NDC is a document in which countries assume roles and strategies to reduce greenhouse gas (GHG) emissions and address climate change; In the implementation of the Orinoco2 project, its main function is to reduce Greenhouse Gas (GE) emissions and promote carbon absorption, including activities or strategies in sectors such as renewable energy, energy efficiency, reforestation, sustainable management of forests, strengthening forest governance, impact on local communities regarding the activities they carry out on their properties and other efforts to reduce greenhouse gas emissions.

Source: Cataruben Foundation, 2023.

5. Carbon ownership and rights

For the implementation, formulation, and execution of carbon projects, national regulations have not established applicable legislation to determine the ownership of carbon in relation to the tenure of land owned by natural or legal persons. Therefore, it is relevant for the project owner to adjust to the existing regulations that deal with land tenure issues in the national territory and thus mitigate the legal risks arising from land disputes.

Accordingly, Cataruben and other environmental project formulators can apply land tenure regulations governing ownership of real estate to determine who holds the rights to the carbon sequestration generated in areas of private land.

Under the implementation model for climate change mitigation projects, the Cataruben Foundation is the project owner and the landowners are the managers of the ecosystems to be conserved within the project. Cataruben is in charge of generating the project's enabling conditions and leading the monitoring, reporting and validation and verification management procedures, while the project participants carry out the necessary activities within the boundaries of each of their properties to comply with the obligations undertaken.

Given the relevance that the area of climate change has acquired globally, the development of regulations to define carbon ownership can be a laborious process that requires detailed analysis of several areas to identify who has the best rights to the benefits derived from carbon sequestration in the ecosystems that are identified in each of the private properties.

5.1. Project owner

Table 45. Project owner information.

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5.2. Project participants — Ecosystem Managers

Table 46. Project participants — Ecosystem Managers.

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AGROFORESTAL LUCERNA SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL RIOGRANDE SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL VENEZUELA SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL TAMANACO SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGRO VERACRUZ SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
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AGRO VERACRUZ SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL VERACRUZ S.A.S.	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL ORIENTE SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL LA MACARENA SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL ROTTERDAM SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL LA LINA SAS/ AGROFORESTAL VILLA DEL SOL SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com
AGROFORESTAL ACACIAS SAS	LUIS HERNANDEZ VILLEGAS	R/L	Cl 5 Oeste 29 70	3217605503	luisvillegas@riopaila-castilla.com

Source: Cataruben Foundation, 2023.

5.2.1. *Other important actors in the project — Ecopetrol SA*

One of the fundamental project activities carried out by the Cataruben Foundation consists of the search for a strategic ally that provides financial and technical resources. The objective of this collaboration is to generate the necessary enabling conditions to carry out the validation and first verification of the project, as well as to anticipate the identification of a final buyer for the carbon credits to be generated by the project. As well as complementing the three-part model (Project Participants, cataruben, Strategic Ally) that ensures a project with high integrity, safeguarding fundamental principles of transparency, governance, distribution of economic benefits, compliance with safeguards and incentive for sustainable development.

In this context, the Cataruben Foundation carried out exhaustive management, exploring various options to fulfill this purpose. Since 2020, conversations began with Ecopetrol in order to establish a solid collaboration. This process evolved through maturation and approval phases, culminating in the signing of macro agreement 3051645 of 2022. This agreement covers the financing of the enabling conditions necessary to validate and verify the Orinoco2 project.

The successful conclusion of this process reflects the continuous commitment of the parties to advance towards the project's objectives, establishing a solid foundation for the validation, verification and subsequent commercialization of the carbon credits generated. This strategic collaboration with Ecopetrol represents a significant milestone in the development of the project, consolidating a partnership that will positively contribute to the results and overall success of the initiative.

Inside Ecopetrol In particular, there was technical and financial support from the area of sustainability and decarbonization plan, this support is given with the objective of enabling the offer of carbon certificates for voluntary compensation within the company's decarbonization framework. In this way it ensures the generation of economic benefits for project participants, which facilitates the execution of activities and the permanence of reductions and removals. In the table 47 Contact information for the liaison with Ecopetrol is provided.

TableTable 47 Ecopetrol Contact information

Organization	**ECOPETROL S.A**
Contact person	Diego Puentes
Address	Bogota Colombia
Phone number	3154549992
Email	diegofe.puentes@ecopetrol.com.co

5.2.2. *Three part model*

In this sense, the alliance model is consolidated under the participation of the parties, which with the development of their functions allow the objectives of the ORINOCO2 project to be carried out successfully, shown in the following figure.

Figure 23 Three-part model for the ORINOCO2 project

5.3. Agreements related to carbon rights

The project areas correspond to private properties with identifiable landholders as described in the land ownership section, with whom a contract was signed to link the project. Each agreement contains:

- Object
- Contract and project duration
- GHG project name
- Responsibilities, obligations, and rights of each of the signatory parties
- Parties signing the agreement
- Agreements for the parties according to the parameters established by Biocarbon Standard
- Notifications

Agreement that was previously socialized with each of the project participants, ensuring that they agree with the management of carbon rights. In it ANNEX 2.1 PROPERTY DOCUMENTS The documents for each property are found. Within which are the legal documents that demonstrate the ownership and rights over the carbon of each one.

5.3.1. Non-origin of Prior Consultation

An analysis of overlapping layers was carried out between the project areas and the areas of indigenous reservations, black communities and other collective communities, which determined that the project is only developed within the limits of private properties. However, to ensure that the project areas are not within the territory, certification of non-origin was requested. Certificate of determination of origin and opportunity for prior consultation for the execution of projects, works or activities, before the Ministry of the Interior. (EXHIBIT 2.2. NOT FROM PRIOR CONSULTATION *)*

5.4. Land tenure

The Cataruben Foundation's legal team has conducted a study of the ownership of each property based on the documents provided by each owner. It was determined that all project participants accredit land tenure over the formally linked properties, on which the project areas are located and over which the project activities are monitored. This analysis is based on a document called "Title Study" that compiles data on both the property and its owner.

Each time the project is verified, the current land tenure status is monitored and followed up to verify if there have been any modifications or if, on the contrary, it is still in its initial state. For this purpose, an update of the Certificate of Tradition and Freedom or document that determines the ownership, possession, or tenure of the property is requested.. In the folder ANNEX 2.1 PROPERTY DOCUMENTS Within each folder of the properties there is the subfolder "LEGAL DOCUMENTS" where the legal documents that demonstrate the ownership of the land and the document of the analysis carried out where it is possible to validate the percentage of participation of each type of ownership identified in the group of linked properties.

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6. Climate change adaptation

In compliance with criterion 11.8 of BCR V3.4, the project develops actions related to climate change adaptation and demonstrates that these are derived from project activities. This is achieved through an analysis of the national climate change policy and planned adaptation actions.

In this sense in the Table 48 establishes an analysis of the criteria, the way in which the project addresses its compliance and finally the activities from which these climate change adaptation actions derive are related.

Table 48. Adaptation to climate change derived from project activities.

Criterion a)	Consider some strategic lines proposed in national climate change policies and/or address aspects framed in the regulations of the country where the project is implemented.
Compliance	**Related project activity**
The project considers the strategic lines: **1. Low-carbon and climate-resilient Rural Development** **- Line of action 3:** Promote comprehensive actions on farms, in farms or communities that help the efficient use of the land, and where the conservation of the existing natural coverage on the farms, the restoration of their degraded areas, and low-carbon livestock intensification are prioritized. , 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 reduces vulnerability to climate change. Specifically, in the following sublines of action. • 3.2. Evaluate GHG emissions from farms, farms or communities, including livestock sources and changes in land use. • 3.7 Implement adaptation and mitigation measures on farms or communities • 3.8 Implement economic instruments for GHG mitigation on farms, or communities.	Regarding line of action 3. The project has three macro activities: 1. Reducing deforestation, 2. Reducing forest degradation and 3. Reduction of land use change in natural savannas. To do this, emissions from changes in land use in forests and savannas, as well as forest degradation, are quantified. (See Annex 1.2.1. Emissions) Likewise, mitigation and adaptation measures are implemented within the farms that are part of the project: The economic instrument of payments for mitigation results is also implemented, seeking to improve the quality of life of the project participants and the financial sustainability of the activities. Regarding line of action 7. The fundamental axes of the project are the implementation of actions, the property implementation plans,

- **Action line 7**: Promote sustainable forest management within the farms, the sustainable use of natural resources, the conservation of forests and water margins, as well as the restoration of degraded areas. • 7.1 Incorporate management and conservation actions for ecosystems and their services into property and community planning, taking into account their role in reducing emissions and increasing territorial adaptation. • 7.2. Implement sustainable forest management and forest conservation at the property and community level. **2. Management and conservation of ecosystems and their ecosystem services** • ***Action line 4:*** Strengthen forest governance to prevent deforestation and forest degradation.	which constitute planning tools based on the conservation and development of sustainable productive activities. In addition, the project incorporates an activity that seeks to Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally. As well as, the strengthening of technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools, the promotion of recognition of areas and figures of conservation for the sustainable management of ecosystems. Actions that contribute to implementing sustainable forest management at the property level. All these actions are framed in the design of the project activities (See section 2.3.8.1.)
Criterion b)	Improves the conditions of conservation of biodiversity and its ecosystem services, in the areas of influence, outside the limits of the project (e.g. natural coverage in areas of special environmental interest, biological corridors, water management in basins, among others.
Compliance	**Related project activity**
The project promotes and provides improvement actions for the conservation and safeguarding of biodiversity and its ecosystem services. In addition, it identifies and monitors HCVs, and manages the improvement of water resources within the properties.	**G5:** Promote the delimitation and signaling in strategic ecosystems and natural protection areas. **B1:** Identification and monitoring of HCVs present in the project area. **B2:** Monitoring the presence of globally threatened species and taking actions to conserve them. **B3:** Restoration actions in degraded ecosystems. **R1:** Promote the recognition of conservation areas and figures for the sustainable management of ecosystems
Criterion	Implements activities that contribute to sustainable low-carbon productive landscapes.

Comply. The project promotes the implementation of sustainable production systems and practices. Providing strengthening of the capacities of project participants, with the purpose of achieving empowerment of communities in the development of responsible actions in the care and preservation of natural resources.	**G2:** Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools. **R1:** Implementation of sustainable fire use management practices for the prevention of forest fires. **R3**:Promotion of the establishment of eco-efficient stoves and wood energy banks **S1:** Implementation of landscape management tools in savannas and sustainable productive practices. **S2:** Implementation of sustainable productive practices in natural savannas.
Criterion c)	It proposes areas with restoration processes in areas of special environmental importance.
Compliance	**Related project activity**
Complies, within the geographical limits of the project there are areas of riparian forests that are fundamental for biodiversity and the environment. In this sense, the identification of potential areas to be restored and the actions necessary to carry out the restoration activities are included.	**B3:** Restoration actions in degraded ecosystems.
Criterion	Design and execute adaptation strategies based on an ecosystem approach.
Compliance	**Related project activity**
Comply. The project is based on the conservation, restoration and sustainable management of natural ecosystems, within nature-based solutions. Therefore, it is important to develop actions to strengthen the	**G2:** Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid

capacities of local communities to achieve compliance with the conservation strategies of strategic ecosystems.	forest fires, sustainable productive systems and landscape management tools. **G6:** Promote the recognition of conservation areas and figures for the sustainable management of ecosystems.
Criterion	Strengthens the local capacities of institutions and/or communities to make informed decisions that allow them to anticipate negative effects derived from climate change (recognition of vulnerability conditions
Compliance	**Related project activity**
Comply. The project includes the development of training for the transfer of knowledge with the local community, with the purpose of providing the necessary tools for making informed decisions about the management of the properties. These trainings are aimed at climate change and conservation actions for strategic ecosystems.	**G2:** Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.

Source: Cataruben Foundation, 2023.

7. Risk management

Following the guidelines of the Standard *BioCarbon Standard, Version 3.4, dated June 28, 2024*, section 14 Risk Management and tools *Permanence and Risk and Management, Version 1.1 of March 19, 2024,* section 4 Reversal Risk Management, in addition to S*ustainable Development Safeguards (SDSs Tool), Version 1.0 April 2024;* The project evaluated the risks related to the implementation of the activities, from the environmental, financial and social dimensions. Based on the identification of risks in these three dimensions, measures were designed to address them, so that the reduction or removal of GHG emissions is maintained during the project quantification period. In this sense:

(a) potential natural and anthropogenic risks that GHG mitigation actions may face were identified and measures to mitigate such risks were determined;

(b) potential financial risks related to the expected costs and investments, as well as the cash flows of the project, were identified and the necessary measures to mitigate the financial risks were defined;

(c) the risks associated with the participation of local communities and interested parties (Ecopetrol) in the concerted project activities were determined, in the medium and short term.

The risk assessment was carried out based on the PMBOK (Project Management Fundamentals Guide) and considered mitigation measures, within the framework of adaptive management.

This means that the project's actions can be adapted to future conditions to ensure the achievement of the project's objectives, reducing uncertainty in the generation of results. To this end, a re-evaluation of these risks will be carried out in each verification period.

7.1. Risk identification and management

The risk assessment was carried out based on the PMBOK (Project Management Fundamentals Guide) for the social, environmental and financial dimension. In the Table 496 The risk classification methodology is presented.

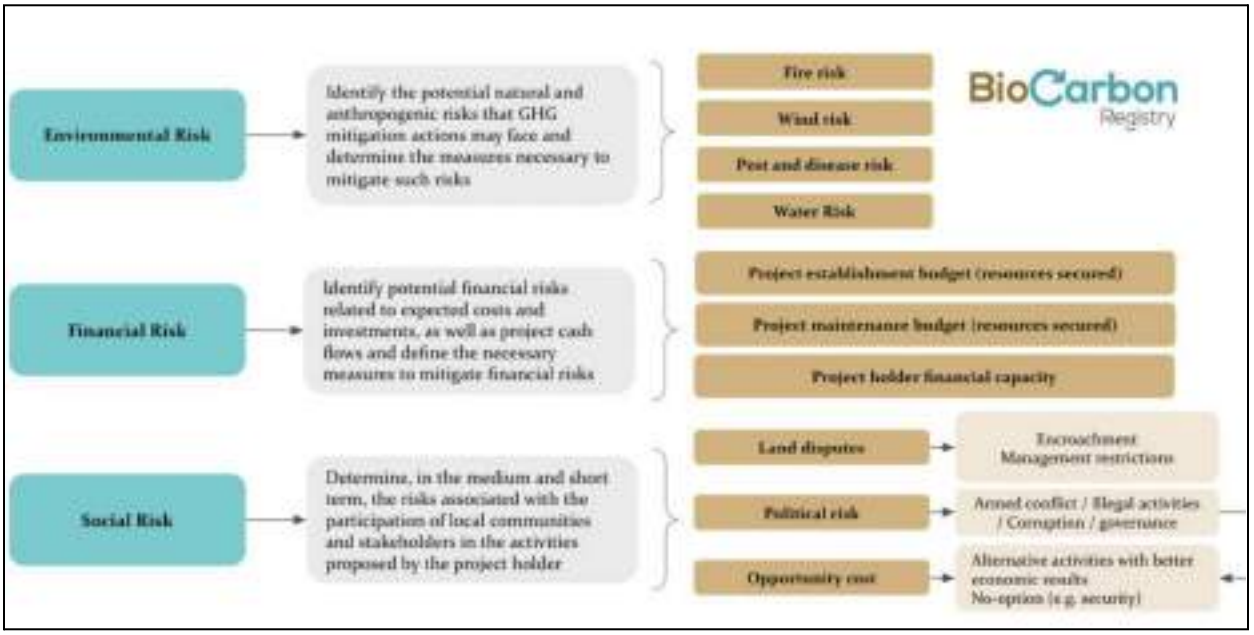
Table 49. Risk Classification System.

Classification (Probability x Impact)	Risk classification	
	Value	Level
9	3	High
6	3	High
4	2	Half
3	2	Half
2	1	Low
1	1	Low

Source: Cataruben Foundation, 2023.

Following the tool's recommendations *Permanence and Risk and Management*, Version 1.1 of March 19, 2024, section 4 Reversal Risk Management, in the figure 24 Some variables taken into account are represented, evaluating whether they were relevant to the characteristics and activities of the project.

Figure 24 Dimensions of risk



Source. BioCarbon Standard, 2024

The risk analysis was enriched with the use of the tool *Sustainable Development Safeguards (SDSs Tool)*, Version 1.0 April 2024, developed by *BioCarbon Standard*. This tool made it possible to identify additional risks in the environmental, financial and social areas relevant to the project. The impact of the event was evaluated, considering its potential affectation in the fulfillment of the execution of the project activities and the reduction of emissions.

The probability of environmental risks was determined from the information obtained from official sources consulted (IDEAM, UNGRD, Colombian Geological System) and the analyzes of deforestation, forest degradation and transformation developed. The probability of financial risks was determined from the information contained in the project's financial model, the observed market trends and Cataruben's experience in project implementation. Likewise, a risk workshop was developed with the strategic ally Ecopetrol that I contribute to raising the level of risk analysis. The probability of social risks was estimated taking into account the historical and social context of the communities in the project area, according to the observations and evidence generated during the development of the socialization and clarifications of doubts of the project. As well as the dynamics of social and cultural conditions identified in each of the properties, evidenced in the questionnaires of social, environmental and economic conditions. Also used was Displacement Report 2023 to evaluate and the risk of displacement.

For its part, the impact was estimated taking into account the effect that the materialization of the risk would have on the execution and sustainability of the project and the impact on the generation of carbon credits. Finally, for the interpretation of the evaluation, according to the tool, High risk means that the reversal risk associated with the variable can impact more than 10% of the carbon benefits accumulated by the project until the moment of verification. Medium risk represents a reversal risk of releasing between 5% and 10% of the issued VCCs, and low risk represents the risk of releasing less than 5% of the VCCs. All risks classified as medium and high must include a mitigation measure and must be monitored.

Table 50. Risk Management

Cod	Dimension	Risk	Impact (I)	Probability (P)	Qualification (IxP)	Value	Qualification	Mitigation Actions
A1	Environmental	Catastrophic Fire Events, of natural or anthropogenic origin	3	3	9	3	High	1. Design of project activities involving fire management education 2. Execution of forest fire prevention measures, 3. Project activity preventive monitoring in summer (Early warnings)
A2	Environmental	Mass removal events, landslides or floods	1	1	1	1	Low	
F1	Financial	Emerging regulation, regulations or changes in the standards or methodologies established new conditions regarding the management of carbon projects	2	2	4	2	Half	1. Constant monitoring of applicable regulations, national regulations and standards. 2. Project design with an adaptive model involving the owners, cataruben and the strategic ally in such a way that it can adapt to the circumstances.
F2	Finance	Lack of resources to implement, validate and verify the project	3	2	6	2	Half	1. Design of a project activity based on seeking a strategic ally that allows generating the enabling conditions of the Monitoring, Reporting and Verification system
F3	Financial	Increase or decrease in the price of the carbon certificate that exceeds or is below the expected cost of the ton in the future. (sensitivity to market prices).	3	1	3	1	Low	
F5	Financial	Possible overlaps not compatible with other climate change mitigation initiatives	3	2	6	2	Half	1. Register in RENARE platform 2. Search and monitoring of carbon program databases

S1	Social	Lack of security of land tenure and consequently of property and rights over carbon	2	2	4	2	Half	1. Legal analysis of carbon ownership and rights prior to verifications
S2	Social	Increase in conflicts between indigenous communities and private owners, due to compliance with project activities	2	2	4	2	Half	1. Generation of spaces for dialogue with indigenous communities near the project areas
S3	Social	Little active participation of property owners in project activities	3	2	6	2	Half	1. Responsibility agreements clearly established in the binding contracts
S4	Social	Dispute over land tenure or claims regarding participation mechanisms (guardianships, demands, prior consultations)	2	1	2	1	Low	
S5	Social	Forced displacement due to security conditions	2	1	2	1	Low	
S6	Social	Materialization of facts against ethics and compliance (bribery, deception, others) in the project.	3	1	3	1	Low	
S7	Social	Loss of efficient communication between project participants	3	2	6	2	Half	1. Establishment of a project monitoring platform with access for all project participants. 2. Design of a governance model between the three main actors of the project

S8	Social	Non-permanence of some properties in the project due to change in economic activity, sale, rental, or transaction that generates more income or dissatisfaction with the project activities	3	2	6	2	Half	1. Establishment of permanence clauses within the binding contract 2. Strengthening the PQRS mechanism 3. Establishment of a governance model between the three project actors

Source: Cataruben Foundation, 2024.

The monitoring and evaluation of risks within the framework of management adapts know can be seen in the Annex Risk analysis and management. A tool that allows risks to be periodically reassessed, and mitigation actions updated within the framework of adaptive management.

7.2. Reversal Risk

In accordance with the terms established in the BioCarbon Standard, Version 3.4 of June 28, 2024, as a guarantee and reversion risk mechanism in the crediting and verification periods, as the case may be, a reserve of 20% of the verified carbon credits is established. This reserve, which will be effective until the end of the project, will be made by the project certifier in an account of the project to ensure that during the life of the project, there is no reduction or transformation of the areas under conservation. In addition, it is indicated that the project owner will only be able to dispose of 10% of the total retained in reserve by the certifying entity in the following monitoring, reporting, and verification period.

Among the barriers that are generated in the execution of the climate change mitigation project led by the Cataruben Foundation, the risk of reversal in the areas linked to it must be considered, which is set within the clauses of the contract in order to establish as an obligation for the parties to conserve the eligible areas, as well as the restrictions of anthropic intervention for them, for which, control is carried out through site visits and/or satellite control, which guarantees continuity and conservation of the area during the life of the project.

8. Sustainable Development Safeguards

The ORINOCO2 project is based on the pillars of conservation, restoration, sustainable production and the generation of economic benefits, with the objective of generating positive impacts in both the environmental and socioeconomic spheres. To ensure these results, we will implement safeguards through key tools.

First, we will ensure compliance with the requirements established in the *Tool for Demonstrating Compliance with REDD+ Safeguards*, version 1.1 (January 26, 2023), developed by *BioCarbon Standard*, as well as the guidelines of the *National Interpretation of Environmental and Social Safeguards for REDD+ in Colombia*. These tools are a guide that will allow us to anticipate impacts to the rights of communities and the environment during the implementation of REDD+ activities.

Additionally, the criteria of the *BioCarbon Standard Sustainable Development Safeguards (SDSs* Tool*)*, version 1.1 (July 4, 2024), will be applied to comprehensively assess the environmental and socioeconomic impacts of the project. This approach will allow us to ensure that the project not only meets the required standards, but also contributes effectively to the sustainable development of the region.

8.1. Environmental aspects

The Cataruben Foundation will conduct an environmental assessment following the guidelines of the Sustainable Development Safeguards Tool (SDSs Tool), version 1.1 (July 4, 2024), developed by BioCarbon Standard. This tool establishes that project impacts must be assessed in relation to land use, resource use efficiency, pollution prevention and management, as well as water, biodiversity, ecosystems and climate change components.

To meet these criteria, the Cataruben Foundation will address each of the components through a specific questionnaire provided by the tool (SDSs). Each question will be answered in a precise and justified manner, and if risks are identified, the necessary preventive, corrective or mitigation measures will be implemented.

The follow-up of these measures will be done through the project's Monitoring Plan, which will ensure that the results of preventive and mitigation actions are continuously evaluated. This plan will provide a clear view of the progress and effectiveness of the implemented actions.

The main objective of this process is to ensure that all project activities are carried out in a sustainable and responsible manner, both with the environment and the local communities. The results of the environmental assessment will be comprehensively documented and included in

Section 8 of the Monitoring Report, which will be essential to ensure transparency and compliance with national and international guidelines.

8.2. Socioeconomic Aspects

The Cataruben Foundation will conduct a socioeconomic assessment following the guidelines of the Sustainable Development Safeguards Tool (SDSs Tool), version 1.1 (July 4, 2024), developed by BioCarbon Standard. This tool establishes that project impacts on key aspects such as human rights, especially in the areas of labor and working conditions, gender equality and women's empowerment, land acquisition, land use restrictions, displacement and involuntary resettlement, indigenous peoples and cultural heritage, as well as community health and safety, must be assessed. In addition, issues related to corruption, economic impact and forest governance will be assessed.

To meet these criteria, the Cataruben Foundation will address each of these components using a specific questionnaire provided by the tool (SDSs). Each question will be answered in a precise and justified manner. In case of identifying risks related to human rights, remediation and remediation actions will be implemented. Preventive, corrective or mitigation measures will also be established for the other components.

The follow-up of these measures will be carried out through the project's Monitoring Plan, which will ensure a continuous evaluation of the results of preventive and mitigation actions. This plan will provide a clear view on the progress and effectiveness of the implemented actions.

The main objective of this process is to ensure that all project activities are carried out in a sustainable and responsible manner with the local communities. The results of the socioeconomic assessment will be comprehensively documented and included in Section 9 of the Monitoring Report, which will be essential to ensure transparency and compliance with national and international guidelines.

9. Stakeholder engagement and consultation

During the stakeholder identification phase, a database of stakeholders potentially interested in the development of the project was built. Annex 4.1.1 Interested Actors To whom the letter containing information on the project design and the potential impacts identified was sent (Annex 4.1.2 Sent Letters). Likewise, the invitation was made to make comments, suggestions, or recommendations through official channels (telephone and emails), and if necessary to establish a virtual or in-person meeting if requested.

9.1. Summary of comments received

Once the letters were sent, 1 comments were received via email electronic, which were answered respectively.

9.2. Consideration of comments received

Once the letters were sent, 2 comments were received via email, which were responded to respectively. The three comments were due to doubts about the implementation of the project. Annex 4.1.1 Interested Actors Column T and U respectively. In the Table 51 The comments and their consideration are summarized.

Table 51. Comments received

Name	Comment	Considerations
Henry Walforth Sánchez S. Agricultural Operations Manager. Agrocacay S.A.S	Good morning Thank you very much for sharing the document with us. I have two questions. Among the activities developed during the project cycle, I do not see research work measuring carbon capture in reforestation with Non-Timber Forest Products. The topic of monitoring threatened species (IUCN) is planned in the project areas, but it is not seen if there is any type of strengthening for the	Good afternoon Henry Answering your questions 1. The main objective of the project is the conservation of natural areas based on a REDD+ model (reduction of emissions caused by deforestation and forest degradation), which differs slightly from the type of AR project (afforestation or reforestation). 2. The model we manage within the project is that the owners carry out the conservation activities and, together with us,

	development of this work. Thank you so much	the monitoring activities. To this end, the Cataruben Foundation carries out periodic monitoring of the project areas, using satellite and sampling. I hope I have clarified your doubts, however, if you require an extension of the project, we could schedule a virtual meeting.

10. Sustainable development goals

The ORINOCO2 project is being implemented in the departments of Meta and Vichada, in the Orinoco region. This area is home to valuable natural savanna and forest ecosystems, historically threatened by agricultural expansion, cattle ranching and other economic activities. To mitigate these impacts, ORINOCO2 focuses on the conservation of forests and natural savannas, with a focus on the preservation of biodiversity and water resources.

The project's activities are aligned with Sustainable Development Goals (SDGs) 6, 13 and 15. In relation to SDG 6 (Clean Water and Sanitation), they will provide training and capacity-building spaces, and among the different topics, "the sustainable management and conservation of strategic ecosystem services (water resources) will be addressed." As for the ODS 13, all activities will contribute to compliance with this, because the indicator is the tons of CO2 that are removed, that is, in the SDG Tool it is specified that by taking into account two inputs: Activity data and Emission factors; and monitoring them in 3 scenarios: Reference region, project area and leakage areas, the number of tons of CO2 removed from the atmosphere is obtained. Therefore, to the ODS 15, all activities will also contribute to this SDG, however, two stand out for directly strengthening the consolidation of sustainable practices on the properties. In summary, for these three SDGs, first (1) what activity/ies would contribute were determined, second (2) the scope of said contribution, third (3) the periodicity of the activity, fourth (4) the unit of measurement adopted, and fifth (5) the evidence of said contribution.

Detailed identification of how project activities contribute to the SDGs will be presented in the SDG Tool, specifying the corresponding targets and indicators. This information will be reflected in the Monitoring Report, which will consolidate data on the project's impact and alignment with the Sustainable Development Goals during the period 2018-2023.

In addition, a Monitoring Plan has been established to follow up and monitor project activities. This plan will allow visualizing how each activity aligns with SDGs 6, 13 and 15, ensuring continuous monitoring and accurate assessment of its contribution to the Sustainable Development Goals.

Table 52. Sustainable Development Goals to which the project contributes.

Sustainable Development Goal	**Summary of the project contribution**

	Water and Sanitation: Ensure availability and sustainable management of water and sanitation for all	Within the Carbon and Water Biodiversity strategy, the project includes a diagnosis to ensure the availability and sustainable management of water resources, as well as universal sanitation. In addition, a plan will be implemented to promote the efficient use and savings of water in the homes involved in the project.
	Climate Action: Adopt urgent measures to combat climate change and its effects	The project is REDD+ type so by reducing deforestation and change in land use in natural savannas it mitigates climate change in Colombia whose main emissions come from the AFOLU sector and deforestation.
	Life of terrestrial ecosystems: Protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss	The project manages resources within the voluntary carbon market to mobilize for the conservation, restoration and sustainable management of ecosystems and biodiversity. Likewise, it carries out activities to identify areas of importance for conservation, monitors natural coverage, as well as species in some degree of threat.

Source: Cataruben Foundation, 2023.

10.1. SDG 6 Water and Sanitation

The project contributes to sustainable development goal number 6, specifically goal 6.1. This seeks to ensure the availability and sustainable management of water for all. The project is aligned with the Indicator **6.1.1**, which evaluates the *"proportion of the population using safely managed drinking water services"*. In this way, within the project efforts are deployed to achieve the completion of the 4 methodological stages, designed to directly impact said indicator:

- Characterization of water supply sources, purification, and use of water resources: This stage aims to carry out a detailed diagnosis of the quality, use, and management of water throughout the scope of the Project. This evaluation generates a solid context to develop fundamental recommendations for future training and actions related to resource management. It should be noted that this stage is equivalent to a percentage of 10% in the contribution of indicator 6.1.1.

- Design of a Quality, Efficient Use and Water Savings Program (PCUEAA), for each of the homes linked to the project: This activity is based on the creation of personalized programs for each property with housing in the project. The purpose of these plans is to manage the quality of the water consumed by the owners, optimize the use and management of water resources, and save water. Each plan will have a total of 3 management sheets that will be addressed according to the needs of the home. These sheets will focus on three main topics: water purification, adequate wastewater treatment and the implementation of sanitary practices in homes. This methodological stage is equivalent to a percentage of 15% in the contribution of indicator 6.1.1.

- Implementation of the Activities and Management Sheets stipulated in the quality, efficient use and water savings plans: This stage will have an execution time of twelve years of development and consists of the transfer of knowledge by the Cataruben foundation to the owners, in order to raise awareness and generate an understanding regarding the importance of the quality, care and efficient use of water. In addition to what was mentioned, as the Cataruben Foundation, activities will be carried out regarding monitoring water quality; These actions are focused on the use of a water test kit that measures 16 parameters in the resource used for human consumption. In addition to the above, a theoretical and practical training will be carried out where the use of water purification tablets (delivered by the Cataruben foundation) will be addressed. This stage has a percentage of 55% equivalent to the contribution of the SDG 6 indicator.

- Monitoring of the implementation of the management sheets created in the PCUEAA's: The fourth and final stage will have an execution time of two years and has a percentage of 20% in the contribution of indicator 6.1.1. As its name indicates, it consists of monitoring the implementation stage. It is worth noting that throughout the project, activities will be monitored (with greater emphasis on water quality) and training will be carried out every 2 years, which will have a communicative report on the status of the activity.

In order to achieve the objectives of quality and sustainability in resource management, the project proposes a structured and focused strategy. In first place, and as proposed in the methodological stage, exhaustive characterizations will be carried out initially; In a continuous improvement approach, property characterizations will be carried out throughout the first years of the project's start that allow evaluating the impact of the actions to be implemented in the future. It is worth noting that the properties that are not characterized for connectivity reasons in the stipulated time will be characterized in the following years until the majority of the characterized properties are obtained.

It is of utmost importance to highlight that the quality program, Efficient Use and Saving of Water (PCUEAA), is created as the fundamental pillar to optimize water management in each linked property. This document is meticulously designed in order to promise a compendium of solutions adapted to the needs of each owner.

10.2. SDG 13 Climate Action

The increase in CO concentration in the atmosphere has experienced a marked increase in recent years, surpassing historical records. This trend has triggered a series of effects worldwide such as warming of the oceans, rising sea levels, thawing of the poles, loss of biodiversity and extreme weather events.

The 2023 Sustainable Development Goals (SDG) report has highlighted that extreme weather events have become more frequent and devastating, impacting populations around the world. Developing countries are particularly vulnerable to the adverse effects of climate change, resulting in irreparable losses to both ecosystems and human communities. This translates into food shortages, the destruction of homes and infrastructure, and the forced displacement of populations (UN Department of Economic and Social Affairs, 2023).

It is expected that if the trend of increasing global temperatures continues, extreme weather events will worsen and become even more difficult to manage. Therefore, it is necessary to implement strategies to reduce and remove global CO2 emissions.

Therefore, andl SDG 13 Climate Action seeks to promote actions aimed at reducing greenhouse gas emissions, strengthening resilience to extreme climate events and improving the capacity of the most vulnerable communities to face the challenges of climate change.

In this context, the project, through the implementation ofl ODS 13, seeks to address objective 13.2 “Incorporate measures related to climate change into national policies, strategies, and plans” and indicator 13.2.2 whose goal is “Reduce total greenhouse gas emissions per year.” To this end, during the quantification period, GHG emissions that take place in the project area and leakage area will be monitored, and their reduction due to the implementation of project activities.

Section 17.1.3 describes the procedures for monitoring project emissions.

10.3. SDG15 Life of Terrestrial Ecosystems

Sustainable Development Goal 15 (SDG 15) focuses on the protection, restoration and sustainable use of terrestrial ecosystems and biodiversity. Its main objective is to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt the loss of biodiversity." This SDG proposes to prevent and avoid the degradation of habitats and the loss of biodiversity, focusing on developing the political

will and capacity to restore the relationship between humans and nature. This is done in order to improve the quality of ecosystems worldwide, fighting climate change, soil degradation and the extinction of species.

Of the project activities that contribute to SDG15 are the G5 activities: Promote the delimitation and signaling in strategic ecosystems and natural protection areas and B2: Monitoring the presence of globally threatened species and taking actions to conserve them.

The overall goals to which project activities contribute are

- **Goal 15.1:** By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and arid areas, in line with the obligations contracted under international agreements,

- **Goal 15.5**: Take urgent and significant measures to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect threatened species and prevent their extinction,

- **Goal 15.a:** Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems through the following global indicators:

- **15.1.1 Forest area as a proportion of the total area.**

The indicator measures *forest area as a proportion of the total area. It* allows quantifying how much of the territory is covered by natural forest and how it is distributed. This indicator establishes a relationship between the area covered by natural forest and the total area of the region at a specific time.

The usefulness of the indicator lies in being a tool to evaluate activities related to REDD + projects (Reducing Emissions from Deforestation and Degradation), as well as to analyze environmental policies and conservation actions. To address the indicator, the National Forest Information System - SNIF will be used.[60], the indicator with the same name, the methodological sheet version 1.2, *Galindo et al., (2019).*

$$PSBN_{jt} = \left(\frac{SCBN_{jt}}{AUER_{jt}}\right) * 100$$

Where,

[60] http://www.ideam.gov.co/web/ecosistemas/bosques-y-recurso-forestal

$PSBN_{jt}$: Proportion of the area covered by natural forest in the spatial reference unit j, at time t.

$SCBN_{jt}$: Area in hectares (ha) covered by natural forest in the reference spatial unit j, at time t.

$AUER_{jt}$: Area in hectares (ha) of the reference spatial unit j, at time t.

The information related to the area covered by natural forest (SCBN) is extracted from the Non-Forest Forest Maps, generated on the Google Earth Engine platform through Digital Image Processing. The maps are presented in raster format and have a resolution space of (30.26 meters * 30.72 meters), with a MAGNA SIRGAS EPSG:3116 projection, compatible with a scale of 1:100,000.

The project areas (**AUER**), correspond to the properties linked under the REDD+ component.

- **15.1.2 Proportion of sites important for terrestrial and freshwater biodiversity that are part of protected areas, disaggregated by ecosystem type.**

To this end, the delimitation and signaling of strategic ecosystems and natural protection areas is promoted (**G5 Activity**). The identification and signaling of Areas of Importance for Biological Diversity (AIDB) has been proposed in order to promote the conservation of ecosystems and their biodiversity. AIDBs, also known as Important Species Conservation Areas or Key Biodiversity Areas (KBAs), are geographic regions that are home to a high diversity of species and unique ecosystems, and play a role fundamental in the protection of natural resources and ecosystem services.

The objective of this activity is to identify properties according to REDD+ coverage and flooded savannas that are part of areas of importance for biological diversity and its conservation. Subsequently, mark the identified areas or promote the process so that they can become Natural Reserves of the civil society.

To identify these properties, a range of areas of low, medium, and high importance of biological diversity will be established. This analysis will be carried out through an intersection analysis of components such as species richness, Intact Biodiversity index, protected areas of the National Natural Park System of Colombia, Natural Reserves of Civil society, areas of importance for bird conservation (AICAS), areas with forest cover and flood-prone savannas, and threatened or vulnerable ecosystems that are part of the properties that are part of the project.

The development of the activities available for this SDG indicator is to identify the importance of these properties according to the aforementioned importance criteria. Subsequently, stimulate

local communities to manage these areas by signaling vulnerable areas such as forests or savannas that must be protected. This progress is monitored using the following formula:

((# identified properties * 0.25 + # properties Implementing signage * 0.75)/ # identified properties)*100

- **15.5.1) Red List Index.**

Among the global goals of SDG15 is 15.5, which seeks to measure changes in extinction risks aggregates for different groups of species. It is based on changes in the number of species in each extinction risk category of the IUCN Red List of Threatened Species.

The associated indicators are: 1. Proportion of habitats especially in danger of extinction and species with a favorable conservation status, with reference from species to species in danger of extinction, 2. Information on programs related to the conservation of habitats and species that they take advantage of for their protection and continued existence, and 3. Adoption of measures to improve the value of biodiversity and reduce its loss.

For this objective, an evaluation of the presence of globally threatened species will be carried out in addition to the development of the wax palm co-benefit, section 2. The project area is located in areas with the presence of globally threatened species and actions are taken to conserve them (Activity B2) through participatory monitoring of biodiversity under the sampling model bioacoustic. This allows them to identify some species in a state of threat according to the IUCN and allow project participants to maintain these species on the property during the development of the project. This progress is monitored using the following formula:

(Participatory monitoring implementation methodology*0.25) + ((number of monitoring with the presence of threatened species/Total number of monitoring)*0.75)*100

- **15.5.a.1 a) Official development assistance specifically aimed at the conservation and sustainable use of biodiversity and b) income generated and finance mobilized through economic instruments relevant to biodiversity**

Percentage increase in average income derived from the sale of verified carbon credits

11. REDD+ Safeguards

In Colombia, a process of interpretation of the Cancun social and environmental safeguards began in 2013. From the beginning, this process was part of a literature review that addressed the national regulatory framework and the most relevant international agreements in this area. In addition, thanks to the support of WWF-Colombia, the Forests and Climate/REDD+ program, the Carbon, and Forest Partnership Facility and the UN-REDD Program, conditions were created to develop meetings and working groups that included the most representative rural communities in the national territory, such as indigenous, black and peasant communities.

This process is in continuous evolution, with the participation each year of more strategic actors committed to strengthening respect and application of these safeguards at the national level. The main objective is to guarantee that REDD+ projects do not cause negative social or environmental impacts in the intervention areas. To achieve this, the guide established by the BCR Standard has been used in the tool. *Sustainable Development Safeguards (SDSs Tool)*, Version 1.0 April 2024.

In line with the above, the project addresses these safeguards following the approach of the document "Social and Environmental Safeguards for REDD+ in Colombia." This document provides a detailed interpretation of fifteen operational and coherent elements for the national context, which guide the activities proposed within the framework of the project. These fifteen elements are grouped into seven safeguards, organized into three main themes: institutional, social and cultural, and environmental and territorial. (Camacho A, Lara I & Guerrero, 2017)[61].

Table 53. Thematic organization of Environmental and Social Safeguards for REDD+.

THEMATIC	CANCUN SAFEGUARD	NATIONAL SAFEGUARD ELEMENT
Institutional	Safeguard A	A1. Correspondence with national legislation.
	Safeguard B	B2. Transparency and access to information.
		B3. Accountability.
		B4. Recognition of forest governance structures.
		B5. Capacity building.
Social and Cultural	Safeguard C	C6. Free, prior and informed consent.
		C7. Respect for traditional knowledge.
		C8. Distribution of benefits.
		C9. Territorial rights.
	Safeguard D	D10. Stake.

[61] Camacho A., Lara I., Guerrero R. D. 2017. "National Interpretation of Social and Environmental Safeguards for REDD+ in Colombia" MADS, WWF Colombia, UN REDD Colombia. Bogota Colombia.

THEMATIC	CANCUN SAFEGUARD	NATIONAL SAFEGUARD ELEMENT
Institutional	Safeguard A	A1. Correspondence with national legislation.
	Safeguard B	B2. Transparency and access to information.
		B3. Accountability.
		B4. Recognition of forest governance structures.
		B5. Capacity building.
Environmental and Territorial	Safeguard E	E11. Conservation of forests and their diversity
		E12. Provision of environmental goods and services.
	Safeguard F	F13. Environmental and territorial planning
		F14. Sector planning.
	G Safeguard	G15. Forest control and surveillance to avoid the displacement of emissions.

Source: Cataruben Foundation, 2023.

Following this same line, the project activities are based on respecting, addressing and complying with these seven (7) social and environmental safeguards. However, in order to continue with the positive approach and compliance, in addition to the national reading and interpretation, which focuses on the implementation of policies, measures, and affirmative actions that guide the gradual reduction of deforestation and land use change. It is necessary to favor, in parallel, access to material and symbolic benefits to local communities and their territory. (Camacho A, Lara I & Guerrero. 2017). A second document and as the main guide I appeal to the document called ***"Tool to demonstrate compliance with REDD+ safeguards" Version 1.1*** on January 26, 2023 developed by BioCarbon Registry. This text offers clarity in both the indicators and the criteria (the type of evidence) that must demonstrate the percentage of compliance with each of these safeguards in the previously mentioned period, basically representing an articulated approach between the BCR vision and the local one. , that is, the context and the individuals who inhabit it (Brigard & Urrutia, 2023)[62].

Starting from the previous context, and from the ORINOCO2 project, compliance, addressing and respect for each of the seven safeguards is projected as follows:

Table 54. *Projection of the Safeguard A approach.*

SAFEGUARD: A "The complementarity or compatibility of the measures with the objectives of national forestry

[62] Brigard & Urrutia, BioCarbon Registry. 2023. TOOL TO DEMONSTRATE COMPLIANCE WITH REDD+ SAFEGUARDS. Version 1.1. January 26, 2023. Bogotá, Colombia. 20 p. http://www.biocarbonregistry.com

programs and international conventions and agreements on the subject"			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
A1 Correspondence with the National legislation	**G1**	Improved income of owners generated by the sale of carbon credits	The activities proposed within the framework of ORINOCO2 must strictly comply with national regulations and international agreements ratified by Colombia. This requirement goes beyond a simple administrative procedure; It requires exhaustive knowledge of the territory to intervene in its environmental, social, economic and political dimensions. The long-term positive impact that the project seeks, such as the mitigation of climate change, and the collateral benefits, such as the improvement of the living conditions of the local population, the adoption of conservation as a habit and duty, the preservation of endangered species and the sustainable management of water resources would be effectively materialized. This approach not only guarantees the legitimacy of the project in the region in accordance with Colombian regulations, but also provides the necessary support to a historically marginalized territory, ensuring a dignified and sustainable stay for its inhabitants.
	G2	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	
	G3	Alliance management that financially allows generating the enabling conditions for the validation and first verification of the project	
	G4	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally	
	G5	Promote the delimitation and signaling in strategic ecosystems and natural protection areas	
	G6	Promote the recognition of conservation areas and figures for the sustainable management of ecosystems	
	R1	Implementation of sustainable fire use management practices for the prevention of forest fires	
	R2	Monitoring of hot spots as an early warning mechanism	
	R3	Promotion of the establishment of eco-efficient stoves and wood energy banks	
	B1	Identification and monitoring of HCVs present in the project area	
	B2	Monitoring the presence of globally threatened species and taking actions to conserve them	
	B3	Restoration actions in degraded ecosystems	
	EG1	Strengthening access and management of financial goods and services with a focus that achieves gender equity	

Source: *Cataruben Foundation, 2023.*

Table 55 *Projection of the Safeguard B approach.*

SAFEGUARD: B "The transparency and effectiveness of national forest governance structures, taking into account national legislation and sovereignty. Provide transparent and consistent information that is accessible to all stakeholders, and update it regularly. Be transparent and flexible to allow for improvements over time. Build on existing systems, if any."			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
B2 Transfer and Access to Information	**G2**	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	Access to information will be guaranteed through a mechanism adapted to the characteristics of the territory to be intervened. Given that the ORINOCO2 reference region covers the departments of Meta and Vichada, a territory with precarious access to traditional means of communication, land access roads in poor condition and considerable distances between municipalities, properties, hamlets, and inspections/paths.; Hybrid communication channels must be enabled and created that adjust to the conditions of the territory. Therefore, we have designed the following mechanism: The Transparency and Access to Information Mechanism for ORINOCO2 is made up of the following tools: a. **Communication system:** A comprehensive communication system will be established that will include various modalities to facilitate the exchange of information, such as telephone lines, email, social networks and in-person attention. These channels will guarantee direct communication with everyone involved in the project and will be designed to ensure easy access to information and promote transparency at all stages of the project. b. **Digital Platforms:** We will develop digital platforms to offer updated and first-hand information about the project, accessible to all interested parties. These platforms will allow fluid and transparent communication. c. **PQRS System:** It is an essential tool that allows us to receive and manage requests and comments from those interested in the project in a transparent and effective way. This system ensures that all concerns and suggestions are addressed in a timely and appropriate manner. d. **Governance Model:** Se will develop a governance model with the objective of promoting active and meaningful participation of all stakeholders in the project. This model will

			focus on establishing structures and processes that facilitate collaborative and transparent decision-making, ensuring that all voices are heard and considered in the planning and execution of actions.
B3 accountability.			ORINOCO2 has the responsibility of offering clear information at all stages of the project, from pre-feasibility to the delivery of results. For this last phase, spaces will be established that allow the *ecosystem managers* know first-hand the impact that the project is having on the reality of their properties and nearby territories. These spaces will be defined with the balanced participation of all parties involved.
B4 Recognition of governance structures.	**G3**	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally	The governance structure can be described as: *the agency that related actors have to negotiate, make or execute conscious decisions related to the conservation, use, and management of natural resources*. For this same reason, ORINOCO2 considers the need to create and consolidate a governance table for the project. This table will be formed by representatives of each of the allies (*ecosystem managers, Ecopetrol and Cataruben*), and will be the setting for conscious and informed decision-making, and active, equal and symmetrical participation in every aspect that affects the project to a greater or lesser degree.
B5 Strengthening capacities.	**EG1**	Strengthening access and management of financial goods and services with a focus that achieves gender equity	Having the ability to exercise the right to make, execute or negotiate conscious decisions requires clarity of thought and, especially, competent capabilities. So, we understand *ability* as that prior knowledge, learned and perfected over time, that allows survival in a specific environment. Based on the above, the workshops, exchange of knowledge or Capacity building, are proposed as part of the activities so that this forest planning is effective. So that the ecosystem managers fully understand that this intangible good It is not represented only by the carbon certificate, but by that change in thinking regarding the environment and the territory itself.

Source: *Cataruben Foundation, 2023.*

Table 56 *Projection of the Safeguard C approach.*

SAFEGUARD: C
"Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into account relevant international obligations and national circumstances and legislation, and bearing in mind that the United Nations General Assembly has approved the "United Nations Declaration on the Rights of Indigenous Peoples"

ELEMENT NATIONAL INTERPRETATION	ID	PROJECT ACTIVITY	APPROACH
C6 Free, prior and informed consent	G2	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	To address this free, full and informed consent, each one of the communities or groups that live in the reference region (ethnic or creole) of the project must be identified and mapped. And this, to define, delimit and secure its eligible area (strategic ecosystems), without causing environmental, economic or social fabric damage due to the implementation of the activities. In short, this identification and mapping indicates which communities (interested or not in the project) to approach, to expose, listen to and clarify the generalities of ORINOCO2, not represented like this, a misconception of Cataruben.
C7. Respect for traditional knowledge			Indigenous reservations, ancestral territories or collective property are not considered to be part of ORINOCO2, and this is because it is not designed to intervene in the territory of ethnic communities. However, it must be guaranteed that the activities do not trigger collateral damage that affects said groups (directly or indirectly). Thus, the respective mapping and identification will be carried out, and if necessary, due approaches will be made with the respective traditional authorities, thus guaranteeing respect for their uses and customs, thoughts and territory.
C8. Profit distribution			To be clear that the distribution of benefits is fair and equitable, we must first define and understand the type of benefits to which the beneficiaries will have access. *Ecosystem managers.* And second, that these benefits respond to affirmative measures and actions that will help reduce GHG emissions. Thus, the main benefits are divided into economic (sale of certificates) and symbolic (strengthening of environmental knowledge and practices). These agreements will be reached jointly and with the approval of all interested parties.
C9. Territorial rights			The knowledge and recognition of the territory, through not only the identification and mapping of the communities present in it, is complemented by a socio-historical and cultural analysis. Thus, recognizing more precisely the traditional practices of conservation and administration of local ecosystems, which implies an approach from the activities, where these are the ones that must be adjusted to the territory and not the other way around, hence the importance of participation active, aware and informed of the *ecosystem managers* in the construction of these.

Source: *Cataruben Foundation, 2023.*

Table 57 *Projection of the Safeguard D approach.*

SAFEGUARD: D "The full and effective participation of stakeholders, in particular indigenous peoples and local communities, in the measures mentioned in paragraphs 70 and 72 of this decision"			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
D10. Stake	**G2**	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	Full and effective participation is a right that will be guaranteed by ORINOCO2 activities. Among them, we can highlight the spaces proposed from the beginning such as (1) consultations of interested parties, socio-environmental characterizations. At this point criteria, concerns, and local ways of thinking are defined. (2) Socialization where doubts are clarified and questions are answered according to the particularities of the project. (3) the knowledge exchanges, workshops, and capacity building that correspond to scenarios that enable decision-making, agency, and most importantly, how these agreements are executed at all levels of ORINOCO2 (4) referring to property implementation plans (PIP). Now, the above, in which it will strengthen the governance model, consolidating itself at the governance table of the ORINOCO2 project. It will, in some way, represent the legitimation of the interested parties through representatives chosen in a clear and impartial manner.
	G4	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally	

Source: *Cataruben Foundation, 2023.*

Table 58 *Projection of the Safeguard E approach.*

SAFEGUARD: AND "The compatibility of measures with the conservation of natural forests and biological diversity, ensuring that those indicated in paragraph 70 of this decision are not used for the conversion of natural forests, but instead serve to encourage the protection and conservation of these forests and the services derived from their ecosystems and to enhance other social and environmental benefits."			
ELEMENT NATIONAL	**ID**	**PROJECT ACTIVITY**	**APPROACH**

INTERPRETATION			
E11. Conservation of Forests and their Biodiversity	**G2**	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	The properties linked to ORINOCO2 must be spaces where conservation is an already defined, internalized practice or at least where the farmer's intention for conservation can be evidenced. That is, the project is aligned from the beginning with current environmental regulations, which means that it cannot go against the preservation and care of the animal species present in strategic ecosystems. Under this scenario, contingency measures will be developed to address possible effects on native biodiversity, and in addition, monitoring will be carried out to account for important biological corridors, strengthening the sustainable use of ecosystem services.
	G5	Promote the delimitation and signaling in strategic ecosystems and natural protection areas	
	G6	Promote the recognition of conservation areas and figures for the sustainable management of ecosystems	
	R1	Implementation of sustainable fire use management practices for the prevention of forest fires	
	R2	Monitoring of hot spots as an early warning mechanism	
E12. Provision of Goods and Environmental services	**R3**	Promotion of the establishment of eco-efficient stoves and wood energy banks	So that ORINOCO2 activities can be translated as affirmative actions for the conservation of strategic ecosystems, it is important to ensure that they will not affect in any way, social, environmental, or economic, the territory or its inhabitants. For this reason, the proposed activities will ensure the conservation of water flows, biodiversity, etc., projecting possible impacts and addressing them as appropriate.
	B1	Identification and monitoring of HCVs present in the project area	
	B2	Monitoring the presence of globally threatened species and taking actions to conserve them	
	B3	Restoration actions in degraded ecosystems	

Source: *Cataruben Foundation, 2023.*

Table 59 *Projection of the Safeguard F approach.*

SAFEGUARD: F "The adoption of measures to address reversal risks"			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
F13. Environmental and Territorial Planning	**G2**	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive	Mitigate or directly cancel *reversal irrigation* It is one of the main objectives of ORINOCO2, since it is not enough for the project to comply with its validity period and its goals 100%, if the intervened territory returns to the same threat level before the intervention. Thus, the activities

		systems and landscape management tools.	create or become a collective habit, prioritizing that intangible value for conservation, that respect for the environment, and not only the material or economic value.
F14. Sector Planning.	**G4**	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally	Being consistent with the previous point, the form of intervention of the activities in the territory, or more specifically in the eligible area. Must demonstrate deep ownership in *the ecosystem manager,* The initial, contractual agreements, socialization, discussion spaces, distribution of economic benefits, etc., would not be enough if the change is not structural, but the way of linking with the territory can be transformed, at this point, it gains strength, a once again the consolidation of the governance table.

Source: *Cataruben Foundation, 2023.*

Table 60 *Projection of the Safeguard G approach.*

SAFEGUARD: G **"The adoption of measures to reduce the displacement of emissions"**			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
G15. Forest Control and Surveillance to avoid the displacement of emissions	**G2**	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	Greenhouse gas (GHG) leakage are one of the most important obstacles to any climate change mitigation project. However, it is Cataruben's responsibility to create the best strategy, which not only projects where deforestation will move, and although it is not a simple task, several tools can be used such as: *forest and carbon monitoring,* early warning systems, community monitoring (between neighbors), the transformation of harmful economic practices, etc., apart from generating alliances for regional environmental authorities, to articulate efforts, these are the components of the strategy that will be established.

Source: *Cataruben Foundation, 2023.*

In summary, some of the most relevant aspects related to compliance with social and environmental safeguards for REDD+ include compliance with the regulatory framework, free access and transfer of information, full and effective participation of stakeholders, conservation, and restoration of key ecosystems , respect, and recognition of local communities, protection of biodiversity and responsible management of water resources. Each of these safeguards will have a specific section that details the requirements, components, approaches, and evidence that demonstrates compliance, adapted to the context, territory, and target population.

12. Special categories related to co-benefits

Given the area where the project activities are carried out, associated with the ecosystems present and the characteristics of the participants, it is decided to certify the co-benefits of the "Wax Palm" category, in accordance with the BioCarbon Standard Version 3.4, dated June 28, 2024.

To this end, additional actions have been defined on the social and environmental components with a model of criteria and indicators that are articulated and form part of the project's activities, in order to be able to follow up, monitor and verify them. The purpose of certifying these co-benefits is to attest to the project's commitment to generate a positive impact on the conservation and restoration of ecosystems, and to stimulate the participation of the social actors involved in the project.

Table 61 shows the conditions defined in the BCR standard to opt for certification of co-benefits of the Palma de Cera category and the way in which the project fulfills them.

Table 61. Category component wax palm

Component	**Requirement**	**Compliance**
Biodiversity Conservation	Carry out restoration activities for degraded ecosystems	**Comply.** Restoration activities are carried out in the project areas
	High conservation values are found in the project area	**Comply.** Within the project, High Conservation Values (HCVs) are identified and monitored.
	The project is located in areas with the presence of globally threatened species (IUCN Red List) and develops actions aimed at the conservation of these species.	**Comply.** The potential distribution area of the species in some degree of threat that the IUCN discriminates within the departments of Meta and Vichada where the project is located is established.
Benefits on communities	Implement sustainable productive systems combining production and conservation actions to generate development	**Comply.** Project activities include sustainable management of natural savannas and generation of non-timber forest products.
Gender equality	Support actions that grant women	**Comply.** Within the

	the right to economic resources on equal terms, as well as access to ownership and control of land and other property. Financial services, inheritance and natural resources in accordance with national laws.	development of the project, the women participating in the project are identified and focused training on financial, economic and productive issues is carried out.

Source: Cataruben Foundation, 2023.

Table 62 below sets out the design of the additional actions that, together with the project activities, complement the actions that result in co-benefits in addition to the mitigation outcomes. The design of the actions is similar to that of the project activities. The objective is to create an overall matrix of project activities within the monitoring plan to allow for a simple and efficient monitoring, reporting, and verification system.

Table 62. Design of co-benefit actions of Palm of Wax.

Biodiversity Conservation	
Id	**B1**
Description	Identify and monitor High Conservation Values (HCVs)
Co-Benefits Component	Biodiversity Conservation
Compliance with the Interests of Rural Communities.	1. HCVs are essential for the management and conservation of ecosystems within the area of a carbon project, since they determine attributes or characteristics of an area or ecosystem that are considered of significant importance for the conservation of biodiversity and the maintenance of ecosystem services. 2. When a carbon project has HCVs, strategies can be generated for the continuity of activities that identify the properties as important sites for biodiversity and the local community.
Consultation Mechanism for the Identification of Objectives and the Definition of Activities	1. The 4 HCVs related to biodiversity were characterized; For which the variables to be used for each were determined through geospatial analysis, using primary and secondary information. The simple description and base variables are detailed below: **Avc1**: Areas that contain concentrations of diversity values in plants, insects, fish, amphibians, reptiles, birds and mammals, important at a global, regional or national level. **Variables**: Richness or number of species. Potential conservation areas. Prioritized areas for

	conservation. **Avc2**: Areas with ecosystems in a good state of conservation at the landscape level, where there are viable populations of most or all species with natural distribution. **Variables:** Size/extent of ecosystems. Average ecosystem area. Connectivity and Continuity. Number of fragments. **Avc3**: Areas that are or contain rare or endangered ecosystems (Singularity). **Variables:** Ecosystems that due to distribution and extension have a restricted distribution (rare ecosystems). **Avc4**: Areas that provide basic goods and services from nature. **Variables:** Ecosystems that serve as a barrier against fires. Areas that have deposits with high amounts of carbon. Areas with high water contributions per sub-basin. Critical areas for erosion control.
Timeline	Every 5 years, an identification and monitoring analysis of the HCVs present in the project area will be carried out.

Indicators to Report the Progress of the Activity

Name	Type	Meta	Unit of measurement	Measurement Manager
identify and monitor HCVs present in the project area	Product	4	AVC presence report	Cataruben Foundation

Id	**B2**
Description	The project area is located in areas with the presence of globally threatened species and actions are taken to conserve them.
Co-Benefits Component	Biodiversity Conservation
Compliance with the Interests of Rural Communities.	1. Many of these communities depend directly on natural resources for their subsistence, such as fishing, hunting, and the collection of forest products. Conservation of globally threatened species contributes to preserving the biological wealth of the region, which in turn protects the livelihoods and food security of local communities.

	2. The presence of threatened species can attract the interest of tourists and scientists, which could generate economic opportunities for rural communities through sustainable tourism and research. This could translate into local jobs and an increase in income for people living in these rural areas. 3. By involving these communities in conservation activities, their knowledge can be used to develop effective strategies to protect threatened species. This empowers communities and gives them a sense of ownership over conservation.
Consultation Mechanism for the Identification of Objectives and the Definition of Activities	1. A sampling protocol will be carried out that includes the prior definition, logistics and structuring of the project; This will define the objects and study area, the scope, acquisition of equipment and inputs to be used for participatory monitoring of threatened species. 2. Definition of sampling points: selection of sampling points that cover the areas within the eligible areas of the land. To carry out this process, QGIS (version 3.26.1) will be used to identify the coverage present in the polygons of each terrain. 3. Training for ecosystem managers: telephone contact is established with the landowners, using a database that contains precise information about the contact, location, and characteristics of each one.
Timeline	Every five (5) years, a monitoring report of species in some threatened state will be presented.

Community benefits

Indicators to Report the Progress of the Activity

Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Participatory wildlife monitoring to identify threatened species	product	3	Monitoring report on species in some threatened state	Cataruben Foundation

Id	**B3**

Description	The project carries out restoration activities in degraded ecosystems
Co-Benefits Component	Biodiversity Conservation
Compliance with the Interests of Rural Communities.	Several of the project participants are interested in carrying out restoration activities to the extent that they have economic, technical, and knowledge options to contribute to improving degraded ecosystems.
Consultation Mechanism for the Identification of Objectives and the Definition of Activities	1. The first phase consists of a social, economic, environmental and productive characterization, to clearly define the objectives. 2. Subsequently, interviews will be carried out with the owners to determine if any restoration action has been carried out following the document Technical Guides for the Ecological Restoration of the Ecosystems of Colombia (Vargas et al., 2012).[63] In order to collect baseline information for restoration activities. 3. Those interested in carrying out a process are helped by generating a Restoration Plan, the process must be adjusted to the particularity of the sites, the degree of alteration, the spatial scales and the proposed objectives.
Timeline	Every 5 years, progress monitoring of restoration activities implemented on the interested properties will be carried out.

Indicators to Report the Progress of the Activity

Name	Type	Meta	Unit of measurement	Measurement Manager
Property with restoration activities	Evidence of restoration	4	Number of restoration activities implemented	Cataruben Foundation

Gender equality

[63] Vargas Ríos, O., Díaz, J., Reyes S., & Gómez, P. (2012). Technical guides for the ecological restoration of Colombia's ecosystems. Ecological Restoration Group (GREUNAL), National University.

Indicators to Report the Progress of the Activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Training developed to strengthen access and management of financial goods and services	product	10	Number of trainings carried out	Cataruben Foundation

Id	**Eg1**
Description	Strengthening access and management of financial goods and services with a focus that achieves gender equity
Co-Benefits Component	Gender equality
Compliance with the Interests of Rural Communities.	Several of the project participants are interested in strengthening their knowledge on how to responsibly manage the economic benefits (assets) acquired by the conservation activities carried out, in addition to strengthening the role of women in decision-making and agency spaces in the framework for the care of strategic ecosystems.
Consultation Mechanism for the Identification of Objectives and the Definition of Activities	1. The first phase consists of carrying out a social, economic, environmental and productive characterization, to define the objectives and points to be strengthened, and clearly, make a diagnosis of female participation. 2. The second phase consists of a survey directed at female owners, which aims to project and evaluate the gender disparity present in the region. 3. Create a training plan that, during the life of the project, will aim to strengthen the knowledge of women linked to the project. 4. In each workshop, the women who are part of the project will be given tools to strengthen their agency and decision-making within the community.
Timeline	Each year a workshop will be held focused on a specific topic related to access and administration of goods and services. Taking gender equality as its center.

Indicators to Report the Progress of the Activity				
Name	**Type**	**Meta**	**Unit of measurement**	**Measurement Manager**
Women attending workshops with a gender focus	Evidence of restoration	10	Number of workshops held	Cataruben Foundation

Source: Cataruben Foundation, 2023.

13. Grouped Project

The project is not a grouped project.

14. Other GHG programs

Not applicable, the project does not come from other GHG programs, nor has it enrolled in other GHG programs.

A systematic search of the carbon standards was carried out, and it is corroborated that no project area is within another project (see section 15.2 Review of other projects).

15. Double counting avoidance

The project is framed, accepts and applies the requirements and mechanisms implemented by Biocarbon Standard defined in the BCR Tool "Avoid Double Counting V2.0.

In this sense, to apply the requirements related to avoiding double counting that depend on the project, specifically in terms of avoiding non-compatible overlaps, the registration procedure in RENARE is carried out in accordance with Resolution 1447 of 2018 article 10. It is the technological platform that has the purpose of managing national information on GHG mitigation initiatives, however taking into account the state of inactivity of said platform (section 15.1.), a tracking of projects registered in the different registration platforms is also carried out from the project (section 15.2).

15.1. National Registry for the Reduction of Greenhouse Gas Emissions - RENARE

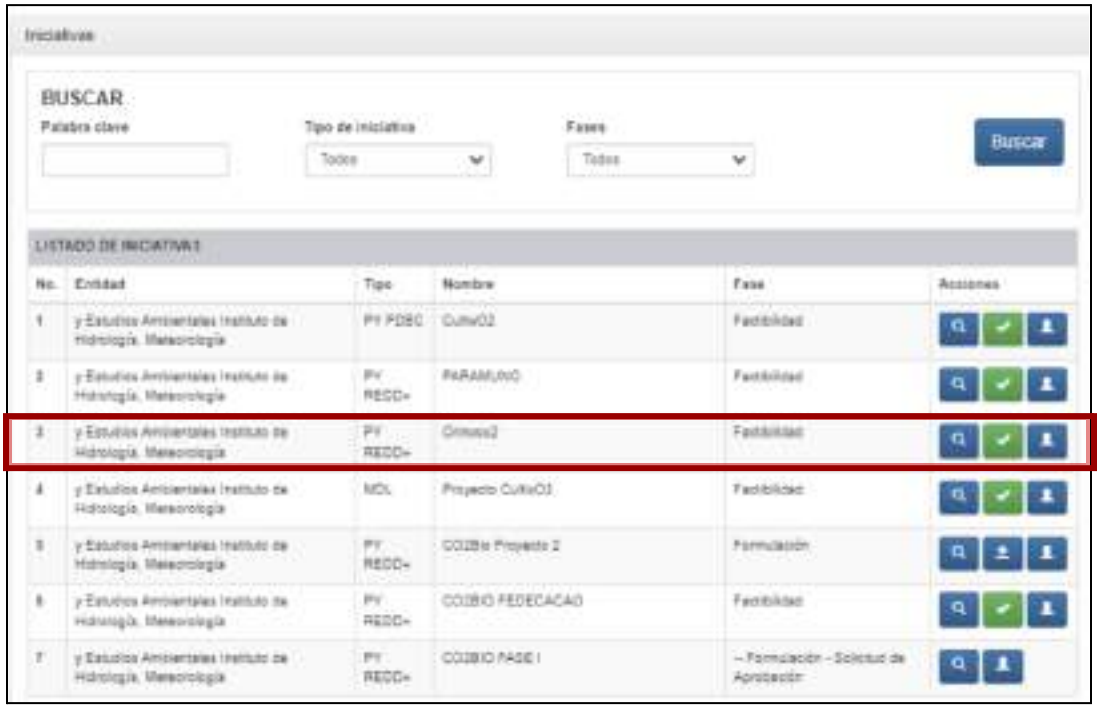
The RENARE platform integrates four registration phases (feasibility, formulation, implementation, and closure), in each of them over time it monitors the results of the GHG emissions reduction projects in the country, the project is registered in the RENARE.

Considering that since last August 9, 2022, we were notified by email that the platform would be temporarily closed for maintenance (Aviso plataforma RENARE) and that the portal was out of service, the project owner has not been able to advance the steps. It is expected that the Ministry of the Environment will complete the maintenance to proceed with the project information report and be able to provide the necessary updates as provided by national regulations.

Information was requested from the Ministry of Environment and Sustainable Development on the estimated date on which the platform would come into operation again (Filed MinAmbiente), however no information has been received in this regard.

Demonstration of any type of overlap requires activation of the RENARE platform, which, unfortunately, is not available at the current date. However, it is relevant to note that, The Orinoco2 project had a registered start on October 1, 2018, and was incorporated into the RENARE in 2022, where until that moment progress was made in the feasibility stage (figure 25), subsequently the platform stopped working.

figure 25. Renare Register



Since the implementation of the project, constant monitoring of the implementation of the platform has continued in order to manage the information in a timely manner. Recently, the platform was partially enabled and we were able to request the transition to formulation. We are still awaiting the review to move forward in the phases.

https://renare.ideam.gov.co/GPY2-web/#/gpy/iniciativas/datos-basicos/consultar/3721

15.2. Review of other projects

A systematic search is carried out for the standards present in the region of influence. For which VERRA stands out[64], COLCX[65], CERCARBONO[66] y BIOCARBON STANDARD[67] 1.4.4.1. Cartographic information. Following identification, the cartographic information of each carbon project present in the area is downloaded directly from the website of the corresponding standard. This information is organized in shapefiles to perform vector analysis.

64 https://verra.org/

65 https://colcx.com/

66 https://www.cercarbono.com/es/

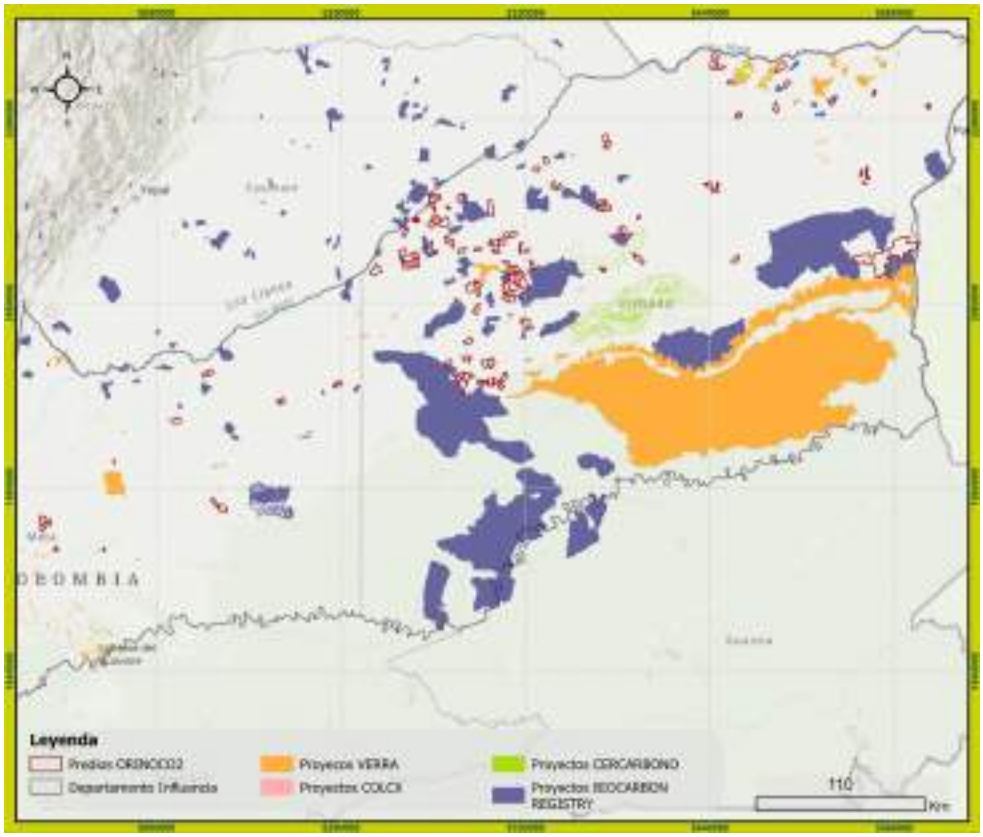
67 https://biocarbonregistry.com/es_es/

Next, the “Intersect” algorithm was implemented between the project areas and the areas defined by each carbon standard. The result obtained were empty shapefiles that conclusively indicate the absence of overlap between the project areas and other projects in the region.

All relevant cartographic data is duly stored and available in the geospatial databases, located on the route. 1.1.4.Gdb\coal projects. The information is also available in each geodatabase feature dataset “Standard projects — double counted”. Likewise, a Map Package file titled 1.4.4.2.1.ORINOCO2 Standard carbon, designed to be accessible in any version of ArcGIS Pro. This package includes geodatabase cartographic information and the mentioned results (To open in any GIS software). Additionally, an Excel file is provided with the name of each project organized by standard, providing additional documentation for easy reference.

In summary, in the departments of Meta and Vichada there is a significant presence of projects, totaling 36, which are distributed according to the standards as follows: VERRA (6), COLCX (7), CERCARBONO (6), BIOCARBONO REGISTRY (17) 1.4.4.3.Database The figure 26, provides geographic information about other projects being developed in the vicinity of the project area.

Figure 26. Location of project areas compared to other projects.



Source: Own elaboration.

16. Monitoring plan

The project monitoring plan is designed based on the adoption of project management tools under agile methodologies and strict compliance with the criteria established in the standard. BCR and quantification methodologies BCR0002 and BCR0005.

The monitoring plan takes into account the following parameters, among others, in order to design a comprehensive project monitoring model and comply with the requirements of the methodological documents and tools of the BCR standard.

Table 63 parameters of monitoring plan

Parameters	Detail
a. Data and information necessary to estimate the removals or reductions of GHG emissions, during the project quantification period:	Section 3 and 16.1 of this document
b. Data and information and complementary information to determine the baseline or scenario:	Section 3 of this document
c. The specification of all possible GHG emissions that may occur outside the project boundaries, attributable to project activities (leakage):	Section 3 and 16.1 of this document
d. Information related to the evaluation of environmental and social effects of project activities:	Section 8 and 16.5 of this document
e. The procedures established for the management of GHG emissions reductions or removals and matters related to quality control for monitoring activities.	Section 16.7 of this document
f. description of the procedures defined for the periodic calculation of GHG emissions reductions or removals and leakage:	Section 3 and 16.1 of this document.
g. The assignment of roles and responsibilities for monitoring and reporting the relevant variables for the calculation of GHG emissions reductions or removals:	Section 16. 8 of this document.
h. the procedures criteria and indicators related to the evaluation of the project's contribution to the Sustainable Development Goals (SDGs);	Section 10 and 16.3 of this document.

i. Execution of project activities;	Section 2.3.8.1 Design of project activities and section 16.2 of this document.
j. the procedures criteria and indicators related to the monitoring of co-benefits and the special category "Wax Palm"	Section 12 and 16.2

In this sense, the monitoring of the components is established. For their part, the monitoring tools or procedure for each component and the procedures are described below.

Table 64 Monitoring Components

Component	Description
Monitoring project limits and emissions	Project limits and emissions are monitored in accordance with the guidelines of methodologies BCR0002 and BCR 0005. The procedure is described in section 16.1. Monitoring of project limits and emissions. The monitoring tools, geographic information system (GDB) and the quantification Excel document are updated.
Monitoring the execution of project activities and co-benefits	Activities BCR0002, BCR0005 are described in section 2.3.8.1 Design of project activities. Actions to qualify for the wax palm category are described in section 12. Special categories related to co-benefits.
Safeguard Compliance Monitoring	Compliance with the safeguards will be managed in accordance with the requirements of the Afolu Sector Methodological Document "Quantification of GHG Emission Reduction REDD+ Projects BCR002", version 4.0 (May 27, 2024), and the tool for Demonstrating Compliance with REDD+ Safeguards, version 1.1 (January 26, 2023), both developed by BioCarbon Standard. Compliance is also given to the criteria of the National Interpretation of Environmental and Social Safeguards for REDD+ in Colombia (Camacho A., Lara I., Guerrero R.D., 2017). This procedure is detailed in section 11. REDD+ safeguards.
Sustainable Development Safeguards	The impacts of the implementation of project activities will be monitored according to the guidelines of the Sustainable Development Safeguards Tool (SDSs Tool), version 1.1 (July 4, 2024), developed by BioCarbon Standard.
Monitoring of Contribution to SDGs	The evaluation of the contribution to the sustainable development goals and its evolutions under identified indicators will be carried out using the tool defined by BCR.

Project Risk Management And Permanence	Project risk management is performed hastily based on the identification and analysis developed in sections 7. Risk Management and 3.5 Leakage and non permanence.
Quality control and quality assurance procedures	The quality management procedures are part of the quality management system of the Cataruben Foundation certified under ISO 9001 and ISO 14001 standards, as well as compliance with data quality management according to ISO 14064-2.

The monitoring plan establishes nineteen monitoring periods (Table 65)

table 65 Monitoring periods

Monitoring period	Monitoring period dates	Duration of monitoring period
1	from 10/1/2018 to 12/31/2022	4.25 years
2	from 1/1/2023 to 12/31/2024	2 years
3	from 1/1/2025 to 12/31/2026	2 years
4	from 1/1/2027 to 12/31/2028	2 years
5	from 1/1/2029 to 12/31/2030	2 years (quantification period update)
6	from 1/1/2031 to 12/31/2032	2 years
7	from 1/1/2033 to 12/31/2034	2 years
8	from 1/1/2035 to 12/31/2036	2 years
9	from 1/1/2037 to 12/31/2038	2 years
10	from 1/1/2039 to 12/31/2040	2 years (quantification period update)
11	from 1/1/2041 to 12/31/2042	2 years
12	from 1/1/2043 to 12/31/2044	2 years
13	from 1/1/2045 to 12/31/2046	2 years
14	from 1/1/2047 to 12/31/2048	2 years
15	from 1/1/2049 to 12/31/2050	2 years (quantification period update)

Monitoring period	Monitoring period dates	Duration of monitoring period
16	from 1/1/2051 to 12/31/2052	2 years
17	from 1/1/2053 to 12/31/2054	2 years
18	from 1/1/2055 to 12/31/2056	2 years
19	from 1/1/2057 to 12/31/2058	2 years

16.1. Monitoring of project limits and emissions.

Project limits and emissions are monitored in accordance with the guidelines of methodologies BCR0002 and BCR 0005. The procedure is described in section 16.1. Monitoring of project limits and emissions. The monitoring tools, geographic information system (GDB) and the quantification Excel document are updated.

- Annex 1..1. GDB REDD+ AND SAVANNAS
- Anex 1..2.1. EMISSIONS_PROJECT / SHEET 4. EMISSIONS MONITORING)

16.1.1. REDD+ area monitoring procedure

According to the methodology BCR 0002 The geographic limits of the project, constituted by the eligible areas[68] on which REDD+ activities are developed, must be included in a Geographic Information System (GIS), georeferencing the total project areas, including the reference region and the leak belt.

Monitoring of REDD+ areas will be carried out over the geographical limits of the project through the use of satellite images from Remote Sensors such as Sentinel, Planet images and in situ observation. The detection of changes in eligible areas will be carried out through Digital Image Processing — PDI through the Google Earth Engine platform, supported by the Computer Assisted Interpretation Procedure — PIAO.

To monitor fires in tree covers, there will be support from the Institute of Hydrology, Meteorology and Environmental Studies—IDEAM through the Heat Point Monitoring platform[69] from Colombia. This comprehensive and technologically advanced approach ensures effective and accurate surveillance of REDD+ areas.

[68] Eligible areas refer to areas that meet the condition of forest presence, on the reference dates established by the BCR standard and BCR 0002 methodology.

[69] http://puntosdecalor.ideam.gov.co/

In this way, the monitoring of the reduction of emissions from deforestation and degradation will be carried out for the geographical areas included in the project. Periodic verification of deforestation and degradation in the project is carried out using the guidelines described in sections 14.4 of the BCR 0002 V. 4.0 methodology or corresponding paragraphs in their updates.

16.1.2. Monitoring procedure for natural savanna areas

In accordance with the BCR0005 methodology, the geographic limits of the project, constituted by the eligible areas of natural savannas on which the project activities are developed, must be included in a Geographic Information System (GIS), georeferencing the total areas of the project, including the reference area.

Monitoring of natural vegetation covers belonging to the savanna will be carried out in a manner analogous to REDD + projects. Remote sensors such as Sentinel and high-resolution sensors such as Planet Images and Worldview-2 will be used, complemented by in situ observations. The detection of changes in eligible areas will be carried out through the application of the Corine Land Cover methodology and the Computer Assisted Interpretation Procedure - PIAO.

To monitor fires of natural vegetation cover, there will be support from IDEAM through the Heat Point Monitoring platform[67]. It is important to note that, in the case of fires that affect eligible areas, a detailed report will be prepared to determine the extent of the impact, the origin of the fire and the transition of post-fire coverage. In this way, we guarantee effective and precise supervision of the savanna areas.

In this way, the monitoring of the reduction of emissions due to changes in land use will be carried out for the geographical areas included in the project. Periodic verification of changes in land use in the project area must be carried out using the procedures described in section 11.2 of the methodology or corresponding paragraphs in its updates.

16.1.3. Emissions monitoring procedure of the project

The quantification of GHG emissions in the monitoring period will be developed according to the guidelines of the BCR 0002 (section 14.5) and BCR 0005 (section 13.1.4) methodologies. In this way, at least monitoring of activity data will be carried out. Meanwhile, the emission factors to be applied will correspond to those initially validated.

16.1.3.1. Deforestation

The estimation of forest deforestation in the project area and leakage area during the monitoring period is carried out with the following equations:

$$CSB_{project,\,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{REDD+proy,1} - A_{REDD+proy,2}\right)$$

and,

$$CSB_{f,\,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{f,1} - A_{f,2}\right)$$

Where:

$CSB_{project,\,year}$	Annual change in the area covered by forest in the project area; ha
$CSB_{f,\,year}$	Annual change in the area covered by forest in the leakage area; ha
t_1	Start year of the monitoring period; year
t_2	Final year of the monitoring period; year
$A_{REDD+proy,1}$	Surface in forest, in the project area at the beginning of the monitoring period; ha
$A_{REDD+proy,2}$	Surface in forest, in the project area at the end of the monitoring period; ha
$A_{f,\,1}$	Surface in forest, in the leakage area at the beginning of the monitoring period; ha
$A_{f,2}$	Surface in forest, in the leakage area at the end of the monitoring period; ha

For its part, the annual GHG emissions from deforestation in the project area and leakage area are calculated following the equations:

$$EA_{REDD+project,\,year} = DEF_{REDD+project,\,year} \times tCO_{2eq}$$

and,

$$EA_{f,\,year} = (EA_{f,\,year} \times tCO_{2eq}) - EA_{lb,\,f,\,year}$$

Where:

$EA_{REDD+project,\,year}$	Annual emission in the project area; tCO2e/ha
$EA_{f,\,year}$	Annual emission in the leakage area; tCO2e/ha

$DEF_{REDD+project,\,year}$	Annual deforestation in the project area; ha
$DEF_{f,\,year}$	Annual deforestation in the leakage area; ha
tCO_{2eq}	Total equivalent carbon dioxide; tCO2e/ha
$EA_{lb,\,f,\,year}$	Annual emission from deforestation in the leakage area in the baseline scenario; tCO2e

Finally, the reduction in emissions from avoided deforestation, in the monitoring period, is calculated according to the equation:

$$RE_{DEF,\,REDD+proy} = (t_2 - t_1)\ x\ (EA_{DEF,\,lb,\,\text{year}} - EA_{DEF,\,REDD+proy,\,\text{year}} - EA_{DEF,\,f,\,\text{year}})$$

Where:

$RE_{DEF,\,REDD+proy}$	Reduction of emissions from deforestation avoided in the monitoring period; tCO2e
t_2	Final year of the monitoring period; year
t_1	Start year of the monitoring period; year
$EA_{DEF,\,lb,\,\text{year}}$	Annual emission from deforestation in the baseline scenario; tCO2e
$EA_{DEF,\,REDD+proy,\,\text{year}}$	Annual emission of deforestation in the project area for the monitored period; tCO2e
$EA_{DEF,\,f,\,\text{year}}$	Annual emission from deforestation in the leakage area for the monitored period; tCO2e

16.1.3.2. Degradation

The estimation of forest degradation in the project area during the monitoring period is carried out with the following equation from the:

$$DFP_{REDD+project,\,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{core} - A_{core-Edge}\right)$$

Where:

$DFP_{REDD+project,\,year}$	Annual primary degradation in the project area; ha
t_1	Start year of the monitoring period; year
t_2	Final year of the monitoring period; year
A_{core}	Project area in core class, in the year of the beginning of the monitoring period; ha
$A_{core-edge}$	Project area that changes from core to edge, in the final year of the monitoring period; ha

On the other hand, the estimation of the degradation in the leakage area is carried out with the following equations:

$$DFP_{f,\,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{core,\,f} - A_{core-edge,\,f}\right)$$

Where:

$DFP_{f,\,year}$	Annual primary degradation in the leakage area; ha
t_1	Start year of the monitoring period; year
t_2	Final year of the monitoring period; year
$A_{core,\,f}$	Area of leakage in core class, in the year of the beginning of the monitoring period; ha
$A_{core-edge,\,f}$	Leakage area changing from core to edge, in the final year of the monitoring period; ha

In this way, the estimate of emissions in the monitoring period is estimated from the relationship between the recorded degradation and the emission factors for class, following the equations:

$$EA_{REDD+proy,\,\text{year}} = (DFP_{REDD+proy,\,\text{year}}\; xDTBCO_{2eq,1})$$

and,

$$EA_{f,\,\text{year}} = (DFP_{f,\,\text{year}}\ xDTBCO_{2eq,1})$$

Where:

$EA_{REDD+proy,\,\text{year}}$	Annual emission in the project area for the monitored period; tCO2e
$EA_{f,\,\text{year}}$	Annual emission in the project area for the monitored period; tCO2e
$DFP_{REDD+proy,\,\text{year}}$	Annual historical primary degradation in the project area; ha
$DFP_{f,\,\text{year}}$	Annual historical primary degradation in the area of leakage; ha
$DTB_{CO2eq,1}$	Equivalent carbon dioxide contained in the difference of total biomass per hectare in the primary degradation class; tCO2e ha-1

Lastly, the reduction of emissions due to degradation, in the monitoring period, is estimated according to the equation:

$$RE_{DEG,\,REDD+proy} = (t_2 - t_1)\ x\ (EA_{DEG,\,lb,\,\text{year}} - EA_{DEG,\,REDD+project,\,\text{year}} - EA_{DEG,\,f,\,\text{year}})$$

Where:

$RE_{DEG,\,REDD+proy}$	Reduction of emissions due to avoided degradation; tCO2e
t_2	Final year of the reference period; year
t_1	Start year of the reference period; year
$EA_{DEG,\,lb,\,\text{year}}$	Annual emission degradation in the baseline scenario; tCO2e
$EA_{DEG,\,REDD+project,\,\text{year}}$	Annual degradation emission in the project scenario; tCO2e
$EA_{DEG,\,f,\,\text{year}}$	Annual degradation emission in the leakage area for the monitored period; tCO2e

16.1.3.3. natural savannas

The estimation of changes in land use in the project area and leakage area during the monitoring period is carried out with the following equations:

$$CSCN_{project,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_1 - A_2\right)$$

and,

$$CSCN_{f,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{f,1} - A_{f,2}\right)$$

Where:

$CSCN_{project,ye}$	Change in the surface with natural vegetation cover in the project area; ha/year
$CSCN_{f,year}$	Change in the area covered by natural vegetation cover in the leakage area; ha/year
t_1	Start year of the monitoring period; year
t_2	Final year of the monitoring period; year
A_1	Surface with natural vegetation cover in the project area at the beginning of the monitoring period; ha
A_2	Surface with natural vegetation cover in the project area at the end of the monitoring period; ha
$A_{f,1}$	Surface with natural vegetation cover in the leakage area at the beginning of the monitoring period; ha
$A_{f,2}$	Surface with natural vegetation cover in the leakage area at the end of the monitoring period; ha

Similarly, the quantification of annual GHG emissions due to changes in land use in the project area and leakage area are calculated following the equations:

$$E_{proy,\,\text{year}} = CSCN_{proy}\, x\,(CBF_{eq} + COS_{eq})$$

and,

$$E_{f,\,\text{year}} = [CSCN_{proy,f}\, x\,(CBF_{eq} + COS_{eq})] - EA_{f,lb}$$

Where:

$E_{proy,\,\text{year}}$	Annual emission in the project area; tCO2/ha
$E_{f,\,\text{year}}$	Annual emission in the leakage area; tCO2/ha

$CSCN_{proy}$	Change of land use in the project area; ha/year
$CSCN_{proy,f}$	Land use changes in the leakage area; ha/year
$EA_{f,lb}$	Annual emission in the leakage area in the baseline scenario; tCO2e
CBF_{eq}	Equivalent carbon dioxide contained in the total biomass; tCO2e/ha
COS_{eq}	Soil carbon content; tC/ha

Finally, the reduction of emissions due to avoiding changes in land use, in natural savannas, during the monitoring period is estimated according to the equation:

$$RE_{proy,\,pm} = (t_2 - t_1)\ x\ (EA_{lb} - EA_{proy,\,pm} - EA_f)$$

Where:

$RE_{proy,\,pm}$	Reduction of emissions by avoiding changes in land use in the monitoring period; tCO2e/year
t_2	Final year of monitoring period
t_1	Start year of the monitoring period
EA_{lb}	Emission from changes in land use in the baseline scenario; tCO2e
$EA_{proy,\,pm}$	Emission due to changes in land use in the project area for the monitored period; tCO2e
EA_f	Emission due to changes in land use in the leakage area for the monitored period; tCO2e

16.1.3.4. Other GHG emissions

If during the monitoring period fires are recorded in the tree component, the CH4 and N2O emissions caused by the combustion of woody biomass must be quantified. In this case, they would apply the procedures established by the IPCC (2006) for this purpose.

16.2. Monitoring the execution of project activities and co-benefits

The tool designed for monitoring project activities and actions of extras of co-benefits corresponds to the project activity monitoring plan. Complying with the requirement of section

14.2 of the BCR 0002 Methodologies and section 13.1.2. of the BCR 0005 methodology: which establishes that the project owner must design a monitoring plan for each proposed activity, according to the following information:

- activity ID
- Indicator ID
- Indicator name
- Type[70]
- Meta[71]
- Unit of measurement
- Monitoring methodology
- Monitoring frequency
- Responsible for measurement
- Indicator result in the reporting period
- Documents to support information
- Observations

Activities BCR0002, BCR0005 are described in section 2.3.8.1 Design of project activities. Actions to qualify for the wax palm category are described in section 12. Special categories related to co-benefits.

For monitoring, a comprehensive tool is developed that includes project activities and co-benefit actions. The tool differentiates activities BCR0002, BCR0005 and co-benefit actions.

Monitoring matrix is attached 6.1. PROJECT ACTIVITIES MONITORING PLAN

16.3. Monitoring of Contribution to SDGs

The evaluation of the contribution to the sustainable development goals under identified indicators will be carried out using the tool defined by BCR. This is described in section 10. Sustainable development Goals.

- 6.3. HERRAMIENTA-ODS-2023.XLSX

16.4. REDD+ Safeguard Monitoring

Compliance with the safeguards will be managed through the Monitoring Plan, which will include the following structural criteria: the Cancun and national safeguards, as well as the monitoring indicators for each safeguard, specifying the type of indicator, the established target, the unit of

[70] Result, product or impact.
[71] Expected value and time for fulfillment

measurement, the methodology and the monitoring frequency. In addition, the person responsible for the measurement, the results of the indicator in the reporting period, supporting documents and additional observations will be identified. This will ensure compliance with the criteria established in the AFOLU Sector Methodological Document "Quantification of GHG Emission Reductions in REDD+ Projects BCR002", version 4.0 (May 27, 2024) of the BioCarbon Standard.

Monitoring indicators will be defined according to the evidence criteria established in the Tool for Demonstrating Compliance with REDD+ Safeguards, version 1.1, January 26, 2023, also developed by BioCarbon Standard. Likewise, the criteria of the National Interpretation of Environmental and Social Safeguards for REDD+ in Colombia will be considered (Camacho A., Lara I., Guerrero R.D., 2017).

The Monitoring Plan will allow measuring compliance with safeguards in aspects such as compliance with legal regulations, transparency and access to information, respect for traditional knowledge, participation, risks, and displacement of emissions. This plan will be updated at each project verification, incorporating results achieved and adjusting indicators as necessary to accurately reflect progress toward objectives. Updates will ensure that the project remains aligned with international and national standards, as well as REDD+ safeguards requirements.

6.2. PLAN DE MONITOREO DE SALVAGUARDAS

16.5. Sustainable Development Safeguard Monitoring

To evaluate the impacts of the implementation of project activities, two matrices will be prepared: one for environmental impacts and the other for social impacts. These matrices will include a series of questions that will help clarify the impact and determine which component is being generated.

In terms of environmental impacts, aspects related to land use, water, biodiversity, ecosystems and climate change will be evaluated. On the other hand, social impacts will address issues such as the right to work and working conditions, gender equality and women's empowerment, land acquisition, land use restrictions, displacement and involuntary resettlement, as well as the situation of indigenous peoples and cultural heritage, community health and safety, corruption, economic impact and forest governance.

Each matrix will include a detailed explanation of the impact and establish prevention and mitigation actions, in compliance with the guidelines of the Sustainable Development Safeguards Tool (SDSs Tool), version 1.1 (July 4, 2024), developed by BioCarbon Standard.

Monitoring of prevention and mitigation actions will be carried out through the project activity monitoring plan. This procedure is detailed in Section 8, entitled "Safeguards for Sustainable Development".

- Anex5..1.1. ENVIRONMENTAL IMPACT ASSESSMENT
- Anex 5.1.2. SOCIOECONOMIC IMPACT ASSESSMENT

16.6. Monitoring of the project permanence

Project risk management is performed in a comprehensive manner based on the identification and analysis developed in sections 7. Risk Management and 3.5 Leakage and non permanence. In this sense, risks are assessed in each monitoring period, the necessary mitigation actions are determined and the impact of the action taken is evaluated. Details in:

- 6.4. RISK ANALYSIS AND MANAGEMENT

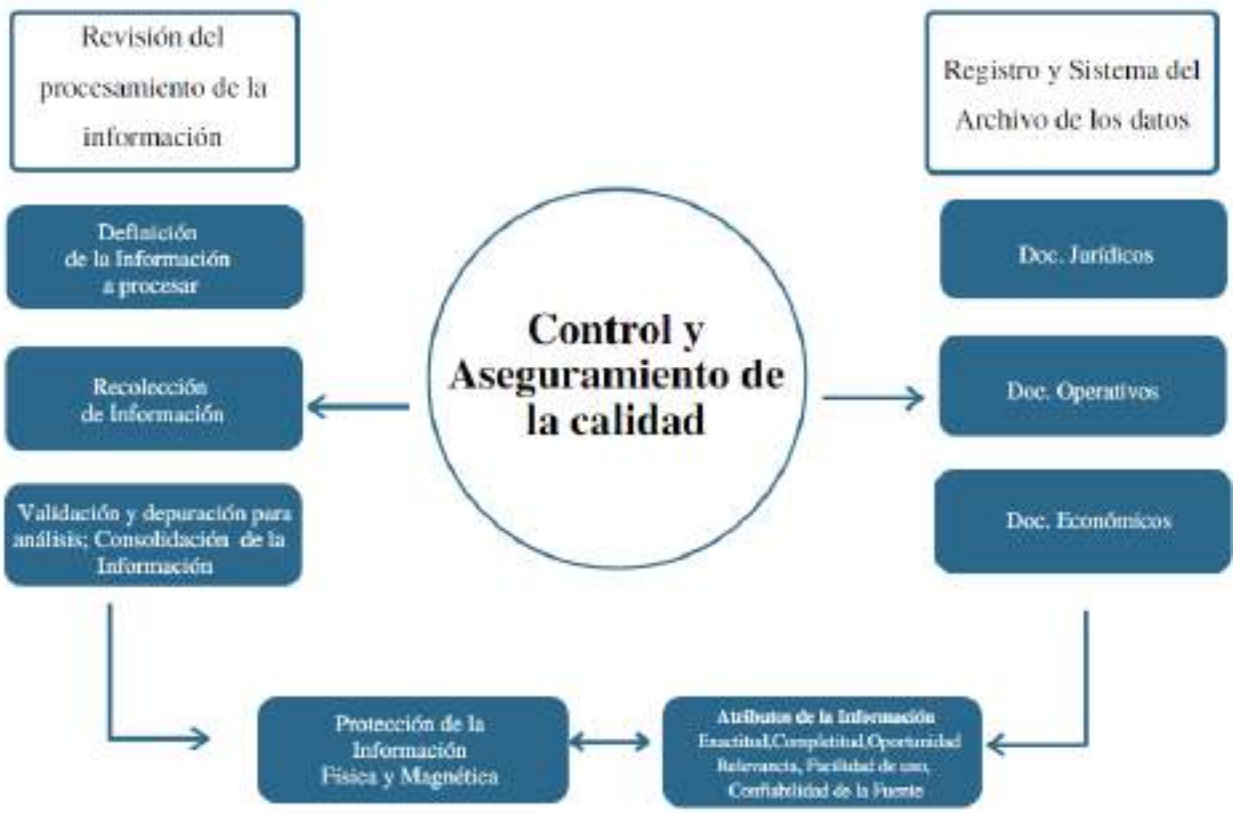
16.7. Quality control and quality assurance procedures

Good quality control and quality assurance are two of the most important elements of a successful operation. Achieving, guaranteeing and maintaining the quality of the information is essential to obtain the expected results in the implementation of the methodologies applicable to each project.

While quality assurance focuses on the processes involved in producing the information output, quality control is the quality inspection of the information provided, to evaluate whether it passes certain quality standards. Quality control aims to detect deficiencies in quality, while quality assurance aims to prevent them from occurring.

The Figure 27 summarizes in detail the process carried out at the Cataruben Foundation to ensure correct control and quality assurance.

Figure 27. Basic structure of QA/QC.



Source: Cataruben Foundation, 2023.

The Cataruben Foundation has planned the measures described below to ensure and control quality during the implementation of the BCR 0002 Methodology and the Methodological Document Sector AFOLU / BCR 0005 Quantification of the Reduction of GHG Emissions and Removals - Activities that Prevent Climate Change Land Use in Natural savanna. Taking into account the applicable legal and technical requirements, and in this way comply with the following aspects:

- ➢ Ensure the correct development and management of the project;
- ➢ Identify and control resources (financial, support, human, etc.) to carry out activities during all project stages;
- ➢ Through the implementation of the necessary manuals, procedures, guides and formats, it must be ensured that the requirements and expectations indicated in the Quantification methodologies, the requirements of ISO 9001/2015, ISO 14001/2015, as well as the legal and regulatory requirements and those of the Cataruben Foundation's own integrated Management System;

- ➢ Identify and control the interrelationships between the participants during the execution of the project phases, indicating for each of them their scope, functions, and responsibilities.

Figure 28. Project phases.

Source: Cataruben Foundation.

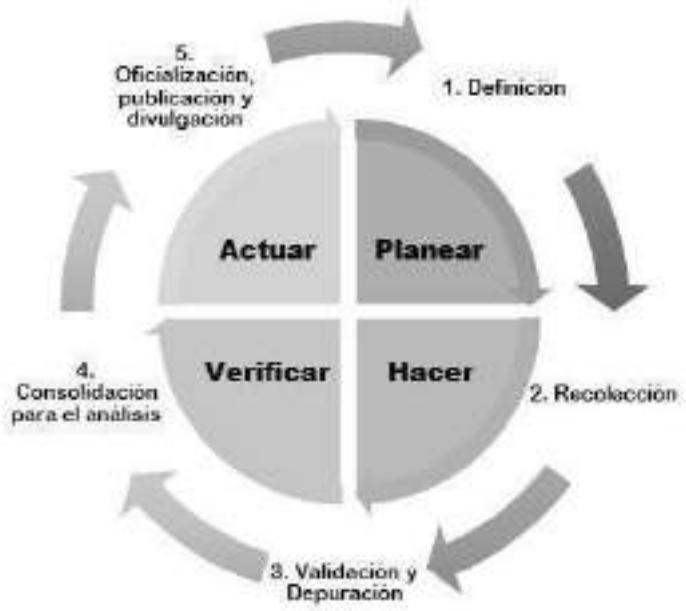
Taking into account that the implementation of the methodologies is fundamentally based on the geographical, social, economic, and environmental information that characterizes the project; Quality assurance and control actions in this aspect are relevant, which is why compliance with the following attributes is established throughout the data collection and processing process:

- ➢ Accuracy: Accuracy means that the data is free of errors (arithmetical and grammatical), is clear, unbiased and reflects the meaning of the data on which it is based.
- ➢ Completeness: The data must be complete and meet all your needs. Incomplete or partial information can result in erroneous decisions and financial and social cost overruns.
- ➢ Opportunity: Opportunity means that the data must reach its recipients in a pre-established time frame, allowing them to decide appropriate actions based on the information received.
- ➢ Relevance: Data is said to be relevant if it answers the questions of stakeholders and allows them to make decisions. At this point, it is important that the information is communicated to the correct people.
- ➢ Ease of use: The data must be understandable. In this way, the reports must be constructed in such a way that no additional time is spent processing them and the required information can be extracted directly.

Reliability of the source: Information must come from reliable sources. The reliability of the source must be evaluated in each delivery of information, taking into account the metrics of collection, validation, purification, and consolidation of information.

To comply with these principles, information management activities must implement the continuous improvement cycle, in order to prevent non-conforming outputs during the process, as described below:

Figure 29. Information management cycle.



Source: Cataruben Foundation.

16.8. Information Processing Review

The review of information processing consists of 5 (five) stages for information management, the first refers to the definition of the information, where the review of the methodological documents applicable to the project is carried out, the second stage is the collection, where the information that was identified as necessary for the implementation of the AFOLU Sector Methodological Document is collected, next is the validation and purification stage of the data, the consolidation of information for the analysis continues, where the information is consolidated in a database digitally and physically, and finally the Officialization, publication and dissemination of the results to interested parties is carried out (Table 66).

Table 66. Review of information processing.

Information Management Stages	Responsible	Controls
Definition of Information: Review of the BCR 0002 Methodology and the AFOLU Sector Methodological Document / BCR0005 Quantification of the Reduction of GHG Emissions and Removals - Activities that Prevent Land Use Change in natural savannas, to identify the type of data that is required, as well as the appropriate tools, means, and strategies for its collection, to prevent duplication of efforts and ensure compliance with applicable technical and legal requirements. In this first step, the structure of the information, the relationships and its integrity are identified, in addition to identifying and ensuring that the sources are reliable and official such as IDEAM and IGAC. (See Annex 5. GOP-07. Procedure for monitoring project limits).	-Manager Project -Care Unit -Unit Quantification -Governance Unit - Geospatial Area -Implementation unit -Economic Area -Operational Risks Unit	This stage of the process must be recorded in the meeting minutes, in which, at a minimum, the following aspects are described and approved: -Technical requirements -Legal requirements -Formats and their content (geographical, social, biodiversity, legality of land) -Tools and means of collecting information (official and appropriate) -Responsible for each activity
Harvest In accordance with the means and tools established in the previous stage, the information identified as necessary for the implementation of the BCR 0005 Methodology and the AFOLU Sector Methodological Document / BCR0005 Quantification of the Reduction of GHG Emissions and Removals - Activities that Avoid Change is collected. of Land Use in savannas. For this process, there are competent personnel and the appropriate tools for collecting information. The information collected is stored on the organization's Drive.	-Manager Project -Care Unit -Unit Quantification -Governance Unit - Geospatial Area -Implementation unit -Economic Area -Operational Risks Unit	Before starting information collection activities, the operability of the equipment to be used and the competence of the personnel carrying out this activity must be verified, both for the use of the tools (procedures and forms) and for the use of technological equipment. Any non-compliance must be reported to the corresponding area to carry out management and prevent delays in programming and/or inadequate processing of the information collected. Procedures and instructions have been established for collecting information at this

Information Management Stages	Responsible	Controls
		stage, which have been validated in the previous stage by the leaders or those responsible for the project and each of the units involved in the process.
Validation and Debugging Once compliance with the information principles has been reviewed in the previous stage, the data is validated and purified through the technological tools and equipment initially established. To comply with the BCR 0002 Methodology and the Sector Methodological Document AFOLU / BCR0005 Quantification of the Reduction of GHG Emissions and Removals - Activities that Prevent Land Use Change in savannas, related to the review of information processing, it will be reviewed 10% of the records of the information collected in order to prevent errors from occurring during the consolidation of the information for the analysis.	-Manager Project -Care Unit -Unit Quantification -Governance Unit - Geospatial Area -Implementation unit -Economic Area -Operational Risks Unit	The data collected must be verified by the Quality Unit, for which the approval of the person responsible for the Quality Unit is established in the records (both physical and digital). If inconsistencies are found in the data collected, they must be recorded in the corresponding form and managed through the non-compliant output procedure.
Consolidation of Information for Analysis The information collected is stored in digital and physical databases in compliance with the Information Control Procedure BCR 0002 Methodology and the Sector Methodological Document AFOLU / BCR0005 Quantification of the Reduction of GHG Emissions and Removals - Activities that Prevent Change in the Use of the Soil in savannas, applicable through the use of the ODK Collect platform.	-Manager Project -Care Unit -Unit Quantification -Governance Unit - Geospatial Area -Implementation unit -Economic Area -Operational Risks Unit	In this stage, the DDP is prepared, which is reviewed and validated by the Project manager according to the requirements identified in the initial stage and the applicable methodology. To validate compliance with the requirements, the information is submitted to an audit by the corresponding entity and corrective actions are established if significant findings are found.

Information Management Stages	Responsible	Controls
Officialization, Publication, and Dissemination Once the DDP is generated and validated, the results are published and disseminated to the appropriate stakeholders.	-Manager Project -Operational Risks Unit	The information generated during the entire process is stored in physical and digital media in accordance with those established in the Information Security Manual (F-GAM-03) and the Archive Manual (FC-GAM-04), in order to guarantee the security and adequate maintenance of said information for the time required.

Source: Cataruben Foundation.

All documented information generated during the process must meet the following characteristics:

- They must be written in the present tense of the verb
- They must have uniformity in terminology and writing
- They must have uniformity in terminology and writing
- They must comply with the image of the Cataruben Foundation in terms of icons, logos, fonts, color palette among other aspects.
- The process leader and/or project manager is responsible for ensuring compliance with the requirements regarding document management of the project.

During all phases of the project, different documents are obtained, among which are the following:

Table 679. Documents obtained in the different phases of the project.

Administrative Documents	During all stages of the project, administrative documents are generated that support and guarantee the veracity of the project information. Said documented information is classified as: - Procedures, standards, policies. - Resource request records (human, financial, purchases, among others). - Administrative records (POA, risk matrices, among others). - Monitoring report. - Performance evaluation. - Meeting minutes. - Audit report
Legal Documents	do you copy of documents that support the ownership of the properties. - Public deed of the property. - Certificate of tradition and freedom. - Real estate registration. - Certificate of healthy possession. - Cadastral certificate. - Property tax. Copies of the identification documents of the project beneficiaries. - Citizenship card. - Chamber of Commerce certificate. - RUT Conservation agreements: - Intention letter. - Certificate of veracity of the information. - Control of documented information. - Legal viability. - Technical viability. - Study of titles. - Linkage contracts. - Confidentiality agreements. - OTHER YES (if applicable). - Special power (if applicable). - Authorization for payment of economic incentives to third parties. (if apply) In the event of the death of a beneficiary of the project, the following must be available: - Death record of the beneficiary. - Birth registration of your heirs. - Succession support. - If you do not have the aforementioned documents, the Project Owner will not be able to make any type of disbursement until you have clarity about the legal status of the property linked to the project.
Technical Documents	Before, during and after the execution of field trips, the following is taken into account: - guides, programs, procedures, and manuals that provide guidelines for the collection and analysis of the information obtained.

	- Databases. - Field records. - Maps of the properties. - Photographic evidence. - Attendance list- - building plan
Economic Documents	The economic documents that are related during the validity of the project are: - Supplier registration format. - Single Tax Registry (RUT) of the ecosystem manager, agent and/or legal representative. - Ruth commitment letter (if applicable). - Bank certificate from the ecosystem manager or representative. - Certificate of existence and legal representation (if applicable). - Power or authorization to transfer economic benefits to a third party (if applicable), duly authenticated. - DIAN resolutions. (if apply) - Supplier selection document. - Supplier evaluation document. - Evidence of socialization of results and selection of suppliers. - Evidence of socialization of supplier evaluation results. - Evidence of application supplier registration documentary package (if applicable) - Minutes of meeting and/or commitment regarding economic issues. - Simulators of economic benefits. - Economic benefits projection documents or CCV projection. - Evidence of socialization and delivery of economic benefits. - Financial benefits account statement. - Collection document (invoices / collection accounts). - Summaries of signing economic documents through the Docusign platform. (if applicable) - Successful payment file (proof of payment). - Preliminary payment plans (if applicable). - Donation certificates. - Linking payment reports. - Economic % distribution letters. - Linking payment invoices. - Linking payment supports. - CCV issuance reports. - Peace and safety. - Tax auditor certificates. (if apply)

Source: Cataruben Foundation, 2023.

These documents are classified and treated in accordance with the guidelines established by the procedures, manuals and policies, where it is required:

- Organize physical and electronic documents through document classification.

- Establish conservation and elimination periods for information and electronic archival documents in document retention tables (TRD).

- Execute partial or complete elimination processes in accordance with the times established in the TRD.

- Ensure the authenticity of records and information throughout the document life cycle.

- Maintain the integrity of the documents, through documentary groupings, in series and subseries.

- Preserve documents and their documentary groups, in series and subseries, in the long term, regardless of the technological procedures used for their creation. The storage, protection, recovery, retention time and final disposition of the records is contemplated in the Master List of Documented Information in general or in the Master List of Documented Information specific to projects, according to the client's requirements.

- Comply with the guidelines established in the document Guidelines for the Consolidation of Legal, Technical and Financial Information in Project Databases

16.8.1. Records Protection

The Cataruben Foundation has established the following methodologies for the protection of records associated with the implementation of the methodology, as described below:

- Physical Records: Records are protected by storing them in filing cabinets located in the archiving area of the Cataruben Foundation facilities, free of moisture, direct sunlight, and any other characteristic that may accelerate deterioration. The Coordinator of the Quality unit and the Administrative Coordinator must guarantee their protection in this way, as well as control their access and consultation.

- Digital Records: To guarantee the protection of the Cataruben Foundation's digital records, these are stored in a Shared Drive of the “Google Drive” application assigned to the project. Guaranteeing the protection of its integrity through access credentials assigned to the different folders, these access credentials will only be assigned by the Quality Coordinator, who will be responsible for determining the role of each collaborator in terms of handling the documented information.

Additionally, there are the following Policies and Manuals that ensure compliance with legal requirements for the processing of information during the execution of the project:

FC-GDN-07. Intellectual Property Policy. It establishes an active, transparent and responsible internal and external management and regulation process through principles and guidelines that

allow the Foundation to strengthen and encourage scientific research and the creation of works of this nature. Likewise, have the necessary mechanisms to mitigate the risk against the use, exploitation, and appropriation of its intangible assets.

FC-GDN-08. Personal Data Protection Policy. The Cataruben Foundation, and in compliance with the constitutional right to Habeas Data, only collects Personal Data when it has been previously authorized by its Owner, implementing for this purpose clear measures on the confidentiality and privacy of Personal Data.

FC-GAM-03. Information Security Manual. Establish security measures and control mechanisms for the information assets of the CATARUBEN FOUNDATION, within the framework of the Information Security Management Manual.

FC-GAM-04. Archive Manual. Its objective is to establish the guidelines for the application of documentary transfers, consultation, and loan of documents, bibliographic collections, updating and application of Document Retention Tables (TRD), opening of new files, establishing information security and management policies documentary along with the management of electronic documents. On the other hand, it is intended that the management of the Cataruben Foundation's archives be functional and comply with the service required by the entity and the applicable regulations, taking into account the importance of documentary management such as the management of the knowledge of the institutions and the improvement of the quality of user services.

Records are a special type of documents that provide evidence of the execution of activities or processes, and whose information can influence decision-making or actions that contribute to the implementation, maintenance, and improvement of the Quality Management System and the execution of the Cataruben Foundation Projects. They can be associated with the completion of pre-established or standardized formats, designed according to the specific needs of data or information collection according to internal guidelines, taking into account the requirements of the AFOLU Sector Methodological Document / Quantification of GHG Emissions Reductions from Projects REDD+ and the AFOLU Sector Methodological Document / Quantification of the Reduction of GHG Emissions and Removals — Activities that Prevent Land Use Change in natural savannas or from an external entity that requests them.

NOTE: This Project Document (PD) shall be completed following the instructions included. However, it is important to highlight that these instructions are complementary to the BCR Standard, and the Methodology applied by the project holder, in which more information on each section can be found.

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