CO2Bio P2-2

Document prepared by The Cataruben Foundation

Project document template (Version 2.2)	
Project name	CO2Bio P2-2
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Project participants	124 private property owners

Project document template (Version 2.2)	
Version	2.2
Date	15/012/2023
Type of project	AFOLU (REDD+ and WETLANDS)
Grouped project	No
Applied Methodology	Methodological Document AFOLU Sector / BCR0002 Quantification of GHG Emission Reductions from REDD+ Projects. Version 3.1. 15 September 2022. Methodological Document AFOLU Sector / BCR0004 Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands. Version 2.0 23 June 2022.
Project Location (City, Region, Country)	Colombia, Orinoco region: Department of Arauca: Arauca, Cravo Norte, Puerto Rondón and Tame. Department of Casanare: Hato Corozal, Paz de Ariporo, Orocué, Pore, San Luis de Palenque, Trinidad and Yopal.
Start date	15/01/2018
Period for quantification of GHG emission reductions	15/01/2018 a 14/01/2038
Estimated total and average annual GHG emission reduction amount	*Total estimated GHG reductions:* **2,752,176 tCO_{2e}** *Average annual GHG reductions:* **131,056 tCO /year$_{2e}$**

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Sustainable Development Goals	SDG 6: Water and Sanitation SDG 13: Climate action SDG 15: Terrestrial Ecosystem Life
Special category, related to Co-benefits	Orchid

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1. Project Eligibility

1.1 Scope

The BCR standard comprises the essential guidelines for the registration of greenhouse gas - GHG emission reduction projects, with the purpose of demonstrating compliance with both the requirements established in national legislation and the stipulated regulations and procedures. At its core, the standard provides a complete set of principles and conditions necessary to certify GHG projects, ensuring that such projects conform to the guidelines established by the standard itself.

The project is eligible under the scope of the BCR Standard by meeting one or more of the following conditions mentioned in Table 1.

Table 1. Scope of the standard.

The scope of 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 Registry, applicable to GHG Removal Activities and REDD+ activities (AFOLU Sector).	X
Quantifiable GHG emission reductions and/or removals generated by the implementation of GHG Removal Activities and/or REDD+ activities (AFOLU Sector).	X
GHG projects using a methodology developed or approved by Biocarbon Registry, applicable to activities in the energy, transportation and waste sectors.	
Quantifiable GHG emission reductions generated by the implementation of activities in the energy, transportation and waste sectors.	

Source: BioCarbon Registry, 2023.

The scope of the project is delimited by the following criteria established in the BCR standard scope:

a) The following greenhouse gasses, included in the Kyoto Protocol: Carbon Dioxide (CO_2), Methane (CH_4) and Nitrous Oxide (N_2O).

b) GHG projects using a methodology developed or approved by BioCarbon Registry, applicable to GHG Removal Activities and REDD+ activities.

c) Emission reductions and/or quantifiable GHG removals generated by the implementation of GHG Removal Activities and/or REDD+ activities.

The CO2Bio P2-2 Project supports and encourages actions that play a significant role in reducing greenhouse gas emissions. These achievements are materialized through a series of comprehensive measures, including the implementation of conservation strategies, land-use planning, forest governance, and active participatory biodiversity monitoring, among other actions supported by the Ecosystem Managers.

The primary mission of this project is to contribute effectively to the fight against climate change while preserving vital ecosystems and biological diversity. The project is expected to reduce 2,752,176 tons of greenhouse gasses, which will lead to the prevention of land use change in wetlands and mitigation of forest deforestation.

The project is based on the Biocarbon Registry voluntary standard version 3.2 and its methodologies described below:

For the Forest area, the AFOLU Sector Methodological Document, BCR0002 *Quantifying GHG Emission Reductions from REDD+ Projects*, will be used as a reference. Version 3.1. September 15, 2022.

For the Wetlands area the AFOLU Sector Methodological Document, BCR0004 *Quantification of GHG Emission Reductions and Removals* - Activities that avoid land use change in Continental Wetlands, version 2.0 23 June 2022.

In addition, the following tools provided by the BCR standard were adopted:

- Baseline and Additionality Tool Version 1.2, dated September 27, 2023.
- Tool to demonstrate compliance with REDD+ Safeguards Version 1.1, January 26, 2023.
- No net harm Environmental and social safeguards (NNH) Version 1.0, dated March 7, 2023.

- Tool for determining contributions to the achievement of the Sustainable Development Goals (SDGs) Version 2.0, March 1, 2022.
- Double Counting Avoidance Tool. v 1. March 09, 2023
- Monitoring, Reporting and Verification Tool. v 1. February 13, 2023.
- Permanence and risk management tool. v 1. Mallet 7 of 2023.

1.2 Type of project

The Project is classified in the AFOLU sector, which includes GHG emission reduction activities through REDD+ activities and activities focused on the Wetland ecosystem.

Table 2. Project characteristics.

Activities in the AFOLU sector, other than REDD+	x
REDD+ Activities	x
Activities in the energy sector	
Activities in the transportation sector	
Activities related to waste management and disposal	

Source: BioCarbon Registry, 2023.

1.3 Scale of the project

Not applicable for REDD+ projects, nor GHG projects in the AFOLU sector.

2. General description of the project

The Project reduces CO2 emissions by developing activities that reduce deforestation of forests, as well as the transformation of natural Wetlands in 124 private properties located in the departments of Arauca and Casanare.

To achieve this objective, the project supports actions that comprehensively address the landscape, considering land use change and the implementation of more sustainable practices in forest and wetland ecosystems. The socio-environmental impact resulting from the development of project activities will allow the ecosystem managers to receive economic benefits to strengthen local governance, promote sustainable rural development and improve their quality of life in a region marked by an agricultural frontier with industrial crops.

The project's activity start date corresponds to 2018, and its environmental, social and economic impact is aimed at 102,863 total hectares, whose accounting areas are distributed in 10,532.3 hectares of forest and 50,352.8 hectares of wetlands. The project area comprises private rural properties, whose ownership corresponds to 113 properties in Property, 2 properties with Tenancy and 9 properties in Possession, in a predominantly floodplain landscape.

It is estimated that this project will achieve a reduction of 2,752,176 tons of greenhouse gasses during the period from 2018 to 2038. To ensure the management of emission reductions, the methodological guidelines detailed in BCR Standard 3.2, which establishes the principles and requirements applicable to the project, are implemented. Additionally, the Project focuses on demonstrating how project activities contribute to the Sustainable Development Goals, specifically SDG 6 (Clean Water and Sanitation), SDG 13 (Climate Action) and SDG 15 (Life of Terrestrial Ecosystems). In addition to demonstrating that actions related to climate change mitigation lead to benefits in addition to the reduction of GHG emissions - Co-benefits in the Orchid category, as a comprehensive and long-term approach to the social and environmental benefits that project activities will bring in biodiversity conservation, community benefits and gender equity.

2.1 GHG Project Name

CO2Bio P2-2 is a project that reduces CO2 emissions by implementing activities that reduce deforestation in gallery forests, as well as the transformation of wetlands on private properties in the departments of Arauca and Casanare.

2.2 Objective

Reduce 2,752,176 tons of GHG by avoiding land use change in Wetlands, as well as forest deforestation; to contribute to the conservation of biodiversity and guarantee carbon storage above and below ground and allowing the management of clean water in strategic ecosystems in private properties in the municipalities of Arauca and Casanare.

2.3 Analysis of causes and agents

The analysis of the causes and agents driving forest deforestation in the area of influence of the project, as well as the reasons behind the transformation in land use of wetlands, has been carried out following the guidelines established in the methodological documents presented below.

2.3.1 Causes and drivers of deforestation

The following analysis of causes and agents of deforestation of the project is developed based on the guidelines established in the most updated version of the methodology BCR0002 Version 3.1. - *Quantification of GHG Emission Reductions from REDD+ Projects,* and what is established in the document Conceptual and Methodological Guidelines for the Characterization of Causes and Agents of Deforestation in Colombia (IDEAM et al., 2018).

2.3.1.1 Spatial and temporal dimensions

The project is located in the floodable savannas of the Orinoco region of Colombia. For the analysis of causes and agents of deforestation, the spatial dimension of the project is defined as the area comprising eleven (11) municipalities distributed in two (2) departments as follows: six (6) municipalities in the department of Casanare (Hato Corozal, Paz de Ariporo, Orocué, San Luis de Palenque, Trinidad and Yopal) and four (4) in the department of Arauca (Arauca, Cravo Norte, Puerto Rondón and Tame). The project 's reference area covers approximately 3,930,473 million viable hectares, including gallery forest and wetland ecosystems.

The temporal dimensions of this analysis of causes and agents of deforestation are framed for the period 2010 - 2018.

2.3.1.2 Context

The purpose of this section is to provide a complete context of the departments of Arauca and Casanare, especially for the period from 2010 to 2018. It seeks to provide an overview of the territorial, socio-cultural, economic and historical environment of these departments. This, in turn, will allow for an in-depth understanding of the socio-environmental setting and the factors and actors involved in deforestation in the specific area addressed by the project.

2.3.1.2.1 Territorial context.

The departments of Arauca and Casanare are located in the eastern region of Colombia, known as the Llanos Orientales, which is part of the Colombian Orinoco region. The Department of Arauca is located at the northern end of Colombia 's Orinoco basin and borders Venezuela, Casanare and Boyacá. It covers an area of 23,818 km² (Gobernación de Arauca, 2016).

Arauca is characterized by its geographic diversity, divided into three physiographic regions. First, there is a small mountainous area in the south of the department, which borders Boyacá and reaches altitudes above 1,000 meters above sea level, with a cold climate. The Eastern Cordillera dominates this region with its forested peaks.

The second region is the Orinoco alluvial plain, which is the most extensive part and occupies almost the entire department. It represents 2.1% of Colombia's total territory and is characterized as a floodplain with fertile soils, drained by the Arauca and Sarare rivers. Prairie and savanna ecosystems predominate.

Finally, the third region is the “piedemonte llanero” (eastern foothills of Colombia), which is characterized by the presence of tropical forest and savanna vegetation. This geographic region is composed of terraces with reliefs that vary from flat to sloping and alluvial fans (Universidad de los Llanos & Gobernación de Arauca, 2016).
The department of Casanare, located in the eastern region of Colombia, is part of the Colombian Orinoco region. With an area of 44,640 km², it borders Arauca, Vichada, Boyacá and Meta. Casanare is divided into three well-defined geographic regions:

The first region, known as Llanos Orientales, covers almost the entire department and is an alluvial plain formed by the deposits of the Orinoco River and its tributaries. This area is characterized by its fertile and floodable soils, which makes it ideal for cattle raising and agriculture. The second region is the Piedemonte Llanero, a smaller strip located to the south and southeast of the

department, near the Altos de la Lindosa and the Serranía de la Macarena. Here, the topography is broken, with hills and low hills.
Finally, the third region, is the mountainous area called Serranía de La Lindosa, is located south of the department and borders Boyacá. This area reaches altitudes of up to 3,500 meters above sea level and is the source of important rivers such as the Upía and Cravo Sur (IGAC & Gobernación del Departamento de Casanare, 2018).

In terms of climate, the municipalities in this area experience two defined climatic periods: a rainy one (April through November), which can lead to flooding, and a dry one (November to March) that increases the risk of forest fires. The average annual temperature is around 25°C, although it can reach 35°C during certain times of the year (Gómez Sandoval, 2017).

In terms of vegetation cover, these departments are characterized by vast savannas, dominated by grasses and low shrubs, with scattered trees. There are also riparian forests along rivers and streams, as well as gallery forests along watercourses and wetlands (García et al., 1997).

Regarding land use, in Casanare, approximately 59.4% of its territory is suitable for cattle raising, while 8.7% has it's destined for agriculture, 2.8% is agroforestry and 1.9% is forestry. Conservation and protection areas cover 28.4% of the Casanare territory, equivalent to 1.2 million ha (IGAC, 2016).

In the case of Arauca, 51% of its area is suitable for cattle raising, 10.1% for agroforestry use, 0.8% is forestry, 0.4% for agriculture and 37.61% is reserved for conservation and strategic ecosystems (IGAC, 2016).

Moreover, in these departments, a significant part of the population is engaged in the production of transitory crops such as rice, corn, beans, paprika, tomato, melon, watermelon, passion fruit, ahuyama (pumpkin), chili, cilantro and yucca, as well as permanent crops such as orange, lemon, avocado, banana, mango, mamoncillo, papaya, African palm, oil, tobacco and pineapple (IGAC, 2016).

2.3.1.2.2 Sociocultural Context

The departments of Arauca and Casanare have a population of 696,710 inhabitants, of which 37.15% correspond to population centers and rural areas (DANE, 2018).

Before the arrival of the Spanish conquerors, the departments of Arauca and Casanare were inhabited by diverse peoples, ethnicities, farmers, Afro-descendants and mestizos, having their own languages, customs and traditions and were mainly engaged in hunting, fishing and agriculture (Organización Nacional Indígena de Colombia, 2019).

In terms of customs and traditions, both Arauca and Casanare stand out for their "llanera" music, a deeply rooted cultural expression in both regions. In addition, both departments have infrastructure that includes roads, airports and basic services such as potable water and electricity. However, it is important to note that in some rural areas, access to these services is precarious.

These departments share characteristics such as their vast territorial extension, a warm climate, and an economy based mainly on extensive cattle ranching and hydrocarbon exploitation. Their importance for the country's economy lies in their oil exploitation areas, which have had a significant impact on the territory. This impact has generated economic benefits but has also had environmental and social consequences that influence population dynamics and production and consumption activities (IGAC, 2016).

Nevertheless, the region has also faced significant challenges in terms of security and violence, mainly related to the presence of illegal armed groups and drug trafficking activity. This has negatively affected people's lives and the region's economy, although measures have been implemented to improve security and reduce violence in the area.

2.3.1.2.3 Economic Context

The departments of Arauca and Casanare, in Colombia, have been influenced by various factors in their economy. Mainly, they stand out for their dependence on oil and natural gas extraction, which has been fundamental for their economic development. In addition, their economy is rooted in agriculture and livestock (FEDESARROLLO, 2014).

During the 2008-2014 period, the economy of these departments was centered on primary activities, such as extensive cattle ranching, agriculture and oil exploitation. The economy was sustained by the export of agricultural products, livestock, and oil. According to the National Administrative Department of Statistics (DANE), in 2008, Casanare's GDP was COP 2,937,013 million, and in 2014 it reached COP 8,303,076 million. In the case of Arauca, its GDP was COP 1,514,685 million in 2008 and increased to COP 4,263,870 million in 2014. This reflected moderate economic growth, largely related to the expansion of the agricultural frontier. Casanare excelled in rice, corn and cattle production, while Arauca had significant oil production (Rey Anacona, 2020).

However, during the 2014-2017 period, the drop in international oil prices negatively affected Arauca, reducing investments in the oil sector. This decline in prices also impacted traditional sectors, leading to an increase in rural unemployment. The decrease in the hydrocarbon sector's share of sectoral GDP from 73% to 45% between 2000 and 2014 had significant effects on local finances, with lower tax and royalty collections (Zapata & Rueda, 2015). Nevertheless, Casanare managed to diversify its economy by boosting crops such as oil palm, pineapple and sugarcane, as well as food processing. In addition, it promoted ecotourism, which boosted the region's economy (Salinas Bustos, 2017).

The region's economic expansion in recent years has led to greater dependence on international markets, which has made the departments vulnerable to fluctuations in export prices and the dollar exchange rate. In addition, the economy has been influenced by volatile oil prices and the effects of Colombia's internal armed conflict. Despite these challenges, the region has maintained sustained growth overall. Between the years 2010 and 2016, the Orinoco recorded higher growth in terms of GDP, with an average annual rate of 5.5% (Delgado & Perez, 2017).

2.3.1.2.4 Historical Context

The departments of Arauca and Casanare comprise ecologically diverse territories and have important hydrological basins associated with the Meta River, being perfect scenarios for environmental issues marked by the exploitation of natural resources and pressure on the region's ecosystems, which has led them to witness disputes over control, occupation and production in the territory (Peña, 2014).

This is why during the course of the Orinoquia's regional history there has been a boom in economic activities such as oil extraction, cattle ranching, agricultural production and land conservation. This boom has led to the presence of illegal armed groups, causing considerable tensions with indigenous and farmer communities in the area (Zapata & Rueda, 2015).

The oil industry boom in the departments of Arauca and Casanare had a profound impact in both social and environmental terms. This growth originated in the early 1980s in Arauca and in the mid-1990s in Casanare, when significant oil deposits were discovered in the region. The oil industry became one of the main sources of income and employment in these departments, generating a massive impact on the economy, society and the environment.

The demand for employment attracted thousands of people to the region, leading to rapid urbanization and an increase in demand for essential services such as housing, health care and education (Cárdenas & Dueñas, 2021). This growth put pressure on local infrastructure and exacerbated tensions in social and labor relations. Moreover, population growth and competition for resources also had a negative impact on security, resulting in increased crime and violence (Gómez Sandoval, 2017).

In terms of the environment, oil exploitation had significant consequences. There were several accidental oil spills, leakages in pipelines and storage tanks, as well as contamination of soil and water sources due to toxic waste spills. These incidents affected the region's flora and fauna and generated growing concern among the local population. In addition, inadequate environmental practices by oil companies were reported, exacerbating community concerns, including extortion of oil companies by armed groups (López et al., 2020).

2.3.1.3 Key stakeholders, interests and motivations

The Orinoco is a biogeographic region with a great diversity of ecosystems, climates, flora and fauna that give it unique characteristics. Therefore, it is imperative to address the worrying problem of deforestation in this area, as interconnected ecosystems are being degraded (ROZO, 2017).

In 2019, 67% of deforestation was attributed to seven main causes: conversion of forests to pastureland, illicit crops, inappropriate extensive cattle ranching practices, illegal mineral extraction, unplanned transportation infrastructure construction, expansion of the agricultural frontier in prohibited areas, and illegal logging. Arauca is among the top 12 deforestation hotspots. These causes, predominant in the region, have experienced a worrying increase in Colombia in recent years (IDEAM, 2020).

According to IDEAM, Arauca and Casanare have an alarming 0.3% and 0.2%, respectively, of forests with early warning of deforestation and are considered medium risk departments (ROZO, 2017).

Civil society has been identified as a key factor in the deforestation of the Orinoco region. Its economic activities, particularly farmer agriculture involving slash-and-burn and cultivation, as well as open-air cattle breeding, raising and fattening and technified agriculture, have experienced uncontrolled growth over the years. This has resulted in the disproportionate expansion of deforested and cleared areas without sustainable policy support, which has had a detrimental impact on the environment and its ecosystems (ROZO, 2017).

On the other hand, hydrocarbon extraction in Arauca (Caño Limón) and Casanare (Cusiana and Cupiagua) by the private sector has caused serious environmental consequences. The loss of natural forests, soil salinization, contamination of water sources by residual waste, and seismic activity resulting from these projects have severely damaged the region (Fundación Grothendieck, 2021).

The unplanned growth of urban centers and the construction of roads and infrastructure have increased the demand for ecosystem services, decreasing the resilience of ecosystems in the region (WWF, 2020).

Environmental policy in the Orinoco has been contradictory, promoting both environmental protection and the expansion of the agricultural frontier, extensive cattle ranching and natural resource exploitation. This has led to the rapid environmental deterioration of the region, with high deforestation, river pollution, loss of biodiversity and conflicts with indigenous communities, evidencing a lack of consistency in environmental protection (Sánchez, 2016).

Regarding illicit crops, various strategies have been implemented to eradicate them, including controversial fumigations with glyphosate. This situation has generated low-intensity conflicts in the region, with confrontations and harassment between armed groups and the security forces. Despite this, a significant decrease in coca production in the region has been achieved (UNODC, 2021).

2.3.1.4 Economic activities and their importance

The Orinoco region represents one of the most important territories for the country's economy, based mainly on the primary sector, focused on obtaining natural resources, thanks to the access of economic sectors that generate significant growth.

The main economic activities in the region are:

Extractive activities: In the Orinoquía, mining and hydrocarbons contribute more than 55% of the region's value added (Martínez & Delgado, 2018), due to the fact that this industry makes a relevant contribution to the income of departmental and municipal authorities through royalties, taxes, contributions, etc. According to figures from the National Administrative Department of Statistics (DANE) the GDP for Casanare has a contribution that reaches 42.44%; while in Arauca it is located at 37.85% (Economía, 2021). These oil revenues represent an important part of the budgets for investment in education, health, infrastructure, etc. Being an engine of development for the region, contributing 24.5% of the national oil production (Economía, 2018).

Livestock: Livestock has become a fundamental activity for the socioeconomic development of the region, especially for families living in rural areas. This agricultural activity is one of the main sources of income and employment in the departments of Arauca and Casanare, due to the large pastures found there, contributing to population and economic growth.

Livestock has experienced remarkable growth in recent years, reflecting the vitality of this livestock subsector. According to the National Administrative Department of Statistics (DANE), livestock contributes significantly to the Colombian economy, contributing 1.3% of the national Gross Domestic Product (GDP), an impressive 19.5% of the agricultural GDP and a solid 53% of the livestock GDP.

Within livestock, the beef and dairy cattle sub-sector occupies a prominent place, with an average share of 23% of the sector's GDP. This sub-sector plays a crucial role in agricultural GDP and exports. According to data from the beef meat chain, in October 2016, the livestock sector contributed 2.4% to national GDP, with livestock accounting for 1.6% of that total. Furthermore, livestock contributed a solid 20% to agricultural GDP and an impressive 53% to livestock GDP. In addition to its economic impact, livestock provided employment to 926,000 people in direct jobs (SIOC, 2016).

On average, the livestock sector generates around 810,000 direct jobs, which constitutes 6% of total employment in Colombia and an outstanding 19% of employment in the agricultural sector (AGROSAVIA, 2018).

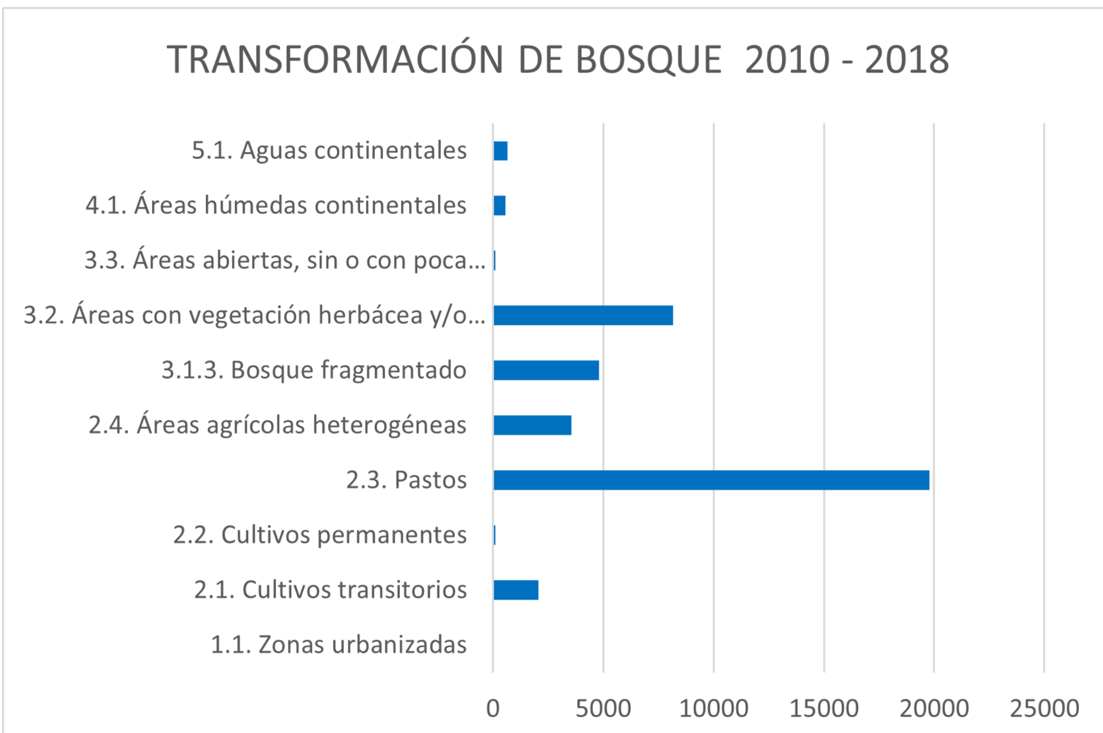
Agriculture: The Orinoco region is Colombia's last agricultural frontier, generating 7% of the national GDP, leading the production of rice, palm oil, livestock, and other agricultural products (Portocarrero & Lee, 2021).

Agricultural production for 2016 reached 28% of national production (6,021,872 tons) in the region (Medrano, 2019). Presenting two major subsectors, on the one hand a commercial agriculture characterized by the intensive use of capital oriented to the market and on the other hand a traditional non-mechanized, self-subsistence agriculture, aimed at self-consumption and satisfying local markets (CALERO, 2018).

2.3.1.5 Direct and Indirect Impact

According to the information collected, it is possible to establish that for the period 2010 - 2018 in the project implementation area a loss of forest cover is identified, 39774.69 ha representing 15.9% with respect to the conserved area and of wetland 394816 ha, representing 27.7% with respect to the conserved area. Figure 1 shows the transition from forest to other land covers during the period of analysis.

Figure 1. Transition of coverage 2010 - 2018

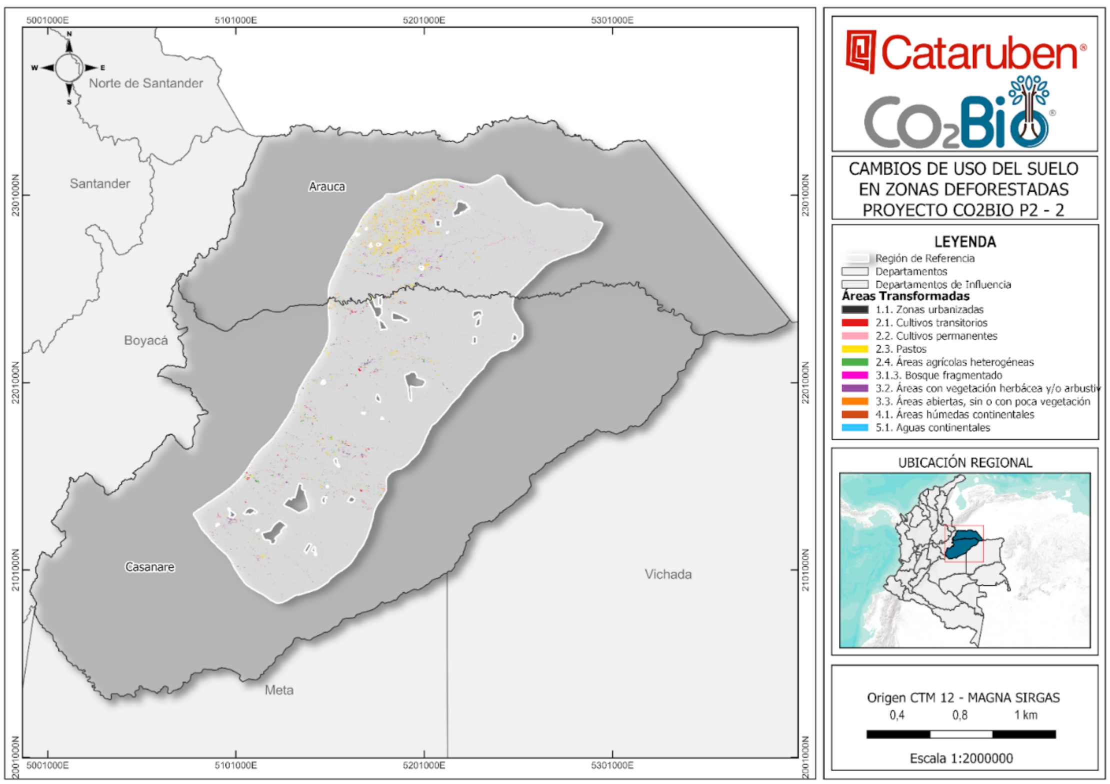


Source: The Cataruben Foundation, 2023.

Image 1 shows the loss of forest cover in the Reference Region, allowing us to identify the activities to which it was transformed; it is evident that pastures (associated with cattle ranching) are the activity with the highest incidence in the area with 7.9% of transformation, followed by fragmented forests (illegal logging) with 1.9% and agricultural areas with 1.4% (agricultural production).

The highest incidence of pasture cover transformation occurs in the Department of Arauca, this may be caused by the extensive cattle ranching present in the indicated sectors, this activity is a potential for deforestation because the greater the number of species, the greater the amount of food needed and therefore the larger the grazing areas.

Image 1. Map of land use change in deforested areas.



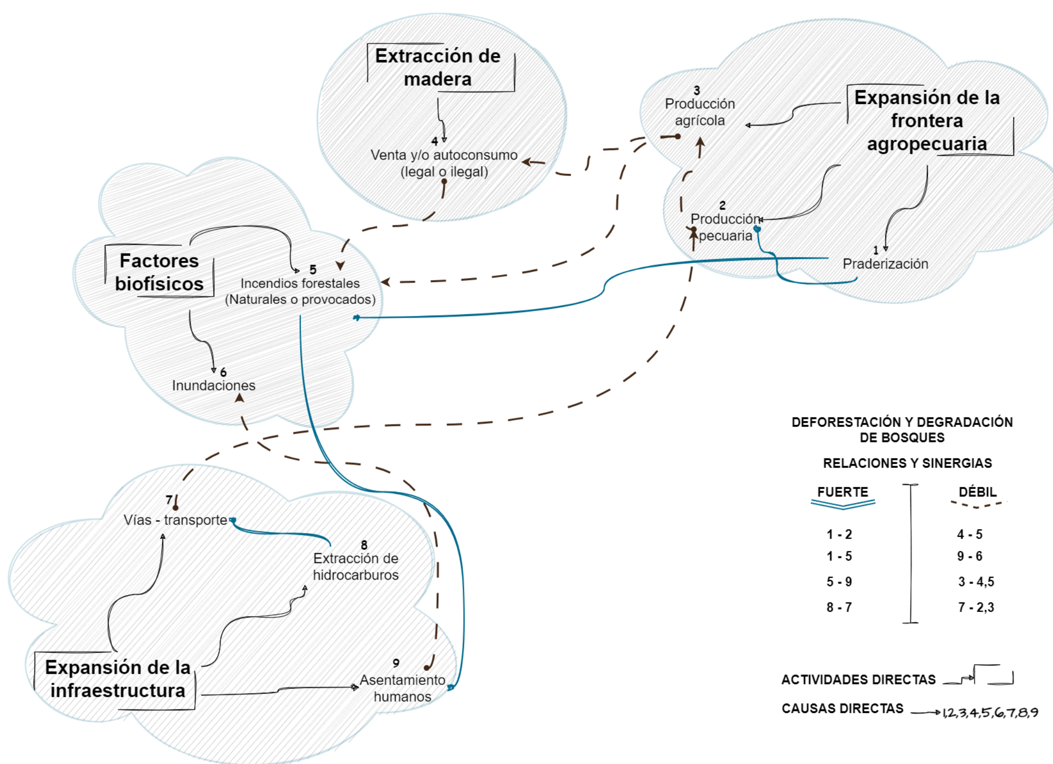
Source: The Cataruben Foundation, 2023.

Figure and image 1 show the loss of the forest category in the period 2010 - 2018 and its relationship with changes in land use associated with environmental drivers/detrimental factors. [Deforestation of forest]() and its corresponding homologation to the Corine Land Cover 2010 - 2018 is used for this analysis.

2.3.1.6 Relationships and synergies

Within the framework of the project, 9 direct causes related to forest deforestation have been identified. These causes are interconnected in different degrees of synergy, according to the guidelines established in the methodological document BCR0002 version 3.1. We have also considered the conceptual and methodological guidelines for the characterization of the causes and agents of deforestation in Colombia, as established in the document Conceptual and Methodological Guidelines (IDEAM et al., 2018).

Figure 2. Relationships and synergies present in forest deforestation activities.



Elaboration: The Cataruben Foundation, 2023.

Strong synergy: Figure 2 shows the direct causes of forest deforestation, which are related to each other as follows: Praderization plays an important role in the relationship between livestock production (2) and forest fires (5), because it requires an increase in the areas of sown pastures to implement extensive livestock systems, which mainly involve the cutting and burning of natural forest.

There is also a strong relationship between hydrocarbon extraction (8) and the construction of roads and transportation (7), which generates the construction of roads, electrical grids and pipelines to facilitate mobility, transportation and access to the extraction fields. Similarly, there is a relationship between forest fires (both natural and provoked) (5) and human settlements (9), which generate a high rate of deforestation, given that this requires the cutting and burning of forests to clear a certain area for urban expansion (construction).

Weak synergy: The existing relationship between agricultural production (3) with forest fires (natural or provoked) and timber extraction, either for sale or self-consumption (legal or illegal), happens because farmers carry out this practice as a weed control measure and to expand their crops. Similarly, there is a weak relationship between roads and transportation (7) with livestock production (2) and agricultural production (3), because these products are mobilized from very distant sectors, which leads to the construction of roads (trails) that generate the deforestation of natural forests.

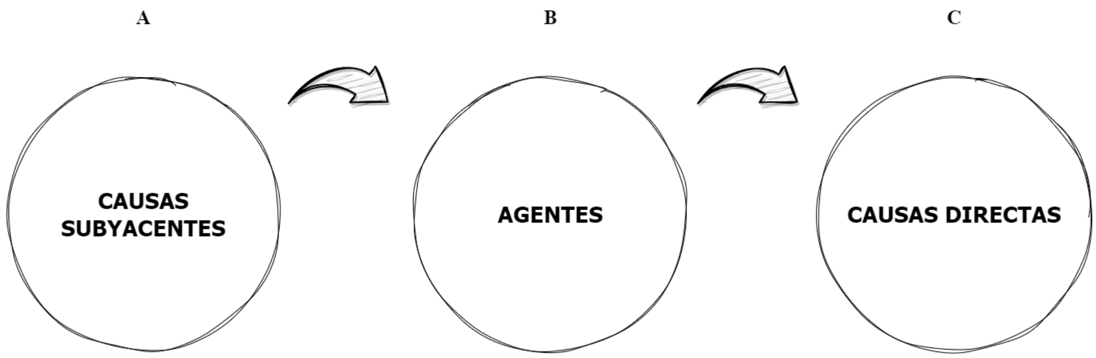
Finally, we found the extraction of timber for sale or self-consumption (legal and illegal) (4) in relation to forest fires (natural or provoked) (5), given that when forests or specific areas are cut down, they are exposed to natural fires that destroy the ecosystem. Likewise, we identified the relationship between human settlements (9) and floods (6). This is due to uncontrolled urban growth which, added to the lack of planning, generates territorial imbalances, significantly increasing the risk of flooding and affecting the population year after year.

2.3.1.7 Chain of deforestation events

A chain of events was defined for the project, including underlying causes, agents, their direct causes and direct activities of forest deforestation, in order to analyze the interests and motivations that trigger a series of transformations in forest cover. According to the guidelines established in the most updated version of the methodological document BCR0002 and what is established in the document Conceptual and Methodological Guidelines for the

Characterization of Causes and Agents of Deforestation in Colombia (IDEAM et al., 2018), the chain of events was established as follows:

Figure 3. Chain of events for an activity.



Source: Conceptual and Methodological Guidelines for the Characterization of Causes and Agents of Deforestation in Colombia (2018).

Elaboration: The Cataruben Foundation, 2023.

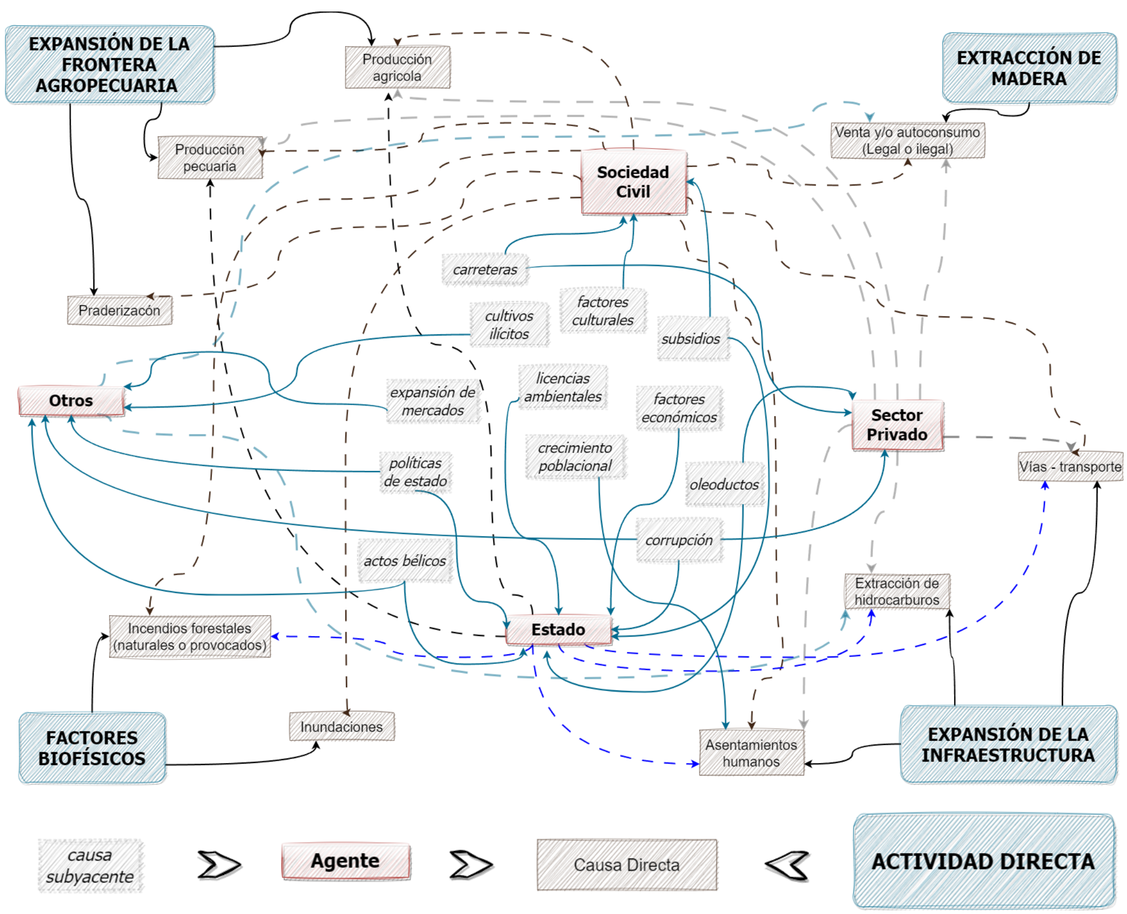
According to the Conceptual and Methodological Guidelines for the Characterization of Causes and Agents of Deforestation in Colombia, underlying causes are identified as deeper factors that influence the decision making of the agents to transform the forest into another cover. These underlying causes generate a specific problem or situation and, in turn, are interconnected in the transformation process of the forest, acting as links in the chain, as shown in Figure 4.

Deforestation is the result of a combination of both natural and anthropogenic factors. Although poverty is often cited as an underlying cause of deforestation, this statement is an oversimplification, as other elements, such as industrial pollution and inappropriate land use, can also contribute to this problem (Conserve Energy Future, 2021). Human activities that have the greatest impact and are responsible for most of the deforestation include cattle ranching, oil palm and rice cultivation, as well as the exploitation of timber products (Stanley, 2022).

In addition, logging, whether legal or illegal, is considered the main underlying cause of forest degradation. Road development may result in limited deforestation, but it also facilitates access to previously inaccessible and unoccupied land. These roads and cleared areas attract settlers who, in turn, continue to deforest the remaining forest to convert it into cropland or pasture for livestock. Land degradation due to livestock practices also drives farmers to repeat this process in new forests, thus perpetuating deforestation (Conserve Energy Future, 2021).

It is important to note that deforestation not only affects humans, but also impacts wildlife, and can trigger flooding and the forced displacement of communities, with long-term effects on both human and animal populations.

Figure 4. Chain of deforestation events.



Elaboration: The Cataruben Foundation, 2023.

The departments of Arauca and Casanare are hotspots of deforestation in Colombia, and this activity is driven by a combination of direct and indirect factors. The relationships between these factors and possible measures to reduce deforestation in the post-conflict period require further investigation.

The study has identified several underlying and direct causes of deforestation in the region. These include uncontrolled land colonization, armed conflict, specifically the eradication of illicit crops, and migratory waves resulting from the displacement of communities. In addition, it highlights the ambiguous role of armed groups and the involvement of the state in stimulating deforestation through the construction of roads for the oil industry, the promotion of extractive industries and cattle ranching (Hoffman et al., 2022).

The oil industry has contributed significantly to deforestation by making previously remote forested areas accessible due to road infrastructure. In addition to these drivers, cultural patterns, lack of knowledge about sustainable use of local resources, land governance problems and lack of economic alternatives also indirectly contribute to deforestation in the Orinoco region of Colombia (Hoffman et al., 2022).

Subsistence farmers and local communities are the main drivers of deforestation in the region. Moreover, there is a high level of uncertainty among stakeholders about the potential effects of the peace agreement between the government and FARC (UNODC, 2019).

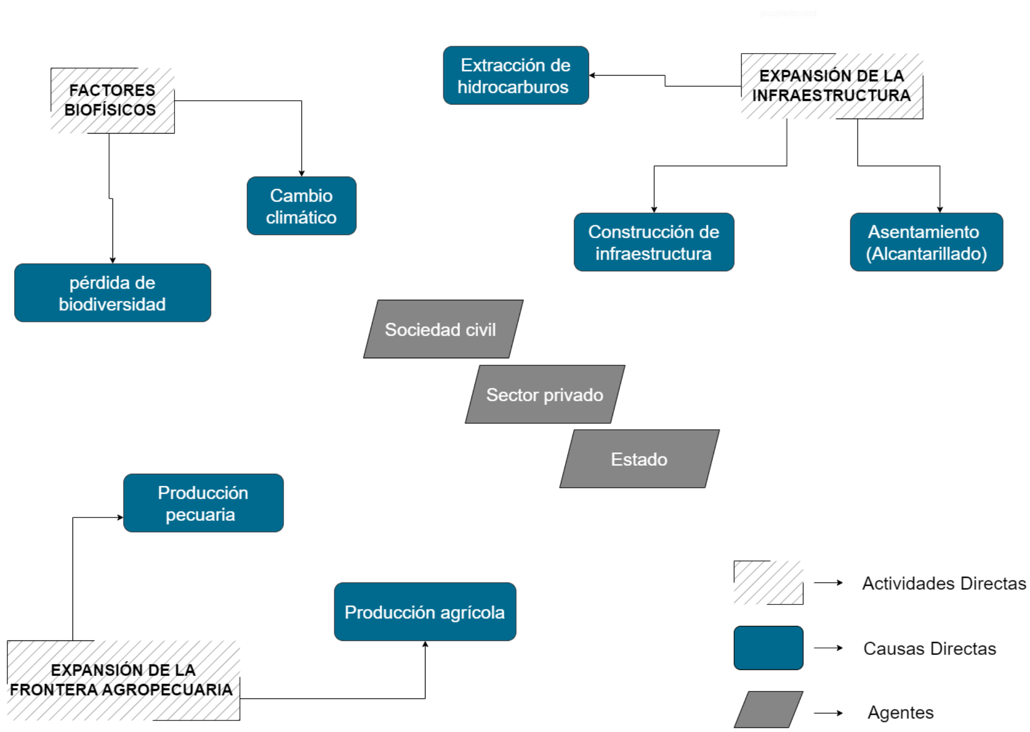
Global population growth has generated an increasing demand for agricultural land, further exacerbating the already imminent problem of land scarcity. The combination of population growth and economic globalization further intensifies this challenge (Lambin & Meyfroidt, 2022).

Agricultural intensification, driven by cash crop production for domestic and international markets, may drive the expansion of cropland in response to population growth and increasing demand for land. Without significant advances in agricultural productivity soon, the growing global population could lead to the disappearance of most forests and woodlands worldwide by mid-century (Solís & Montaníab, 2022).

2.3.2 Causes and drivers of land use change in wetlands

For the Project, the causes and agents that generate land use change in wetlands that affect these ecosystems were identified, see Figure 5. This analysis is carried out based on the guidelines established in the most updated version of the methodological document BCR0004 Version 2.0. Quantifying the Reduction of GHG Emissions and Removals-Activities that prevent land use change in Continental Wetlands.

Figure 5. Causes and agents that generate land use change in Wetlands**.**



Source: The Cataruben Foundation, 2023.

3.2.2.1 Direct causes or anthropogenic activities

There are several direct causes or human activities that lead to changes in land use in Wetlands, and these can have serious consequences for these ecosystems. Globally, wetlands cover approximately 13 million square kilometers, which is equivalent to the land area of Argentina, Brazil, Bolivia, Chile, Ecuador, Paraguay, and Uruguay combined. These ecosystems provide a range of significant benefits to society, including an estimated economic value of around US$70 billion annually in environmental services (GEF, 2015).

Today, wetlands are recognized as strategic biodiversity conservation ecosystems, as well as act as natural buffers that protect soils, maintain freshwater reserves and regulate the global climate. However, in many cases, inappropriate use of these areas leads to their degradation and loss, resulting in their disappearance three times faster than that of forests (GEF, 2015).

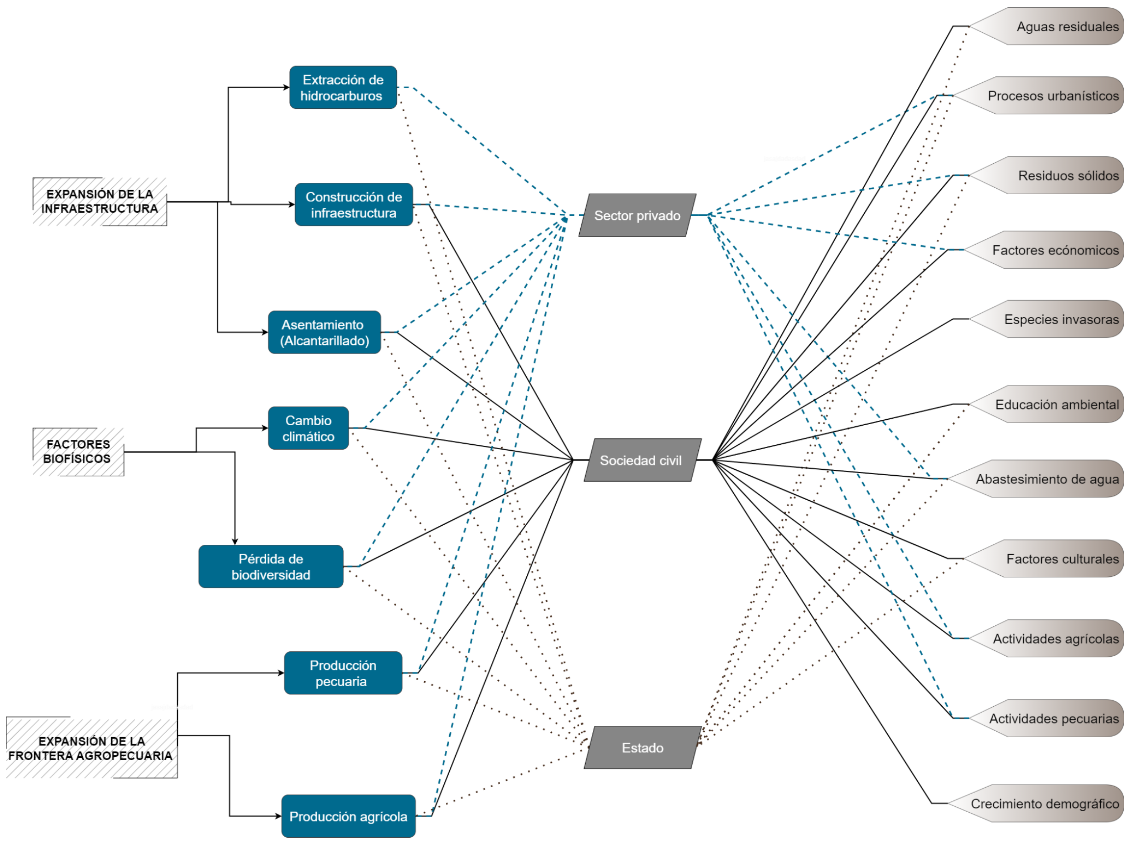
One of the main causes of land use change in Wetlands is agricultural and livestock production, which may involve the conversion of wetland areas to cropland or pasture (UNLP, 2023). In addition, the expansion of human settlements, the construction of infrastructure such as roads, bridges and buildings, and hydrocarbon extraction are also related to the transformation of wetlands, either directly or indirectly, which can cause serious impacts on the ecosystems that depend on them (Heredia & Vásquez, 2019).

Climate change and biodiversity loss, including the proliferation of invasive species, can also alter Wetlands due to rising temperatures, leading to risks such as fires, desertification, and water scarcity, especially during times of drought (Prado et al., 2009). It is important to highlight that land use change is a long-standing problem that has affected wetlands, being one of the human activities that has had a lasting impact on the environment.

3.2.2.2 Agents

The underlying causes are deeper factors that motivate the agents to transform the wetlands, within the project three main agents were identified which are: Private sector (companies, industry), Civil society (Agricultural producer) and the State (Governors, mayor's offices, military forces). In this sense we find that the underlying causes are: Wastewater, urbanization processes, solid waste, economic factors, invasive species, environmental education, water supply, cultural factors, agricultural activities and livestock activities and population growth, see *Figure 6.*

Figure 6. Underlying causes that motivate agents to transform wetlands.



Source: The Cataruben Foundation, 2023.

Agricultural and livestock activities, settlement expansion and weak governance, as well as centralized economic and political power, are some of the main determinants of wetland degradation (Megersa, 2023). The impact is not only on the wetlands themselves, but also on the associated flora and fauna, as well as on the ecosystem services provided by wetlands. Extensive conversion of wetlands to pasture for extensive livestock grazing can lead to soil erosion, nutrient depletion and loss of biodiversity (Sierra et al., 2021).

3.2.2.3 Chain of causation

Table 3 shows the causal chain where the direct causes or anthropic activity associated with each agent and underlying cause recorded in the departments (Arauca and Casanare) are related.

Table 3. Chain of land use change events.

<table>
<tr><th></th><th>DIRECT ACTIVITIES</th><th colspan="2">DIRECT CAUSES OR ANTHROPIC ACTIVITIES</th><th>AGENTS</th><th>UNDERLYING FACTORS</th></tr>
<tr><td rowspan="7">LAND USE CHANGE IN WETLANDS</td><td rowspan="3">Infrastructure expansion</td><td>1</td><td>Hydrocarbon extraction</td><td rowspan="3">*Private sector (companies, industry)</td><td rowspan="7">Wastewater
Urban development processes
Solid waste
Economic factors
Invasive species
Environmental education
Water supply
Cultural factors
Agricultural activities
Livestock activities
Population growth</td></tr>
<tr><td>2</td><td>Construction of infrastructure</td></tr>
<tr><td>3</td><td>Settlements (Sewerage)</td></tr>
<tr><td rowspan="2">Biophysical factors</td><td>4</td><td>Climate Change</td><td rowspan="3">*State (governorships , mayors' offices, military forces)</td></tr>
<tr><td>5</td><td>Loss of biodiversity</td></tr>
<tr><td rowspan="2">Expansion of the agricultural frontier</td><td>6</td><td>Livestock production</td></tr>
<tr><td>7</td><td>Agricultural production</td><td>Civil society (Agricultural producer)</td></tr>
</table>

Source: The Cataruben Foundation, 2023

The wetlands in the reference region of the project are immersed in 4 different types of wetlands: Morichales (Ecosystems that are formed in areas of the savannah where water springs continuously), Saladillales (We find them in the headwaters of the pipes where flood water accumulates to a depth of 20 to 30 cm), Esteros (They are flat and wide bodies of water, present vegetation such as Bora and Buchones. They are home to a great diversity of herons, curlews, peccaries, peccaries, capybaras and tapirs) and Caños (tributaries of lagoons and rivers that are connected to watercourses within the floodplain, generally with nutrient-poor sewage) (Prada et al., 2009).

Human behavior represents a significant threat to the survival of Wetland ecosystems. Both urban and rural growth, driven by the need for housing and infrastructure construction, has led to the alteration of these natural ecosystems. This activity has resulted in the fragmentation of habitats, affecting fauna and flora, as well as in the alteration of water quality, which causes physical-chemical changes in the soil and places Wetlands in high-risk conditions (Heredia & Vásquez, 2019).

It is estimated that more than 80% of the world's wastewater is discharged into areas associated with Wetlands without adequate treatment. Because of this, water quality is increasingly worsening and almost all freshwater resources on earth have been affected to varying degrees. In addition to these factors, climate change directly affects the integrity of these ecosystems (UNLP, 2023). Likewise, the lowlands of the Llanos are also affected by climate change caused by seasonal migrations in the Tropical Convergence Zone (TCZ), which is responsible for significant climate changes such as net loss of wetlands due to drought, desertification, erosion, loss of biodiversity and ecosystem services (Piraquive & Behling, 2022).

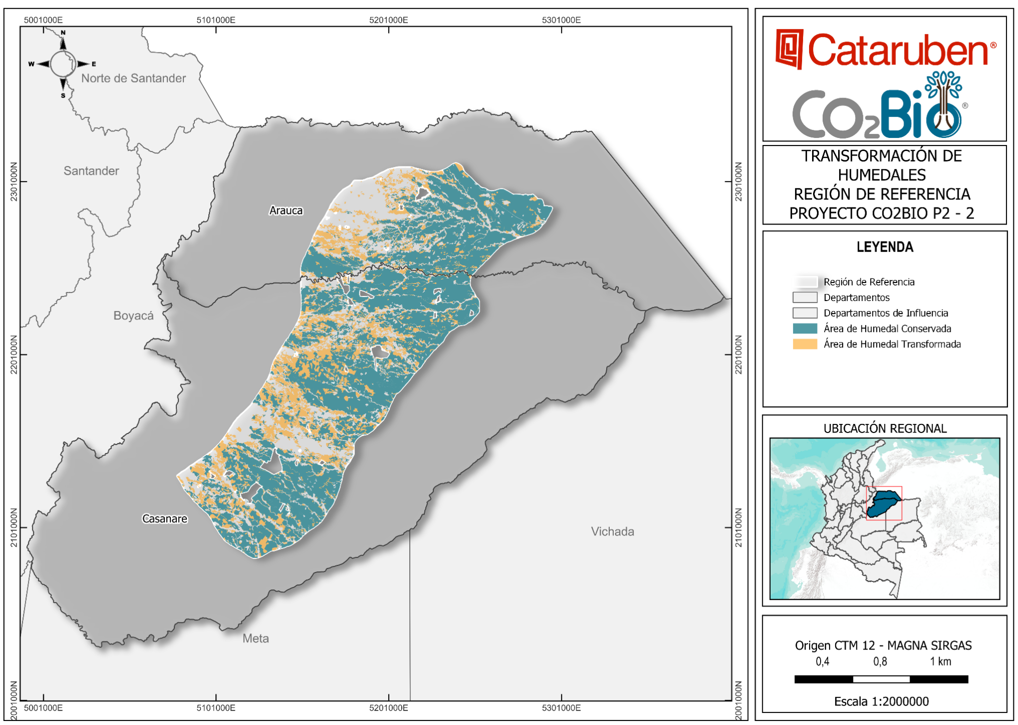
On the other hand, the high demand for land use change in wetlands for agriculture is a key anthropogenic factor contributing to the loss and degradation of these crucial ecosystems. The Orinoquia region is home to 48% of the country's Continental wetlands and is responsible for more than 30% of Colombia's freshwater supply, 28% of agricultural production and 20% of the country's livestock herd (WWF, 2021).

Contamination of wetlands due to agricultural and livestock activities also has an impact on public health, as the use of fertilizers and agrochemicals contaminates the water and soil with eutrophication processes (Heredia & Vasquez, 2019).

After an analysis of changes in coverages carried out for the period 2012 - 2018, it was possible to observe that 27.7% of the wetland areas in the reference region were mostly transformed to clean pasture coverages with 12.1%, and 4.4% of pasture and crop mosaic, identified as main activities agriculture and livestock farming typical of the region.

Regarding the expansion of infrastructure, the transformation of natural cover to that associated with the construction of civil works represents 0.004%. Although it is a small impact compared to other anthropic activities, it also has an impact on floodable savannas. The following is a map of land cover transformation (Image 2) and a graph of the percentage of land cover transformation for each anthropogenic activity (Figure 7).

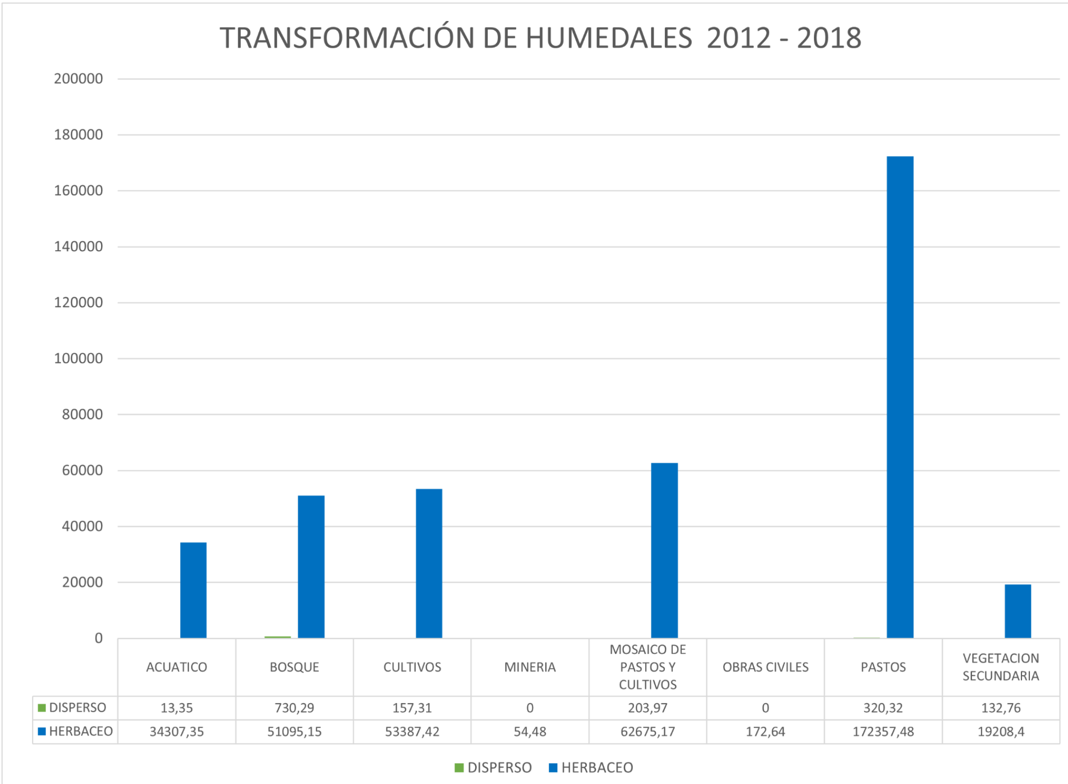
Image 2. Cover transformation in the project reference area.



Source: The Cataruben Foundation, 2023.

The following graph shows the main wetland transformation activities between 2012 and 2018, by the percentage of hectares of natural covers associated with wetland (sparse and herbaceous) transformed.

Figure 7. Wetland transformation.



Source: The Cataruben Foundation, 2023.

2.4 Project Activities

The design of the project activities was carried out following the guidelines and guidelines established in the methodological documents of the AFOLU sector, specifically the methodologies BCR0002 Version 3.1. *Quantification of GHG Emission Reductions from REDD+ Projects* and BCR0004 Version 2.0. *Quanfication of GHG Emission Reductions and Removals - Activities that avoid land use change in Continental Wetlands.*

Project activities designed to reduce and remove GHG emissions while conserving biodiversity and meeting the present and future needs of the rural communities involved are described below.

2.4.1 REDD+ Activities

REDD+ activities are designed based on the analysis of the causes and agents responsible for deforestation (Section 2.3.1 of this document). These activities represent measures aimed at mitigating deforestation, as well as monitoring and conserving flora and fauna, and reducing water consumption for conservation.

The monitoring plan for REDD+ activities is carried out based on the guidelines established in the methodology BCR0002 - Quantification of GHG Emission Reduction REDD+ Projects, in Section 15.2.2.

Table 4. Activity 1: Strengthen knowledge for sustainable ecosystem management and biodiversity conservation through virtual and/or face-to-face training.

Activity ID	1
Description of the activity	**Strengthen knowledge for the sustainable management of ecosystems and biodiversity conservation through virtual and/or in-person training.**
Relationship of the activity to direct or underlying cause	Misinformation and a low level of knowledge regarding sustainable management and the application of environmentally responsible production practices is one of the main reasons behind the transformation of gallery forests. This lack of knowledge has resulted in accelerated and poorly planned development, with insufficient evaluation of environmental impacts. As a consequence, activities have been promoted that transform forests into improved pastures, wetlands into land for monocultures and other strategic ecosystems for various productive purposes. Given this context, the following activity has been established with the purpose of facilitating the transfer of knowledge to both the local community and ecosystem managers. Through face-to-face and virtual sessions, it is planned to strengthen the necessary capacities for the adoption of strategies and actions aimed at the effective management and conservation of ecosystems and biodiversity.
Compliance with the interests of rural communities	This activity plays a fundamental role in the training process of the actors in the territory. This, in turn, ensures the sustainability of the project and fosters community empowerment in the adoption of sustainable practices, leading to balanced development. In addition, the project serves as a mechanism to

	motivate the interest of ecosystem managers to explore alternative markets derived from the conservation of natural resources.
Consultation mechanism for the definition of project activities and participatory construction aspects.	Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment). The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.
Responsibility and role of the actors involved in the implementation of the activity	The Cataruben Foundation: Organization responsible for planning and coordinating the knowledge strengthening cycles. In addition to acting as facilitators and speakers for the trainings. Ecosystem managers: These are the owners of the properties and their responsibility is to actively participate in the training sessions, attending the scheduled sessions and participating in discussions and activities.
Implementation schedule	One every two years, starting from the project start date.

Indicators for reporting the progress of the activity				
Name	Type	Goal	Unit of measure	Responsible for measurement
Training in ecosystem services and conservation of strategic ecosystems	Product	10	Number of trainings	The Cataruben Foundation

Table 5. Activity 2: Promote forest governance in the project area.

Activity ID	2
Description of the activity	**Promote forest governance in the project area.**
Relationship of activity to direct or underlying cause	Among the underlying causes associated with this activity are social aspects, such as low governance, which can lead to the

	overexploitation of forests due to the expansion of the agricultural frontier and illegal logging and forest harvesting. Given these problems, it is necessary to design strategies aimed at protecting these natural resources. For this reason, this activity has been established with the objective of promoting the development of forest governance actions in the properties enrolled in the GHG mitigation project. The purpose of this activity is to provide landowners with the necessary tools, mechanisms and guidance, through relationships with key actors in both the private and public sectors, to safeguard these ecosystems and generate a synergy that contributes to strengthening governance in the territories.
Compliance with the interests of rural communities	Actively involving the rural community in the management of these ecosystems makes them more willing to collaborate in the protection of forests and the implementation of sustainable practices. Empowering rural communities in decision making and management of gallery forests ensures that their local interests and needs are at the center of actions. This will result in the implementation of sustainable management practices that preserve the integrity of the forests, and at the same time, promote the well-being of the communities by ensuring access to forest resources, conservation of their environment and protection of their water security.
Consultation mechanism for the definition of project activities and participatory construction aspects.	Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment). The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each Property in environmental, social, economic, and productive terms, will be monitored.

Responsibility and role of the actors involved in the implementation of the activity	The Cataruben Foundation: This organization is responsible for developing and implementing the governance model, which includes organizing the meetings and providing technical assistance to the working table. It also promotes active participation, among other key functions. Ecosystem managers: These are the owners of the Properties who are responsible for adopting and implementing the actions established in the governance model. Strategic Ally: This is a spokesperson who contributes proposals to strengthen the governance of the Project. This involves promoting active listening, seeking strategic alliances and fostering a culture of conservation.
Implementation schedule	As of the date of the project start date.

Indicators for reporting the progress of the activity				
Name	Type	Goal	Unit of measure	Responsible for measurement
Progress in the implementation of the governance strategy	Result	100	Percentage of progress	The Cataruben Foundation

Table 6. Activity 3: Promote sustainable forest management.

Activity ID	3
Description of the activity	**Promoting sustainable forest management**
Relationship of the activity to direct or underlying cause	Unsustainable logging represents a significant threat to biodiversity and forest ecosystems. Overexploitation of timber resources can lead to loss of natural habitats and species extinction. Consequently, unsustainable logging can result in the loss of livelihoods for forest-dependent rural communities.
Compliance with the interests of rural communities	The development of this activity will meet their needs. By promoting responsible forest management practices, the environment is protected, which directly benefits the health and well-being of communities by ensuring the availability of clean water, healthy air, and an environment conducive to agriculture and wildlife.

<table>
<tr><td>Consultation mechanism for the definition of project activities and participatory construction aspects.</td><td colspan="4">Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment).

The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.</td></tr>
<tr><td>Responsibility and role of the actors involved in the implementation of the activity</td><td colspan="4">The Cataruben Foundation: Organization responsible for planning and coordinating the knowledge strengthening cycles. In addition to acting as facilitators and speakers for the trainings.

Ecosystem managers: These are the owners of the properties and their responsibility is to actively participate in the training sessions, attending the scheduled sessions and participating in discussions and activities.</td></tr>
<tr><td>Implementation schedule</td><td colspan="4">From the date of trading of carbon certificates</td></tr>
<tr><td colspan="5">Indicators for reporting the progress of the activity</td></tr>
<tr><td>Name</td><td>Type</td><td>Goal</td><td>Unit of measure</td><td>Responsible for measurement</td></tr>
<tr><td>Progress in the implementation of the governance strategy</td><td>Result</td><td>100%</td><td>Percentage of progress</td><td>The Cataruben Foundation</td></tr>
</table>

Table 7. Activity 4: Promote the delimitation and/or signage of conservation areas.

Activity ID	4			
Description of the activity	**Promote the delimitation and/or signaling of conservation areas.**			
Relationship of the activity to direct or underlying cause	Activities such as logging, grazing, and the conversion of natural forests into pastures or crops, whether for subsistence or commercial purposes, have a significant impact on these ecosystems. This environmental challenge requires the development of effective strategies to mitigate their negative effects. Therefore, it is established to promote the delimitation and/or marking of conservation areas, which corresponds to a land-use planning mechanism, this activity seeks to increase the management and protection of natural resources. This contributes to safeguarding vital ecosystem services, such as the supply of clean water, biodiversity and climate regulation, which are essential for the long-term needs of rural communities.			
Consultation mechanism for the definition of project activities and participatory construction aspects.	Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment). The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.			
Responsibility and role of the actors involved in the implementation of the activity	The Cataruben Foundation: Organization responsible for providing advice and support to ecosystem managers. Ecosystem managers: Owners of the properties responsible for implementing the activity.			
Implementation schedule	As of the project start date.			
Indicators for reporting the progress of the activity				
Name	Type	Goal	Unit of measure	Responsible for measurement

Delimited and/or marked properties	Product	100%	Percentage of progress	The Cataruben Foundation

Table 8. Activity 5: Promote and improve agricultural production, livestock (on existing lands) and tourism, through the implementation of good sustainable practices.

Activity ID	5
Description of the activity	**Promote and improve agricultural production, livestock (on existing land) and tourism, through the implementation of good sustainable practices.**
Relationship of the activity to direct or underlying cause	Given the context of transformation and deterioration of ecosystems caused by the development of economic activities that lack sustainable planning, it is necessary to encourage ecosystem managers to implement productive practices that respect the environment. These practices are essential to achieve a balance between economic, social and environmental aspects. Therefore, it is essential to design spaces for the dissemination and adoption of strategies that promote these sustainable practices. These spaces will provide the opportunity to share knowledge and experiences, thus encouraging the transition towards a more responsible and balanced approach to natural resource management and the local economy. Consequently, the present activity is established, which seeks to generate in the owners of private properties enrolled in the project the interest in exploring and developing practices such as tourism, one of the leading industries in the generation of income worldwide. The investment required for its development is relatively low, and its result promotes the care, protection and education of natural resources. Additionally, it is projected that the development of the activities implemented in the properties associated with agriculture and livestock will be congruent with the implementation of sustainable agricultural and livestock practices, thus eliminating traditional systems that contribute to the deterioration of ecosystems.
Compliance with the interests of rural communities	Through the development of this activity, communities can improve their livelihoods by increasing agricultural productivity and income, thereby reducing poverty and strengthening economic security. In addition, protecting local natural resources, such as fertile soils and water sources, ensures the long-term availability of resources necessary for the livelihoods of communities.

Consultation mechanism for the definition of project activities and participatory construction aspects.	Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment). The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.			
Responsibility and role of the actors involved in the implementation of the activity	The Cataruben Foundation: Organization responsible for coordinating the development of the pre-farm implementation plans, as well as advising and accompanying the implementation of the actions. Ecosystem managers: Owners of the properties responsible for adopting and implementing the actions established in the property implementation plans.			
Implementation schedule	Permanently, as of the project start date			
Indicators for reporting the progress of the activity				
Name	Type	Goal	Unit of measure	Responsible for measurement
Properties implementing sustainable productive activities	Result	80%	Percentage of progress	The Cataruben Foundation

Table 9. Activity 6: Generate alerts of changes due to deforestation and/or transformation of ecosystems in the project area and its surroundings.

Activity ID	6
Description of the activity	**Generate alerts of changes due to deforestation and/or transformation of ecosystems in the project area and its surroundings.**
Relationship of the activity to direct or underlying cause	Deforestation increases the vulnerability of forests to wildfires by reducing moisture and canopy cover, which creates a more

	flammable environment. The lack of monitoring and early warnings to detect changes in forest cover makes it difficult to prevent and respond effectively to forest fires. The alert generation activity allows early detection of changes in forest cover, which is essential to identify deforestation activities. This facilitates the adoption of timely measures to prevent further damage and to take preventive and early response measures to protect communities and their resources.
Compliance with the interests of rural communities	The development of this activity contributes to the fulfillment of the interests of rural communities for different reasons: ● It contributes to the preservation of habitats and biodiversity, which supports food security. ● Early detection of wildfires through early warnings helps keep people and property safe, while safeguarding the natural resources that communities need.
Consultation mechanism for the definition of project activities and participatory construction aspects.	Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment). The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.
Responsibility and role of the actors involved in the implementation of the activity	The Cataruben Foundation: Organization responsible for monitoring and analyzing the information. Ecosystem managers: Property owners are responsible for validating the results, ensuring the accuracy of the data in the event that changes in land use are identified.
Implementation schedule	Permanently, as of the project start date.

Indicators for reporting the progress of the activity

Name	Type	Goal	Unit of measure	Responsible for measurement

Satellite analysis of properties to identify changes due to deforestation and/or transformation of eligible areas.	Result	100%	Percentage of progress	The Cataruben Foundation

2.4.2 Wetland Project Activities

The design of project activities is based on the results obtained from the analysis of the causes and agents that generate changes in land use in Continental Wetlands, which are analyzed in Section 2.3.2 of this document.

The project activities are detailed below, following the guidelines established by the BCR0004 methodology - quantification of greenhouse gas emission reductions and removals from activities in Continental Wetlands. Section 15.1.2 presents the monitoring plan for project activities in Wetlands.

Table 10. Project activity 1: Strengthening knowledge on wetland conservation and sustainability to prevent the expansion of the agricultural frontier.

Activity ID	1
Description of the activity	**Strengthening knowledge in wetland conservation and sustainability to prevent the expansion of the agricultural frontier**
Relationship of the activity to direct or underlying cause	Lack of knowledge about the importance of wetland conservation and the impact generated by inadequate management of productive activities in these ecosystems are some of the causes that contribute to their transformation. This limited knowledge leads landowners to make decisions that result in the transformation of wetlands, which in turn threatens biodiversity, reduces water availability, and causes the emission of GHGs, among other ecosystem services. Strengthening knowledge about wetland conservation and sustainable production practices is essential to address these challenges, as it will enable rural communities to meet their needs through informed decision making to maintain water quality and ensure future water supply.
Consultation mechanism for the definition of project activities and participatory	Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of

construction aspects.	activities and documents of enrollment). The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.
Responsibility and role of the actors involved in the implementation of the activity	The Cataruben Foundation: Organization responsible for planning and coordinating the knowledge strengthening cycles. In addition to acting as facilitators and speakers for the trainings. Ecosystem managers: These are the owners of the properties and their responsibility is to actively participate in the training sessions, attending the scheduled sessions and participating in discussions and activities.
Implementation schedule	Two trainings every two years, starting from the project start date.

Indicators for reporting the progress of the activity				
Name	Type	Goal	Unit of measure	Responsible for measurement
Trained people in wetland conservation and sustainability	Result	600	Number of people trained	The Cataruben Foundation
Training courses on wetland conservation and sustainability	Result	10	Number of trainings conducted	The Cataruben Foundation

Table 11. Project activity 2: Characterization and implementation of sustainable productive and conservation practices.

Activity ID	2
Description of the activity	**Characterization and implementation of sustainable production and conservation practices.**
Relationship of the activity to direct or underlying cause	The rapid growth and inadequate management of productive activities in the territories have led to the expansion of the agricultural frontier with significant impacts on wetlands. In view of this situation, it is necessary to implement sustainable productive activities and practices aimed at conserving natural resources, increasing productivity and the efficiency of the required resources. In this context, it is proposed to promote the implementation of

	sustainable productive and conservation practices through the planning of the activities developed in the properties enrolled in the GHG Project. This process begins with the characterization and diagnosis of the Property in environmental, social and productive terms, with the purpose of identifying productive patterns and activities that generate impact to the Wetlands. Based on this diagnosis, an implementation plan is prepared for each property. This plan will be used to monitor and follow up on the implementation of productive, sustainable and conservation practices. Strengthening knowledge in the development of productive and conservation activities will allow the communities to protect the water sources available on their Property and improve the productive and economic yields of their activities in a balanced manner.
Consultation mechanism for the definition of project activities and participatory construction aspects.	Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment). The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.
Responsibility and role of the actors involved in the implementation of the activity	The Cataruben Foundation: Organization responsible for coordinating the development of the pre-farm implementation plans, as well as advising and accompanying the implementation of the actions. Ecosystem managers: Owners of the properties responsible for adopting and implementing the actions established in the property implementation plans.
Implementation schedule	On an ongoing basis, from the project start date

Indicators for reporting the progress of the activity				
Name	Type	Goal	Unit of measure	Responsible for measurement

Progress in the implementation of productive, sustainable and conservation practices	Result	100%	Percentage of progress	The Cataruben Foundation

Table 12. Project activity 3: Strengthening governance structures in the territory.

Activity ID	3
Description of the activity	**Strengthening of governance structures in the territory**
Relationship of the activity to direct or underlying cause	Wetland transformation is related to the low participation of local communities in decision-making and management of these ecosystems. When communities are not involved in decision-making processes, decisions made can be disconnected from local needs and perspectives, often resulting in the implementation of activities that are detrimental to wetlands. To address this issue, it is essential to strengthen governance structures. This will strengthen community participation in decision-making spaces and promote sustainable wetland planning. This will allow for the long-term conservation of wetlands and their ecosystem services. In this way, communities will be able to influence the protection of wetlands, safeguarding biodiversity, while improving their quality of life and facing challenges such as climate change, adopting a perspective that seeks long-term wellbeing.
Consultation mechanism for the definition of project activities and participatory construction aspects.	Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment). The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.
Responsibility and role of the actors involved in the implementation of the activity	The Cataruben Foundation: This organization is responsible for developing and implementing the governance model, which includes organizing the meetings and providing technical assistance to the working table. It also promotes active

	participation, among other key functions. Ecosystem managers: These are the owners of the Properties who are responsible for adopting and implementing the actions established in the governance model. Strategic ally: This is a spokesperson who contributes proposals to strengthen the governance of the project. This involves promoting active listening, seeking strategic alliances and fostering a culture of conservation.
Implementation schedule	As of the date of the project start date.

Indicators for reporting the progress of the activity				
Name	Type	Goal	Unit of measure	Responsible for measurement
Progress in the implementation of the governance strategy	Result	100%	Percentage of progress	The Cataruben Foundation

Table 13. Activity 4: Recognition of conservation areas and figures for the sustainable management of biodiversity.

Activity ID	4
Description of the activity	**Recognition of conservation areas and figures for the sustainable management of biodiversity.**
Relationship of the activity to direct or underlying cause	Wetlands are vulnerable to degradation and transformation due to the implementation of unsustainable activities. The recognition of conservation areas and figures aims to prevent the transformation of these wetlands. The designation of conservation figures, such as protected areas or nature reserves, establishes a legal and regulatory framework that promotes the long-term sustainability of the Wetland. These figures establish restrictions and regulations that ensure the environmental integrity of these ecosystems. Wetlands provide a wide range of ecosystem services, such as the provision of drinking water. By ensuring the protection and sustainable management of these ecosystems, these services can

<table>
<tr><td></td><td colspan="4">be maintained and, at the same time, improve the quality of life of the rural community.</td></tr>
<tr><td>Consultation mechanism for the definition of project activities and participatory construction aspects.</td><td colspan="4">Socialization of the conditions, responsibilities and benefits with each of the project participants. As well as, agreements embodied in the letters of intent and the enrolled contract (See 1.1.1. Start of activities and documents of enrollment).

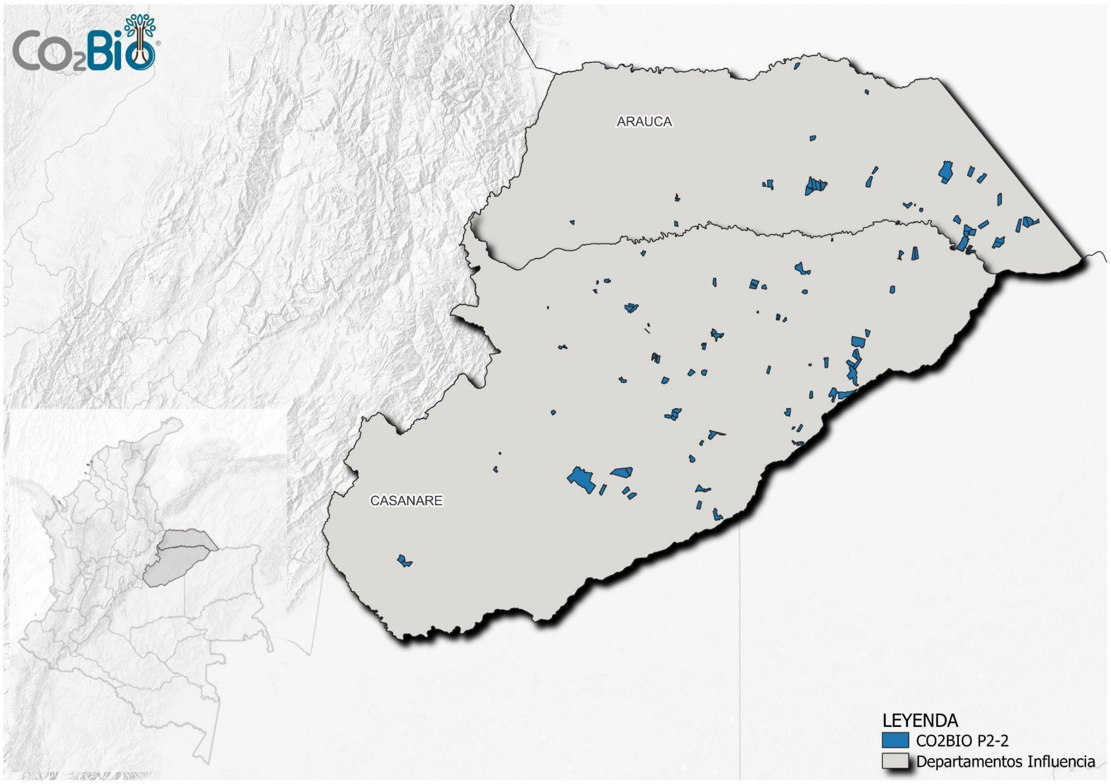
The monitoring of the established goals will be carried out according to what is established in the monitoring plan. At the property level, the actions established in the property implementation plans, which were defined considering the context of each property in environmental, social, economic, and productive terms, will be monitored.</td></tr>
<tr><td>Responsibility and role of the actors involved in the implementation of the activity</td><td colspan="4">The Cataruben Foundation: Organization responsible for providing advice and support to ecosystem managers.

Ecosystem managers: Owners of the properties responsible for carrying out the processes required for the declaration and/or recognition of the conservation figures.</td></tr>
<tr><td>Implementation schedule</td><td colspan="4">Permanently from the start date of the project.</td></tr>
<tr><td colspan="5">Indicators for reporting the progress of the activity</td></tr>
<tr><td>Name</td><td>Type</td><td>Goal</td><td>Unit of measure</td><td>Responsible for measurement</td></tr>
<tr><td>Property declared under a conservation category</td><td>Product</td><td>24</td><td>Number of Properties</td><td>The Cataruben Foundation</td></tr>
</table>

2.5 Project location

The Project is located in eastern Colombia in the Orinoquia biome, with an area of more than 300,000 km2, and an altitude that varies between 80 and 500 meters above sea level, which limits to the north and east with the country of Venezuela, to the south with the Amazon biome and to the west with the Andean biome, specifically in the departments of Arauca and Casanare, with the natural limits being the foothills of the eastern mountain range to the west and the Arauca and Meta rivers to the north. The predominant landscape of this area is the floodable and non-floodable plains known nationally as the eastern plains. See image 3.

Image 3. Project location map



Source: Cartographic (IGAC)
Elaboration: The Cataruben Foundation, 2023.

2.5.1 Characteristics of Orinoquia

The Orinoquia of Colombia, located in the eastern part of the country, includes the departments of Arauca, Meta, Vichada and Casanare, territories that share some main characteristics such as gallery forests, its relief, an extensive area of savannahs and the watershed of one of the most important rivers in the country, the Orinoco River. Two shared factors that in turn give the name to this region, which is popularly known as the Llanos Orientales Region and its name alludes to the Orinoco River basin.

2.5.1.1 Geomorphology.

The predominant topography is slightly undulating and flat, with mountainous areas to the west that are part of the eastern mountain range and the Macarena mountain range, these variations in the altitudinal gradient favor a diversity of climates.

2.5.1.2 Soils.

The soils in general have good physical properties, a very low level of fertility due to the absence of organic matter and nutrients for plants, a marked level of acidity, the absence of calcium and high aluminum content in toxic quantities. The soils are suitable for intensive and semi-intensive cattle ranching with improved natural pastures and implanted pastures.

2.5.1.3 Climatic Aspects.

Most of the region has a tropical climate and the predominant topography is slightly undulating or flat, which is why the region is recognized within the country. However, it also has mountainous areas in the western region that are part of the eastern mountain range and some elevations in the area of the Serranía de La Macarena. Therefore, there is a diversity of climates generated by the altitudinal gradient. The average temperature varies between 4 °C and 28 °C (Correa et al, 2005), while precipitation varies between 1,000 and 7,000 mm (Viloria, 2009). In most of the region the climate is monomodal(2) with a rainy period and a very marked dry season; however, in the vicinity of the mountain zone the climate becomes bimodal.

2.5.1.4. Hydrography.

Since its inception in 1994, IDEAM's purpose has been to account for the state and dynamics of water, its pressures due to its use, the effects of anthropic intervention on its quality, and projections beyond sectoral interests. The National Water Study (ENA) 2022 addresses in depth the interrelation between the different areas of knowledge, mainly hydrology, meteorology, ecology, geology, economics and chemistry, achieving an environmental approximation of knowledge at a national and regional level. The analyses reported in the ENA are remarkable to understand the interdependence of water with biodiversity, soil, subsoil and atmosphere, which is determinant for the phases and processes of the hydrological cycle on which the evaluation of water and water resources is based (IDEAM 2023).

Considering the above, the Orinoco region, located in eastern Colombia and southern Venezuela, stands out for its extensive hydrographic network composed of numerous rivers. According to the National Water Study (2022), this region has nine hydrographic zones, with the basins of the Inírida, Guaviare, Vichada, Tomo, Meta, Casanare and Arauca rivers being particularly relevant. These basins exhibit a monomodal hydrological regime, characterized by a wet peak that occurs from June to August, followed by a dry season between January and April (IDEAM 2023).

It is estimated that 41% of Colombia's subway water reserves are located in the Orinoquia. It is also the third largest river system in the world because of the abundant water that flows into the Atlantic; an example of this is the Guaviare, the longest river in the Orinoquia (1,500 km). In addition to the lotic systems, wetlands also play a fundamental role in the hydrology of the Colombian Orinoquia. These are ecosystems that, due to geomorphological and hydrological conditions, allow the accumulation of temporary or permanent water and give rise to a characteristic type of soil and organisms adapted to these conditions. In Colombia, Arauca and Casanare are among the departments with the greatest representation of wetlands. The Orinoquia has approximately 14,725,346 ha of wetlands (Minambiente 2020).

The following is a description of the watersheds relevant to environmental balance, biodiversity and community livelihoods in the Orinoco region (Minambiente 2020):

- ***Orinoco River:*** The Orinoco River basin is considered the third most important river system in the world in terms of the volume of water discharged into the Atlantic, with an average of 36,000 m^3 /sec. (cubic meters per second), after the Amazon and the Congo. This river has an average monthly flow of 15,220 m3/s and originates in the extreme south of the Guayana Massif, Amazonas State, Venezuela, in the Parima mountain range. It flows into the Orinoco delta state or Amacuro delta, which opens into the Atlantic, occupying with its fan some 18,810 km^2 (Minambiente 2020, Ecofondo 2014).

Regarding the departments where the project is focused, Casanare and Arauca have the following most representative accounts (Minambiente 2020):

- ***Meta river basin***: The Meta river basin is one of the largest and most relevant in the region. It includes the Meta river and its tributaries. The Meta River is one of the main tributaries of the Orinoco River and flows through a considerable part of the Orinoco region. It is vital for agriculture, river transport and fishing in the area. It is essential to highlight the cultural importance of the Meta River basin. Diverse indigenous and farmer communities live in this region, with a close relationship with the land and a rich cultural heritage. These communities depend on the basin's natural resources for their subsistence and maintain ancestral traditions that are reflected in their music, dances and traditional knowledge. However, the Meta River basin also faces environmental challenges, such as deforestation, loss of natural habitats and water pollution due to human activities. The conservation and sustainable management of this watershed is essential to ensure the protection of its biodiversity, ecological balance and the well-being of the communities that depend on it.

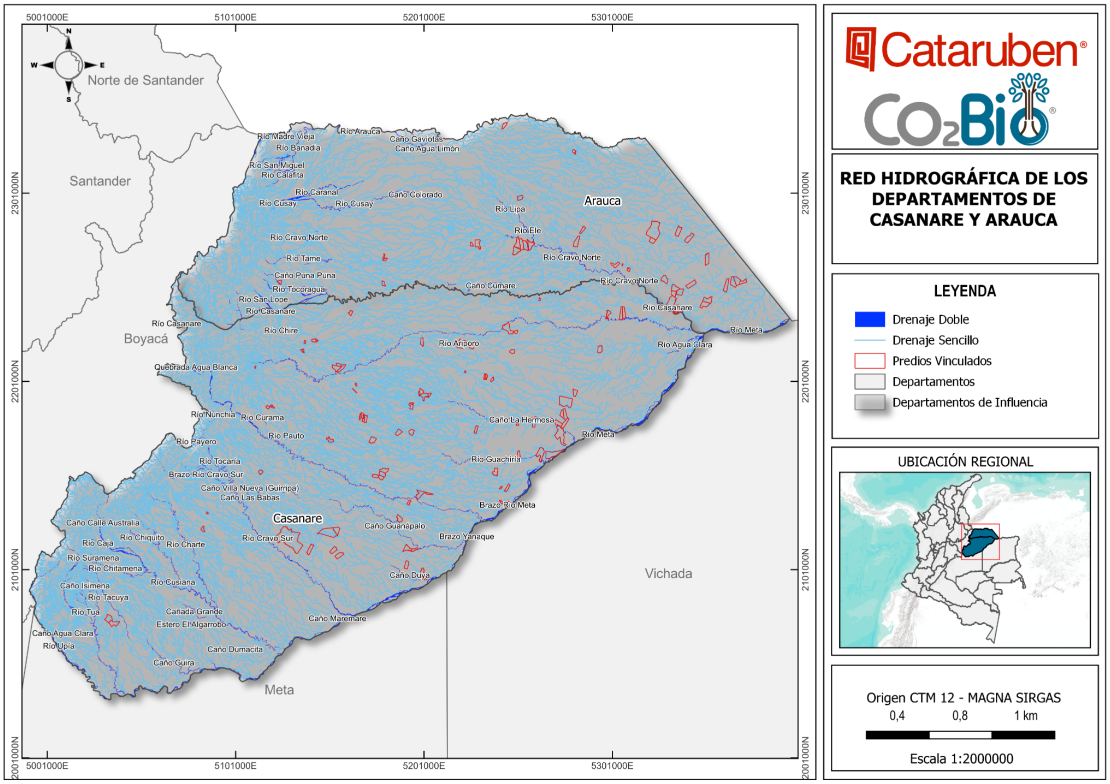
- ***Casanare river basin***: The Casanare river basin comprises the Casanare river and its tributaries. The Casanare River is another important tributary of the Meta River. It is known for its economic relevance, especially in the oil industry, and its biodiversity value.

- ***Arauca River Basin***: The Arauca River is part of the natural border between Colombia and Venezuela. It is recognized for its historical relevance, its tourism potential, and its importance in fishing and river transportation. This watershed extends for approximately 1,100 kilometers, being shared by both countries and playing a crucial role in the biodiversity and balance of local ecosystems. To preserve and protect the Arauca River basin, it is necessary to implement conservation and sustainable water resource management measures. This includes the promotion of sustainable agricultural and fishing practices, proper waste management, and the protection of riparian areas and associated wetlands.

According to reports, fishing is a vitally important activity in this region; freshwater fish in the Orinoquia are not well known. It is known that there are more than a thousand species, many of which are shared with Venezuela. Colombia is among the 15 main countries that export these fish in the world, and for some communities, ornamental fishing is their only legal source of livelihood, as fishing is of great importance to the inhabitants because of its great nutritional value. However, the richness of fish has been affected by human activities, mainly by the loss of cover for cattle ranching and rice and palm monocultures, among others. This reduces flows and increases sedimentation of water bodies (Minambiente 2020).

In relation to the climatic seasons and the reference year (2021), runoff levels in the Orinoco basins were higher than historical averages during the usual dry season. However, during the wet peak, water volumes in these basins were close to the lower range considered normal. On the other hand, the Arauca river basin experienced low values throughout the semester, from May to November, during the wettest season of the year. It is important to note that, according to the drought index established by the National Study, the Colombian Orinoquia is classified at a high and very high level of integrated multivariate drought, which indicates a higher incidence of drought events in this region of the country. This situation highlights the importance of water management and conservation in the Orinoquia to face the challenges associated with this phenomenon (IDEAM 2023).

Image 4. Map of the hydrography of the departments of Casanare and Arauca.



Source: Cartographic (IGAC)
Source: The Cataruben Foundation, 2023.

2.5.1.5 Vegetation.

The diversity of ecosystems includes natural savannas, gallery forests, moriche forests, foothills, flooded forests, estuaries, and rainforests, among others. The region's vegetation is represented by a wide variety of taxonomic groups ranging from grasses to moriche palms. In the flooded savannah, there is a high dominance of grasses that may or may not be wooded, shrublands, palm groves, among which the moriche palms and flooded forests stand out. The dense forests of trees, such as oil and ceibas, are part of the tropical rainforests found mainly in the foothills. Finally, in the rocky alorments of the Guiana Shield, low forests and stunted scrub can be found (Bustamante, 2019).

2.5.1.6 Social.

The territorial and social delimitation of the Orinoco region has generated a wide debate among academics for years, who on several occasions have not reached a consensus on historical, geographical, demographic, cultural, economic and, of course, social aspects. This is because the approach, sources or observations used to approach each of these aspects of this part of the country vary in most cases in their particularities and magnitudes. However, there is a consensus that the presence of ethnic populations, the conquest and colonization of their territories well into the twentieth century continue to be a source of study and analysis, vital when it comes to understanding the settlement of population groups in the territory (ODDR Observatory, 2013).

The social characterization of the Llanos Orientales is complex due to the diversity of its population groups, including indigenous communities, Afro-descendants and farmers (llaneros). The origins of the indigenous populations can be traced back to the migrations coming from the 13th century from the now known territories of Brazil and Venezuela, the most representative being the Chibcha, Caribe and Arawak. Currently, according to data provided by the Colombian Institute for Rural Development (INCODER) and DANE for 2015, there are around 62,465 individuals distributed in 114 reservations legally recognized by the Ministry of the Interior.

Afro-descendant communities are distributed in various parts of the territory between Casanare and Arauca, and their origins can be traced back to the 1990s. This, as a result of migratory processes driven by forced displacement, economic difficulties and the boom of different crops, such as oil palm, especially in the departments of Casanare and Meta (Observatorio ODDR, 2013). According to DANE records, by 2005 there were already 31,921 black people in the region, a significant number by then, representing an average of 0.8% of the total population of the region. Although the four departments that make up the Orinoco region have a large Afro population, the departments where the largest number of families are registered are Casanare and Arauca. However, in the region these collectives have not managed to reach territories formally constituted or recognized by the Ministry of Interior (Observatorio ODDR, 2013).

The farmer population or "criollos" or "llaneros originarios" are the result of a process of miscegenation between the native Indians and the first Spanish colonizers. Several characteristics distinguish them from other communities present in the region, for example, livestock raising. This practice, apart from representing one of the main economic activities in the plains, also symbolizes forms of social, political, religious, economic, etc. cohesion. However, over the decades, the so-called "llaneros nuevos" have gained more strength and are generally located in the plains foothills of the eastern cordillera, because of the violence that marked Colombia in the second half of the twentieth century, and the constant conflicts over land ownership in the territory near the Andes (Piñeros, 2019).

As for the vulnerable population and ethnic minorities, they have been targeted for the implementation of schooling strategies with criteria based on a differential rights approach. This approach was integrated into the educational and social agenda as early as 2011, with primary projects involving flexible education that aimed to positively impact about 11,905 children and adolescents, these Community Ethno-educational Programs (PEC) are supported and promoted by the Ministry of Education in line with the Family Welfare Institute (ICBF). And already by 2013, this education with a differential rights approach provided 6,928 quotas and there were about 5,982 students already in the training stage in the main municipalities of the departments of the Orinoco region (CONPES, 2014).

Finally, in terms of the health system, by 2012 a total of 142,911 people from the entire region were already registered in the General Social Security Health System. Likewise, in the subsidized regime, 80.4% of the affiliated persons already had 100% coverage. However, the coverage of the contributory and subsidized regime was not fully implemented and was reaching a problematic point of stagnation, with a backlog of 30% in terms of individuals not affiliated or not enrolled in the system registered in the system, the most common case being the most remote populations of the department of Vichada (CONPES, 2014).

The region is home to a total population of 1,507,683 people, 70% in urban areas and 30% in rural areas, with a population density of 5.9 inhabitants/km2 (DANE, 2010). Despite the colonization that has occurred in recent decades, it is still considered a sparsely populated territory. Of the total population of the Orinoco, it is estimated that 51,098 inhabitants are indigenous, located mainly in the departments of Vichada and Meta (INCODER, 2010).

2.5.1.7 Economic.

Traditionally, the main land uses have been cattle ranching, oil extraction, agricultural production, and conservation soils. According to data from the Unidad de Planeación Rural Agropecuaria (UPRA, 2015a, 2015b, 2015c, 2015d) 55% of the area is for grazing, 5% for agricultural production, 1.3% of the area is water surface, 0.04% for forestry production and the remaining 38.6% for other uses. Until the 1980s, the agricultural sector contributed 41% of the region's GDP; however, since the early 1990s, oil activity began to make a greater contribution, mainly in the departments of Arauca, Casanare and Meta. This trend has continued to increase, especially in the last 15 years, where the region's dependence on this sector is decisive. An example of this is the effect felt by the region in economic and employment terms during 2016 due to the drop in oil prices.

3. Quantification of GHG Emission Reductions

3.1 Quantification Methodology

For the development of the project, the BCR 2023 Standard was used as a basis, which provides the requirements applicable to the project, as well as the following methodologies:

- Methodological Document AFOLU Sector / BCR0004 Quantification of GHG Emission and Removal Reductions - Activities that avoid land use change in inland wetlands. Version 2.0 23 June 2022.

- Methodological Document AFOLU Sector / BCR0002 Quantification of GHG Emission Reductions from REDD+ Projects. Version 3.1. September 15, 2022.

3.1.1 Conditions for the applicability of the BCR0004 methodology

Regarding the fulfillment of the applicability conditions, it is concluded that;

Table 14. Compliance with applicability conditions.

CONDITION OF APPLICABILITY	COMPLIANCE
a) Project boundaries correspond to the category of Wetland;	To comply with the applicability condition, the geographical limits of the project are superimposed with the map of inland wetlands in Colombia. In effect, the project areas correspond to the categories of Continental Wetlands.
b) The project activities prevent land use change in Continental Wetlands in the Orinoquia.	The activities designed and monitored for the project avoid land use change, which are framed within the framework of strengthening knowledge in wetland conservation and sustainability to prevent the expansion of the agricultural frontier, the characterization and implementation of sustainable production practices, the strengthening of governance structures in the territory and the recognition of conservation areas and figures for the sustainable management of biodiversity; a condition that allows demonstrating GHG reductions during the accreditation period of the project, which can be reviewed in paragraph 18 of the PDD.
c) Project activities include biodiversity conservation actions that integrate preservation, restoration and/or management efforts and sustainable use of the Continental Wetlands.	Project activities include real biodiversity conservation actions, based on the recognition of areas and conservation and environmental management figures for biodiversity conservation in the project area, highlighting the declaration of AICAS, RHRAP, RNSC and RESNATUR, actions that demonstrate effectiveness in the sustainable management of wetlands and their biodiversity. Additionally, the declaration of 15 properties as Civil Society Nature Reserves implies a greater strengthening of land management in the project area. These activities can be seen in numeral 18.4 of the PDD.
d) The causes of land use changes include: expansion of the agricultural/livestock frontier, mining activity, extraction or loss of natural vegetation cover, infrastructure (road and urban) and tourism exploitation (tourism activities that exceed the	The main causes of land use changes identified in the baseline for the Wetland ecosystem are mainly due to the expansion of the agricultural frontier, given by the planting of dry rice and the implementation of oil palm, activities that lead to the loss and extraction of the natural cover of the Wetlands, as well as extensive cattle ranching. This information can be

CONDITION OF APPLICABILITY	COMPLIANCE
carrying capacity of the ecosystem).	reviewed in section 17 of the PDD.
e) Project activities do not lead to the alteration of the water regime of the project area or hydrologically connected areas due to anthropogenic interventions (e.g. irrigation and/or drainage systems, etc.).	Based on the execution of the activities previously agreed with the landowners through the signing of contractual agreements (numeral 5.4 of the PDD, annex Binding Documents), the project guarantees the non-implementation of irrigation and drainage systems in the Wetlands, as well as the implementation of industrial production systems, in order to avoid altering the hydrological regime of the wetlands.
f) Soil disturbance attributable to project activities does not cover more than 10% of the surface area within the project boundaries.	None of the planned activities involve soil disturbance.
g) The areas within the geographic boundaries of the project correspond to the categories of Continental Wetlands.	The project took as a basis the categories of Continental Wetlands determined in the delimitation exercise of wetlands in Colombia prepared by the Alexander Von Humboldt Biological Resources Research Institute scale 1:100,000 (Flórez,C., et al 2016).

Source: The Cataruben Foundation, 2023.

3.1.2 Conditions of applicability of the BCR0002 methodology.

Table 15. Compliance with applicability conditions.

CONDITION OF APPLICABILITY	COMPLIANCE
a) The areas in the geographic boundaries of the project correspond to the forest category (according to the national forest definitions for the Clean Development Mechanism) at the start of project activities and ten years prior to the project start date;	It is shown that the areas correspond to the Forest category, taking into account the analysis made to them based on the cartographic inputs "Non-forest Forest" obtained from the Forest and Carbon Monitoring System - SMByC -IDEAM.

CONDITION OF APPLICABILITY	COMPLIANCE
b) The identified causes of deforestation may include, among others: expansion of the agricultural frontier, mining, timber extraction and infrastructure expansion;	The causes of deforestation identified for the project's baseline, as stated in the PDD, in numeral 29, correspond to: expansion of the agricultural frontier, mainly due to industrial crops (rice, oil palm, soybean and banana), the latter two with a significant increase, from (274.931 hectares - 430,205 cultivated hectares) in the period 1996-2007; for its part, the livestock sector also showed a significant increase, going from 4.8 to 6 million head of cattle, between the period 2011-2008. Finally, the oil sector for the period 2000 to 2007 decreased its deposits in two departments (Casanare and Arauca), which signifies a decrease in the sector from 67% to 47%.
c) The causes of forest degradation identified may include, among others: selective logging, firewood extraction, forest fires, forest grazing and expansion of the agricultural frontier - illicit crops.	The causes of forest degradation identified for the project and included in the baseline and additionality section in number 29 correspond mainly to the expansion of the agricultural frontier, with the planting of rice and oil palm, extensive cattle ranching and the exploitation of fossil fuels.
d) No reduction in deforestation or degradation is expected to occur in the absence of the project.	According to the Baseline and Additionality analysis, the implementation of REDD+ activities and monitoring of GHG reductions for the period 2018-2021 with respect to the project time window, deforestation is not expected to be reduced in the absence of the project.
e) It is possible that, in areas within the Project boundaries, carbon stocks in soil organic matter, litter and Deadwood may decrease, or remain stable.	The possibility of this condition occurring is very likely under the following scenario, if a passive restoration process is managed for the deforested areas, carbon stocks increase or remain stable, a condition that can be demonstrated during the project monitoring periods; but if, on the contrary, agricultural activities continue to be executed in the deforested areas previously identified in the project baseline, these stocks decrease. The latter condition is not present for the project.
f) The quantification of GHGs other than CO2 should be included in the quantification of emissions caused by forest fires (if	The project will quantify the presence of other gasses only in the event of forest fires, which will be verified during monitoring periods.

CONDITION OF APPLICABILITY	COMPLIANCE
applicable) during the monitoring period.	

Source: The Cataruben Foundation, 2023.

3.2 Project boundaries

The project is located in the Orinoquia biome (eastern Colombia) and consists of 124 properties with a total area of 102,863 ha in the departments of Arauca and Casanare.

The wetlands component comprises 97 properties with a total area of 82,306 ha, of which 61% (50,352.8 ha) are eligible wetlands (Table 16). The wetland areas meet the methodological conditions for the quantification of GHG emissions reductions and removals from activities that avoid land use change in Continental Wetlands (BCR0004).

The REDD+ component comprises 102 properties with a total area of 91,270 ha, of which 12% (10,532.3 ha) are forest category areas (Table 18). These areas comply with the methodological conditions for the quantification of GHG emission reductions and removals, REDD+ Activities (BCR0002).

3.2.1 Project Spatial Boundary

3.2.1.1 Delineation of Continental Wetlands.

To carry out the identification, delimitation and classification of the Continental Wetlands in the project area, the wetlands map of Colombia prepared by Flórez et al 2016[1] was used. Based on this cartographic resource, the identification, classification and delimitation of the areas related to the project was carried out.

Regarding climatic conditions in the project region, the data indicate that the average precipitation, measured in milliliters, amounted to 2193.8 during the period analyzed. The evaluation through climograms has identified a monomodal precipitation regime, characterized by a very marked dry season

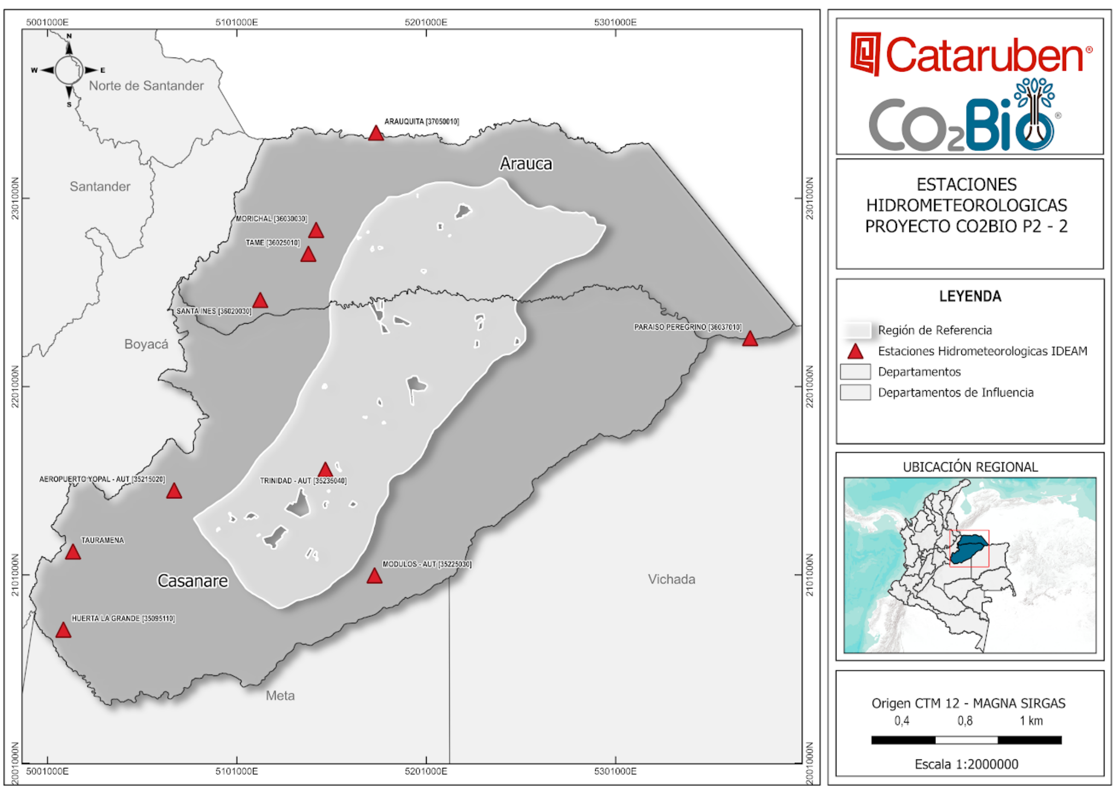
1 *Article citation:* Flórez, C., L. M. Estupiñán-Suárez, S. Rojas, C. Aponte, M. Quiñones, O, Acevedo, S. Vilardy and U. Jaramillo. 2016. Spatial identification of Continental Wetlands systems in Colombia. Biota Colombiana 17 (Supplement 1 - Wetlands): 44-62. DOI: 10.21068/c2016s01a03.

from January to March, followed by a rainy season that extends from April to December (see Figure 8).

In terms of soil composition, there are hydromorphic soils, particularly Aquic and Udic soils, which cover approximately 82.0 % of the total surface area of the properties and all of the wetlands.

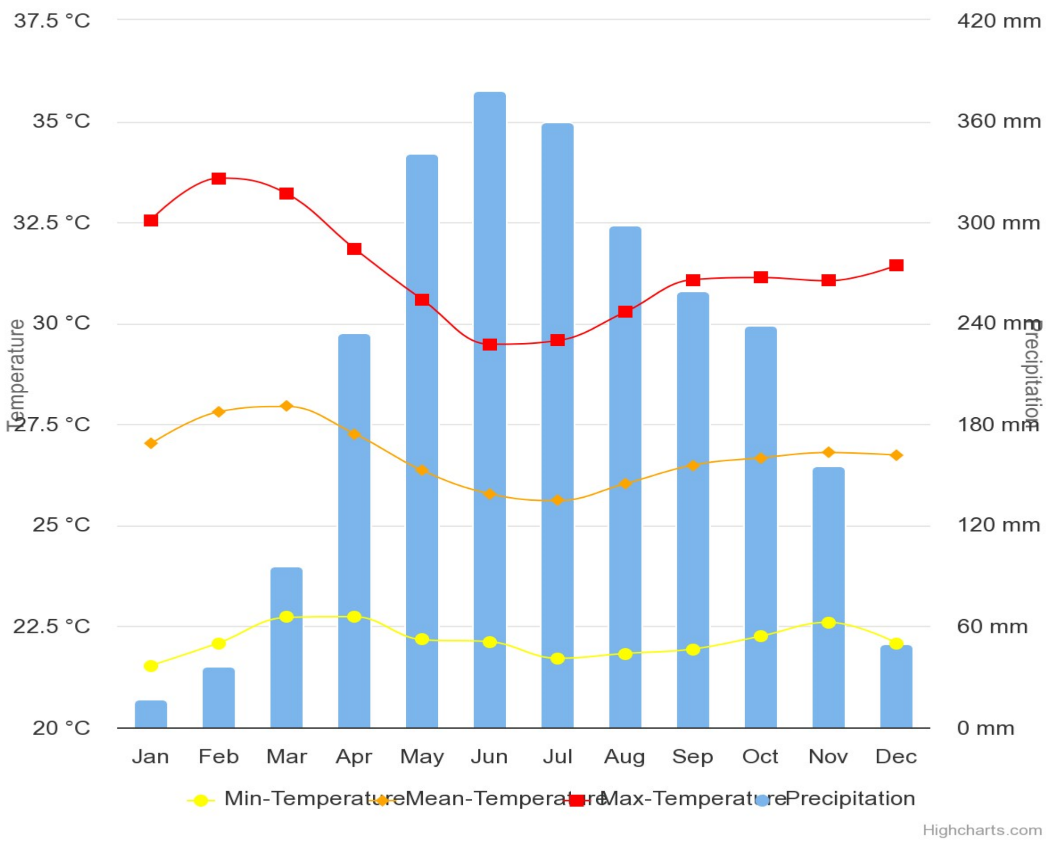
In terms of drainage, most of the soils exhibit dissected drainage conditions, which is characteristic of ecosystems with a deficient drainage system. The predominant landscape in the region resembles an eolian plain, alluvial plain and valley, with a relief comprising terrain types with valleys, flood plains, deltaic plains, overflow plains, depressions and meadows.

Image 5. Location of hydrometeorological stations.



Source: *http://dhime.ideam.gov.co/atencionciudadano/*
Elaboration: The Cataruben Foundation, 2023.

Figure 8. Climogram of average precipitation and temperature, period 1991 - 2020.



Source: https://climateknowledgeportal.worldbank.org/country/colombia/climate-data-historical, 2023.

According to Flórez, et al (2016), four types of wetland systems are distinguished: Permanent open, permanent under canopy, temporary and medium potential. In addition to identifying the natural vegetation cover associated with wetlands generated from the CORINE Land Cover (CLC) methodology adapted for Colombia at a scale of 1:100,000.

3.2.1.1.1.1 Eligible Wetland Areas in the Project Boundary.

Eligible areas correspond to areas that are part of Continental Wetlands ecosystems, and that correspond to the category of natural vegetation cover, other than forest, at the beginning of project activities and five years before the project start date. Based on Flórez et al (2016), the Wetlands were identified for 2018, the date on which the project initiates conservation activities.

To determine the eligibility of the areas, a multi-temporal analysis is performed between the CORINE Land Cover of 2018 (project start date) and the CLC of 2012, both reliable national inputs generated by IDEAM. The crossing of information generates a new cartographic file with the attributes of the initial layers. In this only the natural vegetation cover belonging to the wetlands found in both periods are selected (See Annex Wetlands Procedure).

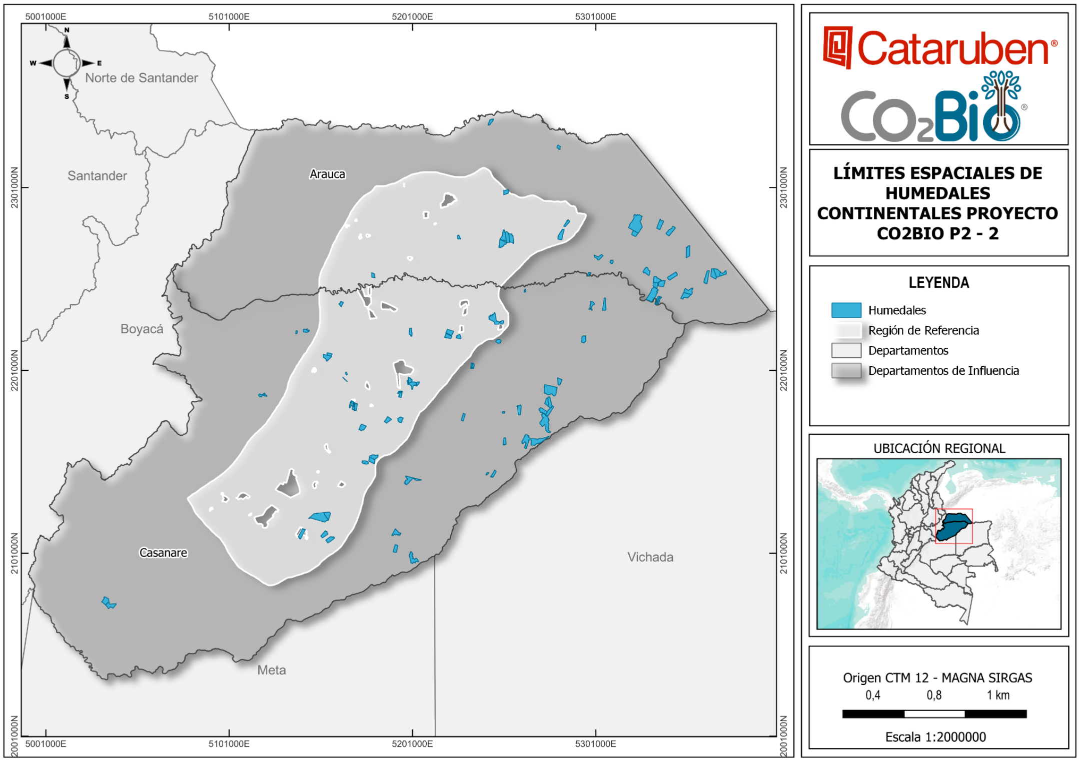
Table 16, represents the eligible wetland area by stratum, information related to the Wetland Project V3.O Feature Dataset Wetland Project Areas.

Table 16. Eligible wetland areas by strata.

STRATUM	AREA (ha)
Dispersed	631,0
Herbaceous	49.721,6
Total Eligible Wetland	**50.352,6**

Source: The Cataruben Foundation, 2023.

Image 6. Map of spatial limits Continental Wetlands



Source: The Cataruben Foundation, 2023.

3.2.1.1.2 LEAKAGE AREA

The leakage area corresponds to the areas with natural vegetation cover[2] to which a displacement of activities that generate changes in land use and are beyond the control of the project owner can be generated.

The area of leakage was determined according to the criteria established by BCR0004 methodology:

- All areas of natural vegetation cover that are within the range of mobility of the identified agents should be included.

[2] Areas meeting eligibility criteria

To establish the boundaries of the leakage areas, a spatial proximity analysis, commonly known as near neighbors, was carried out to determine anthropogenic changes in land use.

The distance of the properties to the sites where there is a transformation of the natural vegetation cover by anthropic actions is evaluated, for example, changes from grasslands to pastures or the establishment of agricultural crops. The national land cover maps for the period 2012 and 2018 were used as input.

The transformation of natural vegetation cover to anthropic cover in the reference period was evaluated. This approach made it possible to understand the mobilization of the transformation outside the project areas, in addition to the identification of those with the greatest cover transformation and their range of mobility. This range of mobility is related to the land cover transformation agents.

The range of mobility resulting from the transformations in the baseline period allowed determining the direction of emissions, as well as the distance of the same to the edge of the Properties with Wetland conservation activities, additionally and to meet the criteria of the methodologies, the areas of restricted access to land use change agents are excluded.

The proximity analysis and the weighted distance defined a leakage belt with a buffer of 600 m from the edge of the Property, with an area of 66,081 hectares, where 39,707 hectares of natural vegetation cover were counted where processing activities can be displaced. The area was monitored in relation to the natural vegetation cover in the temporal limits of the project.

The spatial proximity analysis determined that the leakage area corresponds to *78.9% of* the Wetland project areas. The cartographic information can be found in its respective Geodatabase "Wetlands_V3 Leakage Area", and a map package file called Wetland_LEAKAGE.mpk is also attached.

Table 17 relates the REDD+ eligible hectares to the project's leakage area.

Table 17. Project leakage areas.

ELIGIBLE PROJECT AREAS (ha)	LEAKAGE AREA (ha)
50.352,6	39.707

Source: The Cataruben Foundation, 2023.

3.2.1.1.3 Reference Region

The reference region is a geographic space where the agents involved in the transformation of natural vegetation cover interact, as well as other factors that contribute to the generation and loss of ecosystem services.

The delimitation is a process that starts with the analysis of different social and economic conditions such as proximity to rural areas, population centers, natural resource exploitation activities, agricultural and livestock economic activities, as well as the vocation and use of the land. It also involves threatened ecosystems and areas of exceptional importance for the conservation and connectivity of species.

It is determined that the reference region should be located in the Helobioma of Casanare and Arauca according to the ecosystem map scale 1:100,000 version 2.1. 2017[3] because it is an area that describes the characteristics of the project as it is a territory with poor drainage, permanent flooding and prolonged periods of flooding and perfectly describes the areas corresponding to the wetland categories.

Additionally, the reference region and the project areas have ecosystems in different degrees of threat according to the map of threatened ecosystems (Etter, 2017) ranging from critical to vulnerable category and on which a degree of pressure is exerted by land use vocation. In addition, the aptitude of the territory is distributed in monocultures such as rice "*Oriza sativa*" and oil palm "*Elaeis guineensis Jacq*" and the livestock sector for the establishment of dual-purpose livestock. Hydrocarbon exploitation and exploitation activities have transformed the way in which the territory is mobilized as access roads to the oil platforms are built and are also used to move disturbances in the territory.

3 Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) (2017). Map of continental, marine and coastal ecosystems v2.1. Retrieved from: http://bart.ideam.gov.co/cneideam/Capasgeo/Mapa_ecosistemas_Continentales_Marinos_Costeros_100K_V 2.1_2017.zip

These pressures are shared between the reference region and the project areas, but coincidentally, this zone is critical for species connectivity through the terrestrial, water and flood mobilization corridors documented by the main ecological structure for the Orinoquia developed under the Sulu methodology.

The information describing the source of the information as well as the relationships between the reference region and the project areas is described in the document "Spatial analysis and similarity of the reference region" and is accompanied by an mpk file that provides support to the delimitation.

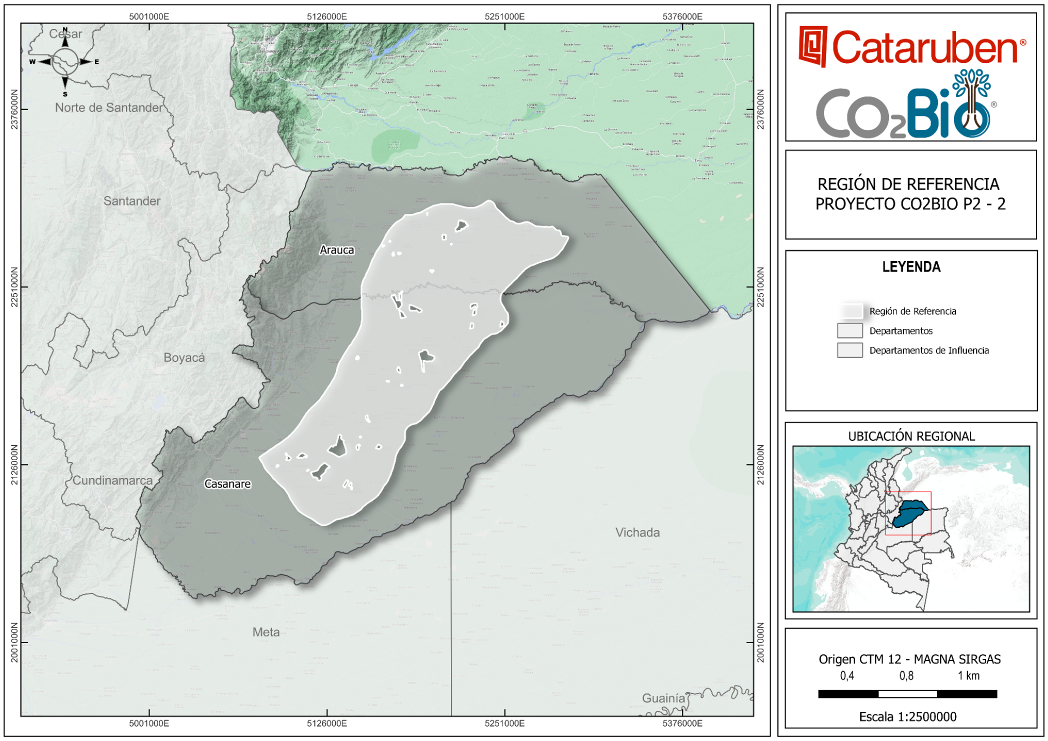
Table 18 establishes compliance with the criteria to be met by the reference region for BCR0004 methodology, item 10.2 "Reference region for baseline estimation".

Table 18. Criteria for the establishment of the reference region

Methodology	Criteria	Description Compliance
BCR0004	The reference region and the project area are part of the same ecoregion.	**Compliant.** The reference region and the project areas are located within the same ecoregion and share the same Biome, which is the Orinoquia biome. Geodatabase Wetlands V3Bioma
	The reference region may include all or part of the project.	**Compliant.** The reference region includes 41% of the project area. Geodatabase "Wetlands V3 Project area and Reference region
	The causes and agents identified in the reference region, which generate changes in land use, can access the project area.	**Compliant.** The project areas correspond to private areas with the same land tenure conditions in the reference region as in the project areas, which makes it easy for agents to carry out deforestation actions in the forest. In addition, the soil, climate, and land cover conditions are similar throughout the territory, and there is also a road network that facilitates the agents' entry into the territory. Geodatabase "Wetlands V3 Project area and Reference region

Source: The Cataruben Foundation, 2023.

Image 7. CO2Bio P2-2 Project reference region.



Source: The Cataruben Foundation, 2023.

The abiotic characteristics of the selected reference region are described below.

3.2.1.1.4 Geographic information

Below is a description of the biotic conditions that comprise the reference region.

3.2.1.1.1.4.1 Terrain Slopes

Image 8 shows the results of the slope analysis for the reference region, this is expressed as a percentage, being divided into 6 classes (0-2%, 2-5%, 5-10%, 10-25%, 30-45% and > 45%). The predominant slopes in the reference region are in the range of 2-5% with "Gently to flat" terrain type. The terrain slope in these areas varies considerably, however it is characterized by a predominantly flat or slightly undulating topography due to its location in the eastern plains region. The extensive plains and highlands have very gentle slopes, although it is possible to find areas with steeper slopes near rivers and/or bodies of water.

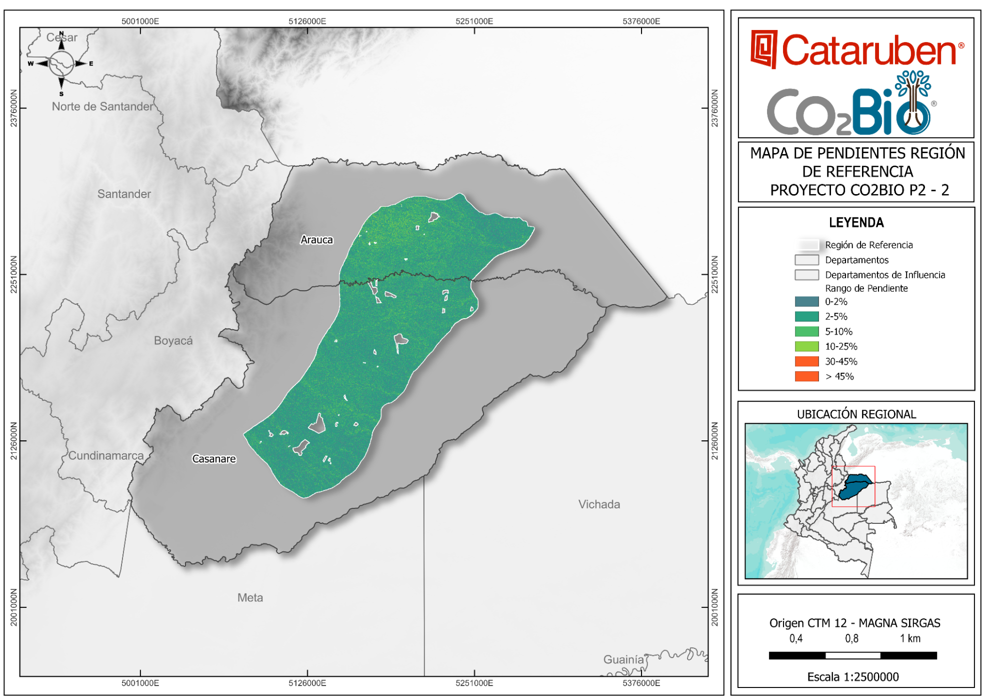
3.2.1.1.4.2 Terrain Elevation

The Digital Elevation Model (DEM) determines the height in meters above sea level (masl). According to the DEM, the reference region presents a degree of elevation between 103 to 221 masl (Image 9). Low altitude areas such as those found in the reference region are generally associated with flat areas and/or near bodies of water, characteristic of the eastern plains region.

3.2.1.1.4.3 Hydrography

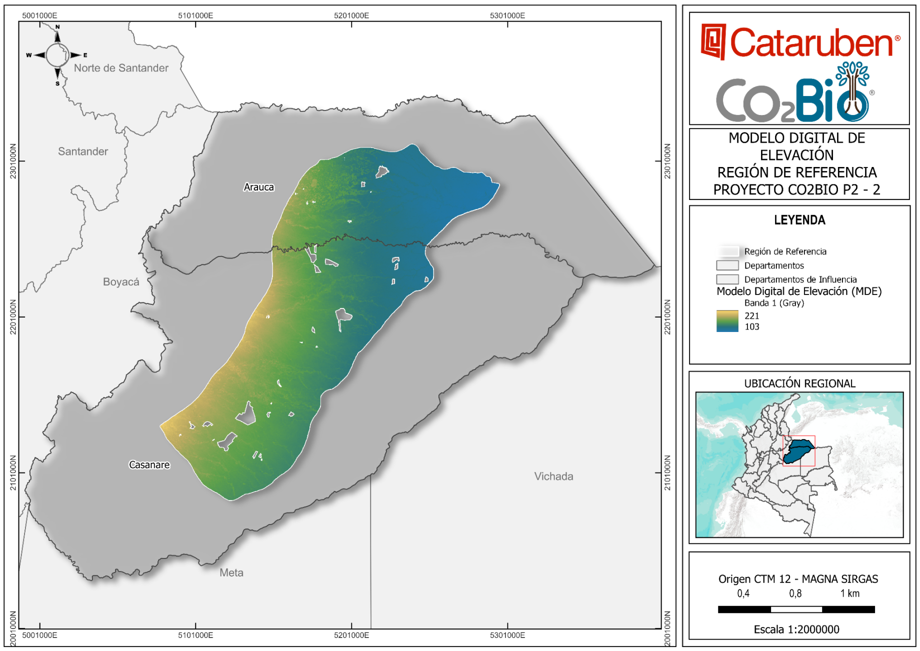
In the reference region there are several rivers and bodies of water that make up its hydrography (Image 10). Different hydrographic zones are identified: Arauca River Basin, Casanare River, Cravo Sur River, Pauto River, among others. Each of these watersheds and their tributaries have unique characteristics and play a crucial role in water supply, biodiversity conservation and socioeconomic development of the communities in the area.

Image 8. Slopes in percentage of the reference region, according to FAO (2009)***.***



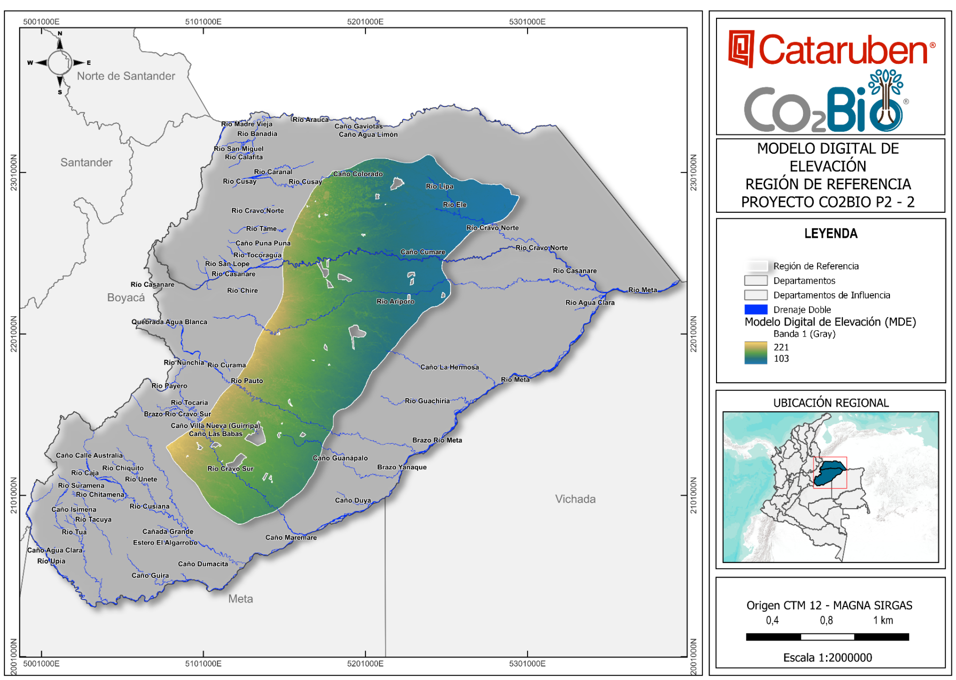
Source: The Cataruben Foundation, 2023.

Image 9. Digital Elevation Model (DEM).



Source: The Cataruben Foundation, 2023.

Image 10. Water network.



Source: The Cataruben Foundation, 2023

3.2.1.2 Delimitation of the Forest Ecosystem

3.2.1.2.1 REDD+ eligible area.

The REDD+ eligible areas of the project correspond to the stable forest found within the boundaries of the properties for a period of at least ten years prior to the start date of the project, according to the definition of forest adopted by Colombia and used by the SMByC. To identify the forests present on the properties, the mapping information of the area covered by natural forest generated by the SMByC for 2010 and 2018 was used.

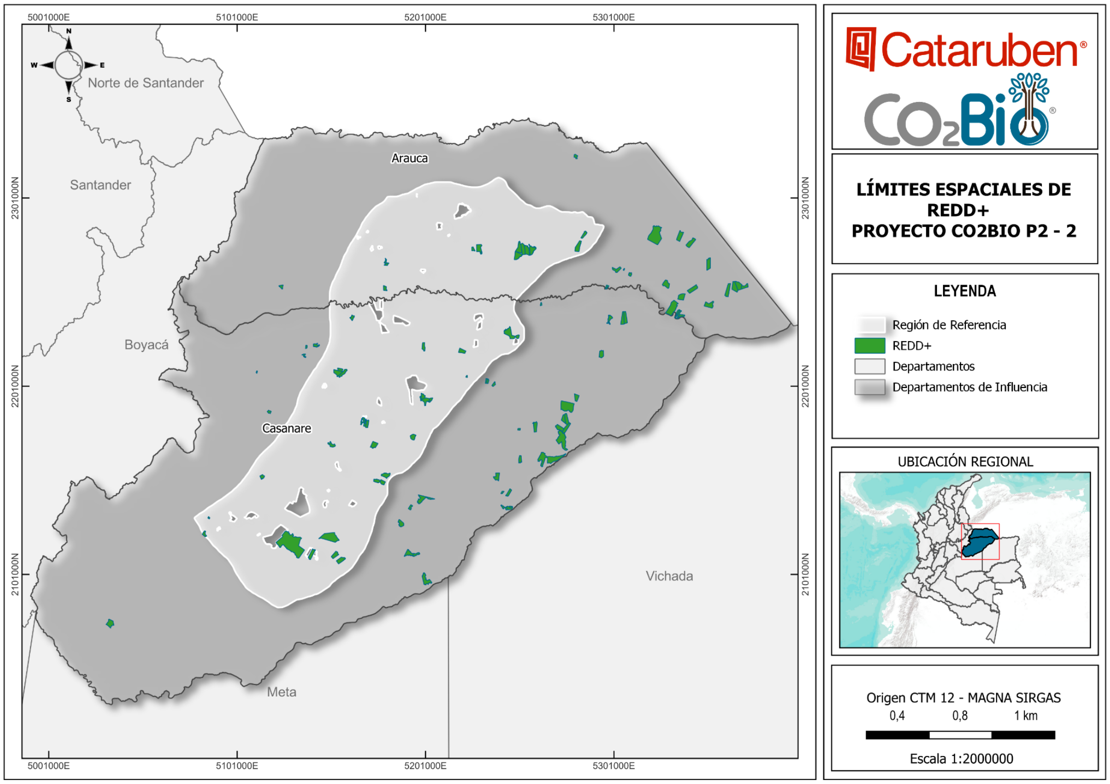
The analyses were carried out using QGIS software and identified a total of 10,532.6 hectares (see Table 19) of stable forest within the project, the distribution of which is shown in Figure 11. The cartographic information is consolidated in the REDD CO2Bio P2-2 V3.0 Geodatabase, Features Dataset Areas REDD project.

Table 19. Eligible REDD+ project areas.

CATEGORY	AREA (ha)
Eligible Forest	10.532,6

Source: The Cataruben Foundation, 2023.

Image 11. Map of spatial limits of the Project.



Source: The Cataruben Foundation, 2023.

3.2.1.2.2.2 Reference Region

This is the geographic space where deforestation is estimated to occur in the project's baseline scenario. To define the boundaries of the reference region, it is important to carry out a selective mapping process that identifies both the agents involved in deforestation activities in the area and the factors that could motivate the population to carry out unplanned logging activities.

It is important to note that the reference region is located in the Orinoquia biome and shares political divisions with the departments of Casanare and Meta. The main drivers of deforestation identified are extensive cattle ranching, promising agricultural crops such as oil palm and rice monoculture. Also taken into account are the density of oil activity, proximity to forests susceptible to deforestation, threatened ecosystems and ecological connectivity.

Each of these cartographic inputs is related in the document called Spatial analysis and similarity of the reference region, which is accompanied by a *map package* file describing how the reference region relates to the project areas. Broadly speaking, it is described that the reference region has its own conditions for the pressure on forests, where livestock, extractive and hydrocarbon exploitation activities converge, as well as the expansion of the road network as a mechanism to connect the territory between communities that are sustained by oil production. All of this converges in an area that has ecosystems in a state of threat from critical to vulnerable and above all in an area that is prioritized for terrestrial ecological connectivity.

The process for the definition of the reference region starts with a cartographic superimposition of the indicated files, the region is delimited based on the category of the helobiomas of Casanare and Arauca subjected under the drivers of the expansion of the agricultural and livestock frontier. The area is defined as forest susceptible to deforestation according to Annex 1 of the NREF[4] . The relationships between distance to rivers and connectivity corridors and their synergies with connectivity corridors are examined.

[4] https://redd.unfccc.int/media/31122019_anexo_circunstancias_nref_nal_v7.pdf

Finally, areas belonging to collective territories are extracted, such as: Legalized and Intended Indigenous Reserves, Black Community Councils, National and Regional Natural Parks, as well as those areas inaccessible to deforestation agents such as carbon project areas.

To determine the areas that are part of other carbon projects, the carbon standards of the area were monitored, especially VERRA, BIOCARBON REGISTRY, CERCARBONO and COLCX. Defining a total of 6 projects represented in 2 standards: Biocarbon Registry (4) and COLCX (2). The areas represented by the projects were excluded from the reference region.

The cartographic information is located in the following path (Annex 1 / 1.3.REDD+/5.Geospatial/5.1.Geodatabase REDD_V3+).

It is important to note that both the REDD+ component and Wetlands share the same reference region, despite the fact that the actors involved in each are different. This coincidence is due to the fact that the delimited region is an area where different environmental triggers converge, where oil activity and terrestrial connectivity influence the disturbance of ecosystems. Image 12 represents the limits of the reference region.

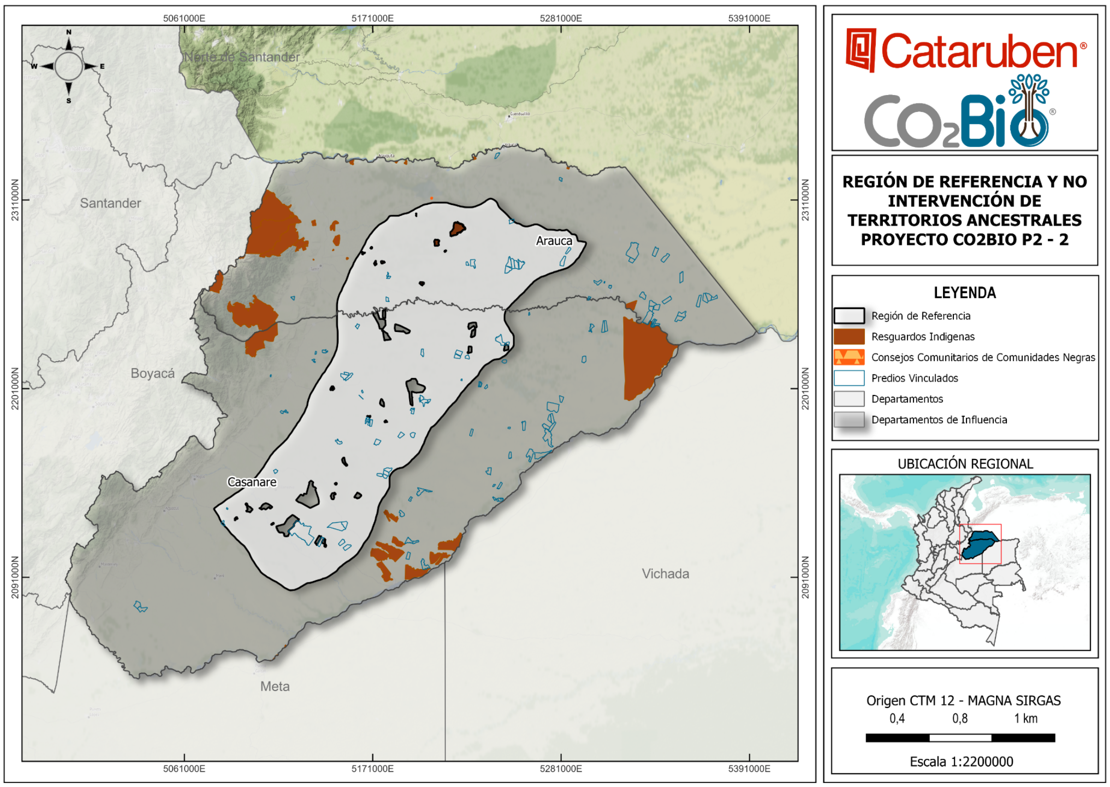
Table 20 establishes compliance with the criteria to be met by the reference region for BCR0002 methodology, item 8.2 "Reference region for baseline estimation".

Table 20. Criteria for the establishment of the reference region

Methodology	Criteria	Description Compliance
BCR0002	The reference region may include all or part of the project area.	**Compliant.** The reference region includes 41% of the project area. Geodatabase V3 Reference Area and Project Areas
	The agents and determinants of deforestation, identified in the reference region, can access the project area.	**Compliant.** Given that the project areas as well as the reference region include private property owners with similar interests in generating subsistence economic resources within regulated markets. Geodatabase V3 Agents.mpk

Methodology	Criteria	Description Compliance
	The project area is of interest to the agents identified in the previous criterion.	**Compliant.** Land tenure conditions are similar in the reference region and in the project areas, which makes it easier for agents to carry out deforestation actions in the forest. In addition, the soil, climate and land cover conditions are similar throughout the territory. Especially the road network makes it easy for the agents to access the region. Geodatabase V3Agentes.mpk cartographic information of Agricultural border and road network.
	Land tenure and land use rights must be characterized in the region of reference.	**Compliant**. The reference region only includes areas of private properties where the owners have the right to use the land. It does not include areas of collective tenure (Indigenous Reserves, Community Councils of Black Communities, Peasant Reserves). Geodatabase V3Agentes.mpk land tenure mapping information.
	Exclude areas of restricted access to agents and drivers of deforestation and degradation.	**Complies.** Areas in which agents have restricted access are excluded, especially those related to Article 329 of Decree Law 2811 of 1974 "National Code of Renewable Natural Resources and Environmental Protection". Collective tenure territories are also excluded. Geodatabase V3 Carbon projects

Image 12. Project reference region - REDD+



Source: The Cataruben Foundation , 2023.

3.2.1.2.3 Leakage area

The LEAKAGE area corresponds to forest areas where deforestation or degradation activity may be displaced as a consequence of the project's conservation activities; these areas are outside the control of the REDD+ project holder.

The area of leakage was determined according to the criteria established by BCR0002 methodology:

- All forest areas that are within the range of mobility of the causes and agents of deforestation/degradation should be included.
- Exclude areas of restricted access to deforestation and degradation agents.

To establish the boundaries of the leakage areas, a spatial proximity analysis, commonly known as near neighbors, was carried out to determine the distribution of deforestation and to analyze land use changes.

The spatial proximity analysis determines the average distance of deforestation using Global forest Watch data as cartographic inputs, specifically the Global Forest Change version 1.10 database[5] .

Forest loss was evaluated in the time limits of the REDD+ component baseline (2010 - 2018) and 2021. This approach allowed understanding the mobilization of deforestation outside the project areas, while the 2021 analysis was inferred from the movement of deforestation due to project activities. From the analysis, deforestation hotspots and their range of mobility were identified. The displacement of emissions is enrolled with the different agents of deforestation and degradation.

The range of mobility resulting from deforestation in the baseline period allowed determining the direction of emissions, as well as the distance of the same to the edge of the REDD+ properties, in addition and to meet the criteria of the methodologies, areas of restricted access to deforestation agents are excluded.

The proximity analysis and the weighted distance defined a leakage belt with a buffer of 250 m from the edge of the Property, with an area of 28,090 hectares, where 5,163 hectares of forest were counted where deforestation activities can be displaced. The area was monitored in relation to the forest areas in the temporal limits of the project.

The spatial proximity analysis determined that the leakage area corresponds to *49.0 %* compared to the REDD+ project areas. The cartographic information can be found in its respective Geodatabase "REDD+ Leakage Area", additionally a map package file called Afugas.mpk is attached.

Table 21 relates the REDD+ eligible hectares to the area of project leakage.

[5] https://storage.googleapis.com/earthenginepartners-hansen/GFC-2022-v1.10/download.html

Table 21. Eligible and leakage areas of the REDD project.

ELIGIBLE REDD+ ELIGIBLE AREAS (ha)	LEAKAGE AREA (ha)
10.532,6	**5.163**

Source: The Cataruben Foundation, 2023.

3.2.2 Carbon stocks and GHG sources

For the wetland component, the GHG reservoirs and sources described in section 9 of the methodological document BCR0004 are taken into account and for the forest areas, the analysis and selection is made on the GHG reservoirs and sources described in section 7 of the methodological document BCR0002. Thus, tables 20 and 21 list the carbon pools selected to quantify the carbon stocks in the high mountain ecosystem areas of the project.

Table 20. Carbon pools, Continental Wetlands component.

CARBON DEPOSITIO N	TYPE OF CONTAINER	INCLUSION	JUSTIFICATION
Soil	Soil organic carbon - SOC or Total soil carbon - CTS	Yes	The change in carbon content in this reservoir is significant according to the IPCC, in addition it can be highly affected by the loss of natural cover and land use change (FAO. 2017, Kauffman et al. 2016).
Total Biomass - BT	Aboveground biomass - BA	Yes	The change in carbon content in this reservoir is significant according to the IPCC and is highly affected by natural cover loss and land use change (FAO. 2017, Kauffman et al. 2016).
	Belowground biomass - BS		
	Leaf litter	No	For the identified strata, carbon stocks in this reservoir are not considered significant.

Source: The Cataruben Foundation, 2023.

Table 21. Selection of carbon pools applied to the REDD+ project.

CARBON DEPOSITION	SELECTIO N	JUSTIFICATION
Aboveground biomass Tree vegetation	Yes	The change in carbon content in this reservoir is significant, according to the IPCC and are susceptible to reduction by land use change Kauffman et al. (2016).
Aboveground biomass Non-tree vegetation	No	The deposit is not included since the establishment of permanent crops is not contemplated.
Belowground biomass	Yes	Its value is representative of carbon stocks, taking into account roots larger than 2 mm.
Deadwood and leaf litter	No	Under a conservative scenario, no significant increase in carbon stocks is expected.
Soil organic carbon	Yes	Carbon stocks in this reservoir are significant and could increase due to project activities. However, this reservoir is highly susceptible to loss due to land use change and deforestation (FAO. 2017, Kauffman et al. 2016).

Source: The Cataruben Foundation, 2023.

3.2.2.1 Sources of GHGs

The emission sources and associated GHGs are presented in the following tables.

Table 22. Selected emission sources and GHGs for inland wetlands.

SOURCE	GHG	INCLUSION	JUSTIFICATION
Woody biomass combustion	CO_2	NO	CO_2 emissions due to woody biomass combustion are quantified as changes in carbon stocks.
	CH_4	YES	The CH4 emission should be included if the presence of fires is identified during the monitoring period.
	N O_2	YES	N2O emissions should be included if the presence of fires is identified during the monitoring period.
Alteration of the water regime	CH_4	YES	CH_4 and N_2O emissions will be included if wetland drainage practices are identified to change to other land uses in the monitoring period.
	N O_2		

Source: The Cataruben Foundation, 2023.

Table 23. REDD+ GHG sources.

SOURCE	GHG	SOURCE SELECTION	JUSTIFICATION OF CHOICE
Woody biomass combustion	CO2	No	According to BCR0002 methodology, CO2 emissions due to woody biomass combustion are not quantified as carbon stock changes.
	CH4	Yes	CH4 emissions will be included if fires occur in eligible areas with woody vegetation cover during the monitoring period.
	N2O	Yes	N2O emissions will be included if fires occur in eligible areas with woody vegetation cover during the monitoring period.

Source: The Cataruben Foundation, 2023.

3.2.3 Time Limits and Periods of Analysis

The Project began GHG reduction activities as of January 15, 2018, with a 20-year crediting period concluding in 2037. These activities are documented and evidenced in the Monitoring Report. All information and projections are made under this scenario described below:

3.2.3.1 Start Date

The start date of the project corresponds to January 15, 2018, date on which the development of conservation activities begins in order to avoid deforestation of forests and the transformation of Wetlands, which translate into effective GHG reductions. This is supported by the *project's Articles of Incorporation*, Letters of Intent signed by the Ecosystem Managers, *field logs of REDD+ activities and wetlands*, *attendance records of REDD+ activities and wetlands training, REDD+ project activities and wetlands implementation supports,* and *supports for contractual enrollment with landowners*. These documents are listed as ***Annex 1.*** */ 1.1 General / 1.1.1 Initiation of activities and enrolled documents 1.1.1 Initiation of activities*.

3.2.3.2 Period for quantification of GHG emission reductions

According to the BCR Standard guidelines (section 10.5) for AFOLU sector projects, the quantification of GHG emission reductions contemplates the following periods:

Accreditation period: January 15, 2018 - January 14, 2038.

3.2.3.3 Monitoring period

According to the BCR Standard guidelines and methodological documents BCR0004 and BCR0002, the project contemplates the following monitoring periods:

Monitoring period V1: January 15, 2018 - December 31, 2021.

3.3 Identification and description of baseline or reference scenario

The BCR Standard states that the baseline represents the sum of the carbon stock changes, included in the Project boundaries, that occurred in the absence of project activities, therefore, the baseline project scenario is established to demonstrate additionality.

The following are the aspects to determine the baseline and additionality scenario, taking as a reference the TOOL BASELINE AND ADDITIONALITY V1.0 of February 2023 and the AFOLU Sector Methodological Documents BCR0002 and BCR0004.

3.3.1 Baseline scenario

The baseline scenario is established taking into account the changes in carbon stocks at the project boundaries, identificating the most likely land use at the start of the project, according to the guidelines established in the AFOLU Sector Methodological Documents / BCR0004 *Quantification of GHG Emission Reductions and Removals - Activities that Avoid Land Use Change in*

Continental Wetlands. Version 2.0 23 June 2022 and BCR0002 *Quantification of GHG Emission Reductions from REDD+ Projects. Version 3.1. 15 September 2022.*

Regarding the additionality criterion, the methodologies define it as the effect of the project activity to reduce anthropogenic GHG emissions below the level that would have occurred in the absence of the GHG mitigation Project or the project activity; therefore, it is established is baseline scenario of the CO2Bio P2-2 Project to demonstrate that the project is additional.

3.3.1.1 Step 0. Project start date

The Project kicked off on January 15, 2018, at which time conservation activities began to be implemented with the purpose of preventing deforestation and land use change in wetlands. These actions are geared towards the effective reduction of greenhouse gasses (GHG) as part of the project objectives.

3.3.1.2 Step 1. Identification of land use alternatives.

In this step, the most likely land use scenarios, which could be the baseline scenario, were identified through the following sub-steps:

3.3.1.1.2.1 Sub-step 1a. Identification of probable land use alternatives in the project area.

Between 1964 and 2008, the population of the Orinoco region grew significantly, from 266,000 inhabitants to 1.45 million. Approximately 63% of this population was concentrated in the piedmont zone. During this period, the annual population growth rate was 4%, exceeding the national average of 2%. In the department of Arauca, the departmental population grew from 102,845 people in 1985 to 256,527 in 2011, i.e. an increase of 143.63%, and in the department of Casanare, the population grew from 47,636 inhabitants in 1985 to 331,734 in 2011, almost 7 times the national average.734 in 2011, almost 7 times greater in a span of 26 years (Dane, 2020); this population increase was driven by two main factors: the agricultural colonization that gained momentum from the mid-twentieth century and the oil boom, which generated the migration of people from different parts of the country. (Viloria de la Hoz, 2009).

Considering the context of the most relevant national and/or sectoral circumstances and policies, as well as the land use history in the area of influence of the project and regional economic trends, the main activities that are developed as realistic and credible alternatives for land use in the scenario without the implementation of the project are presented and described below.

- *Agricultural sector.*

At the end of the 20th century, the agricultural sector was predominant in the four departments of Orinoquia. However, it is important to note that the region's soils have low fertility, which is associated with various physical and chemical limitations. The presence of acidity, high aluminum saturation, susceptibility to erosion and, in general, the fragility of their physical structure make the soils unsuitable for agricultural activities. As a result, extensive cattle ranching is one of the few viable forms of commercial exploitation in the region (Viloria de la Hoz, 2009).

During the period from 2009 to 2014, FEDEGAN reported considerable growth in the department of Casanare, evidenced by a significant increase in the cattle population, which went from 1.6 to 1.9 million head. In parallel, in the department of Meta there was an increase in the number of head of cattle, going from 1.3 to 1.6 million in the same period of time, for the case of the department of Arauca the department's livestock increased by 53.2%, going from 668,000 head of cattle in 2005 to 1,023,500 in 2011. (DANE, 2014).

To continue, according to Viloria de la Hoz, 2009 the Orinoco also has an extensive agricultural area dominated by rice, oil palm, cacao, corn, soybeans and bananas. Between 1996 and 2007, the cultivated area in the four departments of the Orinoco grew by 56% and production by 51%. In 2007, the region had a planted area of 430,000 ha, of which 13% was in the department of Arauca and 25% in Casanare. Tables 24 and 25 show the main crops by area and production in the departments of Arauca and Casanare, respectively.

Table 24. Main crops in the department of Arauca (2000,2005,2011).

ARAUCA						
Product	*2000*		*2005*		*2011*	
	Area (ha)	*Production (to)*	*Area (ha)*	*Production (to)*	*Area (ha)*	*Production (to)*
Cacao	6.004	345	6.450	4.299	13.600	10.205
Cane	816	2.150	1.185	4.076	531	605
Banana	9.372	67.097	8.960	70.660	24.760	334.215
Yucca	5.588	67.868	6.991	86.110	7.985	120.430
Corn	5.521	23.524	3.095	12.088	8.535	35.518
Dry rice	9.788	16.151	15.691	27.863	22.671	36.299

Source: Corporinoquia, 2013.

Table 25. Main crops in the department of Casanare (2000,2005,2011).

CASANARE						
Product	*2000*		*2005*		*2011*	
	Area (ha)	*Production (to)*	*Area (ha)*	*Production (to)*	*Area (ha)*	*Production (to)*
Dry rice	31.521	161.133	44.458	230.447	60.552	257.657
Rice Irrigation	27.378	141.563	20.844	118.075	37.778	172.900
Palm oil	8.782	30.830	11.140	37.998	22.232	87.042
Banana	2.200	18.478	2.263	19.145	2.929	28.204
Soy	500	1.000	300	540	458	824
Honey Cane	1.024	3.683	951	3.748	296	1.126

Source: Corporinoquia, 2013.

According to data reported by DANE for the period 2010-2016, there was significant growth in rice cultivation in the departments of Arauca and Casanare. In the case of the department of Arauca, it went from cultivating 3,423 hectares in 2011 to 16,747 hectares in 2016, representing an increase of 489%. As for Casanare, rice cultivation increased from 65,390 hectares in 2010 to 139,097 hectares in 2016, reflecting an increase of 212%.

According to data provided by the Agustín Codazzi Geographic Institute (IGAC) in 2016, it is revealed that approximately 15.9% of the territory of the Orinoquia has soils suitable for livestock activity, equivalent to an area of 4.02 million hectares. These soils have been identified as suitable and conducive to sustain the presence of livestock, thus providing a solid foundation for the development of livestock in the region. In addition, the report highlights that the second most relevant productive use in the Orinoquia is agriculture, covering approximately 11.3% of the region's total surface area, which corresponds to approximately 2.8 million hectares used for agricultural activities. These data reflect the importance and potential of both livestock and agriculture in the Orinoquia, establishing a solid base for the productive development of both activities in the region.

The other uses that could be developed in the Orinoquia are forestry with 5.07% (1.2 million hectares) and agroforestry with 4.6% (1.1 million hectares), according to the Orinoquia Master Plan, 2016, other large-scale crops such as oil palm and smaller scale crops such as Cacao, coffee, banana, pineapple, corn with outstanding yields are reported, evidencing an increase and participation in the domestic market, representing a great opportunity for the supply of the domestic domestic market.

- *Hydrocarbon extraction.*

According to Viloria de La Hoz, 2019, oil production in the Orinoquia region began in the 1980s in the department of Arauca, specifically through the exploitation of the Caño Limón field. Later, in the 1990s, oil activity expanded to the department of Casanare, with the start-up of the Cusiana and Cupiagua wells. These milestones marked the beginning of an important oil industry in the region, which has had a significant impact on the economic and social development of the Orinoquia.

Until 1996, the department of Arauca was the largest oil producer in the country. However, its position was displaced to second place by the department of Casanare, which maintained its leadership until 2008. It was in that year when the department of Meta was positioned as the main oil producer in the region. During 2005 and 2008, these three departments reported a total production of 132 million and 139 million barrels of oil respectively. These figures demonstrate the relevance and dynamism of the oil industry in the Orinoquia region during that period.

In general terms, between 1990 and 2007, the mining sector in the department of Casanare, mainly driven by the oil industry, experienced significant growth with an average annual rate of close to 17%. On the other hand, in the department of Meta, the average annual growth of the mining sector was 4.3%, while in Arauca negative rates were recorded. However, in the period between 2000 and 2007, the Orinoquia experienced significant changes due to the decline of oil deposits in Arauca and Casanare. This situation led to a reduction in the region's dependence on mining, from 67% to 47%.

Additionally, activities related to hydrocarbons are presented in four main dimensions, for the department of Casanare, in the first place, there are the lands associated with hydrocarbons, which cover approximately 99% of the total area of the department. Secondly, there are the active blocks, which represent about 17.8% of the department's area and are in full exploration and production activity of hydrocarbons. In third place are the licensed areas, which correspond to approximately 9.1% of the department and have permits and licenses for the exploration and exploitation of hydrocarbons. Finally, there are the exploration areas, which cover approximately 50.6% of the total area of the department and are used to search for new hydrocarbon deposits. POTDCAS, 2021. (Government of Casanare, 2021, 46).

According to the Regional Comprehensive Climate Change Plan for Orinoquia, crude oil and natural gas extraction was identified as the main economic activity in the region in 2015. This activity had an outstanding contribution to the Gross Domestic Product (GDP) of the sector at the national level, reaching 74% in that same period. Regarding the departmental distribution, the following percentages were recorded: Arauca with 7%, Casanare with 28% and Meta with 65%. These data highlight the relevance of the hydrocarbon extraction industry in the Orinoquia economy.

- *Illicit crops.*

Although Orinoquia is not one of the regions most affected by illicit crops compared to other areas of the country, it has experienced some presence of these crops, especially in some rural and remote areas. The departments of Arauca, Meta, Guaviare and Vichada have been identified as the areas most prone to illicit crop cultivation in the region.

At the end of the 1990s, Colombia had 160,000 hectares planted with coca, while the department of Arauca was in fifth place with 978 hectares cultivated in

2000, however the cultivated area increased by 280% in 2001 and 2002; however, in 2003 after several eradication campaigns of illicit crops, only 539 hectares were reported in the entire department, later in the period from 2004 to 2007 the area increased reaching 2,116 hectares (UNODC, 2012).116 hectares, and for the period 2008 - 2012 there was a clear trend towards a reduction in the area planted (UNODC, 2012).

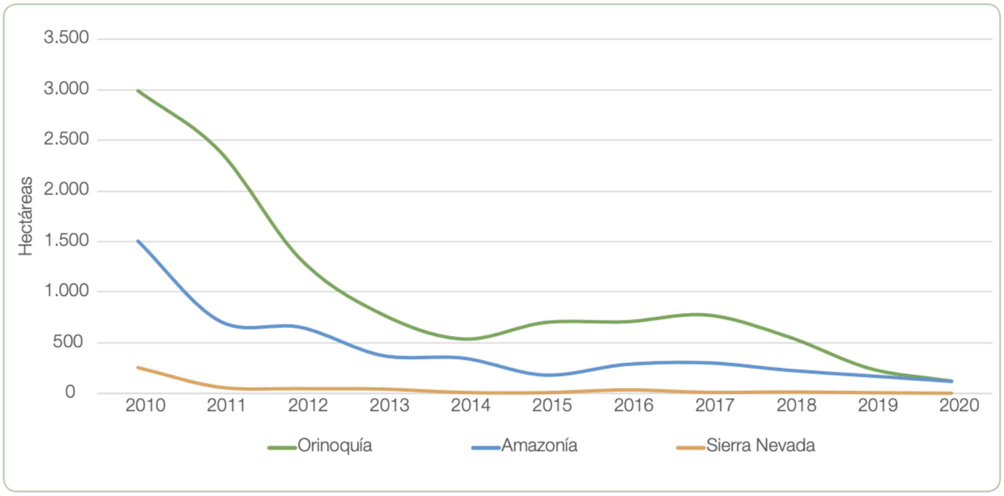
Table 26. Area under coca cultivation in Orinoquia.

Hectares under coca cultivation in Colombia, Orinoquia and other departments									
Department	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Nariño	3.959	9.343	7.494	15.131	17.628	14.154	13.875	15.606	20.259
Putumayo	58.297	66.022	47.120	13.725	7.559	4.386	8.963	12.254	14.813
Goal	11.384	11.123	11.425	9.222	12.814	18.740	17.305	11.063	10.386
Vichada	0	4.935	9.166	4.910	3.818	4.692	7.826	5.523	7.218
Arauca	0	978	2.749	2.214	539	1.552	1.883	1.306	2.116
Subtotal Orinoquia	**11.384**	**17.036**	**23.340**	**16.346**	**17.171**	**24.984**	**27.014**	**17.892**	**19.720**
Total	160.000	163.000	145.000	102.071	86.340	80.350	85.750	77.870	98.899

Source: UNODC, 2012

The Orinoco region has experienced significant agro-industrial development in recent years, which has made it possible to generate licit economic alternatives for the population that previously depended on illicit crops; since then, there has been a sustained reduction, to the point of not registering any expansion processes since 2019 in departments such as Arauca.

Image 13. Historical coca cultivation areas in the Orinoquia, Amazonia and Sierra Nevada regions (2011 - 2020).



Source: (UNODC, 2020)

- ***Continuation of previous land use:***

In the project's area of influence (Orinoco region, departments of Arauca and Casanare), a significant impact has been observed in terms of biodiversity loss and Greenhouse Gas (GHG) emissions due to deforestation and transformation of natural ecosystems. These effects are directly related to the activities mentioned in Sub-step 1a, which include the expansion of the agricultural frontier, industrialization and the extraction of fossil fuels and minerals in the areas of interest.

- ***Projects without certification of emissions reductions:***

This alternative is very likely to occur in the project's reference region, due to the lack of knowledge on the part of territorial and private entities about the operation of climate change mitigation projects and the necessary steps to certify greenhouse gas (GHG) reductions and/or removals.

Several types of non-certified projects were identified within the scope of the project, including: mandatory investment of at least 1%, payment mechanisms for environmental services directed to watersheds and/or conservation agreements. Currently, several governments and municipalities in the departments involved in the CO2Bio P2-2 area of influence are implementing projects that seek to reduce and offset the carbon footprint through activities that have not been certified by a certifying entity. These activities include reforestation plans and conservation of natural parks or recreational areas. Although in many cases these projects address aspects related to REDD+, as mentioned above, they are not usually certified to reduce greenhouse gas emissions.

- ***Other land use alternatives in the project area*.**

Among the most common agricultural practices in the project area is the *planting of dry rice* in the flooded savannah ecosystem, which is very well adapted to the soil and climatic conditions and has a short production cycle. However, the negative effects that this sector is generating are even more relevant: changes in soil use, loss of natural cover, excessive contamination from the use of agrochemicals in water sources, plowing, burning, and the destruction of biodiversity are the consequences that this sector is currently generating.

Therefore, among other land use alternatives within the project area, the implementation of productive activities that allow for the transition from practices that contribute to deforestation and environmental degradation to sustainable and profitable activities is expected. An important focus in this regard is the development of non-timber forest products and green businesses based on the sustainability and proper management of natural forest resources.

The Orinoquia Master Plan (2016), which covers the departments of Arauca, and Casanare, recognizes tourism as an economic activity with great potential in the region, especially considering the growing global demand for nature tourism. According to the definition of the World Tourism Organization (2002), nature tourism encompasses all forms of tourism that are based on nature, where the main motivation is the observation and appreciation of natural environments and traditional cultures. A study conducted by the newspaper La República (Colombia) reveals that traditional tourism products are increasingly being replaced by those that highlight nature, and that contemporary travelers value privacy, freedom of movement, sustainability, tranquility and well-being. This is excellent news for the project areas, which are exceptionally rich in biodiversity, making them one of the most attractive destinations for nature lovers.

In this context, the Orinoquia is in a privileged position to take advantage of this tourism potential, offering unique and authentic experiences in stunning natural settings. The region has a great diversity of ecosystems, from vast plains to tropical rainforests and mighty rivers, offering opportunities for activities such as bird watching, photographic safari, ecotourism, adventure tourism and community-based tourism.

3.3.1.2.2 Sub-step 1b. Consistency of land use alternatives with applicable laws and regulations.

- **Continuation of previous land use**.

The implementation of the *Previous Land Use* alternative in the project area is in line with the laws and regulations promoted by the national government, which are based on the Political Constitution of Colombia and the National Development Plan (2018-2022) entitled "Pact for Colombia, Pacts for productivity and equity in the regions". In the specific context of the Llanos - Orinoquia region, it seeks to establish connections and enhance the sustainable production of food and natural resources in the region, both for the national and international market.

Likewise, the development plans for the department of Arauca "Building the Future 2020 - 2023" and for the department of Casanare "It is Casanare's Time, Productive, Equitable and Prosperous" support the promotion of agribusiness development, livestock and green markets in the region. These plans aim to boost economic growth, foster environmental sustainability, and promote the well-being of local communities.

In this sense, the proposed land use alternative is aligned with national and regional policies and strategies that seek to diversify the economy, promote sustainable production, generate employment and improve the quality of life of people in the Llanos - Orinoquia region. By focusing on agribusiness, livestock and green markets, the project seeks to take advantage of natural resources in a responsible manner, promote sustainable practices and contribute to the economic and social development of the region.

Based on this context, the laws and regulations applicable to this alternative are set forth below;

Article 65 of the Constitution states that "food production shall enjoy the special protection of the State. To this end, priority will be given to the integral development of agricultural, livestock, fishing, forestry and agro-industrial activities, as well as to the construction of physical infrastructure and land development.

Articles 79 and 80 of the Political Constitution impose on the State and individuals the obligation to protect cultural and natural wealth, as well as entrusting the nation with the protection of the diversity and integrity of the environment.

Law 388 of 1997, for its part, establishes that the purpose of municipal land use planning is to complement economic and social planning with the territorial dimension, rationalize interventions on the territory and guide its development and sustainable use through the definition of territorial strategies for land use, occupation and management. Likewise, in 1997, the Ministry of the Environment issued the National Cleaner Production Policy, which seeks to provide a solution to the environmental problems of the productive sectors, preventing pollution at its source.

The Ministry of Environment and Sustainable Development, through Resolution 170 of 2009, delegated the obligation to formulate policies, issue standards, guidelines and promote plans, programs and projects aimed at the conservation, protection, restoration, recovery and rehabilitation of soils.

In addition, in 2011 the National Policy for the Integrated Management of Biodiversity and its Ecosystem Services - PNGIBSE was created, a State Policy that seeks to maintain and improve the resilience of socio-ecological systems at the national, regional, local and transboundary scales.

In sum, in 2013, the National Policy for Integrated Environmental Land Management (GIAS) was created, which provided guidelines to strengthen the environmental planning developed in Colombia, based on the inclusion of the land from its environmental supply.

- ***Projects without certification of emission reductions***:

The national government has established a legal framework that seeks to protect the environment, promote the conservation of natural resources and encourage sustainable production practices:

Paragraph 1° of Article 43 of Law 99 of 1993, amended by Article 216 of Law 1450 of 2011, determines that any project requiring an environmental license and that is executed with the use or disposal of water, taken directly from natural sources, must allocate 1% of the total investment for the recovery, preservation, conservation and monitoring of the hydrographic basin that feeds the respective water source.

For its part, paragraph 1° of Article 174 of Law 1753 of 2015, which amended Article 108 of Law 99 of 1993, enables the forced investment of 1% to acquire strategic areas or ecosystems in the framework of conservation, preservation and recovery of natural resources, as well as to implement in such areas, payment schemes for environmental services or other economic incentives for conservation.

Consequently, Decree 1076 of 2015, Sole Regulatory Decree of the Environment and Sustainable Development Sector in Chapter 3, second section, Title 9, regulates the procedure for the forced investment of 1%. Finally, Decree 2099 of 2016, modifies Chapter 3, second section, Title 9 of Decree 1076 of 2015 as far as procedure is concerned.

Decree Law 870 of 2017 of Minambiente, which establishes payments for environmental services and other incentives for conservation; Decree that has driven the implementation of projects by the Governorate of Casanare and the Autonomous Corporation of the Orinoquia - Corporinoquia.

- ***Other land use alternatives in the project area***:

Although this land-use alternative complies with the regulations and laws established by the national government, it is important to recognize that the production techniques (agriculture, livestock, and mining) used in the Orinoquia region are not the most appropriate. This situation has generated a series of negative impacts on the environment.

Articles 64 and 65 of the Political Constitution of Colombia determine that it is the duty of the State to provide special protection for the production of agricultural, livestock, fishing, forestry and agro-industrial foodstuffs, as well as their commercialization.

In 1997, the Ministry of the Environment issued the National Cleaner Production Policy, which seeks to provide a solution to the environmental problems of the productive sectors, preventing pollution at its source.

Similarly, the Food and Agriculture Organization of the United Nations In Colombia, in 2018, issued the Guide of Good Practices for the Management and Sustainable Use of Soils in Rural Areas, a document in which environmental conditions are determined by which rice planting should be advocated.

In this regard, the Ministry of Agriculture and Rural Development, in February 2019 and within the framework of the National Development Plan (2018-2022), "Pact for Colombia, Pact for Equity" creates the Agricultural and Rural Development Policy (2018-2022) which defines guidelines for the Ordering of agricultural, fisheries and aquaculture production for greater competitiveness.

3.4 Additionality

Regarding the additionality criterion, the methodologies determine as the effect of the project activity to reduce anthropogenic GHG emissions below the level that would have occurred in the absence of the GHG mitigation project or project activity. The "Barrier analysis" and "Impact of project registration" aspects for determining additionality are listed below, taking as reference the TOOL BASELINE AND ADDITIONALITY V1.0 of February 2023 and the AFOLU Sector Methodology documents, BCR0002 and BCR0004.

3.4.1 Step 2 - Barrier analysis

The CO2Bio P2-2 Project demonstrates that it is additional through an analysis of barriers, which are identified and evaluated to demonstrate that the project's conservation and greenhouse gas (GHG) emissions reduction actions are additional to and go beyond what would have been realized in the absence of the economic incentives provided by the sale of carbon certificates. These barriers represent obstacles that hinder or prevent the implementation of the proposed actions and are critical to demonstrating that the project is a real and effective contribution to GHG emission reductions.

Some of the barriers identified in the analysis may include:

Prevent or limit the implementation of this type of GHG project; and

They do not preclude implementation of at least one of the likely land use alternatives.

3.4.1.1.1 Sub-step 2a. Identify barriers that would prevent project implementation.

The CO2Bio P2-2 Project, within the framework of its implementation, managed to identify different barriers that may limit its sustainability in the action window, among which the following stand out;

3.4.1.1.1 Investment barriers, among others:

- *Debt financing is not available for this type of project*:

One of the main barriers to implement GHG projects is the lack of opportunities that exist in the Colombian market to obtain financial leverage, since these projects behave differently from sectors such as agriculture, manufacturing, livestock and hydrocarbons. To support the above, it is necessary to evaluate the main means in the search for resources for climate change mitigation projects, which 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 a stable, governable and direct financing for the implementation of GHG project activities, given the institutional weakness partly caused by the deficit in the country's balance of payments, specifically during the period projected for the validation, verification and certification process of this project.

As evidenced by the reports on the behavior of Colombia's balance of payments published quarterly by Banco de la República (Banco de la República de Colombia, 2021); and to the lack of political will that is represented in the citizen's vision by the high index of institutional distrust, as exposed in the methodology and the protection of the Social Capital Barometer (BARCAS) in its fourth and last study made[6] , which shows that 79.6% of respondents have little or no confidence in the national government (CONTRIAL, 2017).

However, the Colombian government through the Ministry of Environment and Sustainable Development and the Ministry of Finance have implemented different programs and mechanisms, such as PES (Payment for Environmental Services Program) to manage and encourage conservation and restoration actions of various strategic ecosystems, where the beneficiary can become creditor of the resource directly or indirectly, in cash or in kind. Nevertheless, this program does not guarantee that these resources will be used exclusively for the reduction of greenhouse gas emissions, the commercialization of carbon certificates and the compensation of the carbon footprint of natural and legal persons; and 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), only 30% of the resources obtained are destined for conservation areas and strategies, This does not ensure the availability and possibility of access to this funding for the properties of the enrolled Ecosystem Managers, nor does it determine tools to ensure and monitor the correct allocation of funds and implementation of actions in specific cases.

At the same time, there is no evidence at the national level of financing strategies specifically for forestry activities "adequate for sustainable forest management, because existing local resources cannot be applied to the management of native forests and forest plantations, due to a lack of operational mechanisms such as a forest bank or fund", (United Nations Development Program & Viteri, 2010), as reflected in the document analyzing the forestry sector in the context of adaptation and mitigation to land use change, land change and forestry (forestry) sector in Ecuador. Viteri, 2010), as

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

reflected in the document analyzing the forestry sector in the context of adaptation and mitigation to change in the land use, land change and forestry (forestry) sector in Ecuador, but which to a large extent reflects the Latin American context and 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 properties that belong to it, forcing potential implementers of GHG projects that do not meet this financial support not to participate in actions that positively impact the environment and to opt for other land use alternatives such as agriculture where there are offers to finance this type of productive activities; And the project implementer to sectorize the community to be benefited by their economic capacity and not by the environmental impact they mitigate.

Additionally, the conservation activities carried out by the owners of these properties to ensure the reduction and/or removal of CO2 emissions and protection of the biodiversity that 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 by the implementation of these actions, since it does not represent an income but on the contrary an outflow of money, ie, there is no internal rate of return, which reduces the possibility of financial leverage with an external. Therefore, the alternative of implementing other types of activities other than GHG projects that represent profitability is left open, in order to find governance in their finances.

- There is no access to capital markets due to real or perceived risks associated with domestic or foreign direct 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 local conservation of biological and genetic diversity", (Droste & Dogse P, 1994)". However, despite the above premise, there is evidence of limitations in the implementation of the project in terms of access to an investment capital market at the national and international level.

For example, with respect to the General Royalties System for the year 2021, only 8% of the country's resources were allocated for the operation of the Ministry of Environment and Sustainable Development and 10% for the Ministry of Agriculture and Rural Development (National Planning Department, 2022), hence those operating resources allocated for these sectoral ministries distribute the income in their different government programs, which does not guarantee 100% access to this type of public investments and in terms of Foreign Direct Investment for the year 2021 there was evidence of a null allocation of resources to environmental issues according to reports of the Banco de la República, (Banco de la República de Colombia, 2021), and the quarterly report on foreign direct investment in Colombia total and by economic activity, (Banco de la República de Colombia, 1996).

Therefore, access to capital markets in national or foreign direct investment for this type of projects generates a high uncertainty, this is due to the country's economy, security, political stability of the same, the transformation of soils, the extraction of raw materials that continue to affect climate change and at the microeconomic level the risks of permanence of the areas subject to implementation, the costs of validation, verification and certification, and the little knowledge on the subject by the private sector.

On the contrary, access to the capital market is led by direct investments in issues that go against environmental care, that is, mostly driven by national and international investors that inject financial capital to a large extent to unsustainable agricultural activities, to the extraction of oil and its derivatives, among others, especially in protected areas or with large offers of natural resources exploitation in private properties. This barrier translates into an opportunity to open new capital markets to achieve a sustainable economic transition, with the purpose of implementing GHG projects through the financing of carbon credit trading and with respect to the adaptation of the use of these ecosystems in sustainable productive and conservation actions in the framework of local economic development (Vázquez Barquero & ECLAC, 2000).

On the other hand, although today sustainable economic growth is accelerating in the world and with it different ways of allocating funds to investments with environmental benefits, such as the issuance of thematic bonds, especially green bonds that refer to a fixed-income debt for projects that mitigate climate change. it is analyzed that:

1. This refers to an indebtedness that even if it means lower rates, it is still a debt that needs collection and that projects such as CO2Bio P2-2 without participation in the carbon market could not cancel these portfolios because it does not foresee any other way to raise resources.
2. This type of bonds are not so common, "according to the BVC, Colombia has issued 20 bonds with specific destination of resources between December 2016, when the first green bond of Bancolombia was issued (this entity was the second in the market with IFC), until May 2022, with a social bond of Bancóldex" (Capital Inteligente Grupo Bancolombia, 2022)
3. It represents an underlying portfolio "especially green projects due to the high specifications in technological matters make them costly initiatives so that for many companies they become financially unfeasible, consequently, the great challenge is to see how governments leverage the financial part of these projects"
4. Since there are no government policies that exponentialize the lung that exists in Colombia, there are no investors that come to the capital market to buy issues such as those mentioned
5. The standards to define how to access are framed in international standards that become difficult to adapt in a national legislation.
6. Finally, the lack of access to capital markets associated with foreign and national direct investment can be analyzed due to the lack of knowledge of the existence or not of investment mechanisms interested in working with communities of private properties, which aim at the implementation of biodiversity preservation activities accompanied by the establishment of sustainable productive practices, so that this could bias the possibility of accessing a diversification of markets, which also determines a notorious barrier to investment indirectly.

- Lack of access to credit:

Although 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 those framed in Co2Bio P2-2, nor does it frame the characteristics of all the enrolled 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.

Additionally, since 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 obligation of collection in the medium and long term, even when there are subsidiary rates, thus avoiding a sinister portfolio, so they seek figures to support the loan, such as co-debtor, credit history, gross equity, cash flow, financial projections based on financial modeling, documents of title, among others, which in most cases are not within the reach of the ecosystem manager.

On the other hand, the increase of usury percentages in Colombia have had an increase of up to 58.8% for microcredit interest rate for the first quarter of 2023, with respect to the current banking interest rate stipulated by the Financial Superintendence in resolution 1968 of 2022 multiplied by 1.5, reducing the ranges of financial sustainability for the borrower in the short term 0.5, reducing the ranges of financial sustainability for the borrower in the short term. Likewise, the lack of knowledge of a correct financial evaluation can lead to bad debt decisions and therefore not provide sustainability to both the implementation of GHG projects and the owners who wish to finance their conservation activities.

Thus, there is clear discrimination in accessing credit due to these systemic barriers of banking, additionally, the time, conditions and behavior of the projects in terms of operability and guarantee in the permanence of the areas subject to conservation, slows down the implementation of GHG projects in economic terms, even having clear that this type of project demands a substantial growth in income to ensure the conservation of ecosystems and biodiversity that is housed there.

Furthermore, banking represents a high index of institutional distrust by Colombians with a percentage of 69.6% according to the latest BARCAS report (CONTRIAL, 2017), which shows that citizens do not access these financial products and services given a predisposition of negative perception towards this type of provider.

3.4.1.1.2 Institutional barriers, among others:

- Risk related to changes in government policies or laws:

The normative regulation is generated to establish adequate rules of coexistence for society in general in different aspects that are developed in their environment, since it is through these that it is possible to mediate or attack in a direct way different situations that arise in the day to day, with the sole purpose of achieving a balance in the personal interests of the same, as the social without affecting the other.

Colombia has undergone several changes regarding the normative regulation that directs or establishes parameters in areas or topics that are related to environmental projects, these changes generate legal uncertainty in some opportunities, since they are regulations that are generated in relation to projected activities in the future, so there would be no certainty about what may affect or modify the parties, according to the step by step established internally that allows them to become allies complying with all the requirements for the date in force both in the current regulations and in the policies and methodologies applicable to the case.

At present, all projects are adjusted to the standards and methodologies established for this purpose, additionally the National and International regulations that are applicable given the intention and need of each one are verified and included, with the sole purpose of ensuring compliance with them and mitigating legal risks against barriers that may be encountered in terms of types of tenure. For this purpose, a control is kept in the regulations matrix that is reviewed and adjusted quarterly and annually according to the updates that are generated, controls that are established in the Legal Requirements Procedure and others GJP-14 of the project owner's management system.

- Lack of enforcement of legislation on Continental Wetlands or that related to land use:

In the regulations that currently apply to the ecosystems that are related to the projects with the objective of generating their conservation, we identified regulatory provisions, policies and methodologies for forest areas, which on the contrary, we did not find evidence of methodologies or policies for the ecosystem of Continental Wetlands, which is reduced in a way that limits the development of activities to identify the quantification of removals and/or GHG reductions in these. However, at The Cataruben Foundation we always implement strategies aligned to the conservation and non-transformation of these ecosystems, taking into account the scarce normative regulation that applies to them.

Wetlands are ecosystems that exist where the primary basis of its existence is water and there generate life to flora and fauna that is directly related to it; through Law 357 of 1997 the Ramsar Convention was adopted, which is the only compiled legislation for Colombia dictates rules that regulate and protect activities around wetlands, classifies them and establishes obligations and invites the states parties to generate strategies to protect them.

3.4.1.1.3 Barriers due to social conditions, among others:

- Demographic pressure on land (e.g., increased demand for land due to population growth):

The Orinoco region over time has been marked by mirages and imaginaries in several of its most general aspects, and these, in some way, are reflected in its territories and in the immense diversity it harbors (culture, society, economy, etc.), but do not go beyond mere symbolic representations that do not attest to the reality of a territory (Herrera, Rugeles, Sotelo, Vega & María, 2014).

The region, also known as the *Llanos Orientales,* is known specifically for its natural wealth and raw materials, where hydrocarbons and minerals played a crucial role in initiating a migratory diaspora from various parts of the country, which exponentially increased the already massive population of the region (Jiménez, 2012). Thus, this migratory process may represent an important barrier for the activities framed in the project, since it had as a principle the growth of hydrocarbon exploitation, the boom in cattle raising and agro-fuel.

Consequently, a parallel effect is the gradual emergence of illegal groups and the concentrated appropriation of large tracts of land by a small group of the population, which inevitably led to inequality in the distribution, access and ownership of the land, and significantly increased the demand for it (second barrier).

Extensive agriculture is also identified as an important barrier to overcome. Among the most important agroforestry systems for the economy, and at the same time the most problematic for the environment, is the cultivation of rice. In general, it represents 70% of the daily caloric consumption in the country, with Colombia being a producer of around 2.6 million tons per year, and the Llanos Orientales, characterized by containing extensive crops, reaches an area of around 222,687 ha, of which 129,562 ha have been planted in Casanare (DANE and FEDEARROZ, 2018).

According to the above figures, the importance of this crop (especially in Casanare) is capital, which has meant a demographic, technical and even ethical challenge for Cataruben, seen that the implementation of rice implies the negative transformation of the territory (or directly destruction) of native ecosystems, which to some degree CO2Bio P2-2 intends to counteract.

Consequently, the increase in population and the demand for land in the region are evident barriers for the Project, and not only due to a migratory process, which involves (even today) the displacement of foreign families, for an almost eternal search to improve their material conditions of existence. Thus, taking advantage of the important natural and energetic wealth of an unknown territory for them. It is also important to consider that the lands of the orinoquía are ideal for the implementation of cattle raising and some types of agroforestry systems (rice), which has led to the emergence of large estates headed by landowners, who create the conditions for speculation on land rent, and also enjoy important oil deposits in the departments of Arauca and Casanare (Jiménez, 2012).

- Social conflict among stakeholders in the region where the project is developed:

The region of the Llanos Orientales, prior to the enactment of the Magna Carta of 1991, was part of a confusing group of commissariats and intendancies. This, in a way, meant that this huge area was usually considered as "distant", "dangerous" or "little explored". Being, in a way, colonized and managed through a constant struggle among its inhabitants.

That said, it is worth mentioning that since the 1940s (and to date), various guerrilla and paramilitary structures have fought for territorial control of the Colombian Orinoquia. And throughout the eighties and nineties of the last century, this territory was held captive by the Revolutionary Armed Forces of Colombia (FARC) and the National Liberation Army (ELN). To this day, the ELN maintains an almost exclusive stronghold between Arauca and Norte de Santander, an important territory because it represents a border and oil area (Observatorio ODDR, 2013), always threatened by the strengthening of paramilitary groups.

But the conflict is not limited to the emergence of illegal armed groups or to the violence that has arisen as a result of ignorance and the lack of a strong state presence in the region. The conflict also refers to the appropriation and use of land, a colonial legacy that has marked and determined the relationship with a little explored territory. And as mentioned in the previous point, there is a constant tension due to the unequal distribution of the territory. This has been reinforced by the strengthening of practices that have already taken root in the collective “llanero” memory. One example is the practice of cattle raising, which is basically the most important productive activity, not only because of its material value, but also because of its symbolic value. Mainly because it defines the *"llanero"* or "llanera" culture, which is defined by distinctive signs such as: the skill with *the "lazo", the "rejo"* or the skills involved in horseback riding (Chaura, 2012).

But the not so positive aspect of this practice lies in the fact that as an economic practice, it occupies about 90% of the productive areas of the region. Thus, it represents one of the most common forms of employment in the area, being the departments of Casanare, Arauca and Meta where the largest number of cattle destined to the food sector between milk and meat is concentrated (ICA, 2020).

This brief political and social panorama presents a context to be taken into account when addressing the conflict, that is, struggles that in some way have forged the *llaneridad* being fundamental to scrutinize and understand it not only to be able to read the way communities relate to their territory, but also to be able to execute and reproduce the practice of conservation, protection and restoration of the territory in a successful way.

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

There are several illegal practices present in the country that can represent important barriers for this kind of conservation and ecosystem restoration projects, but one of the most representative are illicit crops. And Colombia, for more than 40 years, has had the sad role of being one of the main producers of coca leaf on the planet, according to data from the Illicit Crop Monitoring System (SIMCI, 2021).

In particular, the Orinoco region, being a frontier zone with constant changes in land ownership and use, is a territory with a relative density of this type of crops, being the departments of Arauca, Meta and Vichada the most representative ones. However, the obvious consequence of the implementation of these crops (coca and marijuana) is the deforestation of natural ecosystems. This, in turn, is closely related to poverty in *rural* areas, the armed conflict and little or no interest in the conservation of animal and plant species in the territory.

Despite the above, in the Llanos Orientales, and for several years now, there has been a constant process of agro-industrial strengthening that has meant the gradual adoption of legal alternatives for agricultural production. This, as a response from the National Government, has provided options to families that were economically dependent on these crops, an example of which is the Cacao bet, introduced as a gateway to legality for the most remote farmers of the Llanos Orientales.

According to data from the Monitoring of Territories Affected by Illicit Crops (2020), conducted by the United Nations Office on Drugs and Crime (UNODC). Coca cultivation and its subsequent transition to cocaine have shown a progressive decrease in the orinoco region. Accordingly, in 2005, about 9,709 ha of coca cultivation were reported, but by 2020, there were a staggering 121 ha under cultivation. This shows a decrease of 99%, which means that as of 2018, the territories comprising the Llanos Orientales contain less than 0.5% of cocaine crops in the whole country (SIMCI, 2021).

Illegal mining also represents a barrier to be taken into account by The Cataruben Foundation in order to successfully implement the activities framed from the beginning by the Project. This is due to the fact that this practice is as old as cattle ranching itself, and the orinoco region is characterized by having an important potential in the reserve of minerals considered as strategic.

However, there have been efforts by the national government that have focused strategies to declare some areas of the Orinoco region as *strategic mining areas (*Agencia Nacional de Minería, 2012). Through this regulation, it is expected that these areas will be under the regulations for both exploration and exploitation, and in turn will be subject to auctions by the National Mining Agency. It is also expected to formalize traditional mining and curb illegal mining and its harmful consequences on ecosystems. Although the departments of Casanare and Arauca do not have a large reserve of so-called *strategic minerals* (compared to Meta and Vichada), they are affected to some degree by these exploratory activities, which makes it necessary to take them into account as a latent barrier to the full and successful implementation of the project.

- Lack of skilled and/or properly trained labor:

The conscious management of land use, natural resources and the protection of the natural ecosystems of the Orinoco region is a constant concern for the CO2Bio P2-2 project. For this reason, the activities configured from the Project aim at strengthening these *conscious practices* when thinking about the territory that surrounds us. This territory, which a priori is considered exclusively suitable for extensive cattle raising, reserving certain areas for agriculture in the *Piedemonte* llanero and terrace areas located in the north, where the risk of flooding is constant and common because they represent alluvial soils located in the meadows of the largest rivers, as in the case of the departments of Casanare and Arauca (Riveros, 1983).

The barrier identified in this regard is precisely the lack of information on alternative strategies for land management, conservation and restoration of natural ecosystems in this area. These ecosystems are suffering, with increasing violence, the negative effects of so-called *agricultural development.* This has been a constant conflict for decades between those who concentrate their efforts exclusively on economic development and the accumulation of wealth, and those who show an eagerness for the conservation and restoration of the native biodiversity of the region (Riveros, 1983). Cataruben concentrates its efforts to overcome this barrier, mainly in achieving synergism between these two ways of thinking or tendencies, which would imply the administration of the natural resources of the area of influence of the project in order to strengthen the material conditions of existence of its inhabitants, without compromising the integrity of the native species and their habitat.

In short, the project aims to strengthen the scientific, symbolic and material means of the inhabitants to achieve this articulation, contributing to the development of the region. And thus managing to project the negative impacts of traditional productive activities, gradually transforming them into a constant improvement, where development does not imply, only, the environmental wear of the intervened or neighboring areas.

- Lack of community organization:

As is well known and has been made clear in the previous sections, the Orinoco region is characterized as a heterogeneous territory both in its geography and its cultural richness. And taking this into account, the communities present in the area of influence of the project, that is, the departments of Casanare and Arauca, combine the presence of indigenous population or communities, Afro-descendants and llaneros criollos or *llaneros originarios (*Piñeros, 2019). The latter represent the target population for conservation projects such as Co2Bio P2-2, and this is so because it implies 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 Integral Development of the Orinoco: Altillanura - Phase I (2014) which resulted within the provisions of the National Development Plan 2010-2014: *Prosperity for All.* This document focused on an analysis of the Altillanura orinoquense, addressing its social, cultural, geographic and economic aspects. The data from this analysis set alarm bells ringing due to the evident mismanagement of the public sector, which meant an indifference regarding the administration of public and natural resources, the environmental fragility of the territory and social stability. These aspects are, of course, 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 make possible an egalitarian and inclusive development that would level the scales in order to achieve sustainable development.

However, the CONPES is not the only tool identified that would point to the organization of the territory and its inhabitants. Additionally, a second strategy is the *Orinoquia Master Plan* between 2014 and 2018, it was supported by a strategy for the region called "Environment, Agriculture and Human Development: Growth and Wellbeing for the Plains" of the NDP 2014-2018. This document was shaped using as its main input the information provided during the presentation of the regional dialogues that had the purpose of shaping it.

In particular, 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). Thus, trying to create a bridge between legal security and possible investments in the region, which contemplates tourism, transportation, agriculture, and of course, environment and water resources.

Likewise, a third strategy occurred in 2017 when the "Regional Comprehensive Climate Change Plan for the Orinoquia " (PRICCO) was established, developed in Meta, Vichada and of course in Casanare and Arauca. This document reinforced the urgency of achieving an integration between climate change and the possible relationship between the management processes and the development of the region and 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 we can precisely count the "Llanos-Orinoquía Region Pact: Connecting and enhancing the sustainable pantry of the region with the country and the world". Basically, the aforementioned document made evident the relationship of such a pact with the productivity pact, legality, equity for ethnic communities (in the field of opportunities), and of course, environmental, economic and social sustainability (DNP, 2019).

In short, the lack of community organization, *per se,* is not an insurmountable barrier to the successful development of the activities configured from CO2Bio P2-2. The most logical barrier detected is the lack of a precise and forceful implementation of the strategies and pacts summarized above, either due to bureaucratic inefficiency or corruption itself. However, it is evident the influence they have had in highlighting in the collective imagination of their inhabitants the concern for issues such as: climate change, ecosystem conservation, and the relationship between sustainable development and environmental care. In other words, there is still a long way to go, but the foundations have already been laid and the rural communities are more informed, opening up the possibility of being more open to alternative ideas or processes for understanding and relating to their territory.

3.4.1.1.4 Barriers related to land tenure, ownership, inheritance and property rights, among others:

- Land ownership, with a hierarchy of rights for different stakeholders, limits the benefits for undertaking the project:

In Colombia and specifically in the departments of Arauca and Casanare, where the project is being implemented, it has been identified that land ownership has presented a representative inequality, where a small percentage of citizens have title to the real estate within their current location or domicile, the remaining population only exercises it in an irregular manner. It has been approximately 40 years that the National Government has been trying to generate strategies and agrarian reforms that allow the availability of resources to offer the community in general benefits or economic subsidies for the purchase of land, which slows down the process of formalization of ownership and the proper exercise of governance over them, as a result, processes of possession of properties are generated in a regular and irregular manner, which means that there is no document that reliably proves the ownership of such property.

The beginnings of the legal regulation of property in relation to real estate is given with constitutional provisions, where the recognition of fundamental rights such as private property and collective property is indicated or indicated, with a social purpose, which is the improvement of the quality of life of Colombian citizens.

In the departments of Casanare and Arauca over the years, the right to private and collective property has been violated and/or affected by different factors, one of them and the most common is the armed conflict which has generated displacements and lack of governance over the properties, however under reparation strategies by government entities a large percentage of citizens have resumed the exercise of ownership of their real estate.

In addition to the above, we identified in the Colombian Civil Code provisions on the tenure that is generated against the assets of both natural and legal persons, establishing in its clauses, the classification of this in property, possession and/or tenure, however this does not generate a hierarchy of rights but on the contrary guidelines that guarantee the quality of each Ecosystem Manager to be enrolled in The Cataruben Foundation's projects. The barriers are configured when in the legal analysis of the documentation provided by the applicants it is not possible to identify reliably if they act as owner, possessor and/or holder, that is why a joint work is generated between the parties (interested party-Project holder), in which it is indicated which documents are suggested to provide to be certain of it or if they do not have these, which is the process to follow to go to the competent entities to carry out the due steps, advice is provided to them.

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

In Colombia and specifically in the departments of Arauca and Casanare where the project is being implemented, it has been identified that land ownership has presented a representative inequality, where a small percentage of citizens have title to the real estate within their current location or domicile, the remaining population only exercises it in an irregular manner. Approximately 40 years have passed in which the National Government has been trying to generate strategies and agrarian reforms that allow the availability of resources to offer the community in general economic benefits or subsidies for the purchase of land, but their effects have not been as expected. This slows down the process of formalization of property and the proper exercise of governance over them, as a result, many times there are regular and irregular processes of possession of land, which means that there is no document that reliably certifies the ownership of such property.

The beginnings of the legal regulation of property in relation to real estate is given with constitutional provisions, where the recognition of fundamental rights such as private property and collective property is indicated or indicated, with a social purpose, which is the improvement of the quality of life of Colombian citizens, but its protection has not been absolute because there are rules that interfere in a parallel way in private property in which the general welfare prevails over the particular.

Additionally, over the years in the departments of Casanare and Arauca where the project is being developed, the right to private and collective property has been violated and/or affected by different factors, one of them and the most common is the armed conflict which has generated displacements and lack of governance over the properties. However, it has been an arduous task of the government authorities under reparation strategies to repair these damages and guarantee a large percentage of citizens to retake the exercise of ownership in their real estate that for some reason lost the domain of these.

There are regulations that have expressly established provisions on the tenure of real estate, under which we identify the Colombian Civil Code, which identifies not only the exercise of ownership by natural persons but also by legal entities. The code classifies the tenure in property, possession and/or tenancy, however, this does not generate a hierarchy of rights, but on the contrary, guidelines that guarantee the quality of each Ecosystem Manager to be enrolled in The Cataruben Foundation's projects.

There are barriers within the execution of the planning and execution process of the projects when in the legal analysis of the documentation provided by the applicants it is not possible to identify reliably whether they are acting as owner, possessor and/or holder, which is why a joint work is generated between the parties (interested party-Project owner). This is why a joint work is generated between the parties (interested party-project owner), in which the minimum documents that are suggested to be provided to be certain of it or if they do not have these, which is the process to follow to go to the competent entities to make the necessary arrangements, for which advice is provided to them by the legal team with which the entity has.

- Absence of clearly defined and regulated property rights in relation to natural products and services:

As previously mentioned, private and collective property in the departments where the CO2Bio P2-2 project was generated, there have been different situations that have limited the accreditation of land tenure with the formality that this requires before the competent entities. Additionally the lack of knowledge of the rules and procedures has also had implications, conditioning many of these citizens to exercise the governance of the properties and direct the exploitation of these to agricultural activities, oil activities and livestock.

Considering that the national legislation contemplates a regulation to the types of land tenure in Colombia, ownership analyses are generated that allow Cataruben to identify which person has such quality and preference over a real estate property and all the benefits that are generated from this around any legal act involving the same.

During the process of legal analysis of ownership previously established by The Cataruben Foundation, all the documentation provided by the interested parties is studied and reviewed, which allows us to have certainty about the ownership of the Property and the quality of the person who applies for the project, which allows us to clearly identify that this person can dispose of the property without barriers or limitations and also benefit from any legal act related to it.

As a result of the above, a legal analysis of the documents that make up the tradition of 297 properties has been carried out, in order to determine their legal status with respect to ownership, encumbrances, precautionary measures or limitations to the domain that could affect the development or execution of the project; as a result of this analysis it was possible to establish the carbon ownership of 124 properties, which are contractually enrolled with the owner of the project.

Thus, from the analysis of the documentation provided by the interested parties, there were 170 properties in which three general situations were evidenced that prevented them from being enrolled because they were not considered legally viable properties: **(i)** the first of these is reflected in the impossibility of accrediting the minimum requirements for enrollment to determine the quality in which they exercise land tenure; **(ii)** the second can be glimpsed as the informality in land tenure, taking into account that whoever holds the quality of owner, possessor or holder, has died and the inheritance process has not been initiated or is in progress; and finally, **iii)** the third situation has to do with the annotations of precautionary measures or limitations to the domain registered in the real estate registration folios, which in the future may affect the permanence in the Project.

It follows from the above that, to the extent that property rights can be transparently demonstrated, rights to the benefits generated by the reduction of emissions or removals of greenhouse gasses in the execution of the project can be demonstrated.

- Formal and informal tenure systems that increase the risks of land fragmentation:

To address this issue it is important to establish the difference between ownership and possession of real estate, terms that differ in that possession is the right of a natural or legal person to use, enjoy and enjoy the property, while ownership is the right of dominion over it. Possession is one of the forms of holding a real estate property, however, certain requirements must be complied with according to the law in order to achieve the acquisition of the ownership of the property.

Possession is generated in two ways, one of them denominated according to the regulations governing this matter, in a regular way and the other irregular, one by exercise of the occupation and enjoyment of the property in good faith, through a fair title held by the holder such as sale, exchange, donation, among others, while the irregular refers to the type of possession that lacks what is related in the previous item. Situations that may give rise not only to disputes over the ownership of the Property, but also to processes that allow both the formalization of the ownership and the restitution of the real estate to whoever proves to be the owner.

In this way, it could be mentioned that many of the properties that are the object of occupation by some people tend to be subtracted from a larger property or simply generate the exploitation, use and enjoyment of a percentage of the land and not all of it.

3.4.1.2 Sub-step 2b. Show that the identified barriers would not prevent implementation of at least one of the identified land use alternatives (except the project activity).

Taking into account the analysis of the barriers previously mentioned, in view of the land use scenarios identified in sub-step 1a, the most probable land use alternative to define the project baseline (different from the project activity) is the continuation of the previous land use, given that none of the barriers prevent the continuation of the activities that have been historically developed in the territory.

For the case of projects without certification of emissions reductions, the main barrier to implementation is the lack of funding or investment of resources, and for the scenario of other land use alternatives, the investment resources of the institutions that lead this type of program are limited, so the availability of funding is considered unlikely.

It is important to note that within the project area, the livestock and agricultural sector continues to play a crucial role and continues to be the main source of income for landowners; there are also regional and national regulations and development plans that promote agricultural development in the Orinoquia region. For this reason, the project focuses on promoting sustainable agricultural and livestock practices, encouraging the proper use of natural resources and their conservation, seeking to establish a balance between economic development and the protection of the natural environment, with the objective of guaranteeing responsible and sustainable land use in the Orinoquia region.

3.4.2. Step 3. Project registration impact.

CO2Bio P2-2, with the certification and registration process reduces the impact of the barriers identified above; a process that finaly generates the following benefits:

- Reduction of greenhouse gas emissions by avoiding changes in land use:

The project manages GHG reductions by avoiding deforestation in forest areas and the transformation of Wetlands, efforts that translate into verified carbon credits (VCC), its commercialization becomes a valuable source of investment resources that drive the implementation of project activities, essential to address practices and factors that pose a threat to forests and wetlands in the region.

- The financial benefit of the proceeds from the sale of VCCs, including the certainty and predicted timing of the proceeds:

To make possible the delivery of economic benefits to landowners that make possible the non-transformation of ecosystems and their conservation in the project area, we start initially with a financial analysis, taking into account the monitoring period (initial investment required by the project) and the period of quantification of GHG reductions (action window), thus achieving a financial projection from 2018 to 2037 regarding the verification and certification processes and from 2023 to 2037 period in which 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 VCC inventory is projected according to the quantification analysis and therefore the income generated, so then results are determined through financial indicators, such as the income statement and cash flow which represent the economic performance of the project during its life cycle.

These indicators show a positive financial performance both for the ecosystem manager, thus financing the conservation activities of the ecosystems, and for the sustainability of the project, with a positive net financial projection, i.e., once the total expenditures are projected with respect to the total income during the execution period, it can be concluded that there is sufficient liquidity and solvency to give 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, especially in the financial indicators tabs *(**Annex 1** / 1.1. General / 1.1.6. Financial model*).

Finally, the project establishes guidelines regarding the rights and ownership of carbon 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 technical, financial, scientific, commercial, administrative, operational and monitoring and reporting processes during the accreditation period.

3.5 Uncertainty management

Uncertainty is determined by the accuracy of the maps used to estimate the emissions calculations and the use of field-reported information.

Thus, for the 2012 and 2018 land cover maps it was not necessary to perform the uncertainty analysis because they are national maps, generated by IDEAM that meet this requirement.

For monitoring to the year 2021, satellite images from Landsat 8 OLI-TIRS sensor were used, which provides satellite images with a temporal resolution of 16 days, spatial resolution - pixel size 30*30 meters (compatible with scales 1:100,000). By means of which the interpretation of coverages was carried out.

After interpreting the land coverages, quality control of the reported information is performed through the FC-GOF-09 format Quality control of land cover interpretation. The accuracy evaluation (GOG-26. AcATAMA Instructions) (Annex 1>AcATAMA accuracy results) is performed through the QGIS plugin called "AcATAMA v23.4". It was validated with field views and with satellite images of better resolution than those used for the interpretation, in this case the Sentinel 2A-B satellite was used, spatial resolution of 10*10 meters and high resolution images of sensors such as WorldView 2 and WorldView 3 from the Maxar constellation. The accuracy result for the land cover map year 2021 was 98% (Image 14, accuracy result), which indicates compliance with the methodological requirement that establishes accuracy higher than 90%.

Image 14. Accuracy of the 2021 land cover map through the Corine Land Cover methodology, according to the AcATaMa complement, Wetlands.

```
2) Accuracy:


Overall:

;Overall Accuracy;Standard deviation

;0.98466;0.01534
```

Source: AcATAMa, 2023.

Likewise, the non-forest forest maps used for the analysis of the REDD+ component are reliable inputs, generated by a state entity (IDEAM through the SMByC), adopted by the Republic of Colombia as the forest and non-forest area maps, due to the above, it is not necessary to perform uncertainty analysis because the map has already undergone these processes in its generation.

On the other hand, for the estimation of the uncertainty of the emission factors, formula 15 of the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities[7] " was used:

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

Where:

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

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

[7] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v4.2.pdf

S_i^2	Variance of biomass per hectare in stratum *i;* $(t\ d.m.\ ha^{-1})^2$
W_i	Ratio between the area of stratum i and the sum of the areas of the biomass estimation strata (i.e, $W_i = A_i/A$)
n_i	Number of sampling plots in stratum *i*
b_{TREE}	Average biomass per hectare in stratum *i*; $t\ d.m.\ ha^{-1}$

Thus, the uncertainty analysis for the Wetlands emission factors yielded values of 16.38% and 19.58% for total biomass and soil organic carbon pools (Tables 27 and 28). Under the guidelines of methodology BCR0004, section 15, the use of data with an uncertainty of less than 20% is accepted; however, in the event that the uncertainty exceeds 10%, the lower value of the 95% confidence interval should be applied.

In this order of ideas, to define the emission factors for the Wetland component, the lower value of the confidence interval for the Total Biomass and Soil Organic Carbon pools will be applied.

Table 27. Uncertainty analysis for total biomass in Continental Wetlands.

UNCERTAINTY						
Uncertainty	**bTREE**	**tVAL**	**Stratum**	**Wi**	**S2**	**n**
16,38 %	2,243	1,740	Dispersed	0,01	1003,7331	4
			Herbaceous	0,99	0,156829	15

Source: The Cataruben Foundation, 2023.

Table 28. Uncertainty analysis for SOC in inland wetlands.

UNCERTAINTY						
Uncertainty	**SOC**	**tVAL**	**Stratum**	**Wi**	**S2**	**n**
19,58%	147,009	1,740	Dispersed	0,01	3401,178097	7
			Herbaceous	0,99	4202,639269	15

Source: The Cataruben Foundation, 2023.

On the other hand, the uncertainty analysis of the emission factor for forests yielded a value of **7.98%**. Thus, the average biomass value is accepted under the uncertainty management guidelines of the BCR0002 methodology, since it is below 10% (Table 29).

Table 29. Uncertainty analysis for total biomass in forests.

Uncertainty	b_{TREE}	t_{VAL}	W_2	S_2	n
7,98%	327,22	1,694	1	7847,746922	33

Source: *The Cataruben Foundation, 2023.*

3.6 Leakage and non-permanence

The estimation of emissions from leakage due to project activities will be performed according to the guidelines of methodologies BCR0002 (section 14.5) and BCR0004 (section 13.1.4). Based on the following equations:

$$CSCN_{f,año} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{f,1} - A_{f,2}\right)$$

Where:

$CSCN_{f,año}$	Change in area covered by forest and/or natural cover in the area of leakage; ha/year
t_2	Final year of monitoring period
t_1	Initial year of the monitoring period
$A_{f,1}$	Area with natural vegetation cover in the leakage area at the beginning of the monitoring period; ha
$A_{f,2}$	Area with natural vegetation cover in the area of leakage at the end of the monitoring period; ha

y,

$$E_{f,año} = \left[CSCN_{proy,f} x \left(CBF_{eq} + COS_{eq}\right)\right] - EA_{f,lb}$$

$E_{f,año}$	Annual emission in the leakage area; tCO2/ha

$CSCN_{proy,f}$	Land use changes in the leakage area; ha/yr.
CBF_{eq}	Carbon dioxide equivalent contained in the total biomass; tCO2e/ha
COS_{eq}	Carbon dioxide equivalent contained in soil; tCO2e/ha
$EA_{f,lb}$	Annual emission in the leakage area in the baseline scenario; tCO2e

For the application of the formulas described in this leakage section, it is necessary to review the identification of the area through the nearest neighbor spatial proximity analysis, described in section 3.2.1.2.3. The main objective of this analysis is to identify the deforestation/transformation hotspots using as a basis the accumulated forest loss and natural vegetation cover conversion, the relationship with environmental drivers/detriment drivers and the distance to REDD+ project areas. This process is carried out taking into consideration both the geographical boundaries of the project areas and the baseline deforestation.

A leakage area was established and determined according to the criteria established by BCR 0002 and BCR 0004 methodologies:

- All forest areas that are within the range of mobility of the causes and agents of deforestation should be included.
- Exclude areas of restricted access to deforestation agents.

In order to establish the boundaries of the leakage areas, a spatial proximity analysis, commonly known as near neighbors, was carried out to determine the distribution of deforestation and land cover transformation in the territory.

Initially, forest loss was evaluated in the temporal limits of the baseline of the REDD+ component (2010 - 2018), using data from the Global Forest Change[8] Global Forest Watch. For natural vegetation cover, the 2012 - 2018 time limit was adopted in order to analyze natural vegetation cover transformations using land cover maps (Corine Land Cover). This approach made it possible to identify deforestation and land cover transformation hotspots and their range of

[8] https://storage.googleapis.com/earthenginepartners-hansen/GFC-2022-v1.10/download.html

mobility. This displacement of emissions is enrolled with the different agents of deforestation.

The range of mobility resulting from deforestation/transformation made it possible to determine the direction of emissions, as well as the distance to the edge of the REDD+ properties; additionally, and in order to comply with the criteria of the methodologies, areas with restricted access to deforestation and transformation agents are excluded. From the above, a leakage belt was defined with a buffer of 250 m from the edge of the Property, with an area of 28,090 ha for REDD+, while for natural vegetation cover a buffer of 600 m 66,081 ha was determined. Both areas were monitored in relation to the areas of forest and natural cover in the temporal limits of the project and where emissions - leakage may move to. Annex, procedure for determining project leakage.

3.7 Mitigation results

Compliance with ISO 14064-3:2020 and complementary to the third-party audit, quality and transparency are guaranteed in the verification of the project's mitigation results. This reinforces confidence in the reduction of GHG emissions and the contribution to climate change mitigation in the Andean region of Colombia. External verification reinforces the credibility of the project and the environmental responsibility of The Cataruben Foundation, ensuring the long-term sustainability of the environmental and social benefits generated.

Having external and objective verification of results reinforces the credibility of the Project and demonstrates The Cataruben Foundation's commitment to ensuring environmental integrity and accountability in all of its conservation and climate change mitigation actions. This is essential to ensure that the environmental and social benefits generated by the project are sustainable and effective in the long term.

3.7.1 Eligible areas within GHG Project boundaries

3.7.1.1 Eligible Wetland Areas

Eligible areas correspond to areas that are part of Continental Wetlands ecosystems, and that correspond to the category of natural vegetation cover, other than forest, at the beginning of project activities and five years before the project start date. Based on Flórez et al (2016), the Wetlands were identified for 2018, the date on which the Project starts conservation activities.

To determine the eligibility of the areas, a multi-temporal analysis is performed between the CORINE Land Cover of 2018 (project start date) and the CLC of 2012, both reliable national inputs generated by IDEAM. The crossing of information generates a new cartographic file with the attributes of the initial layers. In this only the natural vegetation cover belonging to the wetlands found in both periods are selected (See Annex Wetlands Procedure).

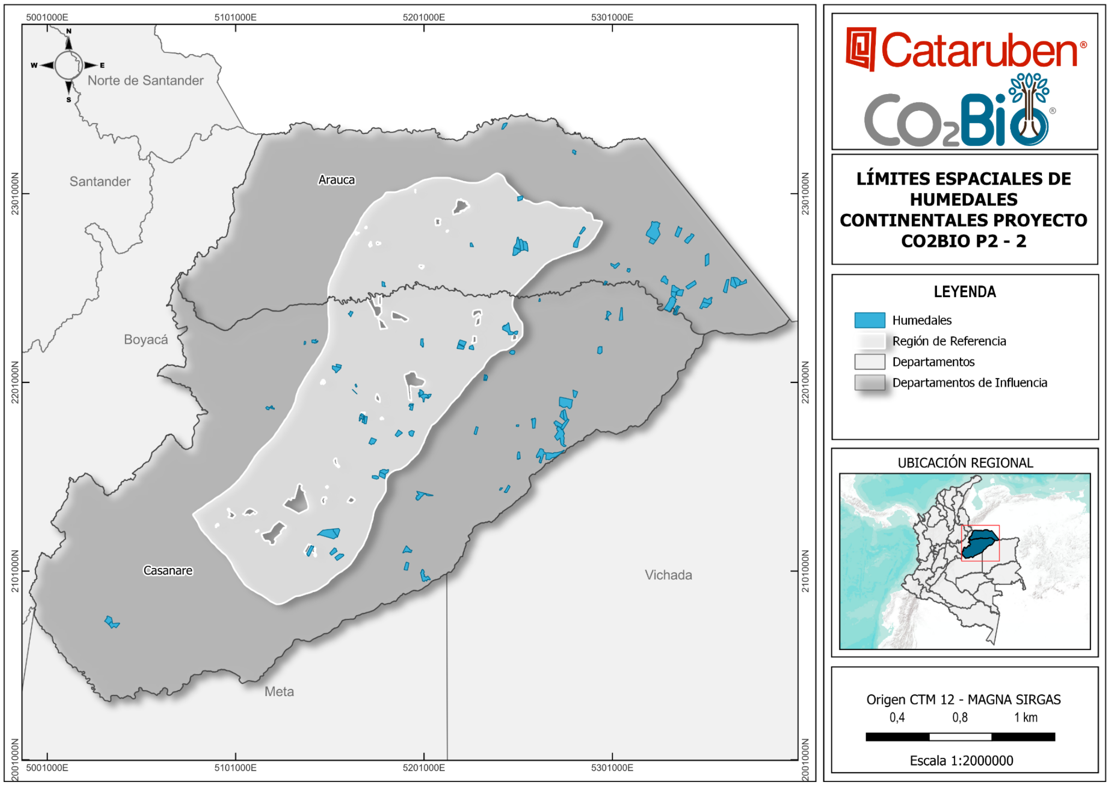
Table 30, represents the eligible wetland area by stratum, information related in the Wetland Geodatabase The Project V2.O Feature Dataset Wetlands Project Areas.

Table 30. Eligible wetland areas by stratum.

STRATUM	AREA (ha)
Dispersed	631,0
Herbaceous	49.721,6
Total Eligible Wetland	**50.352,6**

Source: The Cataruben Foundation, 2023.

Imagen 15. Spatial boundaries map Continental Wetlands



Source: The Cataruben Foundation, 2023.

3.7.1.2 Eligible Forest Areas

Eligible areas for REDD+ activities are those areas that correspond to forest cover according to the national definition established by IDEAM and that meet the condition of being permanent forest at the project start date and 10 years before (***Annex 1*** / 1.3.REDD+ /5.Geospatial/5.1.Geodatabase_REDD+).

To determine the eligible areas, it must be demonstrated that the areas within the geographical limits of the project correspond to the forest category, at the beginning and ten years before the project start date. The non-forest forest map generated by the Forest and Carbon Monitoring System - SMByC of IDEAM, in raster format and with a pixel size of 30.26*30.26 m (compatible with scale 1:100,000) for the project start date 2018 and ten years before (2009) was used as input. The SMByC starts operation from 2010, which indicates that the inputs before the date do not exist, therefore, it was necessary to use the 2010 input.

Constituting the analysis in the period 2010 - 2018.

To determine that the eligible areas 2010 - 2018 comply with the forest category, it is necessary to perform a cross classification also called "Cross classification" in the QGIS software using the Semi-Automatic Classification Plugin (SCP) which from the forest maps mentioned above determines the forest areas that remain constant for both time periods (stable forest) thus complying with the methodology.

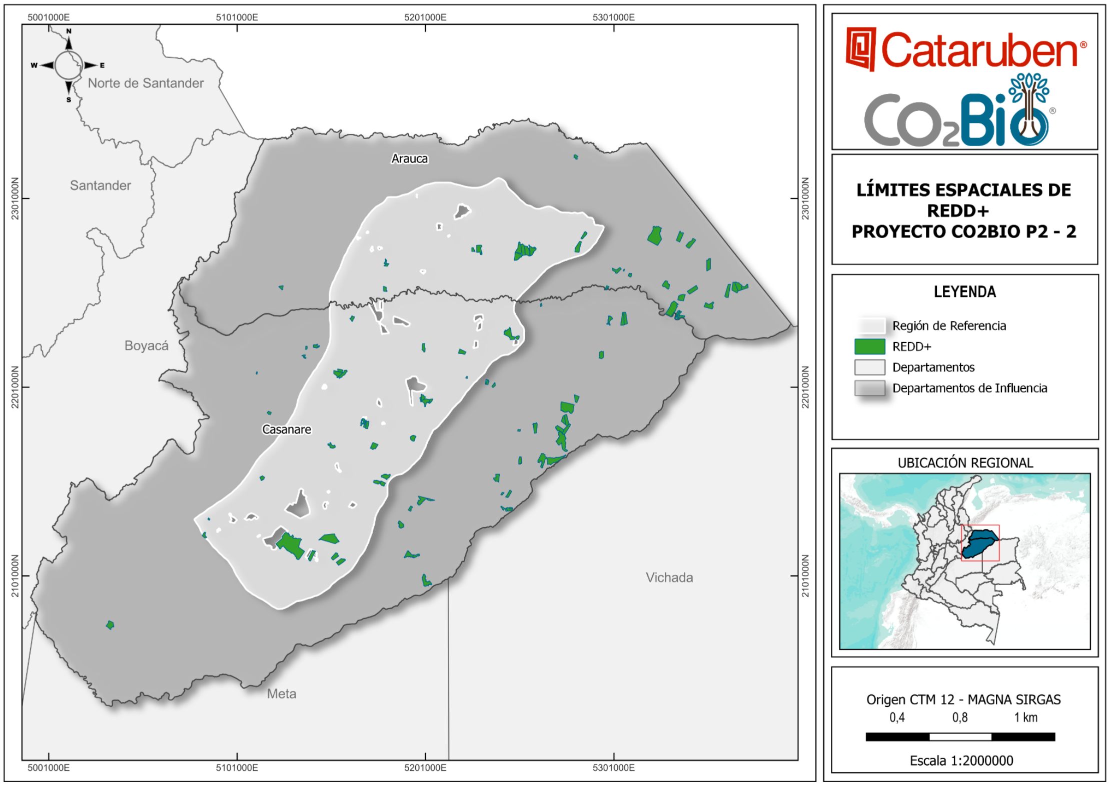
Table 31 shows the eligible areas and Figure 16 shows their spatial distribution. The mapping information is consolidated in the REDD Project V2.0 Geodatabase, Features Dataset REDD Project Areas.

Table 31. Eligible REDD+ project areas.

CATEGORY	AREA (ha)
Eligible Forest	10.532,6

Source: The Cataruben Foundation, 2023.

Image 16. Map of REDD+ Project spatial boundaries.



Source: The Cataruben Foundation, 2023.

3.7.2 Stratification

3.7.2.1 Continental Wetlands

Given the presence of different vegetation cover eligible for the Wetland categories, and in order to improve the accuracy of biomass estimates, it is necessary to stratify the project areas. According to Ricaurte (2019) such a process is performed according to the vegetation associated with the Wetland.

In this case, the strata listed in Table 32 are taken as the coverages present in the project areas.

Table 32. Stratification of natural cover, Wetlands component.

STRATUM	CORINE LAND COVER	STRATOS (ha)
HERBACEOUS	Dense flooded grassland Dense flooded grassland Woodland Dense non-forested flooded grassland	49.721,6
DISPERESED	Open shrubland Dense shrubland	631,0

Source: The Cataruben Foundation, 2023.

The **herbaceous** stratum corresponds to vegetation units dominated by plants with a height between 0.3 and 1.5 meters, while the **sparse** stratum refers to a mosaic of separate and widely dispersed plants. This stratum includes particularly trees, palms, shrubs, herbs and grass species that do not form a continuous cover.

3.7.2.2 Forests (REDD+ activities)

Eligible forest areas are located in the same biome, so it is expected that there will be no significant variation in biomass distribution. Thus, a single stratum is established for the estimation of GHG emissions and reductions.

3.7.3 GHG emission reductions in the baseline scenario

3.7.3.1 Activity data

3.7.3.1.1 Continental Wetlands

The estimation of activity data will be carried out based on the guidelines established in the BCR0004 methodology, section 16.3. The procedures and equations used are detailed below.

3.7.3.1.1.1.1 Estimation of land use changes in Wetlands

Table 33 classifies the Wetlands into 2 strata (Herbaceous - Sparse) and relates them to the Corine Land Cover land covers. The estimation of land use changes in wetlands was done through a multi-temporal land cover analysis (scale 1:100,000) for the project start date and ten years prior to the project start date.

The national land cover maps for the period 2009 - 2018 are used. The coverages in the reference years are stratified according to table 33 and the change of coverages is demonstrated using the **"Intersection"** tool of the ArcGIS software. This tool generates a new shapefile with the information of both coverages.

For there to be a transformation of the 2009 stratum with respect to 2018, the initial natural vegetation cover must change to a transformed stratum cover in 2018; natural vegetation covers that were transformed to covers such as fragmented forest or secondary vegetation are considered a product of cover degradation by anthropogenic action.

Thus, the historical transformation rate of the reference region is estimated and the data are shown in Table 34. The cartographic information regarding this process is found in the Wetlands V3 Reference Region Geodatabase.

To determine the eligible areas, a multitemporal analysis is performed for the period 2012 - 2018 using national inputs, the coverages are stratified in 2012 and through an intercept it is verified which strata are maintained in the Wetland category and which are not. Following this, the eligible areas are monitored to the year 2021. The generation of the land cover map for the year 2021 is done through the Corine Land Cover methodology, where Landsat 8 sensor images are interpreted and the information is validated with Sentinel 2 through the precision analysis in the AcATaMa complement. The uncertainty is measured through the precision and determined at 98.0 %, which meets the requirement requested by the BCR0004 methodology (See AcATaMa Uncertainty Analysis).

Table 33. Natural covers associated with Wetlands and covers defined as Transformed.

TYPE	STRATUM	CORINE LAND COVER
NATURAL HEDGING	Herbaceous	Open rocky grassland
		Dense flooded grassland
		Dense Flooded Flooded Grassland Wooded
		Dense Non-Tree Dense Flooded Flooded Grassland
	Dispersed	Open shrubland
		Dense shrubland
TRANSFORMED	Transformed	Cotton
		Rice
		Cane
		Panelera Cane

		Artificial Water Bodies
		Agroforestry Crops
		Fragmented forests
		Recreational facilities
		Oxidation Lagoons
		Corn
		Crop Mosaic
		Pasture and Crop Mosaic
		Other Permanent Tree Crops
		Other Permanent Shrub Crops
		Other Permanent Herbaceous Crops
		Other Transient Crops
		Palm Oil
		Wooded Pastures
		Pastures Grubbed
		Clean Pastures
		Pastures and Planted Trees
		Conifer Plantation
		Forest Plantation
		Banana and Plantain
		Road and Railway Network and Associated Lands
		Sorghum
		Soy
		Continuous Urban Fabric
		Discontinuous Urban Fabric
		Bare and Degraded Lands
		High Secondary Vegetation
		Low Secondary Vegetation
		Secondary or transitional vegetation
		Waste disposal areas
		Industrial or Commercial Zones
		Urban Green Zones

Source: The Cataruben Foundation, 2023.

3.7.3.1.1.1.2 Historical annual changes

To calculate the annual historical changes in the reference region for the baseline scenario, the following equation is considered:

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

Where:

$CSCN_{LB}$	Change in area with natural vegetation cover in the baseline scenario, in the reference region; ha/year

t_1	Initial year of the reporting period in which the changes are analyzed
t_2	Final year of the reporting period in which the changes are analyzed
A_1	Area under natural vegetation cover in the reference region in t1; ha
A_2	Area under natural vegetative cover in the reference region in t2; ha
A_p	Eligible project area; ha

In this way, the historical transformation rate of the reference region is estimated, which, when related to the eligible area of the project, represents the loss of natural vegetation cover expected in the baseline scenario (Table 34).

Table 34. Annual historical changes in the without-project scenario in Continental Wetlands.

Transformation Rate	t1	t2	A1 (ha)	A2 (ha)	CSCNlb (ha/year)
0,0346396118	2009	2018	1.421.101	1.040.473	**1722,3**
0,0709568685	2009	2018	2.248	1.187	**44,8**

Source: The Cataruben Foundation, 2023.

Likewise, for the leakage area, the historical natural cover change was estimated from the Wetland areas at the project start date multiplied by the transformation rate of the reference region (Table 35).

Table 35. Annual historical changes in the area of leakage in Continental Wetlands.

Stratum	CSCNlb,f (ha/year)	Af (ha)
Herbaceous	**1360,8**	39.285,0
Dispersed	**29,9**	422

Source: The Cataruben Foundation, 2023.

3.7.3.1.1.1.3 Projection of annual changes in the scenario with project

The annual changes in the scenario with project are estimated taking into account the following equation:

$$CSCN_P = CSCN_{lb} x(1 - \%P)$$

Where:

$CSCN_P$	Annual change in the area with natural vegetation cover in the scenario with project; ha/year
$CSCN_{lb}$	Annual change in area under vegetation cover in the baseline scenario; ha/year
$\%P$	Percentage of projected decrease in decrease in coverage changes due to implementation of project activities.

For the Wetlands component, a decrease in natural cover change of 87% is projected, based on the results obtained from the implementation of project activities in the 2018-2021 period.

The following equation is used to estimate annual changes in the leakage area for the project scenario:

$$CSCN_{P,f} = CSCN_{lb,f} x(1 - \%PF)$$

Where:

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

Taking into account the default values suggested by the BCR standard in other methodologies of the AFOLU sector, a value of 10% is established as a projection of the increase in emissions in the leakage area due to the implementation of the project activities.

3.7.3.1.2 Deforestation of forests

The estimation of activity data will be carried out based on the guidelines established in the BCR0002 methodology, section 13.2.1.

For the estimation of the annual historical deforestation rate in the reference region, national data from the official scientific tool for the continuous and frequent monitoring of forest area and deforestation in Colombia called Forest and Carbon Monitoring System was used. To calculate the deforested area in the period 2010 - 2018, only the areas for which forest is detected in 2010 and no forest in 2018 are taken into account. This procedure is performed through the Semi-Automatic Classification Plugin, QGIS software and GOG-19.Guide is used for the quantification of annual historical deforestation. The cartographic information is related to the REDD +V3 Geodatabase, (Reference Region, IDEAM Forest 2010, IDEAM Forest 2010-2018).

To determine the eligible areas, non-forest forest maps were used for the periods 2010 - 2018 and subsequent monitoring to 2021. Through a cross-classification analysis it was determined that the areas within the project boundaries correspond to the forest category at the beginning of the project activities (2018) and ten years ago (2010). The 2010 input is used because the national forest map for 2008 does not exist. The eligible area corresponds to the forest that remains in the period 2010-2018, the verification is carried out in 2021 where the permanence of the eligible forest is monitored.

3.7.3.1.2.2.1 Annual historical deforestation

The calculation of the historical average deforestation of the project area is performed by analyzing the change in forest to non-forest cover, which occurred in the reference region for the period 2010-2018, taking into account the following equation:

$$CSB_{año} = \left(\frac{1}{t_2 - t_1}\right) x \, (A_1 - A_2)$$

Where:

$CSB_{año}$	Annual change in the area covered by forest in the reference region; ha
t_1	Initial year of the reference period; year
t_2	Final year of the reporting period; year
A_1	Area of forest in the reference region, at the initial time; ha
A_2	Area of forest in the reference region at the final point in time; ha

Similarly, taking into account the possible effects on forest transformation as a consequence of the socio-political events recorded in the country during the last few years, an adjustment for national circumstances is applied to the BSC estimated from the historical average, as established in the national reference levels (NREF), using the most conservative scenario defined from the logistic model developed by IDEAM for the period 2018-2022 (MinAmbiente & IDEAM, 2018).

On the other hand, the annual historical deforestation in the leakage area is calculated using the forest cover change analysis for the period 2010-2018, related in the following equation:

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

Where:

$CSB_{f,año}$	Annual change in area covered by forest in the LEAKAGE area; ha
t_1	Initial year of the reference period; year
t_2	Final year of the reporting 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 area of leakage at the end of the reference period; ha

In this sense the values of $CSB_{año}$ and $CSB_{f,año}$ are used to represent the expected forest loss in the project area and leakage area respectively, in the baseline scenario.

3.7.3.3.2.1.1.2 Projected annual deforestation in the scenario with project

Projected annual deforestation in the REDD+ project scenario is calculated using the following equation:

$$CSB_{proy,año} = CSB_{lb,año} x(1 - \%DD)$$

Where:

$CSB_{proy,año}$	Annual change in area covered by forest in the project scenario[9] ; ha
$CSB_{lb,año}$	Annual change in the area covered by forest in the without-project scenario; ha
$\%DD$	Projected decrease in deforestation due to implementation of REDD+ activities[10] .

On the other hand, the projected annual deforestation in the leakage area is estimated with the following equation:

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

Where:

$CSB_{REDD+proy,f\ año}$	Annual change in the area covered by forest in the leakage area, in the scenario with project; ha
$CSB_{f,lb}$	Annual change in the area covered by forest in the leakage area, in the baseline scenario; ha
$\%E_f$	Percentage increase in emissions in the leakage area due to the implementation of REDD activities[11] .

3.7.3.2 Emission factors

3.7.3.2.1 Measurement plan

The definition of emission factors for the project was based on the project's own data. Therefore, dry season monitoring was carried out in eligible areas located in the departments of Arauca and Casanare, measuring Aboveground biomass deposits in wetlands and forests, and soil organic carbon only in wetlands[12] .

The field activities were based on the guidelines of the BCR0004 methodology

[9] The adjustment for national circumstances (%CN) is made taking as reference the proposed reference level of forest emissions from deforestation in Colombia for payment for REDD+ results under the UNFCCC (https://REDD+.unfccc.int/files/31122019_anexo_circumstances_nref_nal_v7.pdf).

[10] A 90% reduction in deforestation is projected, taking into account that the project activities are aimed at conserving the entire eligible forest area.

[11] According to BCR0002 methodology, the use of a default value of 10% is accepted.

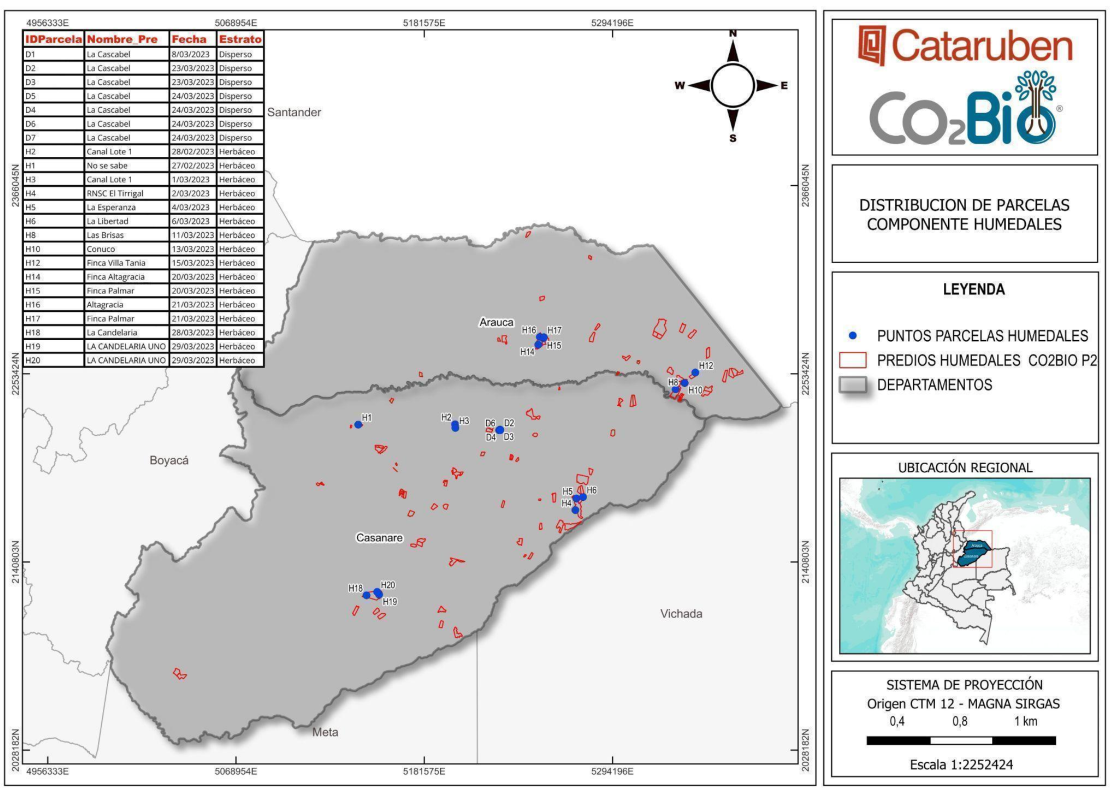
[12] The SOC emission factor in forests was taken from the NREF for the orinoco biome.

in its numeral 16.2.3, as well as the procedure [FC- GOP-15. Procedure for the survey of plots in forests for woody, shrub and herbaceous vegetation](), which in turn is based on the National Forest Inventory of Colombia (Olarte *et al.* 2021).

The selection of the number and location of sampling points was made according to FC-GPP-23. Inventory design procedure for biomass growth monitoring, taking into account the area of each stratum and the variation of biomass content established from reference data for the study region.

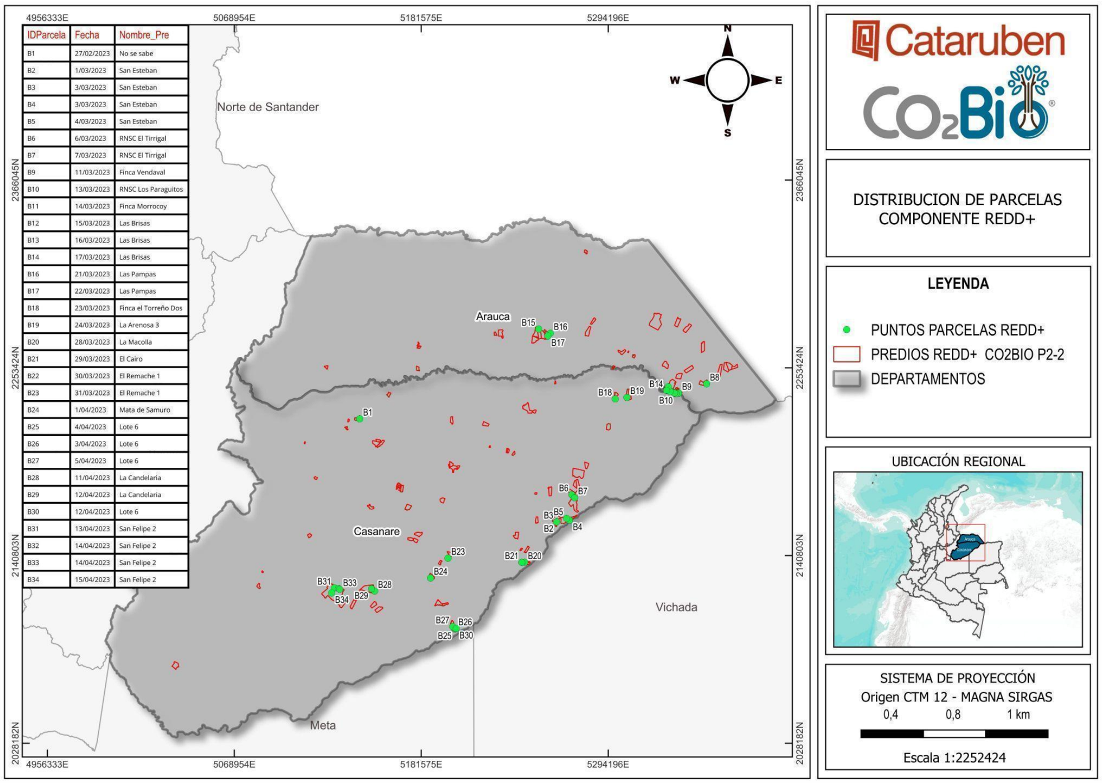
Thus, under a random selection procedure, seven (7) points in the Dispersed stratum and 16 points in the Herbaceous stratum were defined for sampling in wetland areas (Image 17) (Calculation of sampling points - Wetlands). While, based on the eligible area of forests, a total of 34 sampling points were defined for the REDD+ component (Image 18) (Calculation of sampling points - Forests).

Image 17.Location of biomass sampling points, Wetland component.



Source: The Cataruben Foundation, 2023.

Image 18. Location of biomass sampling points, REDD+ component.



Source: The Cataruben Foundation, 2023.

3.7.3.2.2.2 Field measurements

In order to strengthen the technical knowledge of the field professionals and ensure the quality of the data to be collected, a theoretical and practical training was given to the personnel of the two field teams. The theoretical training was held at The Cataruben Foundation's facilities, where the different stages of the FC-GOP-15 procedure for monitoring Aboveground biomass and soils, the use of data collection tools, field formats and the schedule of activities were explained in detail. In the field phase, practical training was given on the steps for calibrating equipment, delimiting the plot, measuring variables, using ODK Collect and filling out forms in each of the ecosystems (Images 19 and 43).

Image 19. Training of field professionals on sampling procedures in wetland areas.

Source: The Cataruben Foundation, 2023.

Image 20. Training of field professionals on forest sampling procedures.

Source: The Cataruben Foundation, 2023

Each sampling unit corresponded to a circular plot with a radius of 15 m^2 with a total area of 707 $m.^2$ with nested subplots according to size category: Fustales (r = 7 m) and Gran Fustales (r = 15 m). The Latizal category (10 cm > DBH ≥ 2.5 cm) was not considered, taking into account that the allometric equations defined for biomass estimation are applicable for DBH greater than 10 cm. Similarly, in the herbaceous stratum of the Wetland component, herbaceous vegetation and soil samples were collected.

Within each sampling unit, at least five (5) reference points were identified, consisting of trees, rocks or landscape elements that will help in the future to return and locate again the limits of the sampling unit. In the cases where there were no elements that fulfilled the characteristics of reference points, pvc tubes of 1 m in length were established at 7.5 m from the central point and oriented to the four cardinal points. For each point, the azimuth (º), horizontal distance (m) with respect to the central point and the geographic coordinates were recorded in digital format (Images 21 and 22).

Image 21 Delimitation of sampling units in areas of the Wetland component. *a) Definition of the dispersed stratum central point. b) Demarcation of transects. c) and d) Selection and marking of reference points of dispersed and herbaceous stratum. e) and f) georeferencing of reference points of dispersed and herbaceous stratum.*

Source: The Cataruben Foundation, 2023.

Image 22. Delimitation of sampling plots in forests*: a) Determination of central point, b) Measurement of plot radius, c) Definition of sampling points, d) Georeferencing of sampling points, e) and f) Marking of reference points.*

Source: The Cataruben Foundation, 2023.

The measurement of trees and shrubs found within the plot was carried out taking into account the defined size categories, starting from the position of the nearest tree in a northerly direction and from the center of the plot towards the end, following the clockwise direction.

For each individual, we recorded its location from the center point (azimuth and horizontal distance), the values obtained for each measured dasometric variable (DBH, stem height, total height and crown cover), as well as observations regarding its vitality, damage and/or alterations (Images 23 and 24).

Image 23. Measurements in the dispersed stratum: *a) and b) definition of central point; c) and d) measurement of DBH; e) distance and azimuth; f) height measurement.*

Source: The Cataruben Foundation, 2023.

Image 24. Registration and measurement of individuals in forest*: a) Azimuth, b) Distance, c) and d) DBH, e) total height, f) crown cover.*

Source: The Cataruben Foundation, 2023.

For herbaceous vegetation, 4 quadrants of $1m^2$ were used, arranged at 7.5 m from the central point at angles of 0º, 90º, 180º and 270º, where all live plant material was collected at ground level; each collected sample was weighed fresh and its value recorded in the digital form. From each composite sample, a subsample of 200 g was taken to be sent to the laboratory, which was duly labeled according to the label generated by the ODK form (Image 25).

Image 25. Sampling of herbaceous vegetation: *a) and b) establishment of sampling quadrants; c) and d) collection of herbaceous vegetation; e) sample weighing; f) sample labeling.*

Source: The Cataruben Foundation, 2023.

Finally, soil samples were taken from the dispersed and herbaceous strata of the Wetland component at a distance of 2 m and an azimuth of 45°, from the central point of the circular plot. At each sampling point, two soil samples were collected[13] at depths of 30 cm, 50 cm and 100 cm. These samples were duly labeled according to the code generated by the ODK format and sent to the laboratory for analysis (Image 26).

Image 26. Soil sampling*: a) and b) sampling at different depths; c) density sampling; d) soil sampling for carbon determination.*

Source: The Cataruben Foundation, 2023.

13 One sample for bulk density analysis and one for %C.

Thus, the field monitoring phase for the Herbaceous and Dispersed strata covered the period from 02/27/2023 to 03/31/2023 (field measurements). The location and dates of data collection are shown in Table 36.

Table 36. Location of biomass sampling points, Wetlands component.

Date of survey	Stratum	Department	Municipality	Vereda	Property Name	Plot ID	Length	Latitude
08/03/2023	Dispersed	Casanare	Paz de Ariporo	Morichales	La Cascabel	D1	70° 57' 11,400" W	5°59'1,700 "N
23/03/2023	Dispersed	Casanare	Paz de Ariporo	Morichales	La Cascabel	D2	70° 56' 54,000" W	5°59'7,900 "N
23/03/2023	Dispersed	Casanare	Paz de Ariporo	Morichales	La Cascabel	D3	70° 56' 58,400" W	5°59'14,400 "N
23/03/2023	Dispersed	Casanare	Paz de Ariporo	Morichales	La Cascabel	D4	70° 57' 14,500" W	5°59'3,900 "N
24/03/2023	Dispersed	Casanare	Paz de Ariporo	Morichales	La Cascabel	D5	70° 57' 5,900" W	5°59'5,200 "N
24/03/2023	Dispersed	Casanare	Paz de Ariporo	Morichales	La Cascabel	D6	70° 57' 16,900" W	5°59'2,500 "N
24/03/2023	Dispersed	Casanare	Paz de Ariporo	Morichales	La Cascabel	D7	70° 56' 56,600" W	5°59'1,300 "N
27/02/2023	Herbaceous	Casanare	Hato Corozal	Berlin	No se sabe	H1	71° 42' 58,434" W	6°0'58,827 "N
28/02/2023	Herbaceous	Casanare	Paz de Ariporo	Montañas del Totumo	Canal Lote 1	H2	71° 11' 33,211" W	6°1'1,004 N
01/03/2023	Herbaceous	Casanare	Paz de Ariporo	Montañas del Totumo	Canal Lote 1	H3	71° 11' 27,900" W	5°59'50,100 "N
02/03/2023	Herbaceous	Casanare	Paz de Ariporo	San Sebastián	RNSC El Tirrigal	H4	70° 32' 40,500" W	5°33'0,700 "N
04/03/2023	Herbaceous	Casanare	Paz de Ariporo	La Hermosa	La Esperanza	H5	70° 32' 20,100" W	5°36'46,500 "N
06/03/2023	Herbaceous	Casanare	Paz de Ariporo	La Hermosa	La Libertad	H6	70° 30' 10,200" W	5°37'13,200 "N
11/03/2023	Herbaceous	Arauca	Cravo Norte	La Esperanza	Las Brisas	H8	70° 0' 0,800" W	6°12'3,100 "N
13/03/2023	Herbaceous	Arauca	Cravo Norte	La Esperanza	Conuco	H10	69° 57' 4,300" W	6°14 3,800 "N
15/03/2023	Herbaceous	Arauca	Puerto Rondon	Lejanías de Juriepe	Finca Villa Tania	H12	69° 53' 35,800" W	6°17'26,900 "N
20/03/2023	Herbaceous	Arauca	Puerto Rondon	Aguas Claras	Finca Altagracia	H14	70° 44' 28,300" W	6°26'45,200 "N
20/03/2023	Herbaceous	Arauca	Puerto Rondon	Aguas Claras	Finca Palmar	H15	70° 42' 50,600" W	6°28'50,600 "N
21/03/2023	Herbaceous	Arauca	Puerto Rondon	Aguas Claras	Altagracia	H16	70° 43' 56,900" W	6°29'15,100 "N
21/03/2023	Herbaceous	Arauca	Puerto Rondon	Aguas Claras	Finca Palmar	H17	70° 42' 39,800" W	6°29'9,800 "N
28/03/2023	Herbaceous	Casanare	Orocue	La libertad	La Candelaria	H18	71° 40' 24,300" W	5°5 32,800 "N
29/03/2023	Herbaceous	Casanare	Orocue	La Independencia	La candelaria uno	H19	71° 36' 19,200" W	5°5 45,800 "N

29/03/2023	Herbaceo us	Casanare	Orocue	La independencia	La candelaria uno	H20	71° 36' 56,810" W	5 6'37,534 "N

Source: The Cataruben Foundation, 2023.

Monitoring in forests covered the period from 02/27/2023 to 04/15/2023 (1. Field measurements). The location and dates of data collection are shown in Table 37.

Table 37. Sampling points for the REDD+ component.

N°	Date	Department	Municipality	Vereda	Property Name	Plot ID	Length	Latitude
1	27/02/2023	Casanare	Hato Corozal	Berlin	Not known	B1	71°41'38,300" W	6° 0' 52,900" N
2	01/03/2023	Casanare	Paz de Ariporo	San Sebastián	San Esteban	B2	70° 37' 27,000" W	5° 27' 8,500" N
3	03/03/2023	Casanare	Paz de Ariporo	San Sebastian	San Esteban	B3	70° 37' 26,800" W	5° 27' 8,600" N
4	03/03/2023	Casanare	Paz de Ariporo	San Sebastian	San Esteban	B4	70° 33' 15,500" W	5° 27' 39,700" N
5	04/03/2023	Casanare	Paz de Ariporo	San Sebastian	San Esteban	B5	70° 34' 13,100" W	5° 28' 15,100" N
6	06/03/2023	Casanare	Paz de Ariporo	San Sebastian	RNSC El Tirrigal	B6	70° 32' 28,700" W	5° 35' 57,900" N
7	07/03/2023	Casanare	Paz de Ariporo	San Sebastian	RNSC El Tirrigal	B7	70° 31' 34,100" W	5° 34' 57,900" N
8	10/03/2023	Arauca	Cravo Norte	La Esperanza	Finca El Ponque #2	B8	69° 48' 18,234" W	6° 11' 48,592" N
9	11/03/2023	Arauca	Cravo Norte	La Esperanza	Finca Vendaval	B9	69° 57' 27,500" W	6° 8' 49,400" N
10	13/03/2023	Arauca	Cravo Norte	La Esperanza	RNSC Los Paraguitos	B10	69° 58' 15,800" W	6° 8' 41,500" N
11	14/03/2023	Arauca	Cravo Norte	La Esperanza	Finca Morrocoy	B11	69° 58' 48,900" W	6° 8' 52,200" N
12	15/03/2023	Arauca	Cravo Norte	La Esperanza	Las Brisas	B12	70° 0' 12,000" W	6° 9' 26,700" N
13	16/03/2023	Arauca	Cravo Norte	La Esperanza	Las Brisas	B13	70° 0' 48,900" W	6° 10' 54,000" N
14	17/03/2023	Arauca	Cravo Norte	La Esperanza	Las Brisas	B14	70° 1' 24,700" W	6° 9' 44,600" N
15	20/03/2023	Arauca	Puerto Rondon	Aguas Claras	Finca Palmar	B15	70° 43' 3,660" W	6° 29' 54,691" N
16	21/03/2023	Arauca	Puerto Rondon	Aguas Claras	Las Pampas	B16	70° 39' 16,400" W	6° 28' 32,200" N
17	22/03/2023	Arauca	Puerto Rondon	Aguas Claras	Las Pampas	B17	70° 40' 4,900" W	6° 27' 40,800" N
18	23/03/2023	Casanare	Hato Corozal	El Brillante	Finca El Torreño 2	B18	70° 18' 9,071" W	6° 7' 2,953" N
19	24/03/2023	Casanare	Hato Corozal	Corralito	La Arenosa 3	B19	70° 14' 20,000" W	6° 7' 32,100" N
20	28/03/2023	Casanare	Trinidad	Santa Maria del Loro	La Macolla	B20	70° 47' 58,600" W	5° 13' 59,900" N

21	29/03/2023	Casanare	Trinidad	Santa Maria del Loro	El Cairo	B21	70° 48' 51,000" W	5° 13' 59,300" N
22	30/03/2023	Casanare	Trinidad	La Reforma	El Remache 1	B22	70° 48' 51,800" W	5° 13' 58,600" N
23	31/03/2023	Casanare	Trinidad	La Reforma	El Remache 1	B23	71° 12' 56,600" W	5° 15' 25,400" N
24	01/04/2023	Casanare	San Luis de Palenque	La Riverita	Mata de Zamuro	B24	71° 18' 39,800" W	5° 8' 59,000" N
25	04/04/2023	Casanare	Orocue	La Esmeralda	Lote 6	B25	71° 10' 46,100" W	4° 52' 21,500" N
26	03/04/2023	Casanare	Orocue	La Esmeralda	Lote 6	B26	71° 10' 42,100" W	4° 52' 29,500" N
27	05/04/2023	Casanare	Orocue	La Esmeralda	Lote 6	B27	71° 11' 26,600" W	4° 53' 8,600" N
28	11/04/2023	Casanare	Orocue	La libertad	La Candelaria	B28	71° 36' 53,100" W	5° 4' 46,900" N
29	12/04/2023	Casanare	Orocue	La libertad	La Candelaria	B29	71° 37' 53,500" W	5° 5' 30,900" N
30	12/04/2023	Casanare	Orocue	La Esmeralda	Lote 6	B30	71° 10' 20,200" W	4° 52' 31,700" N
31	13/04/2023	Casanare	Orocue	El Algarrobo	San Felipe 2	B31	71° 49' 59,200" W	5° 5' 50,300" N
32	14/04/2023	Casanare	Orocue	El Algarrobo	San Felipe 2	B32	71° 48' 39,000" W	5° 5' 37,400" N
33	14/04/2023	Casanare	Orocue	El Algarrobo	San Felipe 2	B33	71° 48' 17,800" W	5° 5' 21,800" N
34	15/04/2023	Casanare	Orocue	El Algarrobo	San Felipe 2	B34	71° 50' 55,100" W	5° 4' 12,700" N

Source: The Cataruben Foundation, 2023

3.7.3.2.2.3 Data analysis

The herbaceous vegetation and soil samples collected were sent to the CIAT Analytical Services laboratory for their respective preparation and analysis, taking into account the type of sample.

For the soil samples, the bulk density analysis was applied based on the cylinder method of known volume and under the gravimetry technique. On the other hand, for the determination of the carbon percentage (%C), the CHN analysis by combustion was used, under the dry combustion method and the Pyrolysis technique using the Perkin Elmer 2400 elemental analyzer.

In the case of the herbaceous vegetation samples, the dry weight of each sample was determined using the gravimetric technique, for which the sample was prepared by removing the remains of soil and drying it at a constant temperature of 105° in a drying oven, to finally determine the dry weight with the help of an analytical balance.

The support of the results delivered by the laboratory can be found in **Annex 1** / *1.2. WETLANDS* / *3. EMISSIONS* / 2. Laboratory.

Aboveground and belowground biomass contents were estimated using data collected in the field and allometric equations applied according to the type of individual sampled. Thus, to calculate Aboveground biomass of dicotyledonous species, the equation of Álvarez et al. (2012) was applied, which relates DBH values and wood density. For the calculation of biomass in palms, dasymetric variables of stem height and total height were taken into account, and the allometric equation proposed by Rodríguez & Soriano (2018) for *Attalea butyracea* was used. As for *Euterpe precatoria*, *the* equation of Restrepo (2003) was used and for lianas or lianas or lianas Zapata et al. (2003) recommended by IDEAM 2011. Finally, to estimate Belowground biomass, the Cairns, Brown & Baumgardner (1997) equation was applied, which relates Aboveground biomass values (t/ha) (Table 38).

Table 38. Allometric equations for calculating Aboveground biomass in the REDD+ component.

Equation	Type of individual	Source
$BA_2 = 65,233*Hest +253,849$	*Attalea butyracea*	Rodriguez & Soriano (2018)
$BA= exp(0.360+1.218\ ln\ (H))$	Palms	Restrepo et al. (2003)
$ln(BA) = 2.406 +(-1.289\ ln(D))+1.169\ (ln(D))^2 + (-0.122)(ln(D))^3 + 0.445\ ln(\rho)$	Fustales and Gran fustales	Alvarez et al. (2012)
$BA= 0.028+1.841\ ln\ D$	Lianas	Zapata et al. 2003
$BS= -1.0587+0.8836\ ln\ (BA)$	Belowground biomass	Cairns, Brown & Baumgardner(1997)

Source: The Cataruben Foundation, 2023.

Note: Where BA is Aboveground biomass is the aboveground biomass of the trees in kg; D is the normal diameter measured at 1.30 m height from the ground in cm, ρ is the wood density in g cm^{-3} ; H is the height of the stem.Hest is the height of the stem or stipe.

Given the complexity of determining wood density values in the field, data from official databases such as the virtual catalog of flora of the Aburrá Valley, Forestal Maderero, Global wood density database (Zanne et al. 2009), Tree functional Attributes and Ecological Database and authors such as Riesco, Imaña and Elías (2019), Camacho & López (2002), Rosales (2020) and Benítez, Velásquez, & Cogollo (2013) among others (Table 39) were used (Table 39). When wood density values were not available for a given species, we proceeded to use the average of the higher taxonomic level (Genus or Family). For individuals without taxonomic information (e.g. indeterminate), the average density of the species found in the entire plot was used.

Table 39. Wood density values for recorded species.

Family	Scientific Name	Common Name	Wood Density	Source
Acanthaceae	*Trichanthera gigantea*	Palo de agua	0,45	Zanne et. al (2009)
Anacardiaceae	*Tapirira guianensis*	Quince días	0,51	Riesco, Imaña and Elías (2019).
Anacardiaceae	*Spondias mombin*	Hobo	0,31	Zanne et. al (2009)
Annonaceae	*Annona muricata*	Guanábano montero	0,32	Zanne et. al (2009)
Annonaceae	*Xylopia ligustrifolia*	Majaguito	0,6	Zanne et. al (2009)
Annonaceae	*Xylopia aromatica*	Malagueto	0,56	Virtual catalog of flora of the Aburrá Valley
Apocynaceae	*Lacmellea edulis*	Leche miel	0,600	Zanne et. al (2009)
Apocynaceae	*Himatanthus articulatus*	Salado, lechero platanote	0,47	Zanne et. al (2009)
Arecaceae	*Euterpe precatoria*	Maporilla	0,273	Zanne et. al (2009)
Arecaceae	*Attalea butyracea*	Palma de vino	0,326	Zanne et. al (2009)
Bignoniaceae	*Handroanthus chrysanthus*	Guayacán	0,901	Benítez, Velásquez and Cogollo (2013).
Bignoniaceae	*Crescentia cujete*	Totumo	0,7	Zanne et. al (2009)

Burseraceae	*Protium heptaphyllum*	Anime	0,81	http://www.forestalmaderero.com/articulos/item/tabla-de-densidad-de-maderas.html
Burseraceae	*Trattinnickia aspera*	Caraño	0,424	Zanne et. al (2009)
Cactaceae	*Pereskia guamacho*	Aguamacho	0,42	Benítez, Velásquez and Cogollo (2013).
Calophyllaceae	*Calophyllum lucidum*	Cachicamo	0,55	https://www.sinchi.org.co/files/publicaciones/publicaciones/pdf/ManualMaderas.pdf
Chrysobalanaceae	*Licania apetala*	Cagüi	0,67	Zanne et. al (2009)
Cordiaceae	*Cordia alliodora*	Laurel	0,39	
Dilleniaceae	*Curatella americana*	Chaparro	0,422	https://repository.javeriana.edu.co/bitstream/handle/10554/34380/PulidoRodriguezEsperanzaNancy2018.pdf?sequence=1&isAllowed=y
Euphorbiaceae	*Sapium jenmanii*	Lechero blanco	0,41	Zanne et. al (2009)
Euphorbiaceae	*Mabea nitida*	Reventillo	0,6	
Euphorbiaceae	*Croton aff. lechleri*	Sangro	0,4	https://www.scielo.sa.cr/pdf/kuru/v17n40/2215-2504-kuru-17-40-33.pdf
Fabaceae	*Copaifera pubiflora*	Aceite	0,48	http://www.tropicaltimber.info/es/specie/copaiba-copaifera-pubiflora/#lower-content
Fabaceae	*Macrolobium acaciifolium*	Arepito	0,45	Zanne et. al (2009)
Fabaceae	*Adenanthera pavonina*	Chocho	0,57	
Fabaceae	*Inga thibaudiana*	Guamo loro	0,58	http://db.worldagroforestry.org/wd/species/Inga_spp
Fabaceae	*Enterolobium cyclocarpum*	Hueso de pescado	0,44	Zanne et. al (2009)
Fabaceae	*Pterocarpus acapulcensis*	Sangrito	0,563	Benítez, Velásquez and Cogollo (2013).
Clusiaceae	*Garcinia madruno*	Madroño	0,67	Zanne et. al (2009)
Lamiaceae	*Vitex orinocensis*	Guarataro	0,51	
Malvaceae	*Sterculia apetala*	Camoruco	0,345	

Malvaceae	*Ceiba pentandra*	Ceiba	0,21	
Meliaceae	*Guarea guidonia*	Trompillo	0,41	
Moraceae	*Ficus benjamina*	Laurel Murruco	0,46	Virtual catalog of flora of the Aburrá Valley
Myristicaceae	*Virola elongata*	Cuajo	0,5	Zanne et. al (2009)
Myrtaceae	*Psidium guajava*	Guayabo revalcero	0,629	
Rubiaceae	*Capirona decorticans*	Araguato	0,593	http://db.worldagroforestry.org//wd/genus/Capirona
Rubiaceae	*Alibertia edulis*	Canilla de venado	0,76	Zanne et. al (2009)
Rubiaceae	*Palicourea rigida*	Chaparrillo	0,58	da Silva et. al., 2020
Rubiaceae	*Faramea occidentalis*	Piedrito	0,55	Zanne et. al (2009)
Sapindaceae	*Sapindus saponaria*	Para para o pipo	0,619	
Simaroubaceae	*Simarouba amara*	Cimaru	0,35	
Urticaceae	*Cecropia engleriana*	Yarumo, o pata de gallo	0,49	
Vochysiaceae	*Vochysia lehmannii*	Saladillo	0,474	

Source: The Cataruben Foundation, 2023.

Similarly, for the estimation of biomass in the herbaceous stratum, the equation proposed by IDEAM (2011) was used:

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

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 harvested material in the field

Finally, an exploratory analysis of the data was carried out using the Excel program, according to GOP-23 Inventory design procedure for biomass growth monitoring, in order to verify the relevance of the information collected, as well as to identify and treat any missing and/or atypical data that might be present. In this way, in order to avoid underestimates or overestimates in biomass contents, those values cataloged as outliers according to the recorded DBH were replaced by the higher value established in the analysis.

Step-by-step calculations and data quality control reports can be reviewed in **Annex 1** / *1.2. WETLANDS* / *3. EMISSIONS* / *3. Data analysis* *and* **Annex 1** / *1.3. REDD+* / *2.*

3.7.3.2.4 Carbon emission factor in total biomass.

The following equation was used to estimate the carbon dioxide equivalent contained in the total biomass (CBF_{eq}):

$$CBF_{eq} = BT\ x\ (f)\ x\ \frac{44}{12}$$

Where:

CBF_{eq}	Carbon dioxide equivalent contained in total biomass. It is assumed that the emission of CO2 from biomass occurs in the same year; tCO_{2e}/ha/year.
BT	Total biomass; t/ha
FC	Carbon fraction of dry matter (0.47)
$\frac{44}{12}$	Carbon to carbon dioxide molecular ratio constant

3.7.3.2.4.1 Continental Wetlands

Based on the field monitoring and after applying the corresponding analyses, the biomass stored in each stratum was determined from the lower value of the 95% confidence interval. Thus, a total biomass of 0.56 t/ha and 75.80 t/ha was estimated for the Herbaceous and Dispersed strata, respectively.

Thus, for the Herbaceous stratum an emission factor of 0.96 tCO_{2e} /ha is established, while for the Dispersed stratum its value is 130.63 tCO_{2e} /ha.

3.7.3.2.2.4.2 Forests

Based on the data analysis and application of the related equations, a total biomass (BT) content of 327.22 t/ha was determined for the REDD+ component of the project. Thus, the emission factor for total biomass corresponds to 563.91 tCO_{2e}/ha.

3.7.3.2.5 Soil Organic Carbon Emission Factor

To estimate the organic carbon content in the soil, the following equation was used:

$$COS = \%C \ x \ DA \ x \ P$$

Where:

COS	Soil carbon; gr/m2
$\%C$	Carbon content
DA	Bulk density of soil; g/cm3
P	Depth of sample profile; cm

Subsequently, to calculate the equivalent organic carbon potentially emitted by the soil in a transformation scenario, it is assumed that SOC is emitted in equal proportions for 20 years once the land use change event occurs. For this purpose, the following equation is used:

$$COS_{eq} = \left(\frac{COS}{20}\right) x \left(\frac{44}{12}\right)$$

Where:

COS_{eq}	Carbon dioxide equivalent contained in soils ;tCO_{2e}/ha
COS	Soil carbon content; tC/ha
$\frac{44}{12}$	Molecular ratio constant between carbon (C) and carbon dioxide (CO_2)

3.7.3.2.5.1 Continental Wetlands

Table 40 lists the emission factors for the SOC applicable to the Wetlands component; these values were established based on the lower limit of the 95% confidence interval.

Table 40. Soil organic carbon emission factor.

Stratum	**SOC** *(tC/ha) Adjusted*	**COS20** *(tC/ha)*	*tCO2e/ha*
Herbaceous	110,85	5,54	20,32
Dispersed	114,5	5,73	20,99

Source: The Cataruben Foundation, 2023

3.7.3.3.2.5.2 Forests

For the definition of the emission factor of the Soil Organic Carbon (SOC) deposit in forests, the value established in the most recent NREF for the Orinoco biome (IDEAM, 2020) was taken as a reference (Table 41).

Table 41. Soil organic carbon (SOC), SOC20YEARS and SOCeq for the five biomes of Colombia.

Biome	**SOC** *(tC/ha)*	**COS20** $_{\text{YEARS}}$ *(tC/ha)*	**SOC**$_{eq}$ *(tCO2e/ha)*
Amazon	73,76	3,69	13,52
Andes	124,65	6,23	22,85
Caribbean	101,34	5,07	18,58
Orinoco	**64,51**	**3,23**	**11,83**
Pacific	92,49	4,62	16,96

Source: IDEAM, 2020.

3.7.3.2.6 Total carbon emission factor

The total carbon emission factor corresponds to the sum of the values established for total biomass and soil carbon deposition, and represents the emission of carbon dioxide equivalent for each hectare deforested. Thus, Table 42 shows the value applicable to the project.

Table 42. Total carbon emission factor.

Stratum	**CBFeq** *(tCO2e /ha)*	**COSeq** *(tCO2e /ha)*	**CTeq** *(tCO2e/ha)*
Herbaceous	0,96	20,32	21,28
Dispersed	130,63	20,99	151,63

Orinoco Forest	563,91	11,83	575,74

Source: The Cataruben Foundation, 2023.

3.7.3.3 GHG emissions in the period of analysis

3.7.3.3.3.1 Continental Wetlands

The estimation of GHG emissions from land use change in Wetlands is carried out according to the guidelines of the BCR0004 methodology, section 16.5. Thus, the following equation is used to calculate annual emissions in the baseline scenario:

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

Where:

EA_{lb}	Annual emission in baseline scenario; tCO_{2e}/ha/year
$CSCN_{lb}$	Historical changes in the baseline scenario; ha/yr.
CBF_{eq}	Carbon dioxide equivalent contained in total biomass; tCO_{2e}/ha
COS_{eq}	Carbon dioxide equivalent contained in soils; tCO_{2e}/ha

The following equation is used to calculate annual emissions in the project scenario:

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

Where:

EA_{P}	Annual emission in the scenario with project; tCO_{2e}/ha/year
$CSCN_{P}$	Change in land use in the scenario with project; ha/year
CBF_{eq}	Carbon dioxide equivalent contained in the total biomass; tCO_{2e}/ha
COS_{eq}	Carbon dioxide equivalent contained in soils; tCO_{2e}/ha

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

$$EA_F = CSCN_F\, x \left(CBF_{eq} + COS_{eq}\right)$$

Where:

EA_P Annual emission in the leakage area; tCO /ha/year$_{2e}$

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

CBF_{eq} Carbon dioxide equivalent contained in the total biomass; tCO /ha$_{2e}$

COS_{eq} Carbon dioxide equivalent contained in soils; tCO /ha$_{2e}$

3.7.3.3.2 Deforestation of forests (REDD+ activities)

The estimation of GHG emissions from deforestation is carried out according to the guidelines of the BCR0002 methodology, section 13.4.1:

$$EA_{lb} = DA_{lb}\, x\, CT_{eq}$$

Where:

EA_{lb} Annual emission in the baseline scenario; tCO /ha$_2$

DA_{lb} Annual historical deforestation in the baseline scenario; ha

CT_{eq} Total carbon dioxide equivalent; tCO /ha$_{2e}$

The following equation is used to calculate annual emissions in the project scenario:

$$EA_{REDD+proy,año} = DA_{REDD+proy}\, x\, CT_{eq}$$

Where:

$EA_{REDD+proy,año}$ Annual emission in the scenario with project; tCO /ha$_2$

$DA_{REDD+proy}$ Projected annual deforestation with project; ha

CT_{eq} Total carbon dioxide equivalent; tCO /ha$_{2e}$

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

$$EA_{f,año} = DA_f\, x\, CT_{eq}$$

Where:

$EA_{f,año}$ Annual emission in leakage area; tCO /ha$_2$

DA_f Projected annual deforestation in the LEAKAGE area; ha

CT_{eq} Total carbon dioxide equivalent; tCO /ha$_{2e}$

3.7.3.4 Reduction of GHG emissions expected with the implementation of the project activities

The project emissions reduction calculation is estimated from the difference between the baseline emissions, the scenario with project and the leakage area in each monitoring year, based on the following equation:

$$RE = (t_2 - t_1)\ x\ (EA_{lb} - EA_P - EA_f)$$

Where:

RE Emission reductions from the implementation of project activities; tCO /ha/year$_{2e}$

t_1 Initial year of the reporting period; year

t_2 Final year of the reporting period; year

EA_{lb} Emission in the baseline scenario; tCO /ha$_{2e}$

EA_p Emission in the scenario with project; tCO /ha$_{2e}$

EA_f Emission in the leakage area; tCO /ha$_{2e}$

3.7.3.4.1 Continental Wetlands

Thus, Table 43 shows the results of the annual emission reduction projection for the project quantification period; for a total of **671,696** tCO_{2e} .

Table 43. Projected GHG emission reductions to avoid land use change in wetland ecosystems, for the period 2018-2038*.*

Year	GHG emissions in the baseline scenario *(tCO2e)*	GHG emissions in the scenario with project *(tCO2e)*	GHG emissions attributable to leakage *(tCO2e)*	Estimated net GHG reduction *(tCO2e)*
2.018	41.411,53	5.383,50	3.070,53	32.958

2.019	42.985,68	5.588,14	3.065,22	34.332
2.020	42.760,65	5.558,88	2.933,01	34.269
2.021	42.536,92	5.529,80	2.807,04	34.200
2.022	42.314,48	5.500,88	2.686,97	34.127
2.023	42.093,33	5.472,13	2.572,51	34.049
2.024	41.873,46	5.443,55	2.463,35	33.967
2.025	41.654,86	5.415,13	2.359,22	33.881
2.026	41.437,52	5.386,88	2.259,85	33.791
2.027	41.221,43	5.358,79	2.165,02	33.698
2.028	41.006,59	5.330,86	2.074,47	33.601
2.029	40.792,99	5.303,09	1.988,01	33.502
2.030	40.580,61	5.275,48	1.905,42	33.400
2.031	40.369,46	5.248,03	1.826,51	33.295
2.032	40.159,52	5.220,74	1.751,10	33.188
2.033	39.950,78	5.193,60	1.679,02	33.078
2.034	39.743,24	5.166,62	1.610,10	32.967
2.035	39.536,89	5.139,80	1.544,19	32.853
2.036	39.331,72	5.113,12	1.481,15	32.737
2.037	39.127,73	5.086,60	1.420,84	32.620
2.038	1.421,70	184,82	53,85	1.183
Total	**822.311,09**	**106.900,44**	**43.717,37**	**671.696**
Estimated annual average	**39.157,67**	**5.090,50**	**2.081,78**	**31.986**

Source: The Cataruben Foundation, 2023.

Step-by-step calculations can be reviewed in ***Annex 1*** */ 1.2. Wetlands / 3. Emissions /* 4. Emission reductions */ 1. Wetland_Emissions / Sheet 1.*

3.7.3.4.2 REDD+ Activities

Table 44 shows the results of the annual emission reduction projection for the project quantification period; for a total of **2,080,480** tCO_{2e} .

Table 44. Projected GHG emission reductions from avoided deforestation, for the period 2018-2038.

Year	GHG emissions in the baseline scenario *(tCO2e)*	GHG emissions in the scenario with project *(tCO2e)*	GHG emissions attributable to leakage *(tCO2e)*	Estimated net GHG reduction *(tCO2e)*
2018	155.075,36	15.507,54	15.476,50	124.091
2019	170.180,67	17.018,07	16.149,39	137.013
2020	177.087,32	17.708,73	16.149,39	143.229
2021	182.732,19	18.273,22	16.149,39	148.310
2022	186.981,27	18.698,13	16.149,39	152.134
2023	121.402,18	12.140,22	16.149,39	93.113
2024	121.023,52	12.102,35	16.149,39	92.772
2025	120.777,67	12.077,77	16.149,39	92.551
2026	120.532,58	12.053,26	16.149,39	92.330
2027	120.287,99	12.028,80	16.149,39	92.110
2028	120.043,90	12.004,39	16.149,39	91.890
2029	119.800,30	11.980,03	16.149,39	91.671
2030	119.557,20	11.955,72	16.149,39	91.452
2031	119.314,59	11.931,46	16.149,39	91.234
2032	119.072,47	11.907,25	16.149,39	91.016
2033	118.830,84	11.883,08	16.149,39	90.798
2034	118.589,71	11.858,97	16.149,39	90.581
2035	118.349,06	11.834,91	16.149,39	90.365
2036	118.108,90	11.810,89	16.149,39	90.149
2037	117.869,23	11.786,92	16.149,39	89.933
2038	4.901,25	490,13	672,89	3.738
Total	**2.670.518,17**	**267.051,82**	**322.987,88**	**2.080.480**
Estimated annual average	**127.167,53**	**12.716,75**	**15.380,38**	**99.070**

Source: The Cataruben Foundation, 2023.

REDD+ / 2. Emissions / 3. Emissions reductions / 1. Emissions_REDD+ V3 / Sheet 1.

4. Compliance with applicable legislation

The Cataruben Foundation is aware of the imperative need to comply with national regulations for the fulfillment of its objectives, goals and projects, with the understanding that it is an obligation for both natural and legal persons to respect the set of rules that regulate individual or community activities within the Colombian territory, in order to ensure the healthy coexistence and protection of the rights of each individual in the community.

To ensure compliance with applicable legislation, the project owner follows policies and methodologies established for the development of projects related to climate change. These policies are designed to identify and follow up on the legal requirements established on issues related to the project, its participants, areas of impact and compliance activities, this approach allows mitigating future legal risks given that its actions in the development of a project are carried out within the established legal limits.

It is important to note that the applicable legislation regulates not only environmental issues, but also social, economic, and cultural situations that are relevant to the development of the project. It is important to consider exhaustive monitoring, given that the regulations are changing and are being modified, updated, or supplemented in accordance with day-to-day changes and the need to develop and study climate change.

This monitoring process is carried out through a matrix of legal regulations that is updated according to the procedure established in the document management system called Procedure GJP-14 Management of Legal Requirements and others that ensures timely and adequate compliance with laws and regulations in constant evolution. Below (Table 45) is a list of the applicable legislation on which the implementation of this project is based.

Table 45. Standards and their context of application in the Project.

STANDARD OR LAW	CHARACTERISTICS	COMPLIANCE
Law 2 of 1959 - Forest Reserves	By means of which the development of the forestry economy and the protection of soils, water and wildlife are regulated, "Protective Forest Zones" and "forests of General Interest" are established, and issues related to uncultivated land are addressed.	The project carries out activities on private properties with the purpose of promoting the conservation and sustainability of natural resources. This ensures that no adverse impacts or interventions are generated in the forest cover, thus avoiding negative environmental consequences. Although the possibility of occupying vacant land in the delimited areas has been identified, a strong emphasis is placed on forest governance and proper management of these areas, aimed at water, soil and forest conservation.
Decree 2811 of 1974 - Environmental Protection	Whereby the National Code of Renewable Natural Resources and Environmental Protection is enacted.	The project aims to comply with national regulatory guidelines to contribute to climate change mitigation and reduce deforestation and the transformation of natural ecosystems.
Law 57 of 1887 - Colombian Civil Code	It comprises the substantive legal provisions that determine in particular the rights of individuals, by reason of the status of persons, their property, obligations, contracts and civil actions.	The project is developed in ecosystems that are located in private properties, which present documentation in accordance with national legislation that allows to prove the tenure in front of it.
Political Constitution of Colombia of 1991	Articles 2, 8, 38, 38, 79, 80 and 95 state the duty of each member of society to protect the cultural and natural wealth of the Nation and guarantee the conservation of a healthy environment.	The project promotes and develops activities for the conservation of forest and Wetland ecosystems, in this sense, it aims to comply with the legal requirement.
Law 164 of 1994 - Climate Change	United Nations Framework Convention on Climate Change Whereby the commitment to adopt measures to reduce GHG emissions into the atmosphere is ratified.	The project aims to comply with national regulatory guidelines to contribute to the reduction of GHG emissions through forest and Wetland conservation activities that contribute to reducing deforestation and the transformation of areas.

STANDARD OR LAW	CHARACTERISTICS	COMPLIANCE
National Policy for Integrated Biodiversity Management of 1996.	To prevent and control the accelerated loss and transformation of biodiversity, as well as to reduce and mitigate the negative effects this generates on the quality of life.	The projects led by The Cataruben Foundation are aimed at contributing to the mitigation of climate change through strategies that include the conservation of forests, wetlands and the biodiversity identified there, in private properties that are formally enrolled with the entity.
Conpes 2834 of 1996 - Forestry Policy	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 improving the quality of life of the population.	The project aims to comply with national regulatory guidelines to contribute to climate change mitigation and reduce deforestation.
Law 357 of 1997 - Convention on Wetlands	Convention on Wetlands of International Importance especially as Waterfowl Habitat", signed at Ramsar on February 2, 1971.	The project aims to contribute to the mitigation of climate change through strategies that include the conservation of forests, wetlands and the biodiversity identified therein, on private properties that are formally enrolled with the entity.
1998 Green Plan	Generate the basis for involving ecological restoration, reforestation for environmental and commercial purposes, and agroforestry in environmental land use planning.	The development of the Green Plan is a process that involves the implementation of activities in the short, medium and long term, thus generating a commitment between the environmental actors of the State, civil society and the private sector, where Cataruben, through its carbon project, contributes to the development of this guideline.
Decree 1320 of 1998 - Prior Consultation	Whereby prior consultation with indigenous and black communities for the exploitation of natural resources within their territory is regulated.	In the development of the project to comply with the guidelines established in this decree, the Ministry of the Interior was consulted to verify if there were any overlaps in the areas to be included in the project with indigenous communities, so this regulation was complied with.
Law 629 of 2000 - Approval of the Kyoto Protocol in Colombia.	Greenhouse gas quantification and reduction, climate change mitigation strategies	The reduction of greenhouse gas emissions in the areas to be conserved within the project contributes to the fulfillment of Colombia's commitments under the

STANDARD OR LAW	CHARACTERISTICS	COMPLIANCE
		Kyoto Protocol on Climate Change.
1998 Ramsar Convention	By which the sustainable use, conservation and management of wetlands is regulated, and aspects related to them are developed in application of the RAMSAR convention.	The reduction of greenhouse gas emissions in the areas to be conserved within the project contributes to the fulfillment of the commitments acquired by Colombia in the Ramsar Convention.
Decree 3570 of 2011 - Ministry of the Environment	Whereby the objectives and structure of the Ministry of Environment and Sustainable Development are modified and the Administrative Sector of Environment and Sustainable Development is integrated.	The project must adopt the requirements and regulations issued by the Ministry of the Environment and Sustainable Development as the entity responsible for overseeing these activities; in this sense, the project aims to comply with the legal requirement.
Law 1753 of 2015 - National Plan for Social Development 2015-2018	The main objective is to build a peaceful, equitable and educated Colombia, in harmony with the purposes of the national government, with international best practices and standards, and with the long-term planning vision envisaged by the Sustainable Development Goals.	Under this law, the National Government sets goals for the reduction of deforestation, encouraging the active participation of producers and committing to establish sustainability agreements. The Cataruben Foundation is aligned with this approach to forest conservation, developing activities aimed at ensuring the sustainability and durability of the forests over time, a goal pursued by the Project.
Law 1819 of 2016 - Structural Tax Reform	Whereby a structural tax reform is adopted, the mechanisms to fight tax evasion and avoidance are strengthened, and other provisions are enacted.	It is the norm that regulated the known green tax or carbon tax, so that it promotes REDD+ projects to generate the compensation of the carbon footprint of each person or entity that is obliged to contribute with this tax in the percentage allowed by law. The project implements Forest and Wetland conservation activities, thus leveraging the development of this activity, which is to contribute to climate change mitigation.
2016 National Climate Change Policy	Strategies and actions to manage knowledge about climate change and its potential consequences on communities, biodiversity, ecosystem services and the country's economy.	The project is aimed at contributing to the mitigation of climate change through strategies that include the leadership of projects that enable training and the development of carbon footprint offsetting strategies

STANDARD OR LAW	CHARACTERISTICS	COMPLIANCE
		and conservation activities.
Decree 298 of 2016 - National Climate Change System.	Whereby the organization and operation of the National Climate Change System is established and other provisions are enacted.	The Cataruben Foundation formulates carbon projects that seek or are aimed at contributing to the mitigation of climate change for which the policies, regulations and strategies dictated by the National Government are foreseen, thus joining efforts to the same end.
Decree 926 of 2017 - Carbon Tax.	It establishes the mechanism and/or regulation of the non-chargeability of the carbon tax, as well as the definition of the agencies that will be in charge of verifying the reductions in carbon emissions, among others, and aims to regulate the procedure to make effective the non-chargeability of the national carbon tax.	This Decree regulates the non-causation of the carbon tax, which means an exemption to the payment of the tax, generating guidelines to calculate its carbon footprint by consumption of fossil fuels and how it can be certified as carbon neutral. The Cataruben Foundation through projects such as CO2Bio allows people obliged to cause the carbon tax to offset up to 50% of it in compliance with the law and thus contribute to the development of conservation activities of forest and Wetland ecosystems.
Law 1844 of 2017- Paris Agreement	Adopts the Paris agreement in Colombia for all countries that are party to it.	The Cataruben Foundation formulates carbon projects that seek or are aimed at contributing to the mitigation of climate change for which the policies, regulations and strategies dictated by the National Government are foreseen, thus joining efforts to the same end.

STANDARD OR LAW	CHARACTERISTICS	COMPLIANCE
Resolution 1447 of 2018 - Monitoring system, GHG emissions reporting.	Its purpose is to regulate the System for Monitoring, Reporting and Verification 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 (GHG) Emissions, which includes the National Registry of Programs and Projects of actions for the Reduction of Emissions from Deforestation and Forest Degradation in Colombia (REDD+).	This Resolution establishes the deadlines for registration of climate change mitigation projects before RENARE and the Monitoring System for Reporting and Verification of mitigation actions at the national level, in relation to the GHG emissions removal accounting system. The project is registered in the RENARE platform in the feasibility phase.
Law 1931 of 2018 - Climate Change Guidelines	Establishes guidelines, mainly on climate change adaptation actions, as well as on greenhouse gas mitigation, in order to reduce the vulnerability of the country's population and ecosystems to the effects of climate change and promote the transition to a competitive, sustainable economy and low-carbon development.	The project adheres to these guidelines, given that it constitutes a strategy to mitigate climate change and reduce deforestation and the transformation of forests and wetlands. Once the platform is operational, the necessary updates will be made to continue to the formulation phase.
Conpes 4021 of 2020 - Deforestation Control and Sustainable Management of Forests	Provides policy guidelines to counteract deforestation and promote sustainable forest management; the goal is to achieve zero deforestation by 2030. This policy will have a follow-up, physical and budgetary execution for the fulfillment of its objectives through the Action and Follow-up Plan (PAS), during an implementation period of 10 years.	The project complies with national regulatory guidelines, thus contributing to climate change mitigation and reducing deforestation in the country's forests.
Decree 446 of 2020 - Verification Body for GHG reductions and removals.	Whereby Article 2.2.11 .1.2 of Chapter 1 of Title 11 of Title 11 of Part 2 of Book 2 of Decree 1076 of 2015 is amended, and an article is added to Chapter 1 of Title 11 of Part 2 of Book 2 of Book 2 of Decree 1076 of 2015, in relation to the accreditation of verification bodies for greenhouse gas emission reductions and removals.	The projects led by The Cataruben Foundation comply with the requirements established in the methodologies for planning and implementing greenhouse gas (GHG) mitigation initiatives. This process follows a step-by-step approach, which involves submitting the initiative to a verifying entity to

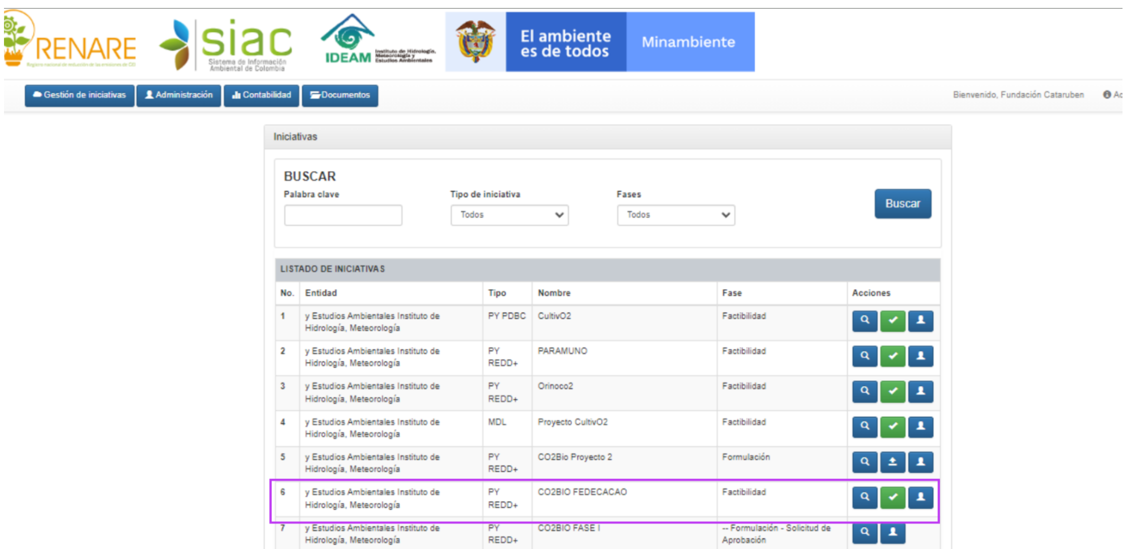
STANDARD OR LAW	CHARACTERISTICS	COMPLIANCE
		validate its development, thus ensuring compliance with the relevant legal requirements.
Resolution 831 of 2020 - Amends Resolution 1447 of 2018.	Whereby Resolution 1447 of 2018 is modified and other determinations are made, regarding the regulation of the Monitoring, Reporting and Validation (MRV) system of GHG mitigation actions at the national level. It modifies and clarifies the methodological procedure of GHG projects, regarding registration and certification.	It establishes guidelines for maintaining and demonstrating the methodological consistency of project baselines, which is why the CO2Bio P2-2 project is aligned with this regulation.
Law 2169 of 2021 - Carbon Neutrality	This regulation establishes minimum goals and measures to achieve carbon neutrality, climate resilience and low carbon development in the country in the short, medium and long term, and establishes other provisions.	The projects led by Cataruben are aimed at contributing to the mitigation of climate change, through strategies that include the leadership of projects that allow training and the generation of carbon footprint offsetting strategies.
Resolution 849 of 2022 - Integral Territorial Climate Change Management Plans - PIGCCT	To establish the "Guide for the formulation and implementation of the Integrated Territorial Climate Change Management Plans - PIGCCT", hereinafter the Guide, which is an integral part of this resolution together with its annexed documents.	Cataruben-led projects are primarily aimed at contributing to climate change mitigation through strategies that encompass the conservation of forests, wetlands and biodiversity on private properties formally enrolled with the entity. It is essential to familiarize oneself with all guidelines and agreements related to climate change mitigation in order to join efforts towards a common goal.
Compliance with regional and local regulations	Municipal Development Plans and Regional Autonomous Corporation Action Plans	The project proposes, for the first monitoring period 2018 - 2021, the implementation of activities in accordance with the special protection and land management figures. However, for future verifications, the project will consider the review of the updates of the land use planning guidelines (Municipal Development Plans and CAR Action Plan), in the monitoring reports considering their modifications.

Source: The Cataruben Foundation, 2023.

4.1 National Registry for Greenhouse Gas Emission Reduction - RENARE

The RENARE platform integrates four registration phases (feasibility, formulation, implementation and closure), in each of which the results of GHG emission reduction projects in the country are monitored over time. The project is registered in the platform under the REDD+ project category in its initial feasibility phase (Feasibility Phase). By being registered in this official platform, the project demonstrates its alignment with national climate change policies and its effective contribution to environmental protection and sustainability in the Orinoquia region of Colombia.

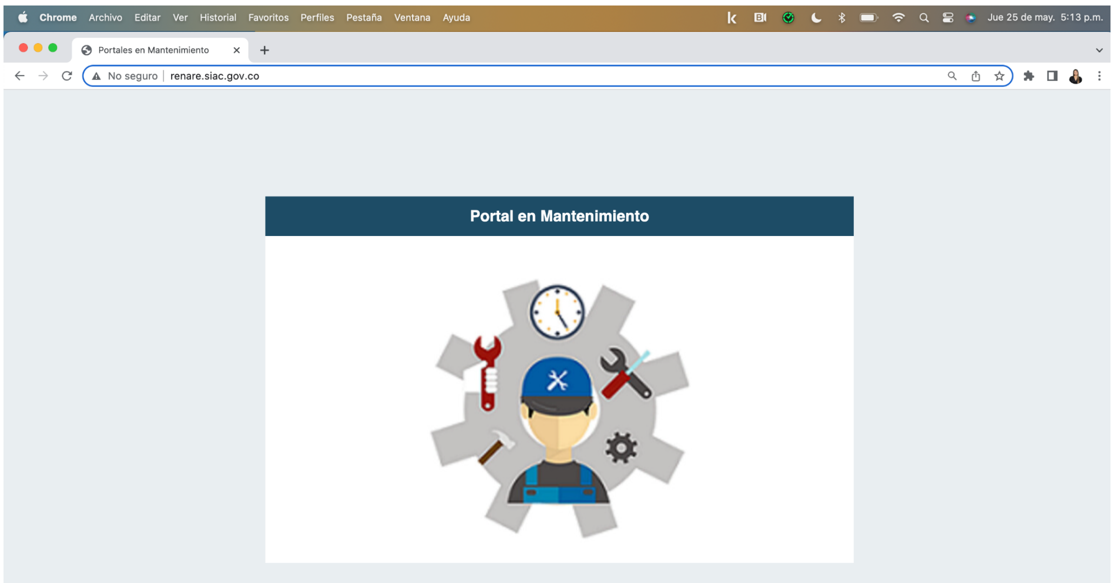
Image 27. Project registration in the RENARE web platform.



Source: Renare, 2022

Considering that as of August 9, 2022, an email notification was sent to the Ministry of Environment stating that the platform would be temporarily closed for maintenance (RENARE platform notice), and that the portal is currently out of service, as shown in *Image 28*, the project owner has not been able to continue reporting the information corresponding to the formulation phase through the platform. However, the Ministry of Environment is expected to complete the maintenance of the application to proceed with the reporting of project information and to provide the necessary updates as required by national regulations.

Image 28. RENARE Platform - Portal under maintenance.



Source: http:/renare.siac.gov.co, May 25, 2023.

It is important to note that the project owner is committed to complying with national regulations and updating the RENARE platform as soon as possible. This will ensure transparency and traceability of the project's progress and achievements in reducing GHG emissions and protecting and conserving forest and wetland ecosystems.

Recently, the Ministry of the Environment and Sustainable Development was asked for information on the estimated date on which the platform would be operational again (Radicado MinAmbiente), but no information has been received.

On the other hand, in order to avoid possible overlapping of areas, a review of projects registered in different GHG Project certification standards such as Biocarbon Registry, Colcx, Cercarbono and Verra was carried out, taking as reference other projects located in the departments of Arauca and Casanare, finding that there is no overlapping and/or double accounting with the areas of intervention of the Project. [Review of projects registered in other GHG certification platforms]().

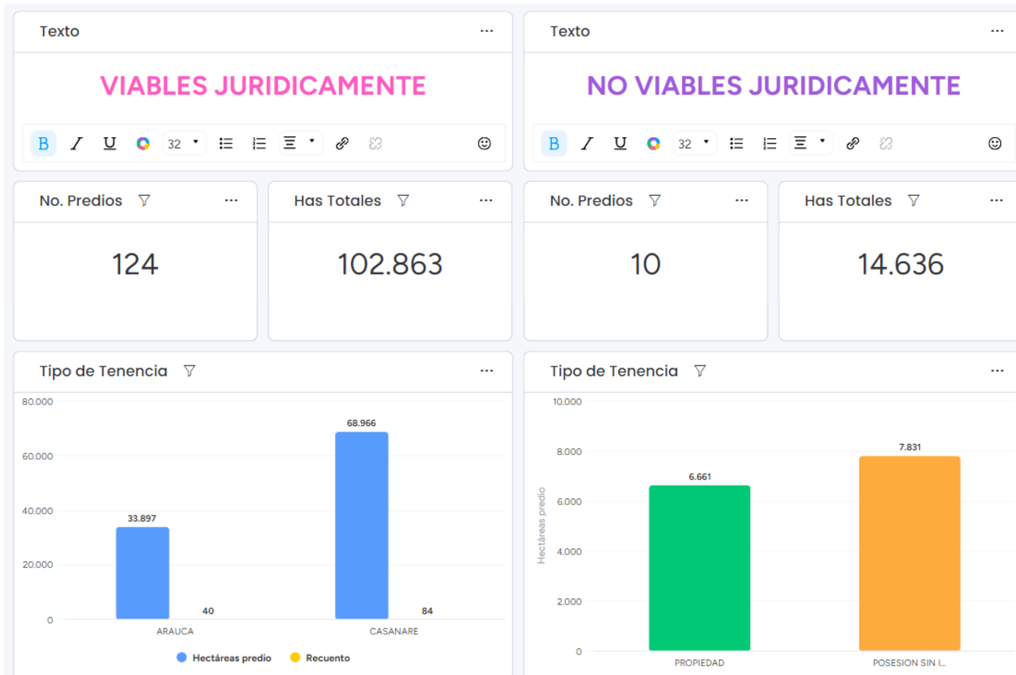
5. Carbon ownership and rights

Property is regulated in the Colombian Civil Code and its concordant norms, which state that property is the real possibility to use, enjoy or dispose of a tangible object, without infringing the rights of others or the law.

For the implementation of the project, the process of analysis of the documentation provided by the interested parties or applicants to be part of the project begins, in order to identify who has the best right to the project.

Cataruben's Governance area together with its group of legal professionals intervene in the process of applying for land for the project, analyzing all the documents provided by the people interested in enrolled, among these we find public deeds, certificates of tradition and freedom, resolutions, contracts, certificates of sound possession, property tax, among others, resulting in a legal concept of feasibility or not, as appropriate or the identification of encumbrances found in such documentation that may limit the ownership of the same and the permanence in the project.

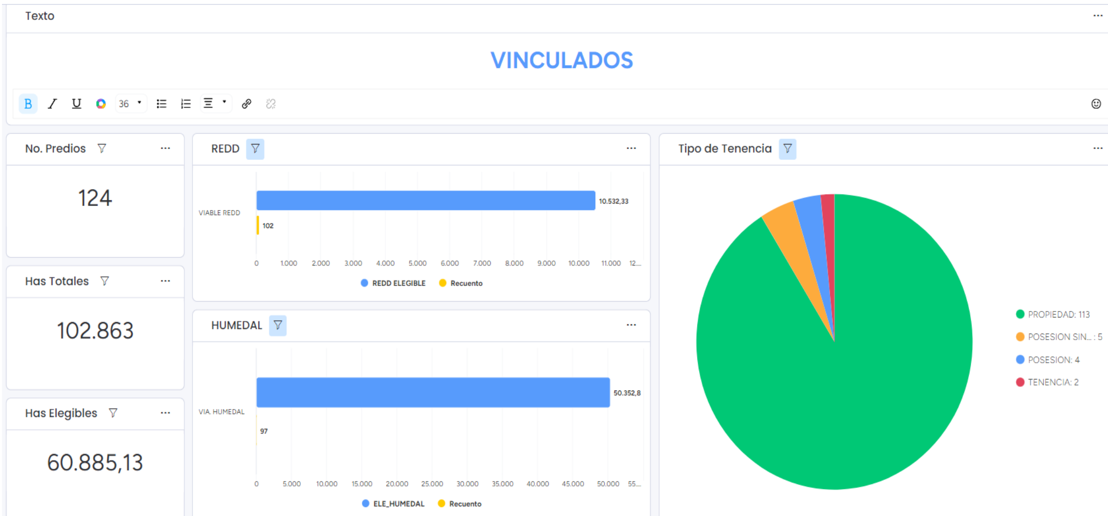
Image 29. Legal analysis process - Cataruben database.



Source: The Cataruben Foundation, 2023.

Currently, it is taken as a reference in terms of carbon ownership that the person who enjoys these rights is the person who proves ownership, possession and/or tenure of the asset, thus, although there is no explicit definition of this, an equivalence is made with property rights based on the legal analysis and supported by the documents that are provided within the process and that are analyzed for this purpose. From this analysis it was possible to establish for CO2Bio P2-2 that 124 properties complied with the necessary documents to determine the type of tenure, classified as owners, possessors and/or holders of the same, which were enrolled formally with the organization accepting the commitment to develop climate change mitigation activities in each of their properties.

Image 30. Determination of the type of tenure - Property enrolled.



Source: The Cataruben Foundation, 2023.

5.1. Project owner

The Cataruben Foundation is a non-profit organization with more than 10 years of presence in the Colombian territory, which implements nature-based climate solutions to conserve biodiversity, water and strategic ecosystems through the implementation of climate change mitigation projects.

Table 46. GHG Project holder contact information.

Individual or organization	THE CATARUBEN FOUNDATION
Contact person	Lisbeth Menjure Barrera
Position	Leader CO2Bio P2-2 Project
Address	Yopal - Casanare Carrera 20 No. 36 - 04
Phone	Tel. 3204690315 / 3203108839
Email	co2bio@cataruben.org

Source: The Cataruben Foundation, 2023.

Specifically, the Foundation has a molecular-type organizational structure of self-directed groups and technological migration in order to execute high-impact projects (Graph 1). Currently, it is legally constituted and in this case is the owner of the project.

Figure 9. Organizational Structure The Cataruben Foundation.

Source: The Cataruben Foundation, 2023.

5.2 Other project participants

5.2.1. Owners

The owners , now qualified because of their important work as Ecosystem Managers, represent a group of people located in the Orinoquia Region, enrolled in turn contractually with the Project, with legal possession of their private properties; in which they have voluntarily decided to conserve the forests and wetlands that lie there and thus the biodiversity that is housed.

The above, motivated by the fact of contributing to the preservation of the environment, joining efforts to be part of the actions that mitigate climate change, implementing conservation activities and protection of natural ecosystems present in their properties to ensure the stay of existing biodiversity and in turn the capture of carbon stocks, also seeking to be recognized for it to implement improvements in their properties that mean economic, social and environmental welfare. Thus, the Ecosystem Managers are the main executors of the conservation commitments and project activities.

For the Ecosystem Managers to be part of the project, they must go through an enrolled process that begins with the documentary attainment of some minimum and necessary requirements to perform a legal analysis in accordance with the requirements previously established by the project's Governance team and in accordance with Colombian regulations and laws; through which the type of tenure that each owner has in his property is fully identified (ownership, possession and tenant), in order to make legally viable the entry of their real estate to the Project, and then continue the course of the enrolled with the different technical analyses that enable the eligibility of the areas to be conserved and end with the completion of the contractual agreements.

General / 1.1.3 Enrolled documents (1.1.3. Enrolled documents), lists the letters of intent and legal documents that include the contract and the supports that demonstrate ownership of the carbon.

Table 47. Project beneficiaries and location of properties.

DEPARTMENT	MUNICIPALITY	VEREDA	PROPERTY	OWNER
Casanare	Hato Corozal	Berlin	El Baúl de los Recuerdos	Edilia Cristina Camargo Gil
		El Brillante	Finca El Torreño Dos	Robert Julio Torres Godoy Rosa Victoria Cisneros
			Finca La Arenosa Dos	Licet Yadira Torres Ospina Maria Consuelo Ospina
			Finca La Arenosa 3	Licet Yadira Torres Ospina
		La Florida	El Guamo	Luis Angel Madrid Berroteran
			Santo Domingo Florideño	Luis Angel Madrid Berroteran
			La Florida	Luis Angel Madrid Berroteran Gilma del Carmen Madrid B
		Las Mercedes	Miramar	Wilmer Javier Mujica
		San Nicolas	El Porvenir	Ronis Lisandro Delgado F
		Santa Barbara	Puerto Lindo	Luisa Maria Herrera Vivas
		Santa Maria del Chire	No Se Sabe	Armira Rincon Mujica Benito Barrera Wilches

	Orocue	Aguaverde	Las Brisas	Ana Brigida Angel Arenas
			Buenos Aires	Gilmar Ignacio Madrid
		Claveles	Lote La Mosca	Luz Marina Granados
		La Esmeralda	Buenavista I	Carlos Arturo Zambrano F
			Lote 6	Fabio Andres Pulido Rivera Maria Camila Pulido Rivera
		La Independencia	La Candelaria	Andres Reyes Diaz
			Candelaria Uno	Andres Reyes Diaz
		La Libertad	Buenos Aires	Edilberto Cruz Rodriguez
		Mariara	Lote Dos (San Felipe 2)	Maria Lucila Reyes O
		San Rafael de Guirripa	El Renacer	Edilberto Cruz Rodriguez
	Paz de Ariporo	Caño Chiquito	San Benito	Marcio Salomon Benavides
		El Caribe	Guaratal 2	Rafael Antonio Riveros
			La Honda I	Rafael Antonio Riveros
		La Aguada	Babilonia	Ofelia del Pilar Latriglia Didimo Emilio Cristancho
		La Hermosa	Lote 2 Ana Maria	Dagoberto Bravo Uribe
			Lote Número Uno La Esperanza	Eduardo Martinez S
			Lote Número Tres El Paraíso	Eduardo Antonio Martinez
			San Jose	Dagoberto Bravo Uribe
			El Tirrigal	Eduardo Fernandez D
		La Lopera	Los Esfuerzos	Rafael Antonio Riveros
		La Veremos	El Garcero	Vicente Cortes Guarin
		Las Guamas	El Caribe	Carlos Armando Yustre
		Los Morichales	La Cascabel	Diana Alexandra Braydi
		Normandía	El Morichal de los deseos	Jose Ramon Gonzalez Argerima Varon Montealeg
		San Esteban	Los Arrecifes	Ciro Alfonso Silva Paez Bethsy Miladis Gutierrez
			Naranjal	Luis Alberto Lopez
			El Brillante	Jairo Manuel Parales Miller
			Finca San Juan Lote	Vianey Pastrana Chaparro
			San Juan 2	Vianey Pastrana Chaparro
			El Canal Lote 1	Vilma Vargas Becerra

			Lagunitas	Raquel Zambrano Silva
			El Espejo	Oscar Zambrano Silva Ana Dilia Abril Tunarosa
			La Esperanza	Pedro Vidal Arenas Angel
			El Milagro	Homero Antonio Garcia
			Finca La Esperanza	Gloria Eugenia Cardenas Judy Lizeth Perez Luis Efren Cardenas Caro Aldemar Parra Huertas
			La Bendición	Carlos Hernan Barragan
			Villa Fernanda	Elkin Benavides Ruiz
			El Palmar	Paco Benavides Ruiz Carmen Cecilia Benitez
			La Cucaracha	Vianey Pastrana Chaparro
			Banco Fresco	Jose Dario Hernandez Hurtado Mabel Cristiano
			San Esteban	Jairo Fernandez Berroteran Omaira Fernandez
			El Delirio	Javier Orlando Parales Julian Eduardo Baron
			El Control	Yenny Marlene Gutierrez
			La Libertad	Blanca Bustamante
			Las Garzas	Lyda Maria Ochoa Tumay
			La Palmita	Magda Johana Romero Willinton Benavides Ruiz
			El Algarrobo	Vicente Cortes Guarin Mireya Nuñez de Cortes
		San José de la Lopera	Campo Hermoso	Merci Lopez Acevedo
		Varsovia	La Yubereña	Rosalba Cristancho
			El Rincon	Las Colineras Inversiones SA
	Pore	Bocas de Pore	El Cebu	Wilson Orlando Valderrama
		Vijagual	Lote 1	Wilson Orlando Valderrama
			Lote 2	Wilson Orlando Valderrama
	San Luis de Palenque	El Tigre	Mata de Samuro	Carlos Alberto Farfan
		Guanapalo	El Garcero	Rafael Antonio Riveros
		La Venturosa	Buenavista	Andrea Hernandez Betancourt

	Tauramena	La Güira	El Tranquero	Julian Ricardo Ramirez H
			Hacienda El Rosal	Yamile Vargas Hernandez
	Trinidad	Araguaney	Las Pampas	Pedro Vidal Arenas Angel
		Bélgica	El Zaman	Jesus Mejia Ruiz
			El Cairo	Jesus Mejia Ruiz
			La Libertad	Jesus Mejia Ruiz
		El Cepilla	La Esperanza	Pedro Antonio Acosta
			Villa Blanca	Yolman Alfredo Acosta Gaitan
		La Esperanza	El Amparo	Martha Dignory Rojas Holguin
		La Reforma	El Remache Numero 1	Dora Maria Pan de Betancourt
		Porvenir de Guachiria	Miralindo	Carmen Elisa Perez Cibo Devier Salazar Garcia
			La Gloria	Gloria Esther Parada
			Campo Lindo	Cirilo Hernandez Damaris Conde
		Santa Maria del Loro	La Macolla	Mary Sol Parada Vargas Jose Uber Garcia Farfan
			El Cairo	Yoryi Judith Garcia Niño James Garcia Niño Herlendis Garcia Niño Lisnelia Garcia Niño
	Yopal	Alemania	La Maporoza	Claudia Tatiana Rincon Maria Del Pilar Rincon
		Tilodiran	Las Brisas	Jorge Eduardo Garcia
Arauca	Arauca	Barrancón	Villa Martha	Luis Fernando Anzola Pinto Jorge Tadeo Anzola Pinto Martha Isabel Anzola Pinto Oscar Gerardo Anzola German Alfonso Anzola Angel Gabriel Lizcano Juan Diego Lizcano Anzola
		Maporita	Moscú	Trino Isnardo Torres Muñoz
		Merecure	Finca La Costeña	Luis Ernesto Rodriguez
	Cravo Norte	Agualinda	Finca La Fuente de Oro	Alvaro Sigifredo Vega
			Los Siete Diamantes	Diego Alejandro Torres
		Buenos Aires	Las Escudillas	Miguel Angel Diaz Sanchez
		Cinaruco	Panamá	Eucaris Quintero Lopez
			El Cielo	Gloria Ines Cedeño Garcia

			La Revancha	Wilson Javier Dinas Vivas
		El Corozo	La Magola	Efidelia Madrid Sergio Antonio Hidalgo Neme
		Juriepe	Finca Cuernavaca	Oscar Eduardo Santana
			Finca Los Pionios	Fenibal Andres Zuluaga Q
			Finca Vida Tranquila	Ciro Antonio Sanchez Vega
			Finca Villa Tania	Tania Leidy Garces Gaitan
		La Esperanza	Finca La Bonanza	Oscar Sadid Santana
			Finca Vendaval	Oscar Julian Murcia
			Finca El Morrocoy	Nicolas Antonio Ojeda Rosa Florez
			Finca La Ponderosa	Richards Jose Santana M
			Finca Los Paraguitos	Elguer Ernesto Ojeda Florez Carmen Yasmina V
			Finca El Ponque 2	Cesar Facundo Torres
			Finca El Ponque 3	Diego Alejandro Torres
		Lejanías	La Calandria	Ana Alfonsa Guerra
			El Corozo	Manuel Guzman Puerta
		Lejanías de Juriepe	Finca Suro Verde	Rosa Ediomilina Alvarado
			Finca Santa Ana	Nelsa Romero Betancourt
		Macuelo	Las Brisas	Libia Margarita Maurno
		Mochuelo	Finca El Conuco	Jose Nicolas Magurno
		Samuco	Finca Santa Martha	Carmen Beatriz Bolivar
		San José	Finca La Ponderosa	Jose Luis Garrido Sanchez Ana Francisca Tineo
	Puerto Rondón	Aguas Claras	Finca Altagracia	Edgar Fabian Mendoza
			Finca Las Pampas	Shirley Johanna Mendoza
			Finca El Palmar	Bolivar Mendoza Bohorquez
			Finca Los Corazones	Yolima Sierra Parra
			Altagracia	Tirso Gustavo Masmela
		El Letrero	Finca Santa Barbara	Cilia Graciela Osorio
	Tame	La Piedra	Altamira	Am Constructores SA
		Las Canoas	Franfol	Am Constructores SA
		Sabana de la Vieja	Sinai	Alejo Alfredo Aponte Arias
		Saparay	Finca Las Delicias	Yudys Janeth Reuto Reuto

Source: *The Cataruben Foundation, 2023.*

5.3. Agreements related to carbon rights

Once it has been clarified who owns the rights and ownership of the carbon, the total legal ownership of the existing verified carbon certificates must be transparently demonstrated, The Cataruben Foundation refers to different requirements that demonstrate the quality of tenure held by the owner of the Property enrolled in the project.

Consequently, in cases where the project owner is a natural or legal person other than ethnic groups and/or local traditional communities, the project owner must request certification from the Directorate of Prior Consultation to determine whether ethnic groups are present in the area of influence of the project.

In accordance with the provisions of ILO Convention 169, prior consultation is the fundamental right of ethnic groups to be able to decide on legislative and administrative measures, projects, works or activities to be carried out within their territories, insofar as these may affect their lives, beliefs, institutions, spiritual well-being and the lands they occupy or use in some way, and to control, to the extent possible, their own economic, social and cultural development.

In this context and with the purpose of not violating the fundamental rights of the communities, The Cataruben Foundation on June 21, 2023 submitted an official letter to the Ministry of the Interior, requesting the determination of the appropriateness and timeliness of the prior consultation for the implementation of the Project, which was duly received and assigned the file number 2023-1-004044-0145285. As a result of this action, the Ministry of the Interior issued Resolution Number ST-1449 of October 4, 2023, which resolved that the prior consultation was not appropriate.

5.4 Land tenure

During the application process for a GHG emissions reduction project, The Cataruben Foundation carries out a call for applications and later legal analysis of documents that are provided by the owners of the Properties with the intention of participating in the CO2Bio P2-2 project, Among the documents that we find and validate are, Certificates of Tradition and Freedom, Public Deeds, Adjudication Resolutions, Court Judgments, Certificates of Good Possession, Cadastral Certificate, Peace and Property Tax Invoice, Purchase and Sale Contracts, map or plan; This in order to know the current legal status of the property, traceability of tenure over the years, boundaries of the properties, geographical location, verification at the Land Restitution Unit that the properties to be enrolled in the project are not in the process of restitution, possible encumbrances that may have the same (mortgages, liens, property restrictions and any other legal restrictions) and background checks.

Once the related documentation has been analyzed, the Governance area is able to determine who is the owner of the land tenure of the postulated property and in effect also owner of the Verified Carbon Certificates (VCC), the enrolled parties formalize the enrolled project through a contract signed by the interested parties, which establishes their obligations, eligible areas of the project's ecosystems that are in the legally viable property, duration of the contract and other provisions, among others. It is pertinent to point out that within the obligations established in the aforementioned document, it is established that the Ecosystem Manager must demonstrate the ownership or tenure of the land during the execution of the project and also the governance of such property.

The legal supporting documentation can be evidenced in ***Annex 1*** */ 1.1. General / 1.1.1 Commencement of activities (Enrolled Documents).*

Table 48. List of Properties CO2Bio P2-2, with their real estate identification, respective owner and consultation of land restitution processes.

DEPARTMENT	MUNICIPALITY	PROPERTY	OWNER	FORESTS	WETLANDS	FOLIO DE MATRÍCULA INMOBILIARIA / CADASTRAL IDENTIFICATION CARD	TYPE OF OWNERSHIP	LAND RESTITUTION PROCESSES
	Hato Corozal	El Baúl de los Recuerdos	Edilia Cristina Camargo Gil	x	x	475-401	Property	No record
		Finca El Torreño Dos	Robert Julio Torres Godoy Rosa Victoria Cisneros	x	x	475-18684	Property	No record
		Finca La Arenosa Dos	Licet Yadira Torres Ospina Maria Consuelo Ospina	x	x	475-18464	Property	No record
		Finca La Arenosa 3	Licet Yadira Torres Ospina	x	x	475-18700	Property	No record
		El Guamo	Luis Angel Madrid Berroteran	x	x	475-6200	Property	No record
		Santo Domingo Florideño	Luis Angel Madrid Berroteran		x	475-6172	Property	No record
		La Florida	Luis Angel Madrid Berroteran Gilma Del Carmen Madrid Berroteran	x	x	475-6209	Property	No record
		Miramar	Wilmer Javier Mujica Colmenares	x		475-6219	Property	No record
		El Porvenir	Ronis Lisandro Delgado Fernandez		x	475-33641	Property	No record
		Puerto Lindo	Luisa Maria Herrera Vivas	x	x	475-17151	Property	No record
		No Se Sabe	Armira Rincon Mujica Benito Barrera Wilches	x	x	475-37320	Property	No record

	Orocue	Las Brisas	Ana Brigida Angel Arenas	x	x	086-5619	Property	No record
		Buenos Aires	Gilmar Ignacio Madrid Angel	x		086-6005	Property	No record
		Lote La Mosca	Luz Marina Granados	x	x	086-1728	Property	No record
		Buenavista I	Carlos Arturo Zambrano Fuentes		x	086-6346	Property	No record
		Lote 6	Fabio Andres Pulido Rivera Maria Camila Pulido Rivera	x	x	852300000000000 20001100000000	Possession	No record
		La Candelaria	Andres Reyes Diaz	x	x	086-5567	Property	No record
		Candelaria Uno	Andres Reyes Diaz		x	086-5571	Property	No record
		Buenos Aires	Edilberto Cruz Rodriguez	x	x	086-6013	Property	No record
		Lote Dos (San Felipe 2)	Maria Lucila Reyes Ordoñez	x		086-7187	Tenure	No record
		El Renacer	Edilberto Cruz Rodriguez	x	x	086-6010	Property	No record
	Paz de Ariporo	San Benito	Marcio Salomon Benavides Ruiz	x	x	475-13488	Property	No record
		Guaratal 2	Rafael Antonio Riveros Cardozo		x	475-23922	Property	No record
		La Honda I	Rafael Antonio Riveros Cardozo		x	475-33336	Property	No record
		Babilonia	Ofelia del Pilar Latriglia Avila Didimo Emilio Cristancho Tarache	x		475-14149	Property	No record
		Lote 2 Ana Maria	Dagoberto Bravo Uribe	x	x	475-33748	Property	No record
		Lote Uno La Esperanza	Eduardo Martinez Sarmiento		x	475-37122	Property	No record
		Lote Tres El Paraíso	Eduardo Antonio Martinez		x	475-37124	Property	No record

			Parales					
		San Jose	Dagoberto Bravo Uribe	x	x	475-33746	Property	No record
		El Tirrigal	Eduardo Fernandez Delgado	x	x	475-7816	Property	No record
		Los Esfuerzos	Rafael Antonio Riveros Cardozo	x	x	0003000000190007000000000	Possession	No record
		El Garcero	Vicente Cortes Guarin	x	x	475-32049	Tenure	No record
		El Caribe	Carlos Armando Yustre Nieves	x	x	475-31899	Property	No record
		La Cascabel	Diana Alexandra Braydi Eslava		x	475-31522	Property	No record
		El Morichal de los deseos	Jose Ramon Gonzalez Lizcano Argerima Varon Montealegre		x	475-11672	Property	No record
		Los Arrecifes	Ciro Alfonso Silva Paez Bethsy Miladis Gutierrez Oropeza	x	x	475-17461	Property	No record
		Naranjal	Luis Alberto Lopez Town Crier	x	x	No record	Possession	No record
		El Brillante	Jairo Manuel Parales Miller	x	x	475-14146	Property	No record
		Finca San Juan Lote	Vianey Pastrana Chaparro	x	x	475-19093	Property	No record
		San Juan 2	Vianey Pastrana Chaparro	x	x	475-34310	Property	No record
		El Canal Lote 1	Vilma Vargas Becerra		x	475-12762	Property	No record
		Lagunitas	Raquel Zambrano Silva		x	475-11329	Property	No record
		El Espejo	Oscar Zambrano Silva Ana Dilia Abril Tunarosa	x	x	475-35776	Property	No record

		La Esperanza	Pedro Vidal Arenas Angel	x	x	475-15156	Property	No record
		El Milagro	Homero Antonio Garcia Agudelo	x	x	475-15100	Property	No record
		Finca La Esperanza	Gloria Eugenia Cardenas Caro Judy Lizeth Perez Cardenas Luis Efren Cardenas Caro Aldemar Parra Huertas	x	x	475-18742	Property	No record
		La Bendición	Carlos Hernan Barragan	x	x	475-14758	Property	No record
		Villa Fernanda	Elkin Benavides Ruiz	x	x	475-13423	Property	No record
		El Palmar	Paco Benavides Ruiz Carmen Cecilia Benitez Garcia	x	x	475-11828	Property	No record
		La Cucaracha	Vianey Pastrana Chaparro		x	475-24840	Property	No record
		Banco Fresco	Jose Dario Hernandez Hurtado Mabel Cristiano Rincon		x	475-32502	Property	No record
		San Esteban	Jairo Fernandez Berroteran Omaira Maria Fernandez Berroteran	x	x	300160019000	Possession	No record
		El Delirio	Javier Orlando Parales Mendez Julian Eduardo Baron Castro	x	x	475-14658	Property	No record
		El Control	Yenny Marlene Gutierrez Oropeza		x	475-17391	Property	No record
		La Libertad	Blanca Xiomara Bustamante	x	x	475-14424	Property	No record
		Las Garzas	Lyda Maria Ochoa Tumay	x	x	475-28582	Property	No record
		La Palmita	Magda Johana Romero Willinton Benavides Ruiz	x	x	475-13487	Property	No record

		El Algarrobo	Vicente Cortes Guarin Mireya Nuñez de Cortes		x	475-9881	Property	No record
		Campo Hermoso	Merci Lopez Acevedo		x	No record	Possession	No record
		La Yubereña	Rosalba Cristancho Tarache	x	x	475-31210	Property	No record
		El Rincon	Las Colineras Inversiones SA	x	x	475-31210	Property	No record
	Pore	El Cebu	Wilson Orlando Valderrama	x	x	475-8094	Property	No record
		Lote 1	Wilson Orlando Valderrama		x	475-9017	Property	No record
		Lote 2	Wilson Orlando Valderrama		x	475-9018	Property	No record
	San Luis de Palenque	Mata de Samuro	Carlos Alberto Farfan	x		475-3960	Property	No record
		El Garcero	Rafael Antonio Riveros Cardozo	x		475-13043	Property	No record
		Buenavista	Andrea Hernandez Betancourt	x	x	475-11572	Property	No record
	Tauramena	El Tranquero	Julian Ricardo Ramirez		x	470-74704	Property	No record
		Hacienda El Rosal	Yamile Vargas Hernandez	x	x	470-74703	Property	No record
	Trinidad	Las Pampas	Pedro Vidal Arenas Angel	x		475-2857	Property	No record
		El Zaman	Jesus Mejia Ruiz	x	x	475-13451	Property	No record
		El Cairo	Jesus Mejia Ruiz	x		475-13450	Property	No record
		La Libertad	Jesus Mejia Ruiz		x	475-13449	Property	No record
		La Esperanza	Pedro Antonio Acosta	x		No record	Possession	No record
		Villa Blanca	Yolman Alfredo Acosta Gaitan	x		No record	Possession	No record

		El Amparo	Martha Dignory Rojas Holguin		x	475-1855	Property	No record
		El Remache Numero 1	Dora Maria Pan de Betancourt	x	x	475-3176	Property	No record
		Miralindo	Carmen Elisa Perez Cibo Devier Salazar Garcia	x	x	475-12604	Property	No record
		La Gloria	Gloria Esther Parada Vargas	x	x	475-31497	Property	No record
		Campo Lindo	Cirilo Hernandez Damaris Conde	x	x	475-12360	Property	No record
		La Macolla	Mary Sol Parada Vargas Jose Uber Garcia Farfan	x		475-17328	Property	No record
		El Cairo	Yoryi Judith Garcia Niño James Garcia Niño Herlendis Garcia Niño Lisnelia Garcia Niño	x	x	475-17671	Property	No record
	Yopal	La Maporoza	Claudia Tatiana Rincon Perez Maria Del Pilar Rincon Perez	x		470-31079	Property	No record
		Las Brisas	Jorge Eduardo Garcia Torres	x	x	470-10470	Property	No record
Arauca	Arauca	Villa Martha	Luis Fernando Anzola Pinto Jorge Tadeo Anzola Pinto Martha Isabel Anzola Pinto Oscar Gerardo Anzola Pinto German Alfonso Anzola Pinto Angel Gabriel Lizcano Anzola Juan Diego Lizcano Anzola		x	410-10849	Property	No record
		Moscu	Trino Isnardo Torres Muñoz	x	x	410-29950	Property	No record
		Finca La Costeña	Luis Ernesto Rodriguez Quenza		x	410-53009	Property	No record
	Cravo	Finca La Fuente de Oro	Alvaro Sigifredo Vega	x	x	410-17343	Property	No record

	Norte	Los Siete Diamantes	Diego Alejandro Torres Garavito	x	x	410-67441	Property	No record
		Las Escudillas	Miguel Angel Diaz Sanchez		x	410-34657	Property	No record
		Panamá	Eucaris Quintero Lopez	x	x	410-25891	Property	No record
		El Cielo	Gloria Ines Cedeño Garcia	x	x	No record	Possession	No record
		La Revancha	Wilson Javier Dinas Vivas	x	x	No record	Possession	No record
		La Magola	Efidelia Madrid Sergio Antonio Hidalgo Neme		x	410-45445	Property	No record
		Finca Cuernavaca	Oscar Eduardo Santana Santana	x	x	410-51996	Property	No record
		Finca Los Pionios	Fenibal Andres Zuluaga Quintero	x	x	410-62096	Property	No record
		Finca Vida Tranquila	Ciro Antonio Sanchez Vega	x	x	410-64085	Property	No record
		Finca Villa Tania	Tania Leidy Garces Gaitan		x	410-52496	Property	No record
		Finca La Bonanza	Oscar Sadid Santana Maurno		x	410-62954	Property	No record
		Finca Vendaval	Oscar Julian Murcia Hidalgo	x	x	410-67445	Property	No record
		Finca El Morrocoy	Nicolas Antonio Ojeda Rosa Florez	x	x	410-61542	Property	No record
		Finca La Ponderosa	Richards Jose Santana Magurno	x	x	410-65494	Property	No record
		Finca Los Paraguitos	Elguer Ernesto Ojeda Florez Carmen Yasmina Vasquez Tineo	x	x	410-60182	Property	No record
		Finca El Ponque 2	Cesar Facundo Torres Serrano	x	x	410-58751	Property	No record
		Finca El Ponque 3	Diego Alejandro Torres Garavito	x	x	410-58747	Property	No record

		La Calandria	Ana Alfonsa Guerra Viuda de Puerta	x	x	410-57235	Property	No record
		El Corozo	Manuel Guzman Puerta Guerra	x	x	410-57239	Property	No record
		Finca Suro Verde	Rosa Ediomilina Alvarado De Ibica	x	x	410-52173	Property	No record
		Finca Santa Ana	Nelsa Romero Betancourt	x	x	410-68008	Property	No record
		Las Brisas	Libia Margarita Maurno Cisnero	x	x	410-24129	Property	No record
		Finca El Conuco	Jose Nicolas Magurno Cisneros	x	x	410-44201	Property	No record
		Finca Santa Martha	Carmen Beatriz Bolivar Villazana	x	x	410-43977	Property	No record
		Finca La Ponderosa	Jose Luis Garrido Sanchez Ana Francisca Tineo Infante		x	410-52140	Property	No record
	Puerto Rondón	Finca Altagracia	Edgar Fabian Mendoza Sierra		x	410-68184	Property	No record
		Finca Las Pampas	Shirley Johanna Mendoza Sierra	x		410-62918	Property	No record
		Finca El Palmar	Bolivar Mendoza Bohorquez	x	x	410-62909	Property	No record
		Finca Los Corazones	Yolima Sierra Parra	x	x	410-62908	Property	No record
		Altagracia	Tirso Gustavo Masmela	x	x	410-71104	Property	No record
		Finca Santa Barbara	Olga Cecilia Puerta Osorio	x	x	410-25167	Property	No record
		Finca Santa Barbara	Cilia Graciela Osorio		x	410-47217	Property	No record
	Tame	Altamira	Am Constructores SA	x		410-21907	Property	No record
		Franfol	Am Constructores SA	x		410-42010	Property	No record

		Sinai	Alejo Alfredo Aponte Arias	x		410-20660	Property	No record
		Finca Las Delicias	Yudys Janeth Reuto Reuto	x	x	410-68222	Property	No record

Source: The Cataruben Foundation, 2023.

6. Adaptation to climate change

6.1. Consider any of the activities proposed in the National Climate Change Policy.

Within the framework of the project, line of action E of the National Climate Change Policy is taken into account, which focuses on the "Management and conservation of ecosystems and their ecosystem services for low-carbon and climate-resilient development".

Specifically, the project area will "Evaluate the conservation status of ecosystems associated with areas of water supply, flooding and drought, and sea level rise, such as water sources and watersheds within priority watersheds, and mangroves in coastal areas".

This assessment will make it possible to analyze and understand the essential ecosystem services provided by the water sources within the Orinoco basin, with the objective of diagnosing and improving their conservation status. The proper functioning of these ecosystems is considered of vital importance, as they provide benefits such as regulation of the water cycle, flood and drought mitigation, biodiversity protection and provision of natural habitats.

6.2. Improve the conditions for the conservation of biodiversity and its ecosystem services in the areas of influence, outside the Project boundaries (natural coverage in areas of special environmental interest, biological corridors, water management in watersheds, among others).

The project's objective is to improve the conditions for biodiversity conservation and ecosystem services. The project aims to contribute to the conservation of forest and wetland areas by providing vital spaces for flora and fauna, which play a fundamental role in the maintenance of ecosystem services.

By conserving these areas, the continued provision of essential ecosystem services is ensured, such as regulating services including climate and air quality, carbon sequestration and storage, erosion prevention, flooding, soil fertility conservation, and pest control, which are fundamental to guarantee the resilience and regulation of ecosystem processes.

Therefore, project activities include capacity building in the environmental management of the properties through training and support through training processes aimed at improving land planning, promoting biodiversity conservation, and fostering sustainable forest management. There are also plans to implement measures to monitor and conserve the fauna and flora in the project area and to monitor threatened ecosystems in order to evaluate their conservation status and take appropriate actions to protect them. In addition, participatory monitoring of endangered species will be promoted, actively involving local communities in data collection and decision-making related to their conservation.

6.3. Implements activities that generate sustainable and low-carbon productive landscapes.

The project will actively promote the adoption of sustainable and low-carbon production systems in the Agriculture, Forestry and Land Use (AFOLU) sector. To achieve this, training and technical assistance will be provided to ecosystem managers. These activities are aimed at sharing knowledge and developing specific competencies for each productive activity they wish to implement.

This involves identifying and applying techniques and technologies to reduce carbon emissions, improve efficiency in the use of natural resources and promote biodiversity conservation. In addition, they will be provided with specific guidance and training on best practices and opportunities available in sectors such as agroecology, sustainable forestry, natural resource management and other economic alternatives.

Considering that a large percentage of ecosystem managers report livestock farming as an economic activity, this activity may present greater interest, therefore, the implementation of silvopastoral systems, the renewal of introduced pastures and the natural regeneration of paddocks will be promoted, some of the benefits of this type of practices are the fixation of nitrogen, shading for livestock, forage with higher protein content and increased carbon sequestration in the soil (World Bank, 2012). Other low-carbon production systems that are gaining strength in the region and that may be of interest are agroforestry systems, beekeeping and meliponiculture.

6.4. Designs and implements adaptation strategies based on an ecosystemic approach.

In this case, in dry seasons the ecosystem managers are affected by this climatic condition, which brings with it the frequency of fires and poor access to water, which generates direct impacts on the cover and conservation areas of the properties; facing this problem, the project will implement adaptation strategies based on an ecosystem approach which aims to generate alerts of changes by deforestation and/or transformation of ecosystems in the project area and its surroundings, through satellite analysis to identify changes by fire, winds, floods, etc.

These alerts are aimed at responding in a timely manner to some of the conditions that may arise and thus be able to act in a timely manner and improve efficiency in the use of natural resources.

The project owner also believes that landowners can adopt conservation practices and sustainable production practices such as implementation of silvopastoral systems, water harvesting, recovery of water sources and gallery forests, landscape connectivity, promotion of natural reserves of civil society, this can increase with advice and training, which is why the project owner will implement knowledge transfer strategies focused on conservation issues and sustainable practices in the crops of the project beneficiaries.

6.5. 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); as well as to take advantage of opportunities derived from the foreseen or evidenced changes.

The project contributes to strengthening 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); as well as to take advantage of opportunities derived from foreseen or evidenced changes. For this reason, we have been implementing knowledge transfer strategies focused on the sustainable management of natural resources and sustainable practices in the properties enrolled in the Project.

Additionally, given the strategic importance that forests and Wetlands represent today for the country, in a context of modernization and promotion of productive sectors, climate change, land use planning, it is intended to integrate different inputs of forest governance that have been developing and others that are being developed in order to integrate them, validate them in a way that responds to the challenges of the country in the current context and in future decades under the concept of sustainable development (Minambiente, 2015).

6.6. For activities in the AFOLU sector

- Agricultural and forestry production systems better adapted to high temperatures, droughts or floods, to improve competitiveness, income and food security, especially in vulnerable areas.

The project will promote the implementation of agricultural and forestry production systems adapted to high temperatures, droughts and floods. These systems seek to improve competitiveness, income and food security, especially in vulnerable areas. To achieve this, training cycles will be carried out and participants will receive support. Through these training processes, sustainable practices will be strengthened and greater efficiency in productive economic activities will be sought.

During the training, knowledge will be shared on appropriate techniques and technologies to address climate and environmental challenges. The use of soil and water conservation practices, crop diversification, agroforestry and other strategies that contribute to climate change adaptation and mitigation will be promoted.

- Comprehensive actions that help the efficient use of land, including, for example: conservation of existing natural land cover, use consistent with the vocation and agro-ecological conditions of the territory, family farming and agricultural technology transfer to increase competitiveness and reduce vulnerability to climate change.

Compliance with these actions is achieved through a contractual document signed by the two interested parties. Through this contractual agreement, the ecosystem managers acquire specific responsibilities aimed at the conservation of the areas related to the project, and at the same time, The Cataruben

Foundation assumes responsibilities that focus on follow-up and monitoring activities to ensure the conservation of these areas.

The contract establishes the obligations and commitments of both parties, creating a mutually beneficial framework of cooperation and collaboration. The Ecosystem Managers commit to implement good conservation practices in the designated areas, such as proper management of natural resources, protection of wildlife, and promotion of sustainable practices. The Cataruben Foundation will provide the necessary support to facilitate the implementation of these best practices. This will include technical advice, training and resources for the development and implementation of conservation projects.

- Actions directly related to climate change adaptation measures, such as: use and management of seeds resistant to temperature change, water management through rainwater harvesting and/or recycling, drainage and irrigation, planting around watercourses to prevent erosion, soil management with practices that reduce compaction and fertilizer reduction techniques.

There are several climate change adaptation measures in the agriculture and forestry sector that can contribute to the goal of reducing emissions and increasing carbon sequestration. The project holder will establish within its activities actions directly related to climate change adaptation measures, such as: silvopastoral systems, landscape connectivity through biological corridors, renewal of introduced or improved pastures, natural regeneration, promotion of the use of clean energy, incorporation of trees in agricultural systems and farm implementation plans that promote sustainable activities.

7. Risk management

To mitigate the risks associated with conservation projects, it is important to evaluate the environmental, financial and social risks related to the execution of project activities; it is important to identify these risks in order to evaluate and implement preventive measures that contribute to their reduction, seeking to guarantee the stability and permanence of the project during the accreditation period.

Therefore, a classification was made according to the possible risks that may occur throughout the project, with measurable indicators, classifying the risks into three levels (high, medium or low) and determining one or more mitigation actions ***Annex 1** / 1.1. General /1.1.3.*

Table 49. Project risks for the Environmental, Financial and Social dimensions, and probability of impact.

DIMENSION	RISK	PROBABILITY OF IMPACT
Environmental	Fire	
	Flooding	
	Emissions due to leakage	
Financial	Liquidity	
	Market	
	Offer	
	Country risk	
Social	Land tenure dispute	
	Little stakeholder involvement	

Impacto	Probalidad	Calificación (Probabilidad x Impacto)	Clasificación Riesgo	
			Valor	Nivel
3	3	9	3	Alto
		6	3	Alto
2	2	4	2	Medio
		3	2	Medio
1	1	2	1	Bajo
		1	1	Bajo

Source: The Cataruben Foundation, 2023.

7.1. Reversal risk management

Within the barriers generated in the execution of the climate change mitigation project led by The Cataruben Foundation, the reversal risk management in the enrolled areas must be contemplated, which is established within the contract clauses in order to establish as an obligation for the parties the conservation of the eligible areas, as well as the restrictions of anthropic intervention for the same, for which, control is performed through site visits and/or satellite control with which the continuity and conservation of the area is guaranteed during the life of the project.

According to the guidelines established in the *Biocarbon Registry* standard, as a guarantee of the above, during the accreditation and verification periods a reserve of 20% of the Verified Carbon Credits is deducted. Additionally, the parties are informed that the project holder will only be able to dispose of 10% of the total amount in reserve by the certifying entity once the verification period under which they were granted has passed. ***Annex 1** / 1.1. General /1.1.1 Start of activities (Enrolled Documents)*.

7.2. Risk Management monitoring plan

7.2.1. Environmental Risks

Fires: Taking into account the geographic location and climatic characteristics of the project area, and the anthropic activities that take place there, such as the use of fire for burning biomass and expansion of the borders for agricultural or livestock purposes, where these uncontrolled fires destroy vegetation cover, especially grasslands, pastures and natural forests and their respective degradation, forest fires are an issue of considerable relevance in the implementation of the project.

Therefore, in the event that a fire is generated on a Property and affects the eligible wetland areas of the project, a written record must be generated, as well as attach photographs and testimonies to establish the procedure to follow, the affected areas must be included and the CO2 and CH4 emissions must be estimated and included in the quantification of emissions.

In this way, different activities were implemented in the properties that are in line with conservation processes established in the contractual agreement signed with the owners, so that, from the conservation activities, the following prevention measures are shared to avoid a fire disaster.

1. Removal of biomass that can function as fuel in a fire
2. Establishment of firewalls
3. Implementation of guardrails
4. Avoid burning during critical summer periods.

Floods: Although floods are an issue of environmental concern, in floodable savanna areas they are considered normal considering the hydrological behavior of the Orinoquia region.

However, for this case, severe floods are contemplated since these can affect ecological communities (both flora and fauna), either because they cover them to a large extent or because they wash them away. The force of the water carries away part of the substrate and vegetation, as well as shallow seeds, which can affect the ability of species to resprout and therefore colonize.

Another of the effects that floods can have on the environment is the dispersion of pollutants when they occur in areas where there are such substances.

Therefore, floods that are considered risks are those that occur by chance or as flash floods that generate loss of cover or damage with major effects on ecosystems.

7.2.2. Social Risks

Land tenure disputes: During the analysis made to the documentation provided by people interested in enrolled in environmental projects led by The Cataruben Foundation, one of the main activities carried out to mitigate risks is the validation and verification of the type of tenure that manages to accredit each of them on the Property. The above, to strictly comply with the provisions of Conpes 3859 of 2016, which dictates guidelines on the actual exercise of ownership, possession and / or tenure, as well as all regulations governing the matter, in order to ensure permanence during the period of quantification of GHG reductions or removals.

The exercise of land tenure as well as forest governance is a highly relevant topic during project implementation, given that all activities are focused on strengthening the relationship between landowners and their environment in general, covering each of the areas that have an impact on the obligations of the project owner's enrollment in the conservation and sustainable use of the environment.

The accreditation of land tenure tacitly fixed by the regulations governing the matter has been divided into Property and whoever holds it acquires the quality of owner, since he has acquired the right through any legal act. For example, a purchase-sale, inheritance, among others, and according to this has made the registration of the same before the competent entity obtaining a registration folio that validates the above mentioned and exposes or reflects the totality of the tradition of the property.

Likewise, we find the Possession and the one who exercises it is qualified as possessor, who manifests to have rights over the property of the real estate for having exercised governance over it for several years but does not have a document that legally proves a tradition over it, and finally, the Tenancy of the land - and the one who executes it is called tenant, who although does not prove ownership if the right to use and enjoy the real estate for a certain time for his own benefit.

Non-appropriation by project stakeholders: The implementation of project activities, the accompaniment, the constant exchange of information related to the behavior of the carbon market and its regulatory, legal and technical aspects, as well as the implementation of the PQRS mechanism, prevents non-appropriation by project stakeholders.

7.2.3. Financial Risks.

Liquidity: Once the project is financially modeled under a preliminary projection, i.e., before the start-up of the project, the cash flow, the income statement and the financial evaluation are determined, which shows the economic status of the project, allowing to establish its viability and the mitigation actions to avoid the liquidity risk.

Market: The main economic benefit of the project that enables the conservation of ecosystems is derived from the commercialization of carbon certificates, therefore, the income of the project is financially modeled, there is a market study taking into account the following principles: Supply and demand, National government instruments and mechanisms that indirectly value and regulate the price of the carbon certificate, Geographic location of the market niche and the value of the exchange rate for the entry of international currency (if applicable), Value of operating and non-operating costs and expenses.

Supply: This translates into the project's need to enroll a minimum number of hectares to guarantee the financial break-even point, so as part of risk management, strategies for land acquisition, communication plans and management of strategic allies are established.

Country risk: Every climate change mitigation project has macroeconomic risks due to the current globalized market. Therefore, the project owner has an economic benefits committee and a relationship team that analyzes both the macroeconomic conditions of the country in which the project operates, as well as the location of the sales market. There, decisions are made that directly affect the risk of financial permanence of the project. Additionally, the project is financially modeled to prevent the increase of the inflation rate and sales price during the accreditation period.

The above is summarized in a monitoring plan (see ***Annex 1** / 1.1 General / 1.1.3 Risk Management Risk Management Monitoring Plan).*

8. Environmental aspects

The main reason for identifying the environmental aspects is to establish which ones could cause significant environmental impacts, also to separate the serious ones from the milder ones (ISO 14001, 2018), and to identify whether the development of an environmental management plan is required to mitigate those negative impacts that could arise from the implementation of the project activities.

Environmental assessment is a process through which the possible environmental impacts that a project may generate in a specific area are analyzed and evaluated. Its main objective is to provide accurate information on the effects that such intervention may have on the environment and natural resources and, if there is any negative impact, to be able to review the corrective actions for possible damages caused.

The owner of the project has carried out an environmental assessment to analyze the impacts that the project activities could cause in the area of influence of the project; the environmental impact matrix with the results obtained is listed below *(Annex 1.1. General/1.1.4.)*

9. Socio-economic aspects

As in the analysis of environmental impacts, socioeconomic impacts can be considered as those resulting after the execution of an activity, product or service, which may have repercussions on the conditions of the components, leaving as a consequence specific alterations or modifications on the aspects in which the different activities to be evaluated were carried out.

The Socioeconomic Impact Assessment (SEIA) is a preventive tool that strengthens decision-making at the project level, aimed at identifying the socioeconomic consequences of the implementation and operation of greenhouse gas projects, in order to establish preventive and control measures that make possible the development of the components to be assessed without prejudice to the implementation of the climate change mitigation project or even as a taxonomy to assess the social and economic benefits, as Olsen and Fenhann tried to standardize in 2008 with a view to defining criteria for the evaluation of CDM projects in terms of their contribution to sustainability, managing to generate important contributions that highlight the social and economic growth aspects at a priority level above 55% in the global valuation of GHG projects.

The main objective of the Socioeconomic Assessment for the Project is to identify the socioeconomic impacts that may arise between the interaction of project activities, the assurance of Safeguards and SDGs as well as Co-benefits compliance, allowing the establishment of management measures to mitigate negative impacts if any.

In accordance with the above and with what is stated in the Annex. Socioeconomic aspects evaluation matrix, it is concluded that since there are no negative effects, there is no need to generate socioeconomic management plans to prevent, mitigate and eliminate these impacts.

For the implementation of the project, the economic impact assessment was conducted taking into account the project activities, Safeguards, SDGs and the proposed Co-benefits, and the impact that these could cause within the social elements of study such as: gender equity, education and training, communication with stakeholders and forest governance in the territories; and the economic elements of study such as: access to goods and financial services, economic benefits of the project, formalization of environmental services as an economic activity and implementation of sustainable production practices. The above, taking into account that although the impacts can be positive or negative, in the case of the valuation of this project it is evident that the impacts are positive.

The socioeconomic aspects assessment matrix was designed and adapted based on the Leopold matrix in alignment to the environmental aspects assessment considered above, applying a rating scale, the magnitude and importance of the impact, understanding that "the tools currently available for this type of analysis are diverse, are based on different assumptions, offer different functionality, focus on different types of impact and satisfy varied purposes" (World Business Council for Sustainable Development, 2013).

10. Stakeholder consultation

The Cataruben Foundation carried out the respective consultation on the implementation of the project, in accordance with the provisions in Numeral 16 of the Standard for the voluntary carbon market, version 3.2; notifying the representatives of the territorial, governmental and non-governmental entities of the departments of Arauca and Casanare, resulting in twenty-nine (29) notified agencies for the two (2) departments mentioned and eleven (11) responses issued according to the requests made in the framework of the consultation *(**Annex 1** / 1.1. General / 1.1.5. Consultation of stakeholders)*.

10.1 Summary of comments received

The notified entities responded to The Cataruben Foundation via email, phone calls and WhatsApp to coordinate the socialization of the Project. Meetings were scheduled with the different agencies and support was provided by telephone and WhatsApp to address specific questions. We sought to establish a good way of working and collaboration with each entity involved *(**Annex** 1.1.5. Consultation of stakeholders/ Comments received)*.

10.2. Consideration of comments received

As mentioned above, a specific mode of communication was established for each entity that responded to the consultation, taking into account the preferences and facilities of both parties. During the meetings with stakeholders, opportunities for collaboration were explored, relevant information was exchanged and possible areas for the project were evaluated. It is important to note that no complaints or claims were received from stakeholders, indicating a level of satisfaction and agreement in the interactions carried out.

10.3. Public consultation

The Project was in public consultation on the Biocarbon Registry website from 06/16/2023/ to 07/16/2023, however no comments were received, as can be seen in the following image. This shows that the public consultation process has been complied with.

Image 31. Evidence of Public Consultation of the Project**.**

Source: The Cataruben Foundation,2023.

11. Sustainable Development Goals (SDGs)

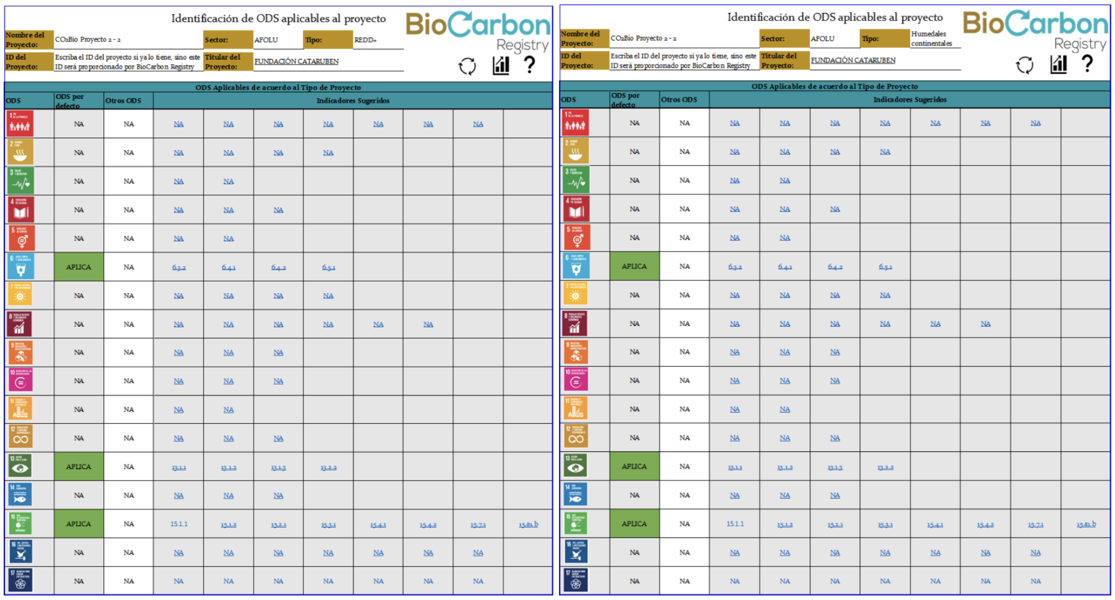
The Sustainable Development Goals (SDGs) were established in 2015 by the United Nations General Assembly (UNGA) with the aim of achieving them by 2030 (Agenda 2030). According to the United Nations, the Sustainable Development Goals are a universal call to action to end poverty, protect the planet and improve the lives and prospects of people around the world. In 2015, all UN Member States adopted 17 Goals as part of the 2030 Agenda for Sustainable Development.

These are: (1) End poverty, (2) Zero hunger, (3) Health and well-being, (4) Quality education, (5) Gender equality, (6) Clean water and sanitation, (7) Affordable and clean energy, (8) Decent work and economic growth, (9) Industry, innovation and infrastructure, (10) Reducing inequalities, (11) Sustainable cities and communities, (12) Responsible production and consumption, (13) Climate action, (14) Undersea life, (15) Life of terrestrial ecosystems, (16) Peace, justice and strong institutions, and (17) Partnerships to achieve the goals.

Investments in sustainable development play a crucial role in the fight against climate change by reducing greenhouse gas emissions and strengthening climate resilience. In this context, it is essential that projects contribute to the common good and promote environmental protection (UN, 2016). In this sense, The Cataruben Foundation Project is aligned with some Sustainable Development Goals (SDGs), which were adopted by the Colombian state as part of the United Nations 2030 Agenda. This agenda establishes a plan to achieve the goals within 15 years, starting in 2015.

The Cataruben Foundation Project applies the *"Tool for the determination of contributions to the fulfillment of the Sustainable Development Goals (SDGs) of Greenhouse Gas (GHG) mitigation projects"*, in accordance with the provisions provided by the BioCarbon Registry standard. Under this premise and taking into account the project typology (REDD+ and Wetlands), the application of the SDGs is listed below:

Image 32. Applicability of SDGs for the Project (REDD+ and WETLANDS)



Identificación de ODS aplicables al proyecto

Nombre del Proyecto:	CO2Bio Proyecto 2 - 2	Sector:	AFOLU	Tipo:	REDD+
ID del Proyecto:	Escriba el ID del proyecto si ya lo tiene, sino este ID será proporcionado por BioCarbon Registry	Titular del Proyecto:	FUNDACIÓN CATARUBEN		

ODS Aplicables de acuerdo al Tipo de Proyecto

ODS	ODS por defecto	Otros ODS	Indicadores Sugeridos							
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2	NA	NA	NA	NA	NA	NA				
3	NA	NA	NA	NA						
4	NA	NA	NA	NA	NA					
5	NA	NA	NA	NA						
6	APLICA	NA	6.3.2	6.4.1	6.4.2	6.5.1				
7	NA	NA	NA	NA	NA	NA				
8	NA	NA	NA	NA	NA	NA	NA	NA		
9	NA	NA	NA	NA	NA					
10	NA	NA	NA	NA	NA					
11	NA	NA	NA	NA						
12	NA	NA	NA	NA	NA					
13	APLICA	NA	13.1.1	13.1.2	13.1.3	13.2.2				
14	NA	NA	NA	NA	NA					
15	APLICA	NA	15.1.1	15.1.2	15.2.1	15.3.1	15.4.1	15.4.2	15.7.1	15.a1.b
16	NA	NA	NA	NA	NA	NA	NA	NA	NA	
17	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Identificación de ODS aplicables al proyecto

Nombre del Proyecto:	CO2Bio Proyecto 2 - 2	Sector:	AFOLU	Tipo:	Humedales continentales
ID del Proyecto:	Escriba el ID del proyecto si ya lo tiene, sino este ID será proporcionado por BioCarbon Registry	Titular del Proyecto:	FUNDACIÓN CATARUBEN		

ODS Aplicables de acuerdo al Tipo de Proyecto

ODS	ODS por defecto	Otros ODS	Indicadores Sugeridos							
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2	NA	NA	NA	NA	NA	NA				
3	NA	NA	NA	NA						
4	NA	NA	NA	NA	NA					
5	NA	NA	NA	NA						
6	APLICA	NA	6.3.2	6.4.1	6.4.2	6.5.1				
7	NA	NA	NA	NA	NA	NA				
8	NA	NA	NA	NA	NA	NA	NA	NA		
9	NA	NA	NA	NA	NA					
10	NA	NA	NA	NA	NA					
11	NA	NA	NA	NA						
12	NA	NA	NA	NA	NA					
13	APLICA	NA	13.1.1	13.1.2	13.1.3	13.2.2				
14	NA	NA	NA	NA	NA					
15	APLICA	NA	15.1.1	15.1.2	15.2.1	15.3.1	15.4.1	15.4.2	15.7.1	15.a1.b
16	NA	NA	NA	NA	NA	NA	NA	NA	NA	
17	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Source: TOOL ODS (BioCarbon Registry, 2023).

According to the above, it was identified that some SDGs were indicated by default, which implies that they are mandatory. In this sense, we proceed to identify those indicators and targets applicable by SDG, as listed below.

Table 50. SDGs applicable to the Project The Project

SDGS	APPLICABILITY	INDICATOR	META
	Default	6.4.1	Increase the change in water use efficiency over time.

	Default	13.2.2	Reduce total greenhouse gas emissions per year.
	Default	15.1.1	Increase forest area as a proportion of total area.
		15.1.2	Increase the proportion of sites important for terrestrial and freshwater biodiversity that are part of protected areas, broken down by ecosystem type.

Source: The Cataruben Foundation, 2023

These goals represent global commitments to address key challenges in pursuit of a more sustainable and equitable future. Each of them has significant implications in terms of social, economic and environmental development. In this sense, the project in question is focused on the implementation of the first stage of the SDGs, and seeks to achieve the goals established in each of them. By emphasizing environmental care, it seeks to ensure sustainable development that benefits present and future generations.

11.1 SDG 6 Water and Sanitation

According to the Sustainable Development Report 2022 "From crisis to sustainable development: the SDGs as a roadmap for 2030 and beyond", with respect to the fulfillment of SDG 6, which aims to "ensure the availability and sustainable management of water and sanitation for all", 5 statuses are identified at the international level: (i) information not available, (ii) significant challenges remain, (iii) significant challenges remain, (iv) challenges remain and (v) SDG achieved.

At the national level, Colombia is in the "Significant challenges remain" status for SDG 6. Although the country's score has been improving moderately over the years (2015-2020), it is still insufficient to achieve the target of ensuring the availability and sustainable management of water and sanitation for all by 2030.

Image 33. Colombia's situation in the international panorama with respect to the fulfillment of SDG 6 (Water and Sanitation) according to the University of Cambridge Sustainable Development Report 2022.

Source: https://dashboards.sdgindex.org/map/goals/SDG6, 2023.

Under this scenario, the Project considers the applicability of SDG 6 (Water and Sanitation). In order to comply with this, in accordance with the TOOL SDG, a target and an indicator are addressed. On the other hand, target 6.4 "By 2030, significantly increase the efficient use of water resources in all sectors and ensure the sustainability of freshwater withdrawals and supplies to address water scarcity and significantly reduce the number of people suffering from water scarcity" and indicator 6.4.1 whose target is "Increase the change in water use efficiency over time" are addressed.

11.1.1 Increase the change in water use efficiency over time 11.1.2.

To achieve these objectives, four methodological stages have been formulated: Diagnosis, Design, Implementation and Follow-up. The first stage consists of an initial diagnosis to determine the number of properties enrolled in the Project and their fluctuation, which is generally accompanied in the initial stage of each project.

The design stage, as its name indicates, allows the creation and development of the methodology (experimental design) to be implemented in the enrolled properties. Here the design of the water saving and efficient use plans (PUEAAs) in the characterized properties is projected, as well as the generation of water resource management sheets to be implemented in the properties in order to improve water conditions for human consumption and wastewater disposal.

In the implementation stage, the activities framed during the design phase will be executed. Finally, in the follow-up stage, monitoring will be carried out to show, through statistical analysis, the changes obtained in favor of water resources in each property enrolled in the Project (UN 2023).

Through the four methodological stages proposed for the fulfillment of SDG 6, the following equation is used to calculate the project's percentage of progress:

$$\%\ de\ avance = \frac{(N°D * 0.10) + (N°DI * 0.15) + (N°I * 0.55) + (N°D * 0.20)}{N°\ Total\ de\ Predios\ (127)}$$

Equation: Calculation to determine the percentage of progress in terms of compliance with SDG 6 Project The Project. ***N°D*** = Number of Diagnosed Properties; ***N°DI*** = Number of Properties with Design; ***N°I*** = Number of Implemented Properties; ***N°S*** = Number of Properties with Monitoring.

In this order of ideas and taking into account the identification of a baseline, which is at 0% at the beginning of the project, given the absence of actions for the development of indicator 6.4.1 (increase in the change in water use efficiency), it was projected during the 20 years of the monitoring plan.

11.2 SDG 13: Climate Action

Climate change is affecting countries on every continent, national economies and the lives of many people around the world. According to the United Nations, weather systems are changing, sea levels are rising and weather events are becoming more extreme.

According to the Sustainable Development Report 2022 "From Crisis to Sustainable Development: The SDGs as a Roadmap to 2030 and Beyond", Colombia is in the "Significant Challenges Remain" status with respect to the fulfillment of SDG 13. The country is on track or maintaining the achievement of the SDG in question to meet the target of taking urgent action to combat climate change and its effects by 2030.

Image 34. Colombia's position in the international panorama with respect to the fulfillment of SDG 13 (Climate Action) according to the University of Cambridge Sustainable Development Report 2022.

Source: https://dashboards.sdgindex.org/map/goals/SDG13, 2023.

Against this backdrop, the Project considers the applicability of SDG 13 (Climate Action), which aims to take urgent action to combat climate change and its effects. To achieve this, the TOOL SDG addresses objective 13.2 "Integrate climate change action into national policies, strategies and plans" and indicator 13.2.2 whose target is "Reduce total greenhouse gas emissions per year".

11.2.1. Reduce total greenhouse gas emissions per year

To meet this objective, it is proposed to monitor GHG emissions as a result of forest deforestation and/or transformation of natural vegetation cover identified in the project areas, as well as the reduction of GHG emissions resulting from the implementation of project activities during the project execution period.

In this sense, based on the deforestation rates and historical transformation of natural cover and the emission factor defined[14] , a projection of annual emissions that would occur in the absence of the project was established, defining an average value of 166,325 tCO2e. Sections 25 and 35 in this document detail the quantification process.

Thus, to evaluate compliance with the target in each monitoring period, the baseline value will be compared with the annual emissions identified in the scenario with the project, expecting a decrease with respect to the baseline scenario.

11.3 SDG 15: Life of Terrestrial Ecosystems

Forests are vitally important for sustaining life on Earth and play a key role in combating climate change. According to the United Nations, deforestation and desertification (caused by human activities and climate change) pose serious challenges to sustainable development and have affected the lives and livelihoods of millions of people.

According to the Sustainable Development Report 2022 "From Crisis to Sustainable Development: The SDGs as a Roadmap to 2030 and Beyond", Colombia is in the "Significant Challenges Remain" status with respect to the fulfillment of SDG 15. The country is in a process of stagnation to achieve the goal of sustainably managing forests, combating desertification, halting and reversing land degradation and halting biodiversity loss by 2030.

[14] Represents the amount of GHG emitted per hectare deforested and/or transformed.

Image 35. Colombia's situation in the international panorama with respect to the fulfillment of SDG 15 (Life of terrestrial ecosystems) according to the University of Cambridge Sustainable Development Report 2022.

Source: https://dashboards.sdgindex.org/map/goals/sdg15 , 2023.

Against this backdrop, the Project considers the applicability of SDG 15 (Life of Terrestrial Ecosystems), which aims to increase the proportion of important sites for terrestrial and freshwater biodiversity that are part of protected areas, disaggregated by ecosystem type. To achieve this, the TOOL SDG addresses target 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 drylands, consistent with obligations under international agreements". This Objective includes two indicators: 15.1.1 "Forest area as a proportion of total area" and 15.1.2 "Proportion of sites important for terrestrial and freshwater biodiversity that are part of protected areas, broken down by ecosystem type".

11.3.1. Forested area as a proportion of total area

Indicator **15.1.1**. *Forest area as a proportion of total area* makes it possible to quantify the proportion of the area covered by natural forest and its spatial distribution. It establishes a ratio between the area covered by natural forest with respect to the total area of the spatial unit of reference at a given time.

It is conceived as a way to evaluate the activities of different projects with a REDD+ approach, as well as environmental policies and conservation actions. The monitoring results guide decision-makers in the formulation of management measures and constitute a key element for obtaining standardized, periodic and permanent knowledge and information on forest ecosystems in the project areas.

$$PSBN_{jt} = (\frac{SCBN_{jt}}{AUER_{jt}}) * 100$$

Equation: Determine the proportion of the area covered by natural forest, taken from *Galindo et al., (2019).*

Where,

$PSBN_{jt}$: Proportion of the area covered by natural forest in reference spatial unit j, at time t.

$SCBN_{jt}$: Area in hectares (ha) covered by natural forest in reference spatial unit j, at time t.

$AUER_{jt}$: Area in hectares (ha) of reference spatial unit j, at time t.

The data on the area covered by natural forest (**SCBN**) are obtained from the Non-forest Forest Maps (reliable inputs of national origin), generated by the Forest and Carbon Monitoring System - SMByC of IDEAM in raster format with a pixel size of 30.26 * 30.72 m and with a MAGNA SIRGAS EPSG:3116 projection (Compatible with scales 1:100,000).

For the project areas (**AUER**), a polygon shapefile is used with 102 geometries belonging to the properties that have a REDD+ component in the Project, equivalent to a total of 85,619.2 ha.

This objective represents the global commitment to fight against forest loss and illegal logging, which affect food sovereignty and the production of ecosystem services and the perceived functioning of ecosystems. In this sense, the project has decided to establish as an objective to increase the areas of forest cover in the properties where REDD+ interventions are carried out.

The activities will guarantee the sustainable use of the forest and the generation of support, regulation, provision and cultural services. In addition to providing protection to endemic species of flora and fauna in the area, this is a major step towards achieving the goals established under the principles of environmental sustainability.

11.3.2. Proportion of sites of importance for terrestrial and freshwater biodiversity that are part of protected areas, by ecosystem type.

The identification and marking of Important Biodiversity Areas (IBAs) to promote the conservation of ecosystems and their biodiversity has also been proposed for the development of this objective. AIDBs, also known as Important Species Conservation Areas or Key Biodiversity Areas (KBAs), are geographic regions that harbor a great diversity of species and unique ecosystems, and play a fundamental role in the protection of natural resources and ecosystem services.

As part of the Project activities, a multi-criteria analysis was carried out to identify Areas of Importance for Biological Diversity and Conservation for the Properties located in the municipalities of Paz de Ariporo, Hato Corozal, Trinidad, Orocué, San Luis de Palenque and Yopal in the department of Casanare, and in the municipalities of Cravo Norte, Tame, Arauca and Puerto Rondón in the department of Arauca, which are the ones that make up the Project.

The activities developed seek to promote the delimitation and signaling of strategic ecosystems and natural protection areas, as well as to encourage the voluntary creation of CSNR (Civil Society Nature Reserves); to demonstrate the increase in the activities implemented, an analysis is made under the formula:

$$(\# PI \; * \; 0,25 \; + \# PIS \; * \; 0,75) \,/\, (\# PI \; * \; 100)$$

PI: Properties identified

PIS: Properties Implementing Signage

Equation: Assessment to define and pinpoint areas of biodiversity importance.

For the development of the project, in the first phase the properties that are most important for conservation will be identified by means of a multi-criteria analysis during the first years; in the second phase the properties that belong to the high and medium categories will be signaled. This signage will be carried out during the development of the years following the identification, in order to show the community that these properties are part of the Project and that there should be no intervention or degradation of the ecosystems present and the biodiversity contained in them.

11.4 SDG monitoring plan

Taking into account that the Project is a Project governed under the BCR Version 3.2 standard, which states that the project owner must assess the contribution of the Project activities to the Sustainable Development Goals (SDGs).

In this case, The Cataruben Foundation - as the project developer - uses the "*Tool for the determination of contributions to the fulfillment of the SDGs*" or **TOOL SDGs**. And additionally, the **"*No Net Harm*"** tool states in its "Monitoring Plan" section that the holder must design and explain a monitoring plan, designating criteria, evidence and the methodology applied to give a detailed account of the project activities and their positive results. And in turn, demonstrate the application of procedures with the evaluation of the project's contribution to the Sustainable Development Goals (SDGs). Under this premise, the following is the SDG Monitoring Plan - The Project (See sheet: "SDG Monitoring Plan").

12. REDD+ Safeguards

REDD+ Safeguards are known as the "rules of the game" for the implementation of any REDD+ Project in the country. They must be known, understood and applied by all stakeholders involved in the process. In other words, they are the set of instruments, agreements, processes and tools that allow that in the implementation of REDD+ Policies, Measures and Actions to address the Causes of deforestation, risks are reduced, benefits are promoted and the rights of communities and their territories are respected (World Wildlife Fund, 2018).

In Colombia, the process of analyzing, addressing and respecting these social and environmental Safeguards of Cancun began in 2013. Integrating a bibliographic exercise that carefully addressed the national regulatory framework, the international agreements signed by Colombia, and of course, with a precise knowledge of the political, social and economic situation of the moment.

In addition to the above, the combined efforts of WWF-Colombia, the Forests and Climate/REDD+ program, the Cooperative Fund for Carbon and Forests, and the UN/REDD+ program created the conditions for the configuration of approaches and articulated work spaces with the most representative and vulnerable rural communities (indigenous, black and farmer). Likewise, this process of approach and reading continues in a gradual configuration, each year more strategic actors and institutions join, in order to strengthen the respect and timely compliance with the Cancun Safeguards in the national territory (Camacho A, Lara I & Guerrero, 2017).

This national reading of the REDD+ social and environmental Safeguards has a very specific purpose, and that is to transfer them to the national context and population. Although their compliance, approach and respect is mandatory worldwide, not all territories, population, practices and conditions are the same, for this reason, it is essential to approach them from those particularities that define each territory as unique, which in this case is the case of the Colombian Orinoquia. Although the document "Tool for compliance with BCR's REDD+ safeguards" is the main route to follow in terms of its approach and compliance,

The Cataruben Foundation (as project developer) also uses the booklet "Social and environmental Safeguards for REDD+ in Colombia"[15] . This reading develops an interpretation that starts from the context and national sovereignty, the result of an inquiry that brings together a variety of visions, thoughts and practices that emerge from the local level, and this conditions the meaning of projecting 15 elements that are included in the 3 proposed themes that frame the 7 REDD+ Safeguards, this relationship that Cataruben makes is illustrated in **Table 51.** In sum, this reading is of mandatory consultation, representing an

15 https://archivo.minambiente.gov.co/images/cambioclimatico/pdf/Reed_/Cartilla-Interpretacion-Nacional-de-Safeguards-ministerio-de-ambiente.pdf

essential instrument that guides the civil population, private and public entities on the right path to implement REDD+ activities in Colombia.

Table 51. REDD+ Safeguards.

Themes National Interpretation	ID	Cancun Safeguards	Elements National Interpretation
Institutional	**1**	The complementarity or compatibility of the measures with the objectives of national forestry programs and international conventions and agreements on the subject.	Correspondence with the National legislation
	2	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 regularly updated. Be transparent and flexible to allow for improvements over time. Build on existing systems, if any.	Transparency and Access to Information Information
			3. Accountability
			4. Structures Recognition of Forest Governance
			5. Capacity building
Environmental and Territorial	**3**	Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into consideration relevant international obligations and national circumstances and legislation, and bearing in mind that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples".	6. Free Consent, Prior Informed Consent (FPIC)
			7. Respect for Knowledge Traditional
			8. Profit sharing
			9. Land Rights

	4	The full and effective participation of stakeholders, in particular indigenous peoples and local communities, in the measures referred to in paragraphs 70 and 72 of this decision.	10. Participation.
Environmental and Territorial	**5**	The compatibility of the measures with the conservation of natural forests and biological diversity, ensuring that the measures identified in paragraph 70 of this decision are not used for the conversion of natural forests, but instead serve to incentivize the protection and conservation of these forests and their ecosystem services and to enhance other social and environmental benefits.	11. Forest Conservation and its biodiversity
			12. Provision of Goods and Environmental Services
	6	Adoption of measures to address reversal risk management.	13. Environmental and Territorial Planning
			14. Sector Planning
	7	The adoption of measures to reduce the displacement of emissions.	15. Forestry Control and Surveillance to avoid the displacement of emissions

Source: The Cataruben Foundation, 2023.

In accordance with the above, the Project guarantees the respect, compliance and approach to REDD+ Safeguards[16] , taking into consideration, firstly, the national interpretation. Taking place, for representing that reading that focuses on the implementation of policies, measures and affirmative actions that guide the progressive decrease of deforestation, and in parallel, brings material and

[16] REDD+ (Reducing emissions from deforestation and forest degradation) refers to a climate change mitigation mechanism created by the United Nations (UN) under the United Nations Framework Convention on Climate Change (UNFCCC). As its acronym indicates, REDD+ seeks the Reduction of Emissions from Deforestation and forest degradation, plus (+) conservation, biodiversity and the good living of the inhabitants of the territories where these projects take place (Gaia Amazonas, n.d.).

symbolic benefits to the local population and the territory (Camacho A, Lara I & Guerrero, 2017), basically being that local reading and adaptation that addresses the context and related individuals.

In addition, from the guidance pointed out by the BCR Standard version 3.2, it complements the national interpretation, defining these Safeguards as *the rules of the game* to avoid risks that may produce negative impacts (social and environmental) that may be exposed as a consequence of poor project implementation. Likewise, to promote those co-benefits that go beyond the mere reduction of greenhouse gasses (BioCarbon Registry, 2023).

However, to ensure compliance with REDD+ Safeguards, priority is given to two main tools: (i) Tool to demonstrate compliance with REDD+ Safeguards Version 1.1 and (ii) No Net Harm" - Environmental and social safeguards NNH Version 1.0 (No Net Harm - Environmental and social safeguards NNH).

The "Tool to demonstrate compliance with REDD+ safeguards" takes into account those fundamental precisions on how the Safeguards should be interpreted, applied and complied with in light of the BCR standard at the national and international level (Biocarbon Registry, n.d. 2023). In this sense, it is mentioned in section "4. Interpretation of Safeguards" that the Projects shall promote and respect the following Safeguards:

Table 52. Identification of REDD+ Social and Environmental Safeguards (BCR Safeguards Tool)

ID	SAFEGUARDS
01	The complementarity or compatibility of the measures with the objectives of national forestry programs and international conventions and agreements on the subject.
02	Transparency and effectiveness of national forest governance structures, taking into account national legislation and sovereignty.
03	Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into consideration relevant international obligations and national circumstances and legislation, and

	bearing in mind the United Nations Declaration on the Rights of Indigenous Peoples.
04	Full and effective participation of stakeholders, in particular indigenous peoples and local communities.
05	The compatibility of the measures with the conservation of natural forests and biological diversity, ensuring that they are not used for the conversion of natural forests but to encourage their protection and conservation, as well as the promotion of other social and environmental benefits.
06	Adoption of measures to address reversal risk management.
07	The adoption of measures to reduce the displacement of emissions.

Source: The Cataruben Foundation, 2023.

On the other hand, the "No Net Harm" - Environmental and social safeguards NNH tool mentions in section "3. No harm to the environment and society", more specifically in the "REDD Safeguards" section the following:

"Implementing REDD+ activities can generate benefits for communities and the environment and reduce GHG emissions. However, there may be some social and environmental risks associated with their implementation. In this sense, REDD+ safeguards are measures aimed at preventing the undermining of fundamental social, economic or environmental rights and the occurrence of negative impacts arising from the design and implementation of REDD+ activities. It also includes measures to enhance the capture and distribution of benefits generated by REDD+ activities." (BioCarbon Registry, n.d., 2023, pg. 6)

Under this premise, BioCarbon Registry points out that project developers must apply the provisions of the aforementioned tool (No Net Harm - NNH) and ensure that they are read, addressed and complied with. These requirements are illustrated in Table 53:

Table 53. Identification of requirements of the "No Net Harms" tool for REDD+ social and environmental safeguards.

ITEM	NO NET HARM" TOOL REQUIREMENT
a	That the actions complement or are consistent with the objectives of national forest programs and relevant international conventions and agreements.
b	Transparent and effective national forest governance structures, taking into account national legislation and sovereignty.
c	Respect for the knowledge and rights of indigenous peoples and members of local communities, considering international obligations, national circumstances and relevant laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples.
d	The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities, in the actions referred to in paragraphs 70 and 72 of this decision.
e	That the actions are consistent with the conservation of natural forests and biological diversity, ensuring that the actions mentioned in paragraph 70 of this decision are not used for the conversion of natural forests, but are used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits.
f	Actions to address reversal risk management.
g	Actions to reduce emissions displacement.

Source: The Cataruben Foundation, 2023.

13. Special categories, related to CoBenefits

The BioCarbon Registry standard (version 3.2) states that actions related to climate change mitigation entail benefits in addition to the reduction or removal of GHG emissions. The standard also mentions that the definition and measurement of Co-benefits is not a mandatory requirement.

Even so, the project owner can define additional actions on social and environmental components and show that it has developed a model of criteria and indicators to monitor and verify compliance.

To demonstrate the approach and compliance with the Co-benefits (Orchid Category), the BCR standard, in its version 3.2, states that: "The project holder that intends to achieve one of these categories must comply with the conditions defined for each of the three components that constitute the additional benefits (biodiversity conservation, community benefits and gender equity)". In this sense, The Cataruben Foundation takes into account the considerations set forth therein.

Table 54. Orchid category requirements

Biodiversity conservation	● Develops effective actions and measures to halt the loss of biological diversity, favoring that ecosystems continue to provide essential services. ● Due to project activities, no invasive species have been introduced.
Benefit on communities	● Identifies and strengthens mechanisms for social and community participation at the local and regional levels. ● The project generates short and long-term benefits to small-scale productive projects with members of the communities in the project area. ● The activities under the GHG project produce an average net increase in the income of local producers.
Gender equity	● It considers determinants set forth in the normative framework related to gender. ● Ensures women's full and effective participation and equal leadership opportunities at all levels of decision-making at the project level.

Source: BioCarbon Registry, 2023.

13.1. Biodiversity conservation

Biodiversity conservation refers to human actions that seek to protect at least a representative portion of nature -genes, species, ecosystems, landscapes- from other human actions that cause deterioration, and also refers to the sustainable use of biodiversity (Gómez-Pompa 1998).

According to BCR Standard version 3.2to demonstrate applicability of this Co-benefits, the project holder must demonstrate that:(a) it develops effective actions and measures to halt biodiversity loss, favoring that ecosystems continue to provide essential services; (b) it establishes objectives and activities that support the Aichi Biodiversity Targets; (c) it carries out restoration activities of degraded ecosystems; (d)in the project area are High Conservation Values (HCV) (e) due to project activities, no invasive species have been introduced; (f) the project area is located in areas with globally threatened species (according to the IUCN Red List) and that the project develops actions aimed at the conservation of these species; and (g) incorporates traceability of raw materials from biodiversity in its administration and management systems.

Within the framework of the Project, the applicability of Co-benefits of the "Biodiversity Conservation" component (Orchid Category) is demonstrated by addressing the following indicators:

Table 55. Co-benefits of the Orchid Category (Biodiversity Conservation) to which the Project applies.

Category	Component	Co-benefit(s)	Indicator
Orchid	Biodiversity conservation	Develops effective actions and measures to halt the loss of biological diversity, favoring that ecosystems continue to provide essential services.	• # of Properties declared as RNSC (Civil Society Nature Reserve) • # of assessments of the status of areas of importance for biological diversity
		Due to project activities, no invasive species have been introduced.	• # of invasive species presence assessments conducted in the project area

Source: The Cataruben Foundation, 2023.

12.2. Benefits to communities

The BCR standard states that the benefits to communities must be real actions of public value creation and local development, with emphasis on improving the quality of life of the communities. To demonstrate applicability of this Co-benefits, the project holder must demonstrate that: (a) identifies and strengthens mechanisms for social and community participation, at the local and regional level; (b) implements sustainable productive systems, combining production and conservation actions to generate local development; (c) considers pre-existing social conflicts and supports the development of efficient models with management of post-conflict scenarios; (d) the project generates short and long-term benefits, to small-scale productive projects, with members of the communities in the project area; (e) it generates actions that improve the capacities and access to opportunities of vulnerable community groups; (f) it defines possible impacts on cultural, archeological or historical heritage and defines actions to prevent or mitigate such impacts; and (g) the project activities produce an average net increase in the income of low-income local producers.

Within the framework of the Project, the applicability of Co-benefits of the "Community Benefits" component (Orchid Category) is demonstrated by addressing the following indicators:

Table 56. Co-benefits of the Orchid Category (Benefits on communities) to which the Project applies.

Category	Component	Co-benefit(s)	Indicator
Orchid	Benefits on communities	Identifies and strengthens mechanisms for social and community participation at the local and regional levels.	● # of people participating in training, decision-making and advocacy spaces in the territory.
		The project generates short and long-term benefits to small-scale productive projects with members of the communities in the project area.	● # of sustainable activities monitored and implemented
		The activities included in the GHG mitigation project produce an average net increase in the income of local producers.	● Increase (%) in producer's income

Source: The Cataruben Foundation, 2023.

12.3 Gender equality

Within the new processes of vindication of fundamental rights, in some way, the issue of women's participation and equality has been emerging or being prepared in recent years. However, these petitions are not new or current, and in most scenarios they refer to the equal participation of genders in public or private scenarios, where the female role has been gradually gaining more and more relevance and strength in the articulated work involved in the efforts of conservation and restoration of ecosystems.

According to the Food and Agriculture Organization of the United Nations (FAO), climate change has a more pronounced impact on women, especially indigenous and farmer women, whose dependence on agriculture, living conditions and marginalization expose them to a greater degree to changes in climate, loss of diversity and pollution. On the other hand, López (2017), points out that "international agreements on forests, biodiversity and climate change mention the need to mainstream gender, all of the above by virtue of Article 2, which requires States Parties to adopt the principle of equality of men and women (...) in order to ensure a remedy for discrimination against women".

Under this premise, and in order to demonstrate applicability of this component (gender equity) of the Orchid category, the BCR standard (Version 3.2) states that the project holder must demonstrate that it considers determinants set out in the regulatory framework related to gender in its country, and likewise, demonstrate that it includes among its activities, strategies or actions that support the goals related to the SDG ``achieve gender equality and empower women and girls" taking into account the realities of the territory. Increase (%) in women's participation in forest governance structures and decision-making bodies.

Within the framework of the Project, the applicability of Co-benefits of the "Gender Equality" component (Orchid Category) is demonstrated by addressing the following indicators:

Table 57. Co-benefits of the Orchid Category (Gender Equality) to which the Project applies.

Category	Component	Co-benefit(s)	Indicator
Orchid	Gender equality	It considers determinants set forth in the normative framework related to gender.	• Number of women trained for the promotion and strengthening of gender equality and women's empowerment.

Source: The Cataruben Foundation, 2023

12.4 Co-benefits monitoring plan

Following the update of the BioCarbon Registry standard (version 3.2), the "No Net Harm" tool states in the "Monitoring Plan" section that the project holder shall design and implement a monitoring plan that, as required by the BCR standard and the applied methodology, presents in detail the appropriate information to monitor project activities and mitigation results, and in turn, according to item "k" of this same section, relates the application of the defined criteria and indicators to demonstrate Co-benefits and the measurement of Co-benefits and special category, where applicable.

In that order of ideas and in order to guarantee the approach of additional benefits on social and environmental components, the Co-benefits Monitoring Plan - The Project is listed below (See sheet: "Co-benefits Monitoring Plan").

14. Evaluation of the Biological Component in Wetlands

14.1. Biodiversity Baseline

The project area is located in a biogeographic region known as the great basin of the Orinoco River and this region has a high diversity of species and ecosystems as a result of the interaction of multiple physical, chemical, biological and even social factors. The landscape, climate and hydrology correspond to types of physical factors that condition the available resources and therefore the distribution of ecosystems and species populations.

This will be followed by a description of the ecoregions, watersheds, hydrogeological zoning, natural ecosystems and key conservation areas within the project area. The status of biodiversity will be identified focusing on two levels of biodiversity: ecosystems and species (fauna and flora groups). Additionally, we will identify areas of high conservation value (HCV). The annexes can be found in the following link Biodiversity baseline.

14.1.1. Ecosystems in the project area.

The Orinoquia region has been recognized as a strategic ecosystem for humanity, due to its high biological diversity associated with 156 types of ecosystems and 92 natural ecosystems are identified (Bustamante, 2019). This area is home to a large amount of flora and fauna within two main ecosystems corresponding to Sábanas and Piedemonte, with an average temperature ranging between 4 and 28 °C. Economically, the region's main activities include cattle ranching, agricultural production, and hydrocarbon extraction, which in turn are the main environmental pressures on flora and fauna (Lasso et al., 2010).

These include natural savannas, gallery forests, morichales, foothills, estuaries, rainforests, among others (CIAT, *et al.,* 2018). Image 36 shows the map of natural ecosystems for the departments of Arauca and Casanare, where 27 general ecosystem types were identified, of which floodable savannas stand out, representing 67.17% of the total ecosystems, followed by seasonal savannas with 7.29% and basal floodable forest with 6.87%.

The flooded savannas of the Colombian Orinoquia cover most of the departments of Arauca and Casanare, which are part of the Llanos Orientales region. This ecosystem is characterized by the dominance of open savannas dominated by an interrupted herbaceous matrix composed of grasses and herbs, or some small woody plants and scattered palms. It is important to note the appearance of transition zones generated by the dynamics of this ecosystem, due to expected flooding and drought events, which vary in magnitude during the year. On the other hand, the floodable savannas are the second most productive and ecologically valuable humid enclave in the Neotropics (Osorio-Peláez et al.,. 2015).

Table 58. Distribution of ecosystem types in the Project area and their percentage with respect to the total area.

Ecosystems	Area (Ha)	Percentage % (with respect to the total area)
Humid Andean shrubland	2919,94	0,058
Humid basal shrubland	86,99	0,002
Basal flooded shrubland	5658,74	0,112
Humid sub-Andean shrubland	268,81	0,005
Andean rainforest	99239,54	1,970
Humid basal forest	103396,81	2,053
Dry basal forest	8368,92	0,166
Humid basal gallery forest	22122,74	0,439
Dry basal gallery forest	971,64	0,019
Basal flooded gallery forest	196581,99	3,902
Basal flooded forest	346103,71	6,871
Sub-Andean flooded forest	284,19	0,006
Sub-Andean flooded riparian forest	74,45	0,001
Sub-Andean humid forest	152808,3	3,033
Andes rocky complexes	66,42	0,001
Glaciers and snowfields	4371,99	0,087
Humid Andean grassland	447,11	0,009
Humid basal grassland	2211,33	0,044
Humid sub-Andean grassland	81,64	0,002
Alluvial Lagoon	34429,62	0,683
Glacial Lagoon	114,23	0,002
Paramo	74724,47	1,483
Aguas Blancas River	157306,25	3,123
Aguas Claras River	340,91	0,007
Seasonal savanna	367192,66	7,289
Flooded savanna	3383517,07	67,166
Basal swamp zone	73828,35	1,466
Total	**5037518,82**	**100,000**

Source: *Cartographic IGAC.*

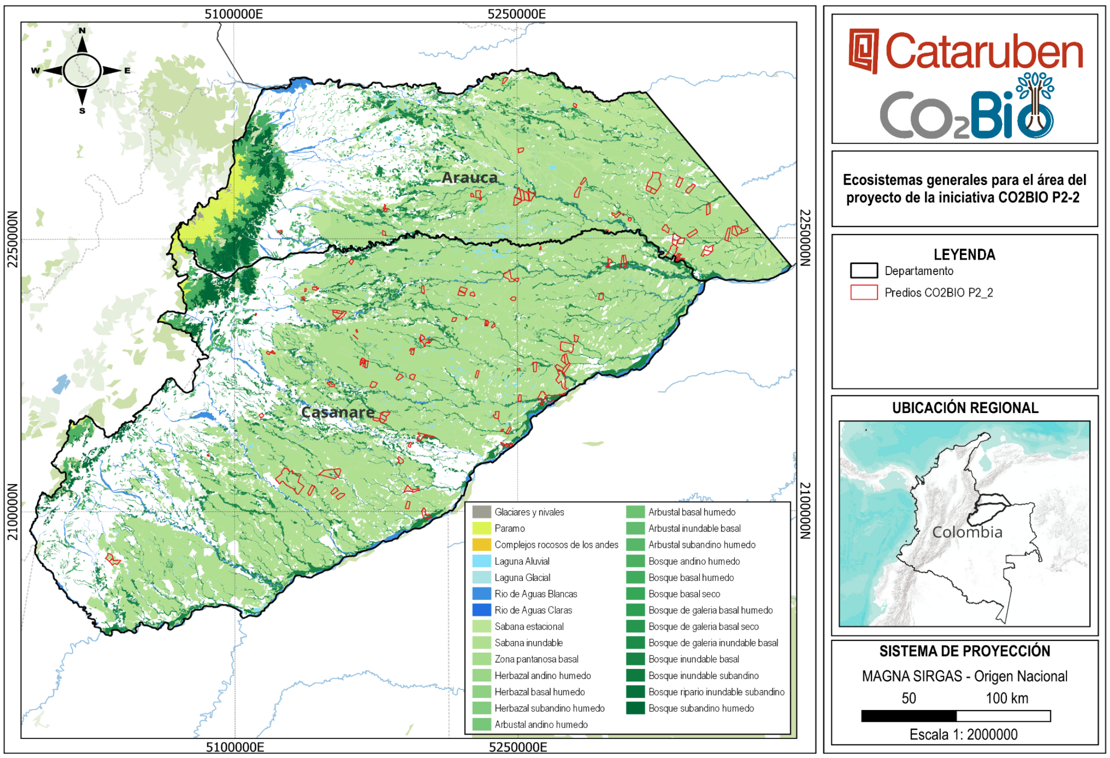
A total of 11 general ecosystems were identified within the project area. It should be noted that in the project properties, the floodable savannah ecosystems represent 82.03% of the total area, being the most representative, followed by the basal flooded forest with 8.81%, being these two the most representative ecosystems within this project as shown in Table 59.

Table 59. Distribution of ecosystem types in the Project area and their percentage with respect to the total area.

Ecosystems	Area (Ha)	Percentage % (with respect to the total area)
Basal flooded shrubland	60,86	0,068
Humid basal forest	311,46	0,347
Dry basal forest	1,93	0,002
Humid basal gallery forest	92,14	0,103
Basal flooded gallery forest	3578,27	3,988
Basal flooded forest	7910,92	8,817
Alluvial Lagoon	581,18	0,648
Aguas Blancas River	444,95	0,496
Seasonal savanna	2487,79	2,773
Flooded savanna	73602,29	82,029
Basal swamp zone	655,17	0,730
Total	89726,96	100,000

Source: *IGAC cartography.*

Image 36. Map of general ecosystems of the Orinoquia region, highlighting the ecosystems within the Properties that make up the Project area.

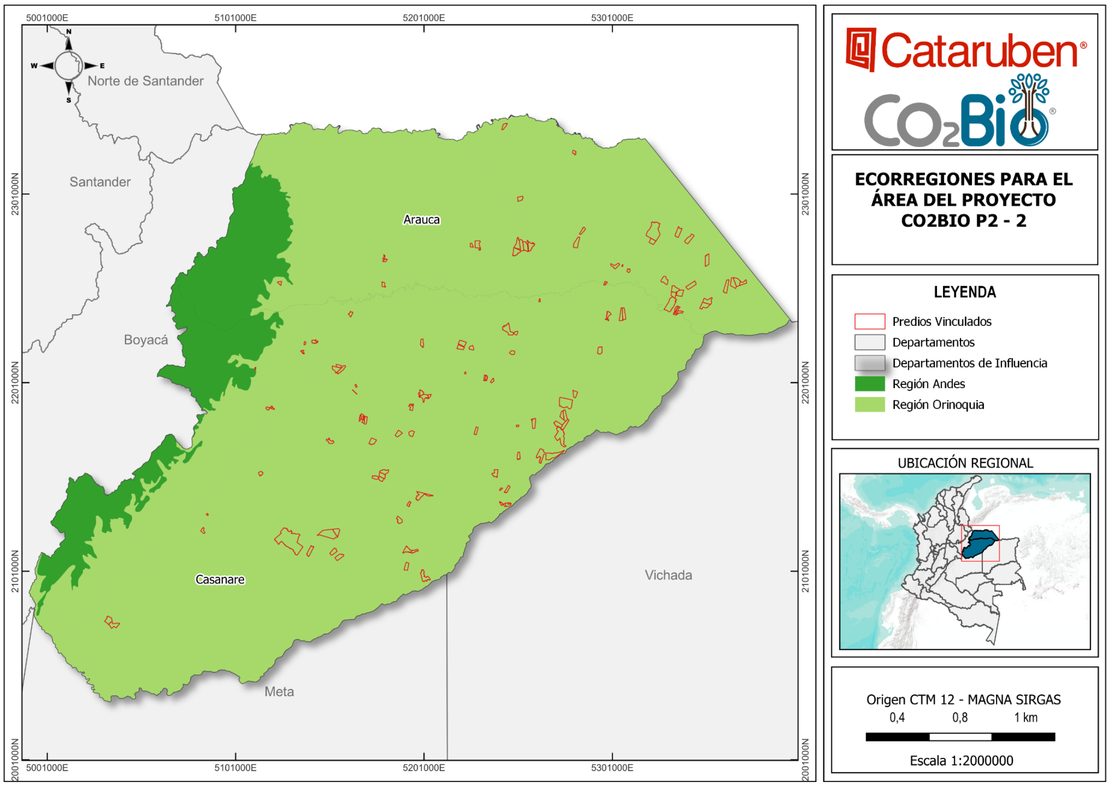


Source: *Colombian Environmental Information System (SIAC).*
Elaboration: *The Cataruben Foundation. Cartographic source: CIAT, et al., 2018.*

14.1.2. Ecoregions of the project area.

In the departments of Arauca and Casanare two ecoregions are identified, the first is the Llanos Orientales with approximately 91.35% (6,210,747.3 ha) of the area, this being the most representative, covering the entire area of the properties that have been enrolled so far. The second ecoregion is the Orinoquia piedmont rainforest, which represents 8.65% (588,133.92 ha) and none of the properties in the project are located in this ecoregion. Image 37 shows the map with the two ecoregions identified and the location of the project properties.

Image 37. Map of ecoregions in the project region.

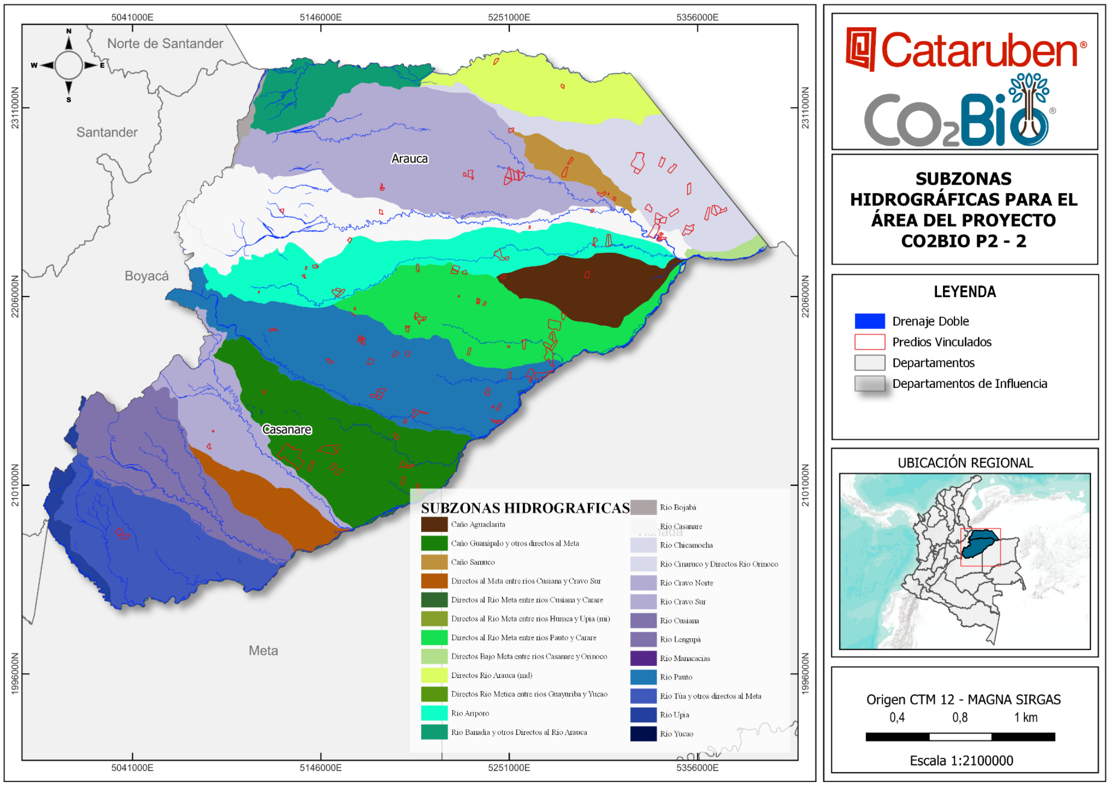


Source: Colombian Environmental Information System (SIAC).
Elaboration: The Cataruben Foundation, 2023.

14.1.3. Project area watersheds

The project area is located in the departments of Arauca and Casanare and is part of the Orinoco River macro-basin, which has an area of approximately 1,000,000 km^2 of which 345,000 km are located in Colombia (Silva-León, 2005). Within this macro-basin are the hydrographic zones of the Meta river, being the most representative in its extension and with an area of 347,713 km^2 , followed by the hydrographic zone of the Casanare river, the Arauca river and Orinoco Directos. For the two departments, a total of 30 hydrographic subzones were identified, of which the Cravo Norte, Pauto and Caño Guanápalo rivers stand out for their greater extension (Image 37).

Image 38. Map of the 6 watersheds present in the project reference region.



Source: Colombian Environmental Information System (SIAC).
Elaboration: The Cataruben Foundation, 2023.

Associated with the hydrographic basins of the region, the following characteristic landscapes are found:

a. Eastern slope of the Eastern Cordillera;
b. Depositional piedmont in Casanare and Meta, derived from Tertiary and Cretaceous rocks;
c. Low flood plains in Arauca and Casanare.

These are grouped into three large zones that are characterized by the shape of the relief: mountain ranges and sedimentation plains. The project area is distributed within the sedimentation plain, also known as the Llanos Orientales, which occupies the largest area of the Orinoco region and includes the floodplain north of the Meta River and the highlands in the south.

Floodplain soils have developed influenced by moisture and are less evolved with respect to soils in other areas of the region. These soils have high acidity, low fertility and present compaction due to livestock activity. For their part, the soils of the highland plains present high iron and kaolin content related to low fertility (Bustamante, 2019).

As mentioned before, the interactions between environmental conditions such as water richness, different fisiographic landscapes and soil characteristics, can be related to the high biological diversity of the region. In terms of numbers, the region has 156 natural ecosystems and 49 human-intervened ecosystems.

14.1.4. Area of conservation importance.

14.1.4.1. Single National Registry of Protected Areas (RUNAP)

The declaration of protected areas is key to biodiversity conservation, as it contributes to the permanence of natural ecosystems. According to the Registro Único Nacional de Áreas Protegidas (RUNAP), the departments that are part of the project area have 124 protected areas (Table 61), of which 112 are Civil Society Nature Reserves (RNSC), distributed in the departments of Casanare (107) and Arauca (5), 3 are National Protected Forest Reserves, and 4 are National Integrated Management Districts (Distritos Nacionales de Manejo Integrado). In this regard, 11 properties enrolled in the project have already been declared as RNSC (See Predios RNSC*), a* figure that will increase given the accompaniment and advice that will be given to other owners in this declaration process, within the framework of the project.

An example of these CSERs are the Properties El Guamo, la Florida, Santo Domingo 2 and Santo Domingo Florideño, which are part of the CSER la Florida located in Hato Corozal, Casanare. These reserves carry out conservation activities for endangered species such as *O. jubatus*, *M. tridactyla, P. brasiliensis* and *Puma concolor*, restoration of natural cover, mitigation of fires in natural savannas, among others.

Table 60. *Single National Registry of Protected Areas (RUNAP) for Arauca and Casanare. Source: SINAP.*

Name	Category	Organization	Department
Cinaruco	National Integrated Management Districts	MADS	Arauca
El Cocuy	National Natural Park	PNN	Arauca
Bombay	Civil Society Nature Reserve	PNN	Arauca
Los Paraguitos	Civil Society Nature Reserve	PNN	Arauca
El Horizonte	Civil Society Nature Reserve	PNN	Arauca
El Guamito	Civil Society Nature Reserve	PNN	Arauca
Cuenca del Rio Tame	National Protective Forest Reserves	MADS	Arauca
Cuenca Alta del Rio Satoca	National Protective Forest Reserves	MADS	Arauca
El Bocachico	Regional Integrated Management Districts	CORPORINOQUIA	Casanare
El Tinije	Regional Integrated Management Districts	CORPORINOQUIA	Casanare
Mata de la Urama	Regional Integrated Management Districts	CORPORINOQUIA	Casanare
Pisba	National Natural Park	PNN	Casanare
El Cocuy	National Natural Park	PNN	Casanare
San Miguel de los Farallones	Regional Natural Parks	CORPORINOQUIA	Casanare
Amanecer en el Palmar 1	Civil Society Nature Reserve	PNN	Casanare
Corozito	Civil Society Nature Reserve	PNN	Casanare
Valledupar	Civil Society Nature Reserve	PNN	Casanare
Montana	Civil Society Nature Reserve	PNN	Casanare
Los Mangos	Civil Society Nature Reserve	PNN	Casanare
La Bramadora	Civil Society Nature Reserve	PNN	Casanare
Arizona	Civil Society Nature Reserve	PNN	Casanare
Las Garzas	Civil Society Nature Reserve	PNN	Casanare
El Boral	Civil Society Nature Reserve	PNN	Casanare
Garzas	Civil Society Nature Reserve	PNN	Casanare
El Lagunazo en Santa Clara	Civil Society Nature Reserve	PNN	Casanare
El Peligro	Civil Society Nature Reserve	PNN	Casanare
Betania Del Lagunazo	Civil Society Nature Reserve	PNN	Casanare
Padrote 1	Civil Society Nature Reserve	PNN	Casanare
La Provincia	Civil Society Nature Reserve	PNN	Casanare
Fundo Raudal De Flor Amarillo	Civil Society Nature Reserve	PNN	Casanare
Finca Matesanto	Civil Society Nature Reserve	PNN	Casanare
La Sonrisa	Civil Society Nature Reserve	PNN	Casanare
Las Brisas	Civil Society Nature Reserve	PNN	Casanare
La Chula	Civil Society Nature Reserve	PNN	Casanare
La Esmeralda	Civil Society Nature Reserve	PNN	Casanare
La Fortuna	Civil Society Nature Reserve	PNN	Casanare
Buenavista	Civil Society Nature Reserve	PNN	Casanare
El Milagro	Civil Society Nature Reserve	PNN	Casanare
La Palma	Civil Society Nature Reserve	PNN	Casanare
Medano Los Morrucos	Civil Society Nature Reserve	PNN	Casanare
La Albania	Civil Society Nature Reserve	PNN	Casanare
El Boral	Civil Society Nature Reserve	PNN	Casanare
San Cristobal	Civil Society Nature Reserve	PNN	Casanare
La Reforma	Civil Society Nature Reserve	PNN	Casanare
Miravalles	Civil Society Nature Reserve	PNN	Casanare
Estero Matemarrano	Civil Society Nature Reserve	PNN	Casanare
Macarena	Civil Society Nature Reserve	PNN	Casanare
El Madrono	Civil Society Nature Reserve	PNN	Casanare
El Garzon	Civil Society Nature Reserve	PNN	Casanare
Las Malvinas	Civil Society Nature Reserve	PNN	Casanare
Cano Viejo	Civil Society Nature Reserve	PNN	Casanare

Santa Trinidad	Civil Society Nature Reserve	PNN	Casanare
Los Musos	Civil Society Nature Reserve	PNN	Casanare
Gaviota-Caracoli	Civil Society Nature Reserve	PNN	Casanare
Los Gavanes	Civil Society Nature Reserve	PNN	Casanare
San Andres	Civil Society Nature Reserve	PNN	Casanare
Marcella	Civil Society Nature Reserve	PNN	Casanare
La Cochinito	Civil Society Nature Reserve	PNN	Casanare
Toraiba	Civil Society Nature Reserve	PNN	Casanare
La Campechana	Civil Society Nature Reserve	PNN	Casanare
Rancho Nuevo	Civil Society Nature Reserve	PNN	Casanare
Buenaventura	Civil Society Nature Reserve	PNN	Casanare
Palomas	Civil Society Nature Reserve	PNN	Casanare
Las Pinas	Civil Society Nature Reserve	PNN	Casanare
San Pablo	Civil Society Nature Reserve	PNN	Casanare
Algarrobo Del Lagunazo	Civil Society Nature Reserve	PNN	Casanare
La Tamandua	Civil Society Nature Reserve	PNN	Casanare
San Juan de Tinije	Civil Society Nature Reserve	PNN	Casanare
Limonal	Civil Society Nature Reserve	PNN	Casanare
Jalisco	Civil Society Nature Reserve	PNN	Casanare
Amanecer en el Palmar 2	Civil Society Nature Reserve	PNN	Casanare
Matabrava	Civil Society Nature Reserve	PNN	Casanare
Veracruz	Civil Society Nature Reserve	PNN	Casanare
Villa Fatima	Civil Society Nature Reserve	PNN	Casanare
La Venturosa	Civil Society Nature Reserve	PNN	Casanare
Rancho Paravare II	Civil Society Nature Reserve	PNN	Casanare
Guacharacas del Cusiana	Civil Society Nature Reserve	PNN	Casanare
La Regadera	Civil Society Nature Reserve	PNN	Casanare
Mata de Palma	Civil Society Nature Reserve	PNN	Casanare
El Campin	Civil Society Nature Reserve	PNN	Casanare
El Tirriagal	Civil Society Nature Reserve	PNN	Casanare
Corocito	Civil Society Nature Reserve	PNN	Casanare
El Boral	Civil Society Nature Reserve	PNN	Casanare
Fauna Silvestre Capibara	Civil Society Nature Reserve	PNN	Casanare
Fundo Palmarito	Civil Society Nature Reserve	PNN	Casanare
Sabanales	Civil Society Nature Reserve	PNN	Casanare
Altamira	Civil Society Nature Reserve	PNN	Casanare
Canas Bravas	Civil Society Nature Reserve	PNN	Casanare
Padrote 2	Civil Society Nature Reserve	PNN	Casanare
Casamba	Civil Society Nature Reserve	PNN	Casanare
La Chivera	Civil Society Nature Reserve	PNN	Casanare
El Lagunazo	Civil Society Nature Reserve	PNN	Casanare
La Palmita	Civil Society Nature Reserve	PNN	Casanare
La Gloria	Civil Society Nature Reserve	PNN	Casanare
Villa Alejandra	Civil Society Nature Reserve	PNN	Casanare
La Florida	Civil Society Nature Reserve	PNN	Casanare
El Esparramo	Civil Society Nature Reserve	PNN	Casanare
Palmeras	Civil Society Nature Reserve	PNN	Casanare
Hato Venecia De Guanapalo	Civil Society Nature Reserve	PNN	Casanare
La Bohemia	Civil Society Nature Reserve	PNN	Casanare
El Venado	Civil Society Nature Reserve	PNN	Casanare
Hato las Covijas	Civil Society Nature Reserve	PNN	Casanare
La Aurora	Civil Society Nature Reserve	PNN	Casanare
Quinto Patio del Lagunazo	Civil Society Nature Reserve	PNN	Casanare
Berlin	Civil Society Nature Reserve	PNN	Casanare
Palmarito Casanare	Civil Society Nature Reserve	PNN	Casanare
Corocora	Civil Society Nature Reserve	PNN	Casanare
Chaparral II	Civil Society Nature Reserve	PNN	Casanare

Los Matapalos del Lagunazo	Civil Society Nature Reserve	PNN	Casanare
Padrote	Civil Society Nature Reserve	PNN	Casanare
Fundo Vida Tranquila	Civil Society Nature Reserve	PNN	Casanare
Betania	Civil Society Nature Reserve	PNN	Casanare
La Travesada	Civil Society Nature Reserve	PNN	Casanare
La Algarabia	Civil Society Nature Reserve	PNN	Casanare
Flor Amarillo	Civil Society Nature Reserve	PNN	Casanare
Charanga	Civil Society Nature Reserve	PNN	Casanare
Miramar	Civil Society Nature Reserve	PNN	Casanare
El Tautaco	Civil Society Nature Reserve	PNN	Casanare
Maturin	Civil Society Nature Reserve	PNN	Casanare
Mesetas de Versalles	Civil Society Nature Reserve	PNN	Casanare
El Triunfo	Civil Society Nature Reserve	PNN	Casanare
Cuenca Hidrográfica de la Quebrada la Tablona	National Protective Forest Reserves	MADS	Casanare

Source: The Cataruben Foundation, 2023.

14.1.4.2. Important Bird and Biodiversity Conservation Areas (IBAs).

Within the departments of Arauca and Casanare there are 9 AICAs, 1 and 8 respectively. These have been established over the years and some are already being evaluated by the Calidris association until 2022.

As a specific case for the Project, the Property RNSC La Gloria, is part of the group of Natural Reserves of the Civil Society of the Altagracia district that were recognized worldwide as Important Bird Areas (IBAs) (Birdlife International, 2021). In these, at least 154 species of birds are recorded, of which 15 are migratory, such as the wigeon (*Anas discors*), the lesser sandpiper (*Calidris minutilla*), the scaled sandpiper (*Calidris subruficollis*), among others. This AICA represents one of the most important sites for the conservation of the wigeon (*O. jubatus*) in the Americas, due to the fact that an estimated number of individuals equivalent to 31% of the entire global population of the species (Calidris, U.S. Fish and Wildlife Service, Birdlife International, Fundación Cunaguaro, Fundación Palmarito, *n.d.*). (Cifuentes-Sarmiento & Ruiz-Guerra, 2022).

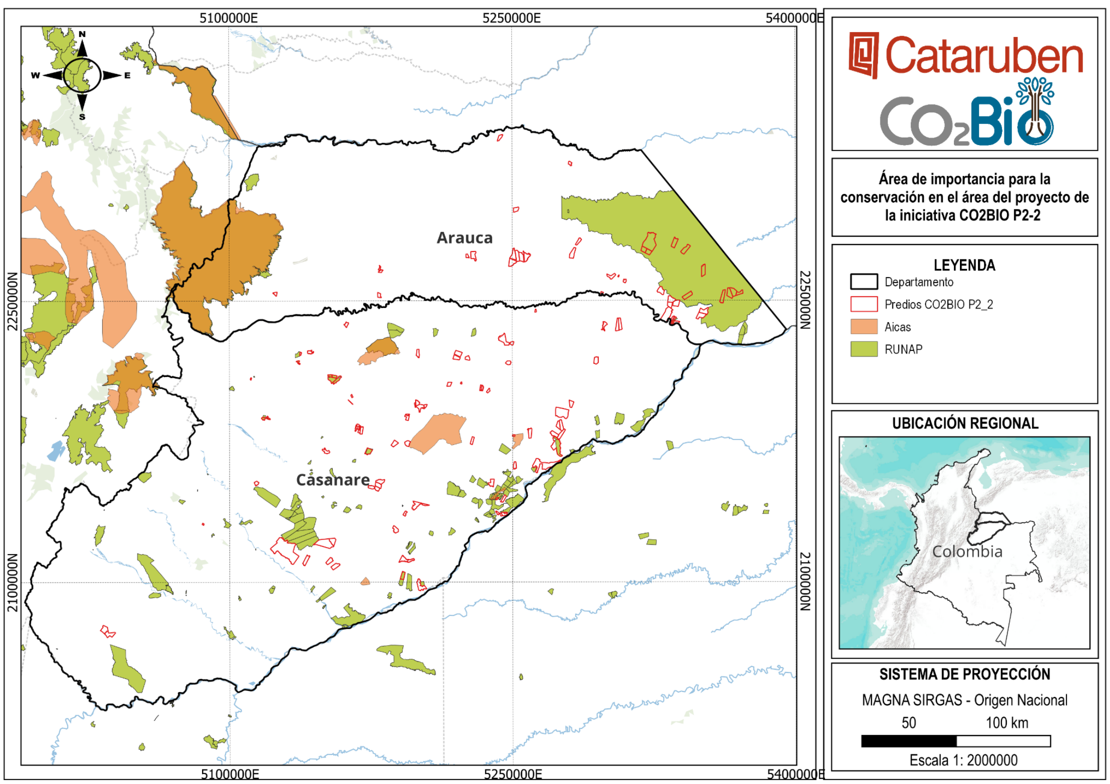
On the other hand, the Flor Amarillo property is in the process of being declared as AICAS. The evidence for the recognition of these properties as AICAS can be found in ***Annex*** AICAs.

The location of the RNSCs and AICAS found within the project reference area are shown in Figure 39. Key Biodiversity Areas (KBAs) and major rivers that can supply community needs and harbor species important for conservation are included in this map.

14.1.4.2.1 Ramsar

The Ramsar areas are sites designated under the Ramsar Convention on Wetlands, an international treaty aimed at the conservation and wise use of wetlands worldwide. The Ramsar Convention was adopted in 1971 in the city of Ramsar, Iran, and has been ratified by numerous countries, including Colombia. Ramsar areas are wetlands that meet the criteria established by the convention in terms of their ecological importance, biological diversity, and socioeconomic value. No Ramsar areas are reported for the project.

Image 39. Areas of conservation importance.



Source: The Cataruben Foundation, 2021.

14.1.5. Vegetation associated with wetlands in the project area (Diversity and richness).

The Colombian Llanos Orientales have 23 million hectares of savannas out of the 269 million hectares found in South America. Colombia is the second largest country, followed by Brazil, which has the largest area: 204 million hectares (Rippstein et al., 2001).

The floodable savannas of the Colombian Orinoquia cover most of Arauca and Casanare, departments where the Project is being developed; they represent 12.5% of the Orinoco basin area and are characterized as a strategic ecosystem of great economic, biological and ecological importance for the Orinoquia region. These savannas are characterized by being located in low, concave terrain, known as bajos and esteros, which are flooded during the rainy season due to precipitation and the overflowing of rivers and streams; and also by higher areas, called bancos and banquetas, which are essential for livestock and wildlife feeding (Sastre et al., 2006).

The vegetation of these savannas is characterized by the presence of *Trachypogon* spicatus, those belonging to the genus *Andropogon* and in third place those conformed by *Anthaenanthia* (Rangel-Ch, 2014); also abundant are aquatic plants, of herbaceous habit and emergent rooted (Fernandez et al., 2015) of the families Poaceae, Cyperaceae and Fabaceae (Mora-Fernandez et al., 2011).

For the present vegetation analysis, a data matrix was generated from the review of various sources of the Alexander von Humboldt Institute- SiB Colombia (https://biodiversidad.co/) and the Global Biodiversity Information Facility-Gbif (https://www.gbif.org/en/), and filtered the information corresponding to the project intervention area, which includes the municipalities of Paz de Ariporo, Hato Corozal, Trinidad, Orocué, San Luis de Palenque and Yopal, in the department of Casanare, and Arauca, Cravo Norte, Puerto Rondón and Tame, in Arauca.

In the area of action of the Project, 712 plant species are reported, distributed in 464 genera and 155 families. The most representative family is Fabaceae with 57 species, followed by Poaceae with 33 species; the above coincides with what is commonly reported in various floristic studies of the area such as

Buriticá (2016), Fernandez et al. (2015), Osorio-Pelaez et al. (2015), among others. The consolidated matrix of the flora present in the project area can be found in the annex Flora of the Project's area of influence.xlsx.

14.1.5.1 Threatened plant species in the project area

The search for the level of extinction risk was carried out using the IUCN database (https://www.iucn.org/). In the region within which the project area is located, flora reports that more than 50% of the identified species do not yet have an extinction risk assessment; in total, results were found for 149 species, of which 147 are of least concern (LC), one, *Hedychium coronarium*, with insufficient data (DD) and *Lejeunea flava*, which was categorized as near threatened (NT).

14.1.6. Fauna associated with Wetlands in the Project Area

The Wetlands of the Colombian savannas are home to a great variety of fauna that has adapted to these aquatic and semi-aquatic ecosystems as a result of the climatic variation of the region. Some of the most outstanding fauna species that inhabit this ecosystem are aquatic birds such as herons, ducks, coots, among others, which find in the wetlands a source of food, shelter and reproduction areas.

We can also find mammals of semi-aquatic habitat such as otters and chigüiros, reptiles such as snakes, alligators, turtles, among other groups such as amphibians and fish, which play an important role in the ecological balance of these ecosystems and contribute to their biodiversity and functioning.

For the Colombian Orinoco, approximately 1043 species of birds, 155 species of reptiles, 254 species of mammals, 663 species of fish, 191 species of anfibes, 5411 species of plants and 680 species of insects have been reported, of which 274 are endemic species (Bustamante, 2019).

To estimate the species richness of the project area, lists of samplings, inventories, GBIF records and Sib Colombia records up to December 2021 were consulted for the departments of Casanare and Arauca (Lasso *et al.*, 2014; Trujillo & Anzola, 2019; Usma & Trujillo, 2011; GBIF, 2021; SiB Colombia, 2021). Thus, in the Annex Fauna of the area of influence of the Project.xlsx, 9 species of anfibes, 340 species of birds, 103 species of mammals, 166 species of fish and 54 species of reptiles are listed. Additionally, the threat status and distribution of species in the IUCN Red List[17] , iNaturalist[18] , eBird[19] , Tropics[20] and GBIF[21] were identified and verified, as shown below in Table 62.

Table 61. Diversity of fauna species reported in the project area.

Taxonomic Group	Families	Genres	Species	DD	NT	LC	VU	EN	CR
Amphibians	4	5	9	0	0	6	1	0	0
Birds	58	268	340	0	12	319	2	1	0
Mammals	26	75	103	6	4	89	3	2	1
Fish	98	112	166	2	2	84	3	0	0
Reptiles	30	34	54	0	4	46	3	0	1
Total	**216**	**494**	**672**	**8**	**22**	**544**	**12**	**3**	**2**

Source: IUCN Red List, iNaturalist, eBird, Tropics and GBIF.

Elaboration: The Cataruben Foundation.

14.1.6.1. Threatened fauna species in the project area.

A species may be in a state of threat due to several factors that affect its survival and ability to maintain stable populations. Factors such as habitat loss or degradation, trafficking and indiscriminate hunting, the effects of climate change, invasive species, and environmental pollution and deterioration.

There are 17 species of fauna, which according to the IUCN were identified in one of the three most threatened categories CR (Critically Endangered), EN (Endangered) and VU (Vulnerable) (Table 62).

[17] https://www.iucnredlist.org/

[18] https://www.inaturalist.org/observations

[19] https://ebird.org/home

[20] http://legacy.tropicos.org/Home.aspx?projectid=33&langid=66

[21] https://www.gbif.org/

Table 62. Faunal species reported within the list of threatened species in the project area in the categories Critical (CR) Endangered (EN) and Vulnerable (VU).

Group	Degree of threat	Species
Mammals	EN	*Ateles belzebuth*
		Pteronura brasilensis
	CR	*Lagothrix lugens*
	VU	*Leopardus tigrinus*
		Myrmecophaga tridactyla
		Tapirus terrestris
Birds	EN	*Pauxi pauxi*
	VU	*Ara militaris*
		Tinamus tao
Amphibians	VU	*Allobates cepedai*
Reptiles	CR	*Crocodylus intermedius*
	VU	*Chelonoidis carbonaria*
		Chelonoidis carbonarius
		Podocnemis unfilis

Source: *IUCN Red List, iNaturalist, eBird, Tropics and GBIF.*

Elaboration: The Cataruben Foundation

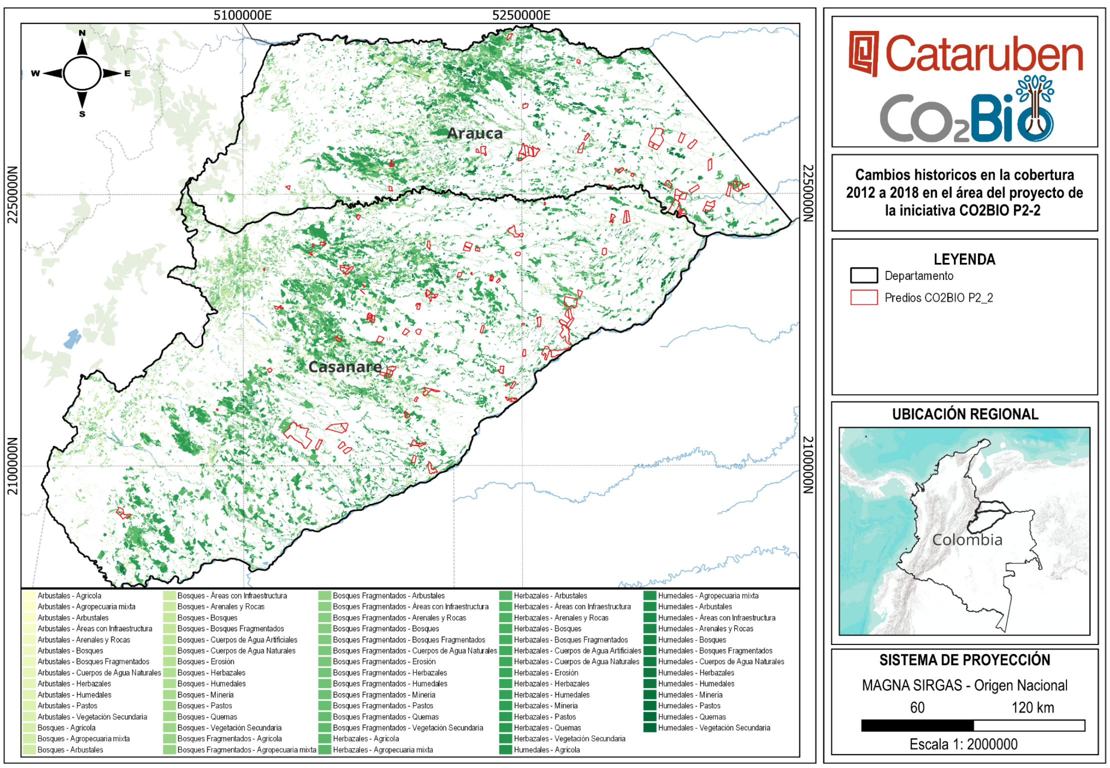
*14.1.7. Historical changes in **coverage***

Land cover maps for the periods 2010-2012 and 2018 at a scale of 1:100,000 were obtained from the Colombian environmental information system (SIAC, 2023), with the objective of comparing historical changes in the land cover present in the project area within the departments of Arauca and Casanare. The land covers were compared under the classification of *categorization of cover units in indicators of* the National Natural Parks System.

As a result of this analysis, land cover has undergone significant changes during these years in the two departments, subject to environmental and social pressures that involve humans as active actors in these modifications (Image 39).

For the two departments, the highest incidence of natural cover change is from grasslands to pastures with 28.49%. This was followed by the transformation of grasslands to agricultural cover (10.25%), mixed agricultural and livestock (6.68%) and wetlands (6.48%), as shown in Table 64. In addition, it was identified that some forest areas have been transformed into grasslands (4.28%) and pastures (4.78%), this may be related to deforestation due to the expansion of the agricultural frontier, increase of monocultures or the incidence of forest fires (Fundación Grothendieck, 2021). In the Orinoco River basin, ecosystems such as humid basal forests and flooded basal forests are at a critical threat level (Prüssmann et al. 2020), which suggests that conservation and mitigation measures should be implemented in this type of cover, contributing to the preservation of fauna and flora and improving the ecological processes of the region.

Image 40 . Land cover map scale 1:100,000 in the periods of 2012 and 2018 for the project area.



Source: *Colombian Environmental Information System (SIAC).*
Elaboration: *The Cataruben Foundation.*

Table 63. Percentage of land cover change per hectare in the departments of Arauca and Casanare.

Change	Area	Percentage of area transformed
Shrublands - Agricultural	555,35	0,04
Arbustales - Mixed agricultural and livestock farming	282,36	0,02
Shrublands - Areas with Infrastructure	7,28	0,00
Shrublands - Sandbanks and Rocks	20,78	0,00
Shrublands - Forests	2390,66	0,17
Shrublands - Fragmented Forests	289,34	0,02
Shrublands - Natural Water Bodies	33,15	0,00
Shrublands - Herbazales	1942,34	0,13
Shrubland - Wetlands	7,89	0,00
Shrublands - Pastures	765,27	0,05
Shrublands - Secondary Vegetation	310,96	0,02
Forestry - Agricultural	15912,10	1,10
Forestry - Mixed Agriculture and Livestock	26591,97	1,84
Forests - Shrublands	2014,91	0,14
Forests - Areas with Infrastructure	133,73	0,01
Forests - Sandbanks and Rocks	431,85	0,03
Forests - Fragmented Forests	25576,57	1,77
Forests - Artificial Water Bodies	26,39	0,00
Forests - Natural Water Bodies	12863,70	0,89
Forests - Erosion	388,69	0,03
Forests - Grasslands	61861,38	4,28
Forests - Wetlands	3655,79	0,25
Forests - Mining	255,37	0,02
Forests - Pastures	69202,28	4,78
Forests - Burning	49,23	0,00
Forests - Secondary Vegetation	64040,97	4,43
Fragmented Forests - Agricultural	3824,09	0,26
Fragmented Forests - Mixed Agropecuaria	16709,14	1,15
Fragmented Forests - Shrublands	727,83	0,05
Fragmented Forests - Infrastructure Areas	28,09	0,00
Fragmented Forests - Sandbanks and Rocks	120,91	0,01
Fragmented Forests - Forests	56995,38	3,94
Fragmented Forests - Natural Water Bodies	2338,26	0,16

Fragmented Forests - Erosion	17,86	0,00
Fragmented Forests - Grasslands	7198,40	0,50
Fragmented Forests - Wetlands	426,63	0,03
Fragmented Forests - Mining	17,48	0,00
Fragmented Forests - Pastures	37511,69	2,59
Fragmented Forests - Burning	54,74	0,00
Fragmented Forests - Secondary Vegetation	30724,86	2,12
Herbazales - Agricultural	148348,75	10,25
Herbazales - Mixed agricultural and livestock farming	96639,63	6,68
Herbazales - Arbustales	13495,79	0,93
Herbazales - Infrastructure Areas	578,26	0,04
Herbazales - Sandbanks and Rocks	1546,78	0,11
Herbazales - Forests	115711,07	8,00
Grasslands - Fragmented Forests	3388,57	0,23
Herbazales - Artificial Water Bodies	85,53	0,01
Herbazales - Natural Water Bodies	12947,83	0,89
Herbazales - Erosion	1043,65	0,07
Herbazales - Wetlands	93813,16	6,48
Herbazales - Mining	308,28	0,02
Herbazales - Pastures	412240,04	28,49
Herbazales - Burns	7531,60	0,52
Herbazales - Secondary Vegetation	30114,24	2,08
Wetlands - Agriculture	2059,66	0,14
Wetlands - Mixed Agriculture and Livestock	1123,30	0,08
Wetlands - Shrublands	375,78	0,03
Wetlands - Areas with Infrastructure	28,79	0,00
Wetlands - Sand and Rock Wetlands	11,05	0,00
Wetlands - Forests	2455,98	0,17
Wetlands - Fragmented Forests	14,85	0,00
Wetlands - Natural Water Bodies	6890,07	0,48
Wetlands - Grasslands	41792,51	2,89
Wetlands - Mining	35,24	0,00
Wetlands - Pastures	6750,09	0,47
Wetlands - Burns	162,15	0,01
Wetlands - Secondary Vegetation	1024,34	0,07
TOTAL	**1446822,66**	**100,00**

Source: *Colombian Environmental Information System (SIAC).*
Elaboration: *The Cataruben Foundation.*

For the project areas, there was a change in natural cover with the greatest incidence in the transition from grasslands to forests with 27.55%. This was followed by the transformation from grasslands to pastures with 21.42% and grasslands to Wetlands with 11.38% as shown in Table 64. These values show that the transformation from grassland to forest with a high percentage value means that there is a process of improvement and recovery of ecosystems such as forests within the project area.

It was identified that there are transitional changes between grasslands and pastures, and between grasslands and mixed agricultural and livestock cover with a high incidence that may be the result of land use for maintenance activities of the communities in the area.

Table 64. Percentage of land cover change per hectare in the project area.

Change	Area	Percentage of area transformed
Arbustales - Mixed agricultural and livestock farming	0,12	0,001
Shrublands - Forests	1,55	0,012
Shrublands - Fragmented Forests	51,73	0,388
Shrublands - Pastures	7,46	0,056
Forestry - Agricultural	15,87	0,119
Forestry - Mixed Agriculture and Livestock	92,68	0,696
Forests - Shrublands	1,31	0,010
Forests - Sandbanks and Rocks	6,14	0,046
Forests - Fragmented Forests	135,78	1,019
Forests - Natural Water Bodies	130,21	0,977
Forests - Grasslands	1025,54	7,696
Forests - Wetlands	0,63	0,005
Forests - Pastures	191,87	1,440
Forests - Burning	21,78	0,163
Forests - Secondary Vegetation	231,6	1,738
Fragmented Forests - Agricultural	9,1	0,068
Fragmented Forests - Forests	161,39	1,211
Fragmented Forests - Natural Water Bodies	1,05	0,008

Fragmented Forests - Grasslands	137,49	1,032
Fragmented Forests - Pastures	5,6	0,042
Fragmented Forests - Secondary Vegetation	56,1	0,421
Herbazales - Agricultural	445,11	3,340
Herbazales - Mixed agricultural and livestock farming	1164,52	8,739
Herbazales - Arbustales	559,77	4,201
Herbazales - Areas with Infrastructure	5,72	0,043
Herbazales - Forests	3672,15	27,558
Grasslands - Fragmented Forests	22,1	0,166
Herbazales - Natural Water Bodies	66,94	0,502
Herbazales - Erosion	47,57	0,357
Herbazales - Wetlands	1517,01	11,384
Herbazales - Pastures	2854,61	21,422
Herbazales - Burns	117,19	0,879
Herbazales - Secondary Vegetation	97,11	0,729
Wetlands - Agriculture	19,68	0,148
Wetlands - Forests	1,47	0,011
Wetlands - Natural Water Bodies	144,65	1,086
Wetlands - Grasslands	231,69	1,739
Wetlands - Pastures	73,11	0,549
Total	13325,4	100,000

Source: Colombian Environmental Information System (SIAC).

Elaboration: The Cataruben Foundation.

*14.1.8. High Conservation Values (HCV) of the **project** area.*

High Conservation Values (HCVs) are a tool used in biodiversity conservation and sustainable natural resource management. They determine attributes or characteristics of an area or ecosystem that are considered of significant importance for biodiversity conservation and the maintenance of ecosystem services.

HCVs may include elements such as the presence of threatened species, unique or representative habitats, fragile ecosystems, areas of high biological diversity, key ecosystem services, significant cultural or historical sites, and any other recognized conservation value (HCV Resources Network, 2013).

Within the project area, specifically for the department of Casanare, HCVs have been identified and evaluated through the study "Biodiversity of the department of Casanare identification of strategic ecosystems" (Usma and Trujillo, 2011) conducted by the government of Casanare and the World Wildlife Fund (WWF). The latter has advanced in a methodological proposal to use HCV criteria in the identification of priorities for conservation in the ecoregional complex of the Orinoco river basin, which was the starting point for the inclusion of biodiversity conservation criteria, supported by the methodologies proposed in the framework of the Forest Stewardship Council - FSC certification programs (Jennings *et al.* 2002) in which six HCV criteria are obtained. The criteria and inputs used for the classification of each of the HCVs are shown in Table 65.

Table 65. Criteria used for HCV classification in the project area.

AVC	*DESCRIPTION*	*VARIABLES*
AVC1.	*Areas containing concentrations of globally, regionally or nationally important concentrations of diversity values in plants, insects (butterflies and ants), fish, amphibians, reptiles, birds and mammals.*	*Species richness or number of species. Potential conservation areas. Prioritized areas for conservation.*
AVC2.	*Areas with ecosystems in good conservation status at the landscape level, where there are viable populations of most or all naturally occurring species.*	*Size/extent of ecosystems. Average area of ecosystems. Connectivity - Euclidean distance. Longitudinal continuity - cohesion. Number of fragments.*
AVC3.	*Areas that are or contain rare or endangered ecosystems (Singularity).*	*Ecosystems whose distribution and extension are restricted to Casanare. Rare ecosystems for their presence along the Casanare.*
AVC4.	*Areas that provide basic goods and services from nature.*	*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.*
AVC5.	*Important areas to meet the basic needs of local communities, in terms of subsistence or health.*	*Ecosystems that provide: hunting, fishing, timber and/or medicinal plants, watering places.*
AVC 6.	*Areas of great importance for the traditional cultural identity of local communities.*	*Sites with archeological value, sacred sites, salt tradition, religious tourism, recreational tourism, indigenous ancestral territories.*

__Source:__ Jennings et al. 2002 and Gobernación de Casanare - WWF Colombia, 2011.
Elaboration: The Cataruben Foundation

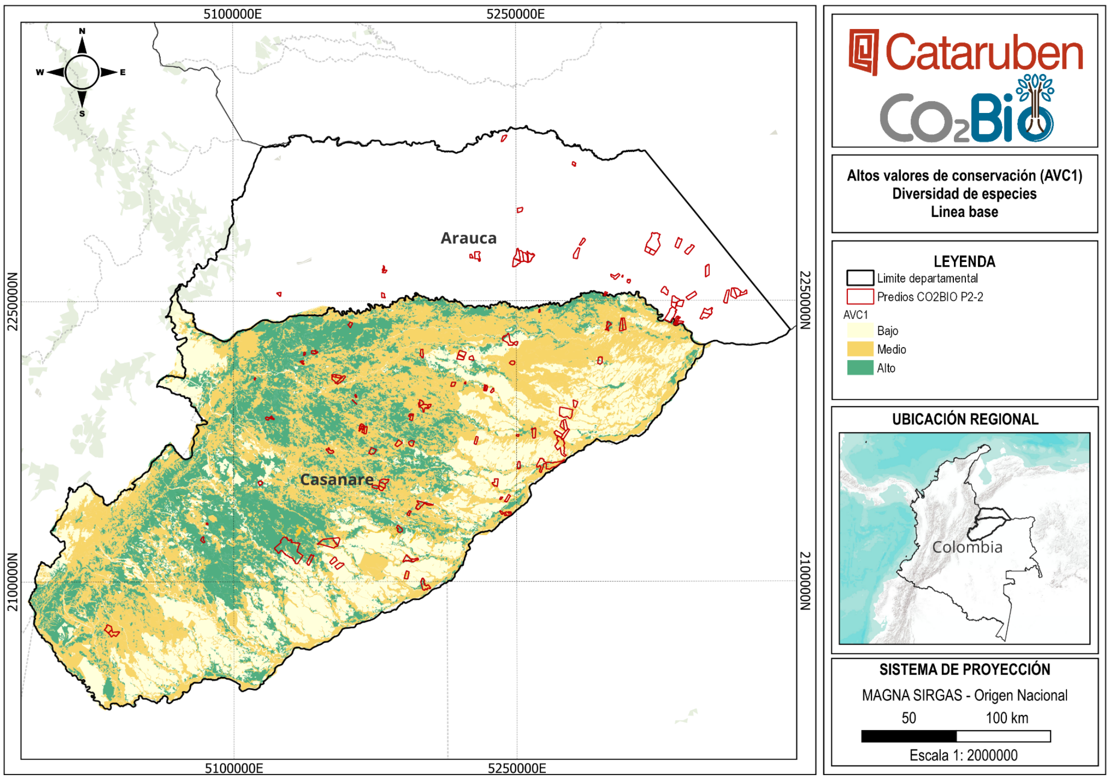
For the development of the project baseline, HCVs 1, 2, 3 and 4 were identified by means of cartographic analyses related to biodiversity and the provision of ecosystem services, describing in a macro manner the attributes determined in each of these HCVs.

14.1.8.1 HCVs - 1: Species Diversity

For the description of HCV 1 for the baseline, the cartographic analysis carried out by Trujillo *et al*. (2011) was used, based on the weighting of each variable, obtaining a spatial classification by levels: low, medium and high conservation value. The information corresponding to HCVs - 1, relates those areas that contain concentrations of globally, regionally or nationally important biodiversity values, such as endemism, endangered species or species habitats within the department of Casanare.

In Casanare there are 86 (67.7%) properties and in Arauca 41 (32.3%) of the 124 enrolled properties and all the properties are distributed in the Eastern Plains ecoregion. Image 41 shows that the department of Casanare has the presence of HCV1 in the high and medium category in more than 50% of the territory. This indicates that this territory has the presence of species that is significant to assert the presence of this HCV.

Image 41. High Conservation Value Areas (HCV1) for species diversity related to the project area under the analysis of Trujillo et al, (2011).



Source: (Gobernación de Casanare - WWF Colombia. 2011).
Elaboration: The Cataruben Foundation.

To characterize HCV 1 for the two departments, a baseline analysis was developed regarding the potential distribution of important species for conservation (endemic and threatened species) (IUCN 2023).

On the other hand, the map of Continental, Coastal and Marine Ecosystems of Colombia (IDEAM, 2017) was taken into account. Of the 41 general ecosystems present in both departments, groupings were established according to similarities of some attributes, 18 ecosystem groupings are obtained (Table 67).

A reclassification of the variables described above was carried out. The highest assigned value of 3 is given to Protected areas, AICAS and general ecosystems given their ecosystemic importance: 1) Agroecosystem, transformed transitional, artificialized territory, rocky complexes and other areas. 2)

Shrubland, artificial water body, glaciers and snowfields, grassland, savannah, secondary vegetation and swampy area. 3) Forest, fragmented forest, gallery and/or riparian forest, rivers, lagoons and Paramo.

To define the areas of high biological diversity value, the product of the sum of the variables obtained with a minimum value of 2 and a maximum value of 6 (Table 66), were categorized into three ranges: high, medium and low.

Table 66. AVC1 classification.

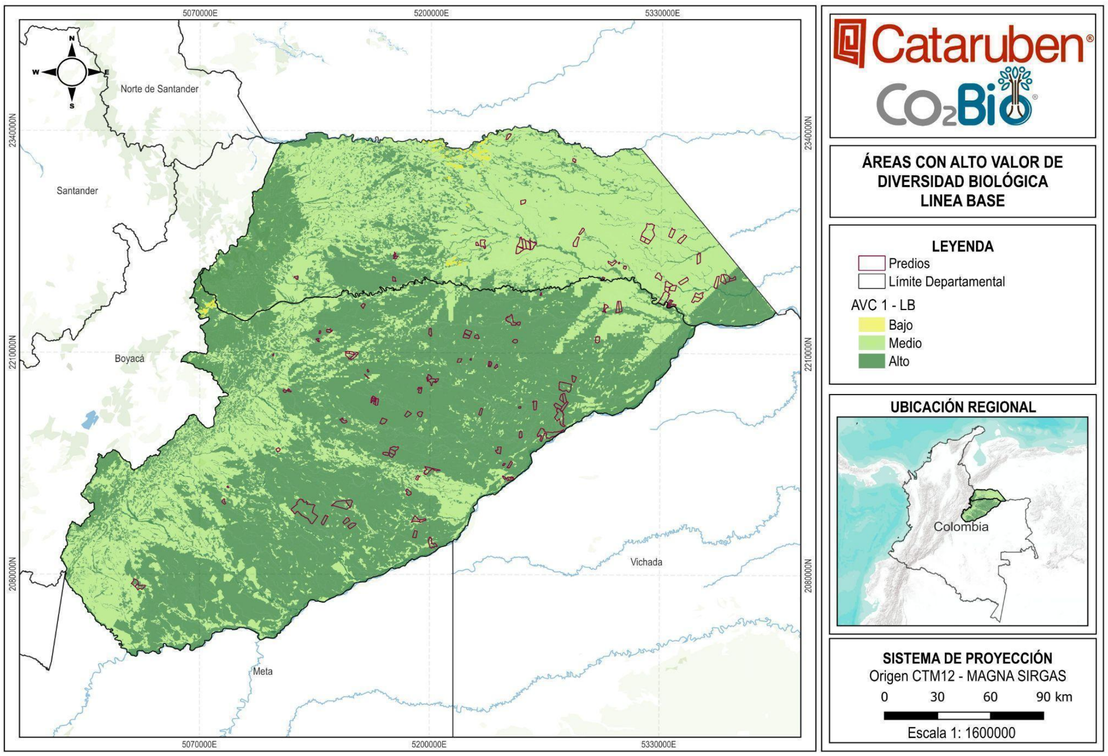
Matching potential conservation areas				
Biological wealth		Under	Medium	High
	Under	2 (1: Bass)	3 (2: Medium)	4 (3: High)
	Medium	3 (2: Medium)	4 (2: Medium)	5 (3: High)
	High	4 (2: Medium)	5 (3: High)	6 (3: High)

Source: The Cataruben Foundation.

As shown in Image 41 for the two departments, it was identified that in most of the territory the high category is present, highlighting the presence of forest areas and Wetlands, which are also part of the vulnerable ecosystems of the departments. These areas serve as refuge for the species present and protect a great diversity of species, which may lead to these results for the region of the eastern plains and the plains foothills.

The medium category is distributed in areas that have a greater presence of transformed cover or that are used for activities such as agriculture and livestock or are close to areas with infrastructure and artificialized territories. It is reported that most of the properties in the department of Casanare are in the high category, while in Arauca they are in the medium category.

Image 42. High Conservation Value Areas (HCV1) for the diversity of species identified in the project area.



Elaboration: The Cataruben Foundation.

14.1.8.2. HCVs - 2: Landscape-scale ecosystems and mosaics

For the landscape level analysis, the 2018 Corine Land Cover layer from IDEAM was used and imported into ArcGIS 10.8 software and landscape metrics were generated using the Patch Analysis fragmentation analysis extension.

The following landscape metrics calculated at the landscape and class level were obtained for the entire landscape mosaic of the departments of Arauca and Casanare: total number of patches (Pnum), mean patch size (MPS), total area of each class (CA) and total surface area (TLA). Two spatial pattern analyses were performed: a) at the landscape level, applied to the entire area of interest. b) at the class level, where the calculations were applied to each landscape set, i.e., to each of the land uses and land covers individually. The latter is important for calculating the area occupied by a given land cover.

To define the HCV2 thresholds, an integrity analysis was performed considering the following landscape metrics: total area of each class (CA), mean patch size (MPS), the total number of patches (Pnum) and Euclidean distance to nearest neighbor (ENN_MN) (Table 67). The latter was obtained with Fragstats 4.2 software.

The thresholds for each category were determined based on Jenks' Natural Breaks classification method, considering their distribution. They were categorized into three ranges: High, Medium and Low, and assigned a numerical value: 3, 2 and 1 respectively. The results of each class for the set of natural type coverages were classified as medium or high integrity; on the other hand, the transformed category was classified as low integrity, that is, the anthropic type coverages were assigned a value of 0 for each indicator.

Regarding the landscape level analysis, a value of 18791 patches (Nump) were obtained for the year 2018 in the whole area and a total surface of the study area of 6798117 ha. Of the 17 land covers at the level of both departments, the most representative covers were grasslands (3220,561 ha), pastures (1354,059) and forests (961,373 ha). It is observed that the largest number of patches is represented by pastures (4151) and secondary vegetation (3034); although grasslands and forests represent those coverages with the largest average size, 1340 ha and 358 ha respectively.

Table 67. Ranking indicators for the definition of landscape integrity.

Coverage	Value Class	CA	AC value	MPS	MPS valu e	Num P	Num P Value	ENN_MN	ENN valu e	Sum	Valu e	Category
Glacial and Snow Zones	2	225	1	75	1	3	3	966,0667	3	10	2	Media
Artificial Water Bodies	2	495	2	45	1	11	3	22503,1151	1	9	2	Media
Mining	1	2128	0	58	0	37	0	7337,0287	0	1	1	Download
Erosion	1	2153	0	83	0	26	0	17082,8590	0	1	1	Download
Burns	1	9092	0	168	0	54	0	6010,5917	0	1	1	Download
Areas with Infrastructure	1	11555	0	48	0	241	0	5274,6144	0	1	1	Download
Sand and Rocks	1	14051	2	64	1	221	3	1900,0006	2	9	2	Media
Shrublands	2	33531	2	137	1	245	3	2812,2429	1	9	2	Media
Fragmented Forests	3	64604	2	145	1	445	2	1758,3971	2	10	2	Media
Natural Water Bodies	3	116512	2	323	2	361	3	764,9218	3	13	3	High

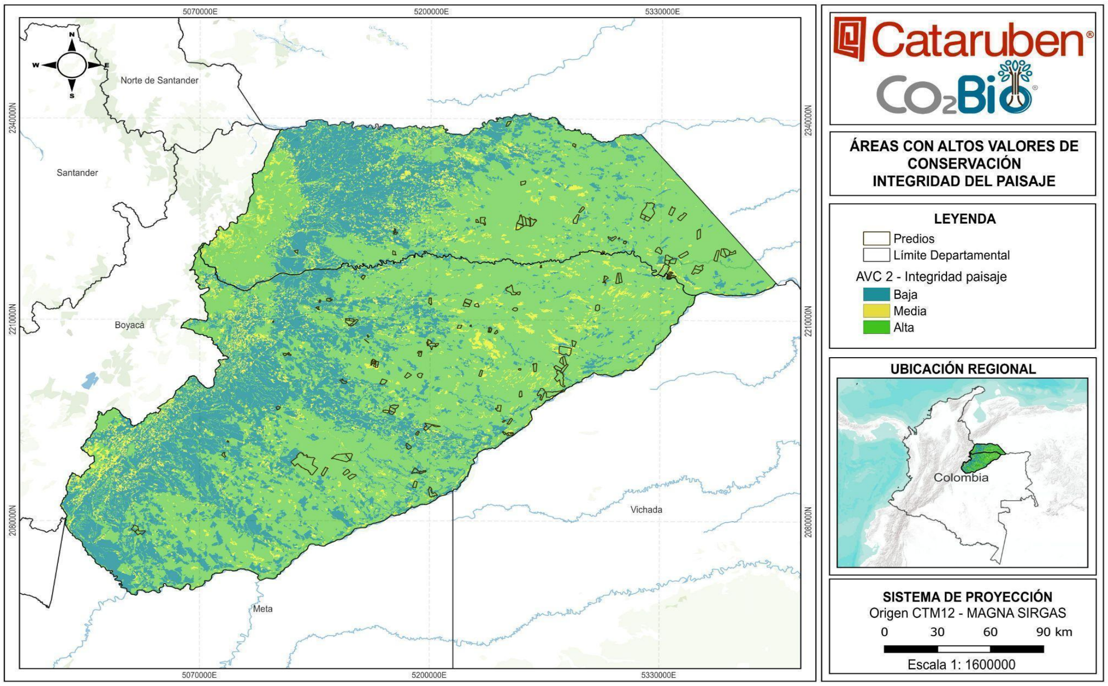
Wetlands	2	135168	2	162	1	834	2	1619,0097	2	9	2	Media
Secondary Vegetation	2	239668	2	79	1	3034	1	701,2192	3	9	2	Media
Mixed farming	1	274613	0	101	0	2717	0	891,7530	0	1	1	Download
Agricultural	1	358330	0	271	0	1321	0	1164,6962	0	1	1	Download
Forests	3	961373	3	358	2	2686	2	357,9942	3	13	3	High
Pastures	1	1354059	0	326	0	4151	0	449,2507	0	1	1	Download
Herbazales	2	3220561	3	1.340	3	2404	2	504,6513	3	13	3	High

Elaboration: The Cataruben Foundation.

The analysis of landscape integrity resulted in a map showing areas categorized as high, medium and low that can be considered as having a high conservation value at the landscape level. Most of the areas in the departments of Arauca and Casanare are in the high category as shown in Image 42. Most of these areas were characterized in terms of the characteristics of the ecosystems that result in a homogeneity between natural coverages that can harbor a great diversity and ecological services.

Areas in the low category are associated with zones transformed by anthropogenic activities that reduce the connectivity of ecological processes and displace natural fauna species and replace flora species. The transformation of cover diminishes the quality and integrity of the landscape because it limits the processes of regeneration and restoration of ecosystems, leading to a loss of landscape features that give quality to natural ecosystems.

Image 43. High Conservation Value Areas (HCV2) Ecosystems and landscape-scale mosaics identified in the project area.



Source: (Gobernación de Casanare - WWF Colombia. 2011).
Elaboration: The Cataruben Foundation, 2023.

14.1.8.3. HCVs - 3: Ecosystems and Habitats

To define the areas with ecosystems in a state of threat, the IDEAM's Continental, coastal and marine ecosystems of Colombia layer was used. For the identification of areas with low, medium and high threat ecosystems, numerical values of 1, 2 and 3 were assigned, corresponding to low, medium and high intervals, respectively.

Of the 41 general ecosystems present in both departments, groupings were established according to similarities of some attributes, resulting in 18 ecosystem groupings. Of these 18 groupings, the highest assigned value of 3 was given to Forest, Gallery and/or riparian forest, Fragmented forest, Lagoon, Paramo and Rivers given their ecosystemic importance; Shrubland, Grassland, Savanna, Secondary vegetation, Artificial water body, Swampy area, Glaciers and snowfields, were assigned a value of 2. Finally, a value of 1 was assigned to anthropic coverages such as Agroecosystem, Artificial land, Transitional transformed and rocky complexes.

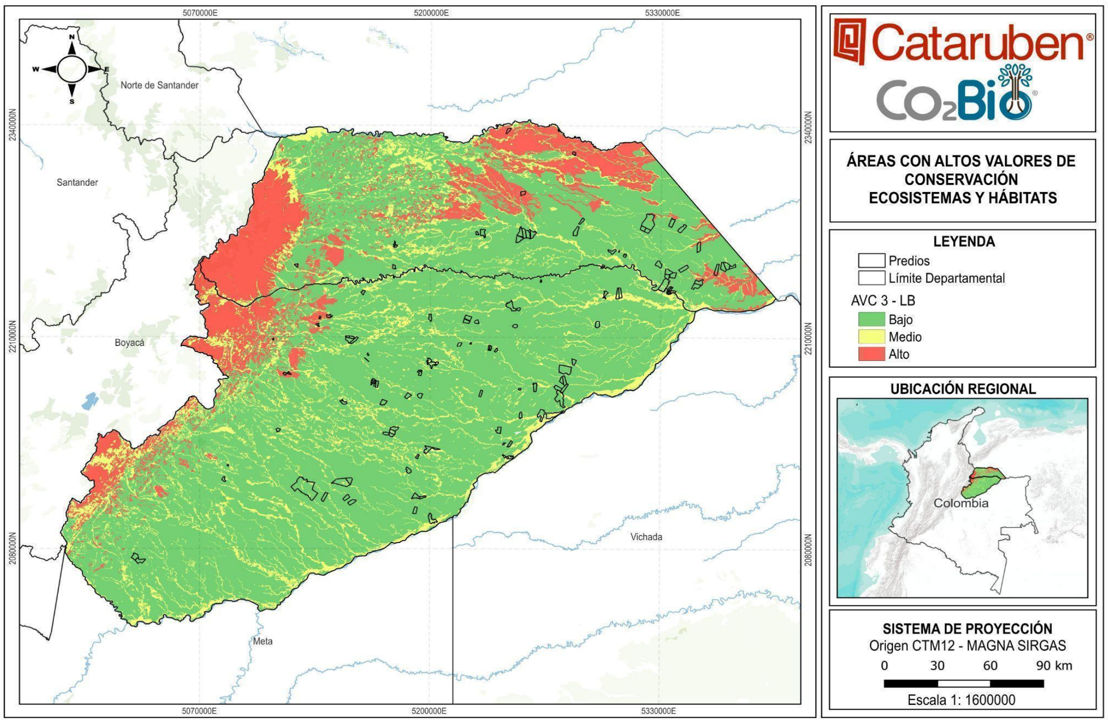
Additionally, we used the cartographic input of ecosystem rarity obtained from the project Main ecological structure of the Colombian Orinoquia - Methodological update of the sulu map (Prüssmann, 2020). Based on the distribution of the data, using the Natural Breaks classification method, 3 categories were defined, assigning values between 1 and 3, 1 for very low rarity, 2 medium rarity and 3 for the highest rarity.

Finally, these two layers were merged to generate a single layer called areas containing rare and/or threatened ecosystems. According to the behavior of the data, they were reclassified defining 3 categories, high (3), medium (2) and low (1). This whole process was carried out from ArcGIS Pro.

The result of this geospatial process (Image 36) shows that the Piedemonte llanero ecoregion is where the ecosystems were identified as being in the high category, which implies that the Andean humid forests are ecosystems of great importance and are part of the most important coverages in this region. The medium category identified areas with gallery forests or flooded riparian forests associated with rivers and streams that may be vulnerable ecosystems due to pressures such as deforestation or changes in land use. Savanna coverages were identified as low according to the rarity of this ecosystem because it is present to a large extent in the two departments.

In relation to the properties in the project area, it was determined that most of the properties are associated with floodable savannas, which are the most representative of the region and determine a low category for these ecosystems. In the medium category, forest areas associated with rivers and streams are identified, even though their occupation within the properties is lower. The high category includes seasonal savannah ecosystems, which are considered ecosystems with a significant degree of rarity and are represented in some properties enrolled in the project. According to these observations, most of the areas of the properties are in the low category, which implies that these high conservation values have not been solidly identified within the Project.

Image 44. High Conservation Value Areas (HCV3) Ecosystems and habitats identified in the project area.



Source: (Gobernación de Casanare - WWF Colombia. 2011).
Elaboration: The Cataruben Foundation, 2023.

14.1.8.4. HCVs - 4: Ecosystem services.

Ecosystem services are the benefits received by humans that provide conditions such as food supply, drinking water, climate regulation, air quality, soil formation, aesthetic and cultural benefits, etc. that are directly linked to the quality of life of the inhabitants. These services can be of support, provisioning, regulation and cultural services that are possible thanks to biodiversity and the quality of ecosystems.

To determine the areas that provide ecosystem services, three variables were analyzed: non-forest forest from the Forest and Carbon Monitoring System (SMByC) of IDEAM, Corine Land Cover year 2018 of IDEAM and hydrological factors obtained from the project Main ecological structure of the Colombian Orinoquia - Methodological update of the sulu map (Prüssmann, 2020). The latter includes indicators of water regulation (IRH), water use (IUA) and flood volumes (VH).

Given the distribution patterns of the data, they were classified into three ranges: high, medium and low using the natural breaks method. Each range was assigned a numerical value: high = 3, medium = 2 and low = 1.

Subsequently, the Forest variable was reclassified and assigned a value of 3. On the other hand, of the 38 land covers present in the study region, groupings were established according to the categorization of land cover units, and 17 land cover groupings were obtained.

The highest assigned value of 3 was given to Forest, Fragmented forest and Natural water bodies due to their ecosystemic importance; Shrublands, Grasslands, Secondary vegetation, Artificial water body, Wetlands, Glaciers and snowfields were assigned a value of 2. Finally, a value of 1 was assigned to the Agricultural, Mixed Agricultural and Livestock, Sand and Rocks, Erosion, Mining, Pastures and Burned land coverages. The variable of ecosystem rarity was also analyzed and a rarity layer was generated: low, medium and high.

For the identification of areas that provide ecosystem services, the three layers were superimposed, resulting in a minimum value of 3 and a maximum value of 9 (numerical values of 1, 2 and 3 were assigned, corresponding to the intervals of low, medium and high, respectively). The result of this analysis made it possible to identify the type of ecosystem services shown in Table 68.

Table 68. Ecosystem services identified in the Project area.

Type of service	Identified ecosystem services
Use	Water capture and storage Water supply Feed production Use of raw materials Non Timber Forest Products Water production
Regulation	Regulation of pests and disease vectors Microclimatic regulation Buffering of extreme weather events Runoff reduction Habitat maintenance

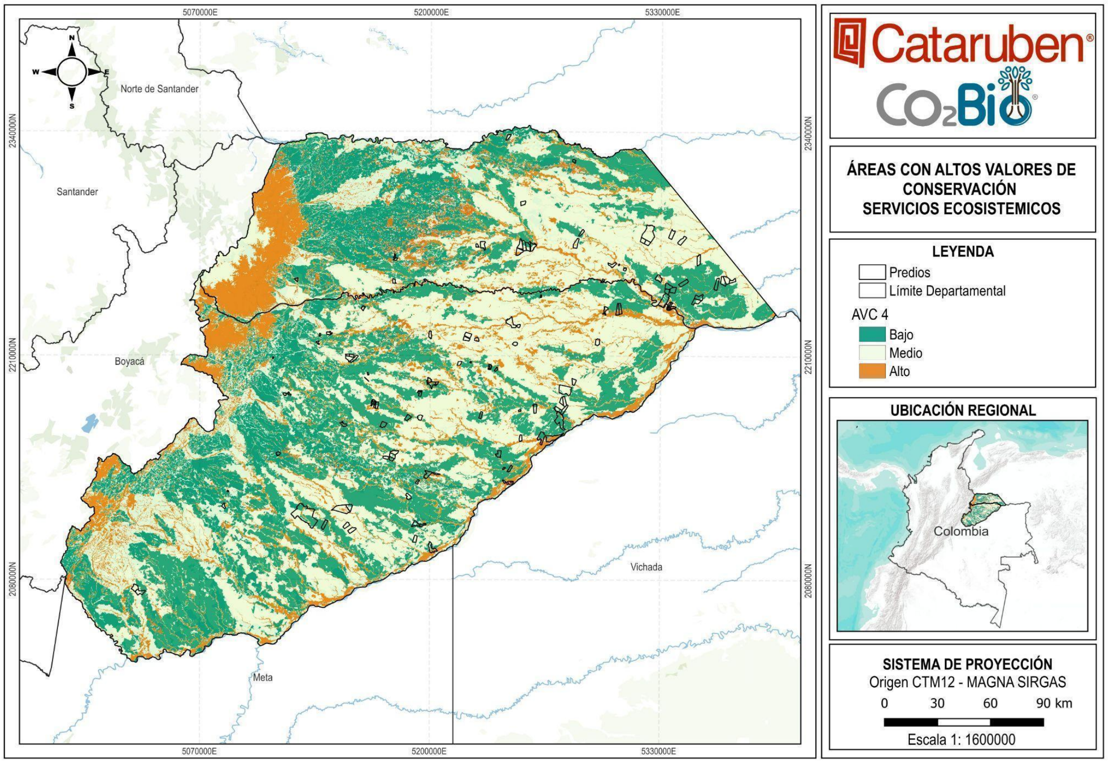
	Air regulation Prevention of erosion and preservation of soil fertility CO2 storage Water treatment
Culture	Recreation Aesthetic benefits Ecological hikes Research on educational values Spaces for spiritual and religious activities
Support	Habitat for vertebrates Medicinal resources Pollination Photosynthesis Conservation of genetic diversity Soil formation

Elaboration: *The Cataruben Foundation*.

As a result of the procedure for the identification of ecosystem services, the map of areas that provide environmental goods and services in Arauca and Casanare is obtained (Image 44). In this map, the high category is associated with ecosystems such as humid forests, gallery and riparian forests, and rivers or streams that provide the 4 goods and services of support, regulation, culture and exploitation that are of great importance for the community and its subsistence.

The areas in the medium category are identified because they present some of the ecosystem services such as savannas that can provide some of these services. For the low category, these services are not identified; these areas are associated with places of great anthropogenic intervention that may have lost the quality to provide services to the community.

Image 45. Areas of High Conservation Value (HCV4) Ecosystem services identified in the project area

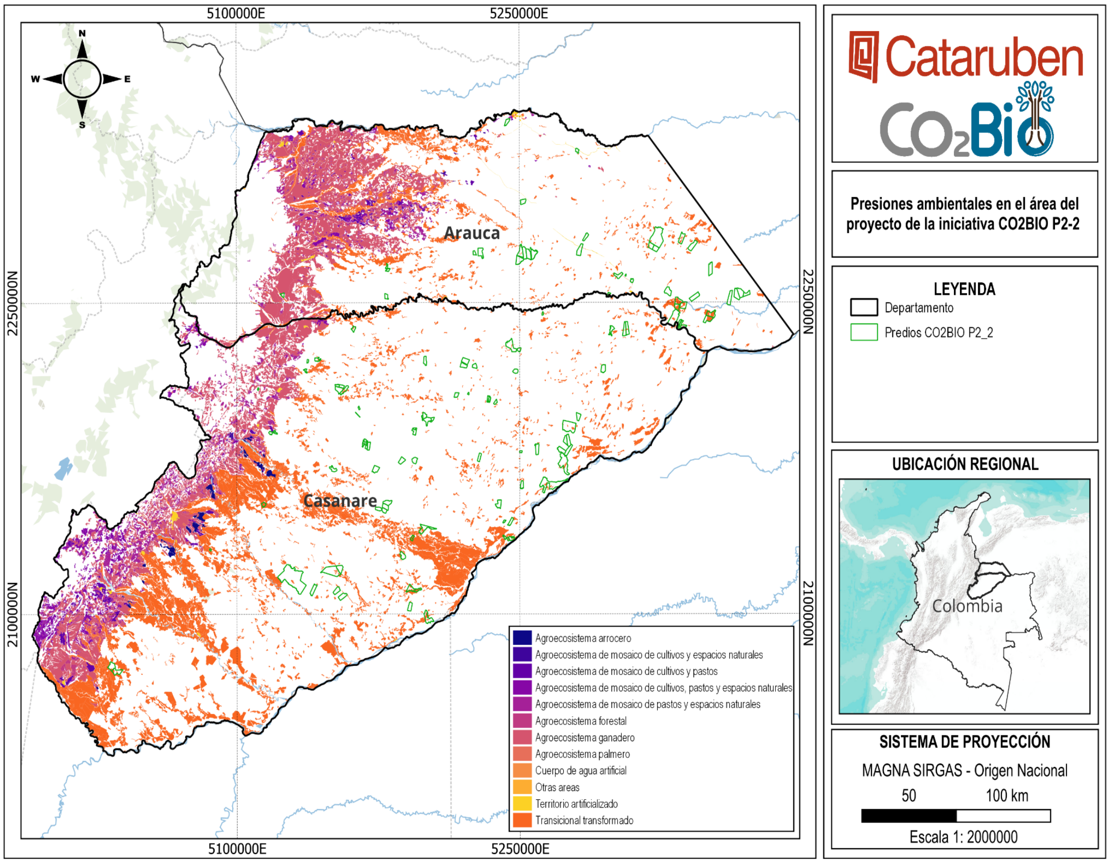


Source: (Gobernación de Casanare - WWF Colombia. 2011).
Prepared by: The Cataruben Foundation, 2023

14.1.9 Habitat loss and degradation

This is one of the main pressures on biodiversity at the global and regional levels, as it is related to the conversion of natural cover for agricultural uses, including deforestation. In the Orinoco region, natural cover conversion is generated by the expansion of the agricultural frontier, mainly by rice and palm cultivation and extensive cattle ranching (Image 46). Additionally, one of the pressures commonly identified by the owners of the properties is the burning of natural savannas to adapt the land for crops such as rice and livestock, in addition to spontaneous fires that are intensified by the wind during drought seasons.

Image 46. Environmental pressures in the project area.



Source: Colombian Environmental Information System (SIAC).
Elaboration: The Cataruben Foundation, 2023.

Climate change: Climate change is already having an impact on biodiversity and future projections show that these effects will be increasingly greater. At the local level, variations in temperature and seasonality (rainy season and droughts) are some of the effects that will have the greatest impact on biodiversity by affecting ecosystem processes and functions.

Pollution and nutrient loading: The burning of fossil fuels and agricultural practices in which fertilizers are used have doubled the amount of reactive nitrogen that stimulates plant growth. This generates changes in the plant composition of the Wetlands, because it favors the growth of certain highly competitive invasive species that benefit from the added nutrients.

Overexploitation and unsustainable use: In this category the main pressure corresponds to productive practices mentioned in the category of habitat loss and degradation, because their development implies the implementation of unsustainable activities that jeopardize the permanence of wild populations, as well as the provision of ecosystem services. It is important to mention that in the project area there are different conflicts with wildlife, as some species are consumed by the communities and others are stigmatized as very dangerous species for the integrity of people or for economic activities (felines and reptile species).

Invasive alien species: Invasive alien species represent a worldwide threat to ecosystems and native species, as well as causing economic damage. The management of invasive alien species prevents biodiversity loss by reducing the probability of extinctions of native and endemic species that are affected by the competition generated. However, studies are insufficient to estimate the magnitude of the effect of these species.

It is evident that the measures designed to mitigate these pressures should be aimed at promoting the implementation of good practices that are sustainable alternatives for the economic development of the region. These measures were integrated into the design of project activities presented in section 2.4 and 16.

Table 69. Studies conducted in the project area describe the effect of pressures on biodiversity.

No	Type of pressure	Effect on biodiversity according to research conducted	Source
1		Some productive activities such as the cultivation of oil palm, rice and pasture correspond to the main causes of land use change and habitat loss and are related to the stress factors of water demand and the decrease in the provision of ecosystem services.	Ricaurte et al, 2017
		Under the scenarios of oriented production and agroindustrial development, oil palm expansion by 2020 could generate a biodiversity loss of 0.08% (±0.04) and 0.25% (±0.13) respectively.	Garcia-Ulloa,Sloan,Pacheco, Ghazoul & Pin-Koh, 2012.
		The expansion of palm cultivation may reduce the biodiversity of the northern and eastern sector of	Vargas, Laurance,

	Habitat loss and degradation	the country by 21.8% according to the index of biodiversity change using mammal diversity.	Clements & Edwards, 2015.
		In the Orinoco region, approximately 25% (3626 ha) of the land planted with oil palm between 2001 and 2005 corresponds to gallery or riparian forests, wetlands, foothills or natural savannahs.	
		Oil palm cultivation areas overlap or overlap with 4.9% of ecosystems whose remnants were classified as Endangered (Magdalena valley forests and Orinoco flooded savannas). However, the areas suitable for palm cultivation show a low congruence with areas where endangered species are concentrated. According to trends, the expansion of palm cultivation may threaten biodiversity by encompassing areas with 26-35 threatened species (birds, mammals and anfibiose).	Ocampo-Peñuela,Garci a-Ulloa, Ghazoul & Etter, 2018.
		It is important to mention that in recent years, efforts have been made to design sustainable strategies for oil palm cultivation. Among these strategies is the identification, valuation and management of High Conservation Values (HCVs) carried out by different institutions in some palm production areas of the country.	Vargas, Laurance, Clements & Edwards, 2015; Inter-American Development Bank (IDB), Global Environmental Facility (GEF), FEDEPALMA, CENIPALMA, WWF & IAvH, 2014.
		The conversion of natural areas such as flooded savannas to productive systems, such as oil palm, rice and livestock systems, generates a change in the richness and composition of taxonomic groups, such as birds. This is due to changes in the structure of the ecosystem, from a natural ecosystem dominated by grasses to a productive palm oil system with a tree structure. However, the results of these comparative analyses are determined by the habits (generalist or specialist species) of the groups evaluated.	Gómez - Zuluaga, Espinosa & García - Azuero, 2019.
		There is very little published information on the effect of rice cultivation in the region. However, it is known that this type of cultivation generates a great environmental impact as it modifies the structure of the landscape and soils (mechanization of zurales), causes the loss of microorganisms, varies the composition of flora, and in some cases contributes to deforestation.	Botana & Schnake, 2011.
2	Climate change	Twenty-five percent of the region's bird species are related to climate-mediated migration	Gómez - Zuluaga, Espinosa & García - Azuero, 2019.

		phenomena.	
		Variations in temperature, humidity and precipitation will generate changes in the geographic distribution of species, due to the reduction and loss of habitats. Because the variations will occur in a short period of time, species will have less probability of adapting to the new circumstances, which will generate migrations to regions with suitable conditions for their development.	CIAT & CORMACARENA, 2018
3	Contamination andnutrientloading	Due to human activities, a large amount of reactive nitrogen (N) has been introduced into natural ecosystems. Reactive N is used as a fertilizer, however, as it is used in large quantities it can cause a cascade of problems in ecosystem functions and contributes to global warming.	Subbarao, et al., 2012
		The upstream phase of the hydrocarbon industry falls into this category as a consequence of discharges of drilled rock cuttings into water systems, contaminated with toxic drilling fluids and the generation of produced water containing high levels of hydrocarbons and chemical additives, by discharge into water bodies or injection into the subsoil.	Mendoza, 2018
		According to water quality indices, water resource degradation occurs mainly due to the increase of nitrogen and phosphorus from agriculture and animal production. The variation of nutrients in the Wetlands generates the growth of algae and aquatic plants that decrease the capacity to dissolve oxygen in the water, which results in a negative impact on the ecosystem. The variation of natural ecosystem conditions compromises the provision of ecosystem services.	Trevisan, et al., 2020.
4	Overexploitation and unsustainable use	It is clear that the aforementioned agricultural activities also correspond to pressures of overexploitation and unsustainable use. However, there are other pressures in the region, such as wildlife hunting for consumption. This practice is difficult to demonstrate in each Property, since sometimes the owners prohibit hunting in their areas, but outsiders illegally enter the natural areas and extract mammals such as white-tailed deer, armadillos, marrano de monte, birds such as the roadside duck, some species of turtles and even lizards (food consumption, sale of skins). On the other hand, there is a conflict with the feline	Castro, Merchán, Gárces, Cárdenas & Gómez, 2013A Castro, Merchán, Gárces, Cárdenas & Gómez, 2013B. Montes-Peréz, Escobar-Bernal, Albarracín-González, Adame-Erazo & Camacho, Reyes (2016).

		group because they consume domestic animals, which economically affects the owners of the properties who decide to hunt the felines as a solution. Similarly, the snake group is also affected, because historically they have been stigmatized as dangerous species.	Sarmiento, Monroy & Sanchez, (2017).
			Garrote, Rodríguez-Castellanos, Trujillo,n Mosquera-Guerra & Castaño - Uribe (2017).
			Guerra, Trujillo, Cuero, Bolivar, Valencia, Arboleda & Meluk, 2019.
5	Exotic species invasive	For the department of Casanare, 26 species of flora are recognized as invasive. 19 are introduced, 4 are cryptogenic and 3 are wild; 14 of these species are in invasion risk A (high), 7 in category M (moderate), one in category B (low) and 4 in category R (require further analysis). Among these species, there are common aquatic plants of the Wetlands of the Orinoco such as: Eichornia crassipes, Pistia stratiotes, Salvinia auriculata, Limnobium laevigatum, Andropogon bicornis, Panicum maximum and Ludwigia helmithorriza.	Córdoba-Sánchez, Miranda-Cortés, Avila, Avila, Avilán & Pérez-Rojas, 2011
		The conversion to extensive grazing for livestock and the introduction of exotic pastures represents 5.5% of the total hectares of agricultural land in Colombia.	Rincon, 2018.

Source: The Cataruben Foundation.

Based on the tools proposed by the Biocarbon Registry methodology, the following activities that could be carried out to avoid or reduce the loss of biodiversity in the project's area of influence are considered below:

Table 70. Analysis of tools as input to reduce biodiversity loss in the project area.

No	Type of pressure	Measures to reduce pressure on the intervention area	Application in the intervention area	Tool
1	Loss and degradation of habitats	1. Constant monitoring for evidence of habitat loss. 2. Generate a standard for conservation practices.	1. Conduct constant monitoring of land change. 2. Implement, together with the landowners, a land plan according to the conservation objectives and the socio-environmental situation of the participants.	Open Standards for the Practice of Conservation. www.cbd.int/doc/pa/tools/Open%20standards%20for%20the%20practice%20of%20conservation.pdf
2	Climate change	1. Provide articles, videos and various other resources that will help local communities, policy makers and other interested parties access research on climate change adaptation and mitigation. 2. Provide an overview of the literature related to the contribution of traditional/indigenous knowledge to our understanding of global climate change: observations, impacts and opportunities for adaptation. 3. Summarize approaches and strategies for applying local knowledge to climate change adaptation in different sectors.	To complement The Cataruben Foundation's General Plan to continue promoting environmental education in relation to climate change. 2. Share in the trainings, studies where local and traditional knowledge is also valued and included for the understanding of climate change concepts.	Voluntary guidelines for the design and effective implementation of ecosystem-based approaches climate change adaptation and disaster risk reduction and supplementary information. www.cbd.int/doc/publications/cbd-ts-93-en.pdf
3	Contamination and nutrient loading	1. Identify water pollution, since the stability of the biodiversity of aquatic ecosystems depends on	1. Implement training on environmental contamination, including water, as well as sustainable use and proper	Water pollution and aquatic biodiversity. 10.15406/bij.2020.04.00159

		this.	management of water resources.	
4	Overexploitation and unsustainable use	1. Decision-making processes must be inclusive and respect the needs and ecological knowledge of women, indigenous peoples and local communities. 2. Pre-existing sustainable practices should be recognized and supported at the local and regional levels, including through the strengthening of tenure rights and the redistribution of power in decision making. 3. Governments should also develop legislation on extended producer and supply chain responsibility; support technological innovation and technology transfer to improve resource circularity; and ensure green public procurement.	1. Conduct prior consultation with the community before any implementation activity is carried out. 1.2. Characterize the community in different areas, social, economic and environmental, to know their needs and their level of ownership of the territory. 2.1. Investigate sustainable practices that are being carried out and through training improve and implement them in the project area. 2. From governance to give a guide to the owners to legalize their properties as long as they wish to be part of Cataruben's projects.	The Sustainable Use of Natural Resources: The Governance Challenge www.iisd.org/articles/sustainable-use-natural-resources-governance-challenge

5	Exotic species invasive	1. Establish a classical biological control program. Ethical and social value-based framework for integrating biological control. 3. Existing international regulatory frameworks for classical biological control	1. Recognize the exotic species present in the area of intervention. 2. Train landowners on exotic species in the area and on proper management to prevent their spread. 3. Review international frameworks for the management of exotic species in the intervention area.	The Application of Classical Biological Control for the Management of Established Invasive Alien Species Causing Environmental Impacts. www.cbd.int/doc/publications/cbd-ts-91-en.pdf

Source: The Cataruben Foundation.

15. Grouped project

The Project does not consider the inclusion of areas after validation. For this monitoring report, the areas corresponding to the Forest and Wetland ecosystems will be validated.

16. Monitoring plan

16.1 Wetland Ecosystem Monitoring Plan

The following is the monitoring plan designed to record and evaluate changes in Project boundaries, project activities, socio-environmental effects, emissions and changes in the biodiversity of the project, based on the established methodological guidelines, in order to generate accurate and quality information in the verification process, complying with the requirements of BCR Standard Version 3.2 and BCR0004 methodology.

16.1.1 Plan Monitoring Project boundaries

The methodology establishes the monitoring of the geographic boundaries of the project for the executed activities, which must be included in a robust and organized geographic information system, georeferencing the total project areas and including the reference region and the leakage area.

Periodic verification of land use changes in the project area should be carried out using the procedure described in Section 16.3.1 of the methodology.

16.1.1.1 Eligible Areas with Wetland Area

Eligible areas will be monitored using the highest resolution satellite imagery freely available and appropriate for the relevant time period. The monitoring will have an annual periodicity identifying changes in land covers associated with Wetlands. These changes will be evaluated and recorded in accordance with the Corine Land Cover classification methodology, thus ensuring that the coverages are maintained in accordance with this methodology.

For a detailed list of eligible areas enrolled and enrolled in the project, review Table 71, which provides information on the eligible property-level areas enrolled in the project.

Table 71. Eligible properties with wetland area.

CO2Bio P2-2			
PROPERTY	**ELIGIBLE AREAS (HA)**	**PROPERTY**	**ELIGIBLE AREAS (HA)**
EL MORICHAL DE LOS DESEOS	472	FINCA EL PALMAR	830,3
EL PORVENIR	209,6	ALTAGRACIA	949,6
BANCO FRESCO	446	LOTE 2 ANA MARIA	246,8
EL CANAL LOTE 1	496,4	SAN JOSE	72,7
VILLA MARTHA	408,2	SAN BENITO	146,4
EL CONTROL	682	LOTE LA MOSCA	740,9
FINCA ALTAGRACIA	741,1	FINCA LAS DELICIAS	281
BUENAVISTA I	628,8	FINCA EL MORROCOY	140,3
EL ALGARROBO	388,4	EL GARCERO	146,6
FINCA LA COSTEÑA	559	LA PALMITA	225,8
LAS ESCUDILLAS	412,5	LOS ARRECIFES	611,3
LA CUCARACHA	99,2	FINCA VIDA TRANQUILA	671,3
CANDELARIA UNO	858,7	EL MILAGRO	755,4
LA MAGOLA	905,9	EL ESPEJO	604
FINCA LA BONANZA	175,7	FINCA LA FUENTE DE ORO	260,4
FINCA LA PONDEROSA	167,6	LA ESPERANZA	601,6
LAGUNITAS	822,2	SAN JUAN 2	141,1

LA CASCABEL	251	FINCA SAN JUAN LOTE	166,1
FINCA LA ESPERANZA	562,6	LA FLORIDA	679,2
LA GLORIA	62,3	EL GUAMO	278,1
PUERTO LINDO	59,4	LA CANDELARIA	1999,9
BUENOS AIRES	703,2	FINCA LA ARENOSA 3	302,9
EL RENACER	777,8	EL REMACHE NUMERO 1	289,4
LAS BRISAS	190,3	LAS BRISAS	875,4
FINCA SANTA ANA	903,3	LA REVANCHA	832,8
FINCA LOS PARAGUITOS	110,9	EL CIELO	530,5
LA LIBERTAD	736,9	PANAMÁ	4170,2
MIRALINDO	418,5	EL BRILLANTE	619,3
EL DELIRIO	50,3	NO SE SABE	226,8
MOSCÚ	238,4	FINCA CUERNAVACA	375,5
EL COROZO	478,3	EL RINCÓN	432,3
LOTE 6	177,2	CAMPO HERMOSO	588,8
LA CALANDRIA	290,6	NARANJAL	821,5
FINCA LOS PIONIOS	776,5	LA YUBEREÑA	1715,5
FINCA LA PONDEROSA	52	EL TRANQUERO	384
EL PALMAR	270,1	LOTE NÚMERO UNO LA ESPERANZA	473
FINCA SURO VERDE	446,1	EL CAIRO	525,2
EL BAÚL DE LOS RECUERDOS	25,5	LA LIBERTAD	287,9
SAN ESTEBAN	800	FINCA VILLA TANIA	989,9
EL TIRRIGAL	1334,2	LOS ESFUERZOS	2590
VILLA FERNANDA	125,7	LOTE NÚMERO TRES EL PARAÍSO	100
LA BENDICIÓN	442,2	HACIENDA EL ROSAL	658,7
FINCA SANTA MARTHA	83,7	LA HONDA I	94,6
FINCA EL TORREÑO DOS	244	GUARATAL 2	30
FINCA EL PONQUE 2	164,4	LOTE 1	36,9
FINCA EL PONQUE 3	407,4	LOTE 2	104,8
FINCA EL CONUCO	442,9	EL CEBU	168,7
FINCA LOS CORAZONES	930,6	EL AMPARO	313,5
FINCA SANTA BÁRBARA	236,3		

Source: *The Cataruben Foundation, 2023.*

16.1.1.2 Areas LEAKAGE

For the leakage areas, a report on the change of natural vegetation cover identified as wetland to transformed cover and natural vegetation cover corresponding to wetlands that transitions to other stages of ecological succession will be made at each verification. The monitoring will be carried out under the CORINE Land Cover methodology adapted for Colombia and with the corresponding inputs to guarantee the quality of the information.

16.1.2 Monitoring Plan Wetland Ecosystem Activities

In accordance with the design of the project activities for the reduction of GHG emissions and the conservation of the biodiversity of the Continental Wetlands, the monitoring plan for the project activities was established, where the activity ID, activity name, indicator ID, indicator name, indicator type, indicator target, indicator unit of measurement, monitoring methodology and frequency and those responsible for the execution and measurement, indicator result in the reporting period, documents to support the information and observations are established.

The monitoring plan for the Wetland project activities can be viewed in the following path: ***1. Annex*** / *1.2 Wetlands* / *1.2.1 Project Activities*

16.1.3 Project emissions monitoring plan

Monitoring for emissions estimation is carried out according to the verification periods stipulated by the project and under the guidelines of the BCR0004 methodology (section 19). Thus, in each verification period, at least the activity data must be monitored; as for the emission factors, they will correspond to those initially validated.

16.1.3.1 Activity data

The estimation of changes in the natural cover of the Wetland, in the project area, during the monitoring period is carried out with the equation:

$$CSCN_P = \left(\frac{1}{t_2 - t_1}\right) x \left(A_1 - A_2\right)$$

Where:

$CSCN_P$	Change in the area with natural vegetation cover in the project area; ha/yr.
t_1	Initial year of the monitoring period
t_2	Year final of monitoring period
A_1	Area in natural vegetation cover in the project area at the beginning of the monitoring period; ha
A_2	Area in natural vegetation cover in the project area at the end of the monitoring period; ha.

For its part, the estimation of changes in the natural cover of the Wetland, in the area of leakage, during the monitoring period is carried out with the equation:

$$CSCN_F = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{F,1} - A_{F,2}\right)$$

Where:

$CSCN_F$	Change in the area of natural vegetation cover in the leakage area; ha/yr.
t_1	Initial year of the monitoring period
t_2	Year final of monitoring period
A_1	Superficiency in natural vegetation cover in the leakage area at the beginning of the monitoring period; ha
A_2	Surface area in natural vegetation cover in the leakage area at the end of the monitoring period; ha

16.1.3.2 GHG emissions in the period under analysis

The annual emission from changes in the natural cover of the Wetland in the project area is calculated following the equation:

$$EA_P = CSCN_P\, x \left(CBF_{eq} + cos_{eq}\right)$$

Where:

EA_P	Annual emission in project area; tCO /ha/year$_{2e}$

$CSCN_P$	Change in the area with natural vegetation cover in the area of the project; ha/year
CBF_{eq}	Carbon dioxide equivalent contained in the total biomass; tCO /ha$_{2e}$
COS_{eq}	Carbon dioxide equivalent contained in soils; tCO /ha$_{2e}$

On the other hand, the annual emission in the leakage area is calculated following the equation:

$$EA_F = \left[CSCN_F\, x \left(CBF_{eq} + cos_{eq}\right)\right] - EA_{F,LB}$$

Where:

EA_F	Annual emission in leakage area; tCO /ha/year$_{2e}$
$CSCN_F$	Change in the area of natural vegetation cover in the leakage area; ha/yr.
CBF_{eq}	Carbon dioxide equivalent contained in the total biomass; tCO /ha$_{2e}$
COS_{eq}	Carbon dioxide equivalent contained in soils; tCO /ha$_{2e}$
$EA_{F,LB}$	Annual emission in the area of leakage in the baseline scenario; tCO$_{2e}$

16.1.3.3 Other GHG emissions

In the event that fire damage to the tree component is identified during the monitoring period, the CH_4 and N_2O emissions caused by the combustion of woody biomass must be quantified. For this, the following equations will be taken into account:

$$Emisiones\ de\ CH_4 = Carbono\ liberado\ *\ 0,016\ *\ CO_2EFM$$

$$Emisiones\ de\ N_2O = Carbono\ liberado\ *\ 0,00011\ *\ CO_2EFN$$

Where:

CO_2EFM	Carbon dioxide equivalent, factor 21
CO_2EFN	Carbon dioxide equivalent, factor 310

16.1.3.4 Project GHG emission reductions expected from the implementation of project activities

The calculation of emission reductions in each monitoring period is estimated from the difference between baseline emissions, emissions in the project area and the leakage area.

Therefore, the estimated reduction in emissions from avoiding changes in the natural cover of the Wetland during the monitoring period is calculated according to the equation:

$$RE = (t_2 - t_1) x (EA_{LB} - EA_p - EA_F)$$

Where:

RE	emission reductions by avoiding changes in the natural vegetation cover of the Wetland, in the monitoring period; tCO /ha/year$_{2e}$
t_2	Final year of the monitoring period; year
t_1	Initial year of the monitoring period; year
EA_{LB}	Emission due to changes in the natural vegetation cover of the Wetland in the baseline scenario; tCO /ha/yr.$_{2e}$
EA_P	Emission due to changes in the natural vegetation cover of the Wetland in the project area for the monitored period; tCO /ha/yr.$_{2e}$
EA_F	Emission due to changes in the natural vegetation cover of the Wetland in the leakage area for the monitored period; tCO /ha/yr.$_{2e}$

16.1.4 Plan for monitoring changes in biodiversity associated with Continental Wetlands.

The project's monitoring plan responds to the fulfillment of biodiversity conservation objectives associated with the Continental Wetlands. For this, a monitoring plan was adjusted, which is associated with a participatory monitoring program, a follow-up of high conservation values and a Wetland Biodiversity Monitoring Plan. These actions are implemented in order to conserve and maintain biodiversity in the area associated with landscape characteristics and ecosystem services provided by the properties.

In turn, participatory monitoring allows educating the community and raising awareness about the impact on fauna in the important ecological processes within the ecosystems in order to comply with the general objectives of the project. The biodiversity monitoring plan is presented in the following annex Biodiversity monitoring plan for Wetlands.

16.2 REDD+ Monitoring Plan

The following is the monitoring plan designed to evaluate changes in Project boundaries, REDD+ activities, REDD+ Safeguards and Project emissions, based on the established methodological guidelines, in order to generate accurate and quality information in the verification process.

16.2.1 Project boundaries Monitoring Plan

The methodology establishes the monitoring of the geographic boundaries of the project, this activity is developed in each verification, following a robust and organized Geographic Information System (GIS), georeferencing the total project areas and including the reference region and the leakage area.(***Annex 1*** / 1.3.REDD+/5.Geospatial/5.1.Geodatabase_REDD+).

The monitoring will be performed for the eligible areas and the leakage belt, the reference region is not monitored until the baseline update, the monitoring will be performed with the non-forest forest inputs or other similar adopted by the republic of Colombia.

16.2.2 Monitoring plan for REDD+ activities

REDD+ activities designed based on the analysis of causes and agents of deforestation are included in the REDD+ activity monitoring plan, which lists: activity ID, activity name, indicator ID, indicator name, indicator type, indicator target, indicator unit of measurement, indicator monitoring methodology and frequency, person responsible for execution and person responsible for measurement, indicator results in the reporting period, documents to support the information and observations.

The monitoring plan for REDD+ activities is located in the following path: 1. ***Annex 2*** */ 1.3.* REDD+/ *1.*

16.2.3 REDD+ Safeguards monitoring plan

As described in section 18 of the BCR Standard (version 3.2), the project holder must demonstrate compliance with the Safeguards REDD+ considering the national context and including the definition of indicators for monitoring, reporting and verification. The Cataruben Foundation as project holder makes use of the "Tool to Demonstrate Compliance with REDD+ Safeguards" and the "No Net Harm" tool.

In accordance with the provisions of the "Methodological Document AFOLU Sector - Quantification of GHG Emission Reduction REDD+ Projects BCR0002" regarding the Monitoring of REDD+ Safeguards, it is important to note that all the required content aspects (indicators, targets, monitoring methodology and frequency, responsible parties, among others) are taken into account.

Finally, in order to ensure compliance with social and environmental safeguards and in accordance with the provisions of the aforementioned tools, the following is a list of the REDD+ Safeguards Monitoring Plan - The Project

16.2.4 Project Emissions Monitoring Plan.

Monitoring for emissions estimation is carried out according to the verification periods stipulated by the project and under the guidelines of the BCR0002 methodology, Section 14.5.

In this sense, in each verification period the activity data must be monitored; in turn, the emission factors to be taken into account will correspond to those initially validated.

16.2.4.1 Deforestation

The estimation of deforestation in the project area during the monitoring period is estimated with the following equation:

$$CSB_{proy,año} = (\frac{1}{t_2 - t_1})\ x\ (A_{REDD+proy,1} - A_{REDD+proy,2})$$

Where:

$CSB_{proy,año}$ Annual change in the area covered by forest in the project area;

ha/year

t_1 Initial year of the monitoring period; year

t_2 Final year of monitoring period; year

$A_{REDD+proy,1}$ Forest area in the project area at the beginning of the monitoring period; ha

$A_{REDD+proy,2}$ Area under forest, in the project area at the end of the monitoring period; ha

The estimation of deforestation in the LEAKAGE area during the monitoring period is estimated with the following equation:

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

Where:

$CSB_{f,año}$ Annual change in area covered by forest in the area of leakage; ha/year

t_1 Initial year of the monitoring period; year

t_2 Final year of the monitoring period; year

$A_{f,1}$ Area under forest, in the leakage area at the beginning of the monitoring period; ha

$A_{f,2}$ Area under forest, in the leakage area at the end of the monitoring period; ha

16.2.4.3 GHG emissions during the monitoring period

The GHG emissions estimation relates the activity data for each monitoring period to the validated emission factors.

16.2.4.3.1 Deforestation

The following equation is used to estimate annual emissions from deforestation in the project area:

$$EA_{REDD+proy,año} = DEF_{REDD+proy,año}\, x\, TCO_{2eq}$$

Where:

$EA_{REDD+proy,año}$	Annual emission in the project area; tCO /ha$_2$
$DEF_{REDD+proy,año}$	Annual deforestation in the project area; ha
TCO_{2eq}	Total carbon dioxide equivalent; tCO /ha$_{2e}$

The calculation of annual emissions from deforestation in the leakage area uses the following equation:

$$EA_{f,año} = (DEF_{f,año}\ x\ TCO_{2eq}) - EA_{lb,f,año} +$$

Where:

$EA_{f,año}$	Annual emission in leakage area; tCO /ha$_2$
$DEF_{f,año}$	Annual deforestation in the LEAKAGE area; ha
TCO_{2eq}	Total carbon dioxide equivalent; tCO /ha$_{2e}$
$EA_{lb,f,año}$	Annual emission from deforestation in the leakage area in the baseline scenario; tCO$_{2e}$

16.2.4.4 Quantification of project emission reductions

The calculation of emission reductions in each monitoring period is estimated from the difference between baseline emissions, emissions in the project area and the leakage area.

Therefore, the estimate of avoided deforestation emissions reduction, in the monitoring period, is estimated according to the equation:

$$RE_{DEF,REDD+proy} = (t_2 - t_1)\ x\ (EA_{DEF,lb,año} - EA_{DEF,REDD+proy,año} - EA_{DEF,f,año})$$

Where:

$RE_{DEF,REDD+proy}$	Emission reductions from avoided deforestation in the monitoring period; tCO_{2e}
t_2	Final year of the monitoring period; year
t_1	Initial year of the monitoring period; year
$EA_{DEF,lb,año}$	Annual emission from deforestation in the baseline scenario; tCO_{2e}
$EA_{DEF,REDD+proy,año}$	Annual emission from deforestation in the project area for the monitored period; tCO_{2e}
$EA_{DEF,f,año}$	Annual emission from deforestation in the leakage area for the monitored period; tCO_{2e}

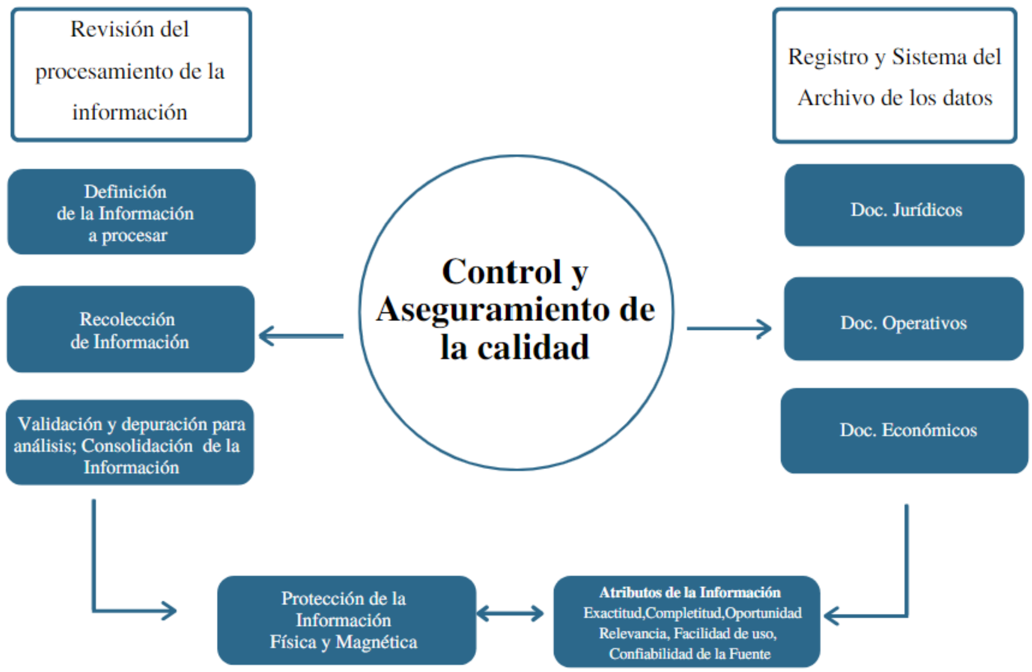
17. Quality Control and Quality Assurance Procedures

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 fundamental 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 supplied, to assess whether it passes certain quality standards. Quality control aims to detect quality deficiencies, while quality assurance aims to prevent them from occurring.

Figure 10 summarizes in detail the process carried out at the Cataruben Foundation to ensure proper quality control and quality assurance.

Figure 10. Basic structure of QA/QC.



Source: The Cataruben Foundation,2023.

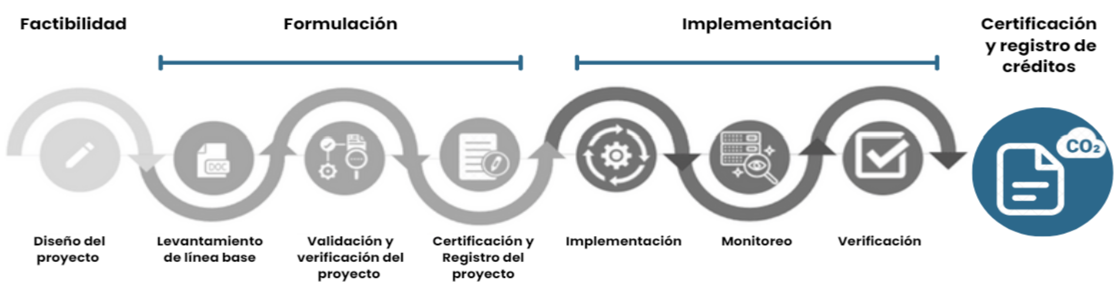
The Cataruben Foundation has provided for the measures described below, for quality assurance and quality control during the implementation of the Methodological Document AFOLU Sector /BCR0002 Quantification of GHG Emission Reductions from REDD+ Projects Version 3.1. of September 15, 2022 and the Methodological Document AFOLU Sector / BCR0004 Quantification of GHG Emission Reductions and Removals-Activities Avoiding Land Use Change in Continental Wetlands. Version 2.0. 23 June 2022, for each of the phases of the CO2Bio P2-2 project (Figure 11), taking into account the applicable legal and technical requirements and thus 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 the activities during all stages of the project;
- Through the implementation of the necessary manuals, procedures, guidelines and formats, it must be ensured that the requirements and expectations indicated in the methodologies for Quantifying GHG Emission

Reductions from REDD+ Projects and methodology for Quantifying Emission Reductions and GHG Removals-Activities that Avoid Land Use Change in Continental Wetlands are met, the requirements of ISO 9001/2015, ISO 14001/2015, as well as legal and regulatory requirements and those of The Cataruben Foundation's own Integrated Management System;

- Identifify and control the interrelationships between the participants during the execution of the project phases, indicating for each of them their scope, roles and responsibilities.

Figure 11. Project phases.



Source: The Cataruben Foundation.

Taking into account that the implementation of the methodologies has as a fundamental basis the geographic, social, economic and environmental information that characterizes the Project, the quality assurance and control actions of this aspect are relevant, which is why the following attributes are established throughout the data collection and processing process:

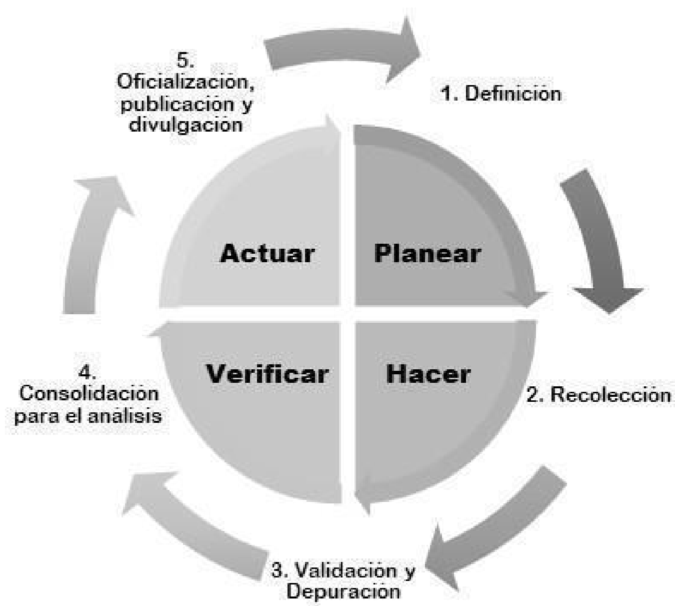
- Accuracy: Accuracy means that the data are free of errors (arithmetic and grammatical), are clear, unbiased and reflect the significance of the data on which they are based.
- Completeness: Data must be complete and meet all your needs. Incomplete or partial information can result in erroneous decisions and financial and social cost overruns.

- Timeliness: Timeliness means that the data must reach its intended recipients within a pre-established time frame, allowing them to decide on appropriate actions based on the information received.
- Relevance: Data is said to be relevant if it answers stakeholders' questions and enables them to make decisions. At this point it is important that the information is communicated to the right people.
- Ease of use: The data must be understandable. In this way, reports should be constructed in such a way that no additional time is spent in processing them and the required information can be extracted directly.

Source reliability: The information must come from confiable sources. The reliability of the source must be evaluated in each delivery of information, taking into account the metrics of collection, validation, debugging and consolidation of information.

To comply with these principles, information management activities should implement the continuous improvement cycle, in order to prevent non-conforming outputs during the process, as described below:

Figure 12. Information management cycle.



Source: The Cataruben Foundation.

17.1 Information Processing Review

The review of the 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 made, 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, This is followed by the data validation and debugging stage, followed by the consolidation of information for analysis, where the information is consolidated in a digital and physical database, and finally the officialization, publication and dissemination of the results to interested parties (Table 72).

Table 72. Review of information processing.

STAGES OF INFORMATION MANAGEMENT	RESPONSIBLE	CONTROLS
Definition of information: Review of the Methodological Document AFOLU Sector / BCR0002 Quantification of GHG Emission Reductions from REDD+ Projects and the Methodological Document AFOLU Sector / BCR0004 Quantification of GHG Emission Reductions and Removals-Activities that Avoid Land Use Change in Continental Wetlands, to identificate the type of data required, as well as the appropriate tools, means and strategies for their collection, in order 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. Project boundaries monitoring	-Project Manager -Attention Unit -Quantification Unit -Governance Unit -Geospatial Area -Implementation unit -Economic Area -Operational Risk Unit	This stage of the process must be recorded in the minutes of the meeting, in which at least the following aspects are described and approved: -Technical Requirements -Legal Requirements -Forms and their content (geographic, social, biodiversity, legality of properties). -Tools and means of data collection (oficial and appropriate). -Responsible for each activity

procedure).		
Harvesting: In accordance with the means and tools established in the previous stage, the information identified as necessary for the implementation of the Methodological Document AFOLU Sector / BCR0002 Quantification of GHG Emission Reductions from REDD+ Projects and the Methodological Document AFOLU Sector / BCR0004 Quantification of GHG Emission Reductions and Removals-Activities that Avoid Land Use Change in Continental Wetlands is collected. Competent personnel and the appropriate tools are available for this process**.**	-Project Manager -Attention Unit -Quantification Unit -Governance Unit -Geospatial Area -Implementation unit -Economic Area -Operational Risk Unit	Prior to the start of data collection activities, the operability of the equipment to be used and the competence of the personnel performing this activity must be verified, both for the use of the tools (procedures and forms) and for the use of the technological equipment. Any non-compliance must be reported to the corresponding area in order to prevent delays in programming and/or inadequate processing of the information collected. Procedures and instructions have been established for the collection of information at this stage, which have been validated in the previous stage by the leaders or persons responsible for the project and each of the units involved in the process.

Validation and debugging: Once compliance with the principles of the information in the previous stage has been reviewed, the data are validated and cleaned using the technological tools and equipment initially established. To comply with the Methodological Document AFOLU Sector / BCR0002 Quantification of GHG Emission Reductions from REDD+ Projects and the Methodological Document AFOLU Sector / BCR0004 Quantification of GHG Emission Reductions and Removals-Activities that Avoid Land Use Change in Continental Wetlands, related to the review of the information processing, 10% of the records of the information collected will be reviewed in order to prevent errors from occurring during the consolidation of the information for the analysis.	-Project Manager -Attention Unit -Quantification Unit -Governance Unit -Geospatial Area -Implementation unit -Economic Area -Operational Risk Unit	The data collected must be verified by the Quality Unit, for which the approval of the person in charge of 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-conforming output procedure.
Consolidation of information for analysis: The information collected is stored in digital and physical databases in compliance with the Information Control Procedure Methodological Document Sector AFOLU / BCR0002 Quantification of GHG Emission Reductions from REDD+ Projects and the Methodological Document Sector AFOLU / BCR0004 Quantification of GHG Emission Reductions and Removals-Activities that Avoid Land Use Change in Continental Wetlands, applicable through the use of the ODK Collect platform.	-Project Manager -Attention Unit -Quantification Unit -Governance Unit -Geospatial Area -Implementation unit -Economic Area -Operational Risk Unit	At this stage the PDD 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 audit by the corresponding entity and corrective actions are established in case of finding significant findings.

Oficialization, publication and dissemination: Once the PDD has been generated and validated, the results are published and disseminated to the relevant stakeholders.	-Project Manager -Operational Risk Unit	The information generated throughout the process is stored in physical and digital media in accordance with the provisions of the Information Security Manual (F-GAM-03) and the Archive Manual (FC-GAM-04), in order to ensure the security and proper maintenance of such information for as long as required.

Source: The Cataruben Foundation.

All documented information generated during the process must comply with the following characteristics:

- They must be written in the present tense of the verb
- They must have uniformity in terminology and wording.
- They must have uniformity in terminology and wording.
- They must comply with The Cataruben Foundation's image in terms of icons, logos, fonts, color palette and other aspects.
- The Process Leader and/or Project Manager is responsible for ensuring compliance with project document management requirements.

During all phases of the project, various documents are obtained, including the following:

Table 73. Documents obtained in the different phases of the project.

ADMINISTRATIVE DOCUMENTS	LEGAL DOCUMENTS	TECHNICAL DOCUMENTS	FINANCIAL DOCUMENTS
During all stages of the project, administrative documents are generated to support and guarantee the veracity of the project information, such documented information is classified as follows: - Procedures, standards, policies. - Resource request records (human, financial, purchasing, among others). - Administrative records (POA, risk matrices, among others). - Follow-up reports. - Performance evaluation. - Meeting minutes. - Audit report	Copies of documents that support the tenure of the Property - Public deed of the Property. - Certificado of tradition and freedom - Real estate registration. - Certificate of sound possession. - Cadastral certificate. - Property tax. Copies of identification documents of project beneficiaries. - Citizenship card. - Chamber of Commerce certificate. - RUT Conservation agreements: - Letter of intent. - Truth-in-Information Act. - Control of documented information. - Legal feasibility. - Technical feasibility. - Title study. - Enrolled contracts. - Confidentiality agreements.	Before, during and after the execution of the field trips are taken into account: - Guides, programs, procedures and manuals that provide guidelines for the collection and analysis of the information obtained - Databases. - Field records. - Property maps. - Photographic evidence. - Attendance list - Property plan	Within of the economic documents that are related during the life of the project are found - Supplier registration form. - Unique Tax Registration (RUT) of the ecosystem manager, proxy and/or legal representative. - Rut commitment letter (if applicable). - Bank certificate of the ecosystem manager or proxy. - Certificate of existence and legal representation (if applicable). - Power of attorney or authorization to transfer economic benefits to a

ADMINISTRATIVE DOCUMENTS	LEGAL DOCUMENTS	TECHNICAL DOCUMENTS	FINANCIAL DOCUMENTS
	- OTHER (if applicable). - Special power of attorney (if applicable). - Authorization of payment of economic incentives to third parties (if applicable). In the event of the death of a project beneficiary, the following must be available: - Beneficiary's death record. - Birth registration of your heirs. - Succession support. - In the absence of the aforementioned documents, the Project Holder may not make any disbursement until it is clear about the legal status of the Property enrolled in the project.		third party (if applicable), duly authenticated. - DIAN Resolutions. (if applicable) - Supplier selection document. - Supplier evaluation document. - Evidence of socialization of results and supplier selection. - Evidence of socialization of supplier evaluation results. - Evidence of request for supplier registration documentation package (if applicable) - Minutes of meetings and/or commitments regarding economic issues. - Economic

ADMINISTRATIVE DOCUMENTS	LEGAL DOCUMENTS	TECHNICAL DOCUMENTS	FINANCIAL DOCUMENTS
			benefit simulators. - Economic benefit projection or CCV projection documents. - Evidence of socialization and delivery of economic benefits. - Statement of economic benefits. - Collection document (invoices / accounts receivable). - Summaries of signature of economic documents through the Docusign platform (if applicable). - Successful payment file (proof of payment). - Preliminary payment plans (if applicable). - Donation certificates.

ADMINISTRATIVE DOCUMENTS	LEGAL DOCUMENTS	TECHNICAL DOCUMENTS	FINANCIAL DOCUMENTS
			- Enrolled payment reports. - Distribution letters % economic. - Enrolled payment invoices. - Enrolled payment supports. - CCV emission reports. - Peace and safety. - Certificates of statutory audit. (if applicable)

Source: The Cataruben Foundation, 2022.

17.2 Registration and data filing system

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's Projects. They can be associated with the completion of pre-established or standardized formats, designed according to the specific needs of data collection or information according to internal guidelines, taking into account the requirements of the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions of REDD+ Projects and the Methodological Document AFOLU Sector / Quantification of GHG Emission

Reductions and Removals-Activities that Avoid Land Use Change in Continental Wetlands, or of an external entity that requests them.

During all the phases of the Project, different documents are obtained, among which are the following:

Table 74. Data registry and filing system.

Legal Documents	Operational Documents	Economic Documents
Copies of documents supporting the tenure of the Property. Public deed of the Property. Certificate of tradition and freedom. Real estate registration. Certificate of sound possession. Cadastral certificate Property tax. Power of Attorney Copies of identification documents of project beneficiaries. Citizenship card. Conservation agreements Enrolled letter of enrollment Enrolled contracts Confidentiality agreements	Before, during and after the execution of the field trips, the following is taken into account: Instructions, programs, procedures and manuals that provide guidelines for the collection and analysis of the information obtained. Field records Property Maps Photographic evidence	The economic documents include: Financial simulators. Accounts receivable. Accounts receivable payments

Source: The Cataruben Foundation.

These documents are classified and treated according to the guidelines established by procedures, manuals and policies, where required:

- Organize physical and electronic documents through document classification.
- Establish retention and disposal deadlines for information and electronic records in document retention schedules (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, by means of document groupings, in series and subseries.
- Preserve the documents and their documentary groupings, in series and subseries, in the long term, regardless of the technological procedures used for their creation. The storage, protection, retrieval, retention time and final disposition of the records are contemplated in the Master List of Documented Information in general or in the Master List of Documented Information specific to the projects, according to the client's requirements.

17.3 Protection of records

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 and stored in filing cabinets in the archive area of The Cataruben Foundation's facilities, free from humidity, direct sunlight and any other characteristic that could accelerate their deterioration. The Quality Unit Coordinator and the Administrative Coordinator must guarantee their protection in this way, as well as control their access and consultation.
- Digital Records: To ensure the protection of The Cataruben Foundation's digital records, these are stored in a Shared Drive of the "Google Drive"

assigned to the project. Ensuring the protection of their 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 employee in terms of handling the documented information.

In addition, the following policies and manuals ensure compliance with legal requirements for the treatment of information during the execution of the project:

FC-GDN-07. Intellectual Property Policy. Establishes a process of management and internal and external regulation, active, transparent and responsible through principles and guidelines to promote and encourage scientific research and the creation of works of this nature in the Foundation. Likewise, to have the necessary mechanisms to mitigate the risk of 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 previously authorized by the Data Subject, implementing for this purpose, clear measures on confidentiality and privacy of Personal Data.

FC-GAM-03. Information Security Manual. To establish security measures and control mechanisms for The Cataruben Foundation's information assets, within the framework of the Information Security Management Manual.

FC-GAM-04. The purpose of this manual is to set out the guidelines for the application of document transfers, consultation and loan of documents, bibliographic collections, updating and application of the Documentary Retention Tables (TRD), opening of new files, establishing information security and document management policies together with the management of electronic documents. On the other hand, it is intended that the management of The Cataruben Foundation's archives is functional and complies with the service required by the entity and the applicable regulations, taking into account the importance of document management as the knowledge management of the institutions and the improvement of the quality of services to the user.

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