ORINOCO2 P2

Document prepared by FOUNDATION Cataruben

Project name	***ORINOCO2 P2***
Project owner	***Cataruben Foundation***
Account holder	***Cataruben Foundation***
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Other project participants	*196 properties*
Version	*1.0*
Date	*March 15, 2025*
Project type	*REDD+* *Activities that avoid land use change in natural savannahs*
Grouped project	*No*
Methodology(s) applied	*BCR 0002 V. 4.0* *BCR 0005 V1.1*
Project Location (City, Region, Country)	*Departments of Meta, Casanare and Vichada* *Orinoquia Region* *Colombia*
Start date	*01/02/2020*
GHG emissions reduction quantification period	*01/02/2020 al 31/12/2024*

Total estimated amount and annual average of GHG emissions reduction/removal	*ODS 5* *ODS 6* *ODS 13* *ODS 15*
Sustainable Development Goals	*List the sustainable development objectives that the project meets (demonstrated).*
Special category, related to co-benefits	*Indicate the special category to which the project applies, demonstrating results.*

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1 Project type and eligibility

1.1 Scope in the BCR Standard

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

1.2 Project type

according to the provisions of section 11.1 of the BCR standard. It is established that the project implements activities in the AFOLU sector other than REDD+, in this case activities that prevent land use change in natural savannahs, REDD+ activities are also implemented

Activities in the AFOLU sector, other than REDD+	*X*
REDD+ Activities	*XX*
Activities in the energy sector.	
Activities in the transportation sector.	

Activities related to waste handling and disposal	

1.3 Project scale

Not applicable

2 Project overview.

ORINOCO2 P2, From now on, the project is a climate change mitigation initiative in the AFOLU sector, focused on reducing emissions caused by deforestation, forest degradation and land use change in the Colombian Orinoquia.

Located in the departments of Casanare, Meta and Vichada in eastern Colombia, one of the main agricultural and livestock regions of the country, the project faces the challenge of generating low-carbon, socially and environmentally positive production and conservation models. The main causes of deforestation, degradation and land use change include agricultural expansion and fires, both natural and anthropogenic. The main agents are communities and natural events.

The project implements forest conservation activities and promotes the sustainable use of savannahs. Design actions to reduce pressure on forests, reduce risks of forest fires and promote sustainable production that avoids changes in land use. Participants receive economic incentives derived from the sale of carbon certificates, resources that finance conservation and project activities, thus closing their sustainability cycle.

The project's focus on areas of biological importance, such as riparian forests and natural savannahs, together with the inclusion of private landowners, and strengthening the capacities of women generates benefits aligned with the Palma de Cera category of the standard BCR. In addition, the activities contribute to SDGs 6 (Clean Water and Sanitation), 13 (Climate Action) and 15 (Life on Earth), which is demonstrated with the SDG tool developed by BCR.

The Cataruben Foundation leads as owner of the project, with Ecopetrol as a strategic partner and the owners as key participants. Cataruben and Ecopetrol facilitate favorable conditions, lead monitoring, validations, verifications, commercialization of carbon credits and distribution of benefits. The owners carry out activities on their land, promoting effective collaboration between actors, transparency and active participation. This model maximizes environmental and social benefits, strengthens the sustainable management of ecosystems and contributes to mitigating climate change.

Thus, the project will achieve emissions reductions, generating social and environmental benefits.

2.1 GHG project name

Orinoco2 P2

2.2 Goals

- *Reduce deforestation, forest degradation and change in land use in natural savannas on private properties in the departments of Casanare, Meta and Vichada, through conservation, restoration and sustainable management activities, contributing to the mitigation of climate change.*
- *Promote benefits for biodiversity and socioeconomic development in the project implementation areas.*

2.3 Project activities

The project implements activities to prevent the alteration of land use in natural savannahs, such as the management and conservation of grasslands, thus avoiding the transformation of natural cover. Additionally, REDD+ activities are implemented to conserve carbon reserves, by managing the causes and agents that give rise to each activity.

2.3.1 Activities that avoid land use change in natural savannahs

Activities designed to prevent land use change are based on a comprehensive analysis of the causes and agents that drive such change. (Anexo x x x x x). This analysis details the context of the project area, the actors involved, and the underlying causes of land use changes in the project region. Furthermore, these activities were designed with the active participation of ecosystem managers, also known as project participants. (Annex Property Implementation Plans).

The identified causes include economic factors and lack of knowledge about sustainable practices, resulting in the expansion of the agricultural frontier. Private property owners, who decide how the land is used within their property boundaries, are the agents of change. Therefore, activities focus on establishing conservation and sustainable use agreements, along with continuous training in environmental and productive matters. The final objective is to generate economic incentives through the commercialization of carbon certificates, which contribute to the continuity and maintenance of these activities.

The modification of land use for livestock farming, or the cultivation of traditional or industrial products, has been the main cause of the expansion of the agricultural frontier.

Underlying causes/drivers	Agents	Activities that generate loss of coverage.	direct causes
Productive interests and motivations for the generation of wealth.	Individual or associated producers	Cattle raising	Expansion of the agricultural frontier Prairieization
Lack of knowledge in alternative markets that promote conservation.			
Lack of knowledge in the implementation of sustainable practices associated with livestock activity.			
Lack of incentives and conservation policies.			
Productive interests and motivations for the generation of wealth.	Agroindustrial Companies	African Palm Production	Expansion of the agricultural frontier
Lack of knowledge in alternative markets that promote conservation.			
Regional development policies and models.			
Productive interests and motivations for the generation of wealth.	Agroindustrial Companies; Individual or associated producers	rice production	Expansion of the agricultural frontier Forest fires of anthropogenic origin
Lack of knowledge in alternative markets that promote conservation.			
Regional development policies and models.			
Productive interests and motivations for the generation of wealth.	Agroindustrial Companies; Individual or associated producers	corn production	Expansion of the agricultural frontier
Lack of knowledge in alternative markets that promote conservation.			
Regional development policies and models.			
Productive interests and motivations for the generation of wealth.	Community	Population growth	Expansion of the agricultural frontier
Lack of knowledge in alternative markets that promote conservation.			
Lack of knowledge about sustainable production practices.			
Absenteeism from the presence of public entities			
Interests and motivation for subsistence.	Agroindustrial Companies; Individual or associated producers	Production of traditional crops for self-consumption	Expansion of the agricultural frontier
Lack of knowledge of alternative markets that promote conservation			

Underlying causes/drivers	Agents	Activities that generate loss of coverage.	direct causes
Lack of knowledge in sustainable production practices and non-timber forest products.			
Lack of knowledge about sustainable production practices.			
Productive interests and motivations for income generation.	Individual or associated producers	Cocoa Producers	Expansion of the agricultural frontier
Lack of knowledge of alternative markets that promote conservation			
Lack of knowledge in sustainable production practices and non-timber forest products.			
Regional development plans.			
Productive interests and motivations for income generation.	Individual or associated producers	Cashew Nut Producers	Expansion of the agricultural frontier
Lack of knowledge of alternative markets that promote conservation			
Lack of knowledge in sustainable production practices and non-timber forest products.			
Regional development plans.			
Industrial growth	Agroindustrial Companies	Sale or lease of property.	Expansion of the Agricultural Frontier Prairieization
Lack of knowledge of alternative markets that promote conservation	Increase in the settled rural population		
Cultural factors	Individual producers		
Economic factors			

The design of project activities focuses on addressing root causes and collaborating directly with stakeholders to prevent land use change in natural savannahs. The short, medium and long term goal is to ensure that savanna resources remain available by encouraging sustainable production practices among landowners. By strengthening the capacity of landowners to make informed decisions and sustainably manage the natural savannah, the project aims to provide stable livelihoods and generate income for families. Consequently, the activities are designed to address the causes and thus carry out an intervention that generates a measurable impact on the reduction of emissions.

activity ID	S1

Component	Innovative economic dynamics
Description	Improve landowner income generated by the sale of carbon credits obtained from the natural savannah ecosystem
Applied methodology	RCB 0005
Relationship with direct or underlying cause	Related to the interests and motivations of production for income generation, also involving ignorance of alternative markets that promote conservation. From the generation of certificates generated from the project activities, they can continue to develop and the project participants feel that it is a financial incentive.
Fulfillment of the interests of rural communities.	Activity of great interest on the part of the project participants, since it represents the possibility of increasing average income and the availability of resources to carry out conservation, restoration and sustainable production activities.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.xx.x.x. Initial meeting). Manifestation of the owners' willingness to be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See 6.5.1.2.2. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization responsible for planning and coordinating the monitoring, reporting and verification stages, as well as the commercialization of verified carbon certificates and transfer of economic benefits to project participants. **Project participants:** They are the owners of the properties and their responsibility is to actively participate in the activities established in the project, and guarantee the conservation of the

	different strategic ecosystems present in their territories. To provide the information necessary to carry out the transfer of economic resources in a transparent manner. **Ecopetrol:** Technical and financial ally that allows consolidating the enabling conditions to ensure the generation of economic benefits, which facilitate the execution of the project activities.
Implementation timeline	From the date of commercialization of the carbon certificates

Indicators to report the progress of the activity

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

ID	S2
Component	Technical support
Description	Implementation of landscape management tools in savannas
Relationship with direct or underlying cause	Productive interests and motivations for income generation. Lack of knowledge of alternative markets that promote conservation. Lack of knowledge of sustainable production practices and non-timber forest products.
Fulfillment of the interests of rural communities.	The project participants are interested in generating sustainable production models in the savannahs through production and conservation, to the extent that they have the economic, technical and knowledge incentives that the project can provide.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.xx.x.x. Initial meeting). Manifestation of the will of the owners of be part of

	a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See 6.5.1.2.2. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This in the context of adaptive management in the face of the particular conditions of each era.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization in charge of promoting and training ecosystem managers in the implementation of landscape management tools in savannahs. **Project participants:** They are the owners of the properties and their responsibility is to actively participate in the training, as well as promote the implementation of landscape management tools in savannahs, providing evidence and sharing experiences with the Cataruben Foundation.
Implementation timeline	Starting in the fourth year of the project.

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measure	Measurement Manager
Number of properties that implement Landscape Management Tools in natural savannahs	Result	103	Number of properties	Cataruben Foundation

ID	S4
Component	Innovative economic dynamics
Description	Implementation of sustainable productive practices in natural savannahs

Applied methodology	RCB 0005
Relationship with direct or underlying cause	This activity is related to the development of the productive motivations that the participants develop on the respective properties. Through these actions we initially seek to transfer the necessary knowledge about the implementation of good sustainable production practices in natural savannahs.
Fulfillment of the interests of rural communities.	This activity is of great interest to project participants, since it allows them to strengthen their knowledge in the sustainable management of their productive activities. The owners consider favorably the adoption of the implementation of sustainable productive practices in natural savannahs, to the extent that these actions allow them to strengthen the protection of the different ecosystems present on their properties. At the same time, they will be able to obtain incentives to conserve and develop economic activities aligned with conservation.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.xx.x.x. Initial meeting). Manifestation of the will of the owners of be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See 6.5.1.2.2. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization responsible for training and promoting the implementation of sustainable productive practices in natural savannahs **Project participants:** They are the owners of the properties and their responsibility is to actively participate in the training, as well as voluntarily implement sustainable productive practices according to the productive and economic projection.
Implementation timeline	Permanently, from the start date of the project.
Indicators to report the progress of the activity	

Name	Type	Meta	Unit of measure	Responsible for measurement.
Number of properties that implement sustainable production practices or conservation, soil management and conservation actions	Result	103	Number of properties	Cataruben Foundation

ID	S3
Component	Innovative economic dynamics
Description	Management alliance that financially allows the generation of the enabling conditions for the validation and first verification of the project.
Applied methodology	RCB 0005
Relationship with direct or underlying cause	This project, which brings together multiple private owners, requires a large financial and technical effort to ensure long-term sustainability and mechanisms to establish monitoring, reporting and verification procedures and tools. Which enables an alternative market that promotes conservation, restoration and sustainable production and directly impacts the reduction of deforestation, forest degradation and change in land use in natural savannahs.
Fulfillment of the interests of rural communities.	The project participants are interested in financing the creation of favorable conditions for the monitoring, reporting and verification system of the activities they develop. This so that they can continue to be carried out in the long term, thanks to the efforts of the Cataruben Foundation.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.xx.x.x. Initial meetings). Manifestation of the will of the owners of be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See 1.1. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See 6.5.1.2.2. Property Deployment Plans). These plans not only serve as a monitoring tool

	between Cataruben and the owners. They can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization responsible for planning and coordinating the monitoring, reporting and verification stages, as well as the commercialization of verified carbon certificates and transfer of economic benefits to project participants. **Project participants:** They are the owners of the properties and their responsibility is to actively implement actions aimed at reducing GHGs, reducing deforestation and reducing degradation, as well as presenting the necessary evidence for the monitoring plan. **Ecopetrol:** Technical and financial ally that allows consolidating the enabling conditions to ensure the generation of economic benefits, which facilitate the execution of the project activities.
Implementation timeline	From the date of commercialization of the carbon certificates

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measure**	**Measurement Manager**
Alliance or formalized agreement	Product	1	Agreement	Cataruben Foundation

ID	S4
Component	Information and knowledge management.
Description	Plan to strengthen the technical capacities of the community for the management of natural savannahs and the conservation of strategic ecosystem services, fire management to prevent forest fires, sustainable production systems and landscape management tools.
Applied methodology	RCB 0005
Relationship with direct or underlying cause	Due to the lack of knowledge of alternative markets, production practices and non-timber products that promote the conservation and efficient use of natural resources, a training plan is proposed that

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

Implementation timeline	Starting from the 2nd year of the project start date and until the 19th year.			
Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measure**	**Measurement Manager**
Progress in the execution of the Training Plan aimed at strengthening the community's capacities in ecosystem services and conservation of strategic ecosystems	Product	100%	Percentage	Cataruben Foundation

2.3.2 REDD+ Activities

According to the analysis of causes and agents of deforestation and degradation (ANEXO XXXX). Deforestation and forest degradation are mainly caused by the expansion of the agricultural frontier and forest fires. Various actors drive these activities, including large agribusinesses, individual or associated producers, and the growing rural population that is dedicated to subsistence activities or owns private land.

Often, economic interest motivates these actors, leading to the unsustainable exploitation of natural resources. This situation is aggravated by the lack of knowledge about sustainable practices for the management of these resources.

Forest fires, both natural and man-made, are related to the absence of preventive and mitigation measures. These fires seriously damage ecosystems and biodiversity.

The agents that drive deforestation and forest degradation in the study area are mainly: individual or associated producers, agro-industrial companies and settled communities. Motivated by economic and cultural factors and misinformation, these agents convert natural forests for other uses, through activities such as the expansion of the agricultural frontier, the creation of grasslands, timber extraction and forest fires.

- The expansion of the agricultural frontier is mainly due to the need to increase areas for livestock farming and crop production, both for sale and for self-consumption.

- Grasslands are created by converting forests into areas for livestock farming, driven by productive factors and by land grabbing and titling.

- The extraction of wood, carried out mainly for self-consumption and in a disorderly manner, is used as a source of fuel, construction materials and food, among others; This logging produces forest fragmentation and facilitates access to other agents of deforestation.

- Forest fires are caused by high temperatures, prolonged dry periods and human activities such as agricultural practices and the expansion of crops and pastures.

In the tabla Xxx The analysis of causes and agents that cause deforestation and forest degradation is detailed.

Underlying causes/drivers	Agents	Activity	direct causes
Productive interests and motivations for the generation of wealth.	Individual or associated producers	Cattle raising	Expansion of the agricultural frontier Prairieization
Lack of knowledge in alternative markets that promote conservation.			
Lack of knowledge in the implementation of sustainable practices associated with livestock activity.			
Lack of incentives and conservation policies.			
Productive interests and motivations for the generation of wealth.	Agroindustrial Companies	Agricultural production	Expansion of the agricultural frontier
Lack of knowledge in alternative markets that promote conservation.			
Regional development policies and models.			
Productive interests and motivations for the generation of wealth.	Community	Population growth	Expansion of the agricultural frontier Forest fires of anthropogenic origin
Lack of knowledge in alternative markets that promote conservation.			
Lack of knowledge about sustainable production practices.			
Absenteeism from the presence of public entities			
Lack of knowledge of the dynamics caused by the natural conditions of the ecosystem and the changes caused by the climate crisis.	Natural ecosystem conditions, accelerated by climate change.	Forest Fires of Natural Origin	Forest Fires of Natural Origin

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

Project activities were designed to address the root causes of ecosystem degradation, such as forest fires, timber extraction, grassland development, and agricultural frontier expansion, primarily by landowners.

Identifying underlying causes, such as lack of incentives for conservation or restoration, low incomes, and lack of awareness of alternative regulated markets, among other cultural and demographic factors, was crucial to understanding why landowners degrade the ecosystem or sell their land for agricultural expansion.

Therefore, the activities aim to address these causes and generate a measurable impact on emissions reduction..

activity ID	R1
Component	Innovative economic dynamics

Description	Improve landowner income generated by the sale of carbon credits earned in the forest ecosystem
Relationship with direct or underlying cause	Related to the interests and motivations of production for income generation, also involving ignorance of alternative markets that promote conservation. From the generation of certificates generated from the project activities, they can continue to develop and the project participants feel that it is a financial incentive.
Fulfillment of the interests of rural communities.	Activity of great interest on the part of the project participants, since it represents the possibility of increasing average income and the availability of resources to carry out conservation, restoration and sustainable production activities.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.x.x.x.x Initial meetings). Manifestation of the owners' willingness to be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See x.x.x.x.x. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization responsible for planning and coordinating the monitoring, reporting and verification stages, as well as the commercialization of verified carbon certificates and transfer of economic benefits to project participants. **Project participants:** They are the owners of the properties and their responsibility is to actively participate in the activities established in the project, and guarantee the conservation of the different strategic ecosystems present in their territories. To provide the information necessary to carry out the transfer of economic resources in a transparent manner.

	Ecopetrol: Technical and financial ally that allows consolidating the enabling conditions to ensure the generation of economic benefits, which facilitate the execution of the project activities.
Implementation timeline	From the date of commercialization of the carbon certificates

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measure**	**Responsible for measurement.**
Percentage increase in average income derived from the sale of verified carbon credits	Impact	25%	Percentage increase in average income	Cataruben Foundation
Percentage of owners with better income from the sale of verified carbon credits	Impact	100%	Percentage of homeowners with better income	Cataruben Foundation

ID	R2
Component	Forest Management
Description	Implementation of sustainable management practices for the use of fire for the prevention of forest fires
Applied methodology	RCB 0002
Relationship with direct or underlying cause	Forest fires are a direct cause that generates deforestation and forest degradation. In this area of the national territory these phenomena are very common, sometimes they are generated by natural causes or by human intervention. Therefore, this activity has the focus of promoting sustainable practices, aimed at the conservation of strategic ecosystems, through the implementation and adequate management of fire.
Fulfillment of the interests of rural communities.	The project participants have interests in preventing forest fires, given the motivations oriented to the social, environmental and economic benefits that the preservation of these strategic ecosystems entails; However, many homeowners do not have the knowledge or resources necessary to implement prevention activities.

Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.x.x.x.x Initial meetings). Manifestation of the will of the owners of be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See x.x.x.x.x. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization in charge of promoting and training landowners in sustainable methods and practices for managing the use of fire. **Project participants:** They are the owners of the properties and their responsibility is to actively participate in training, and implement actions focused on the implementation of sustainable practices to prevent, control and mitigate fires.
Implementation timeline	Permanently from the start date of the project.

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measure	Measurement Manager
Number of properties that implement sustainable practices to prevent forest fires	Result	75	Number of properties	Cataruben Foundation

ID	R3
Component	Technical support
Description	Monitoring of the forest area under conservation within the project limits.

Relationship with direct or underlying cause	This activity is related to the prevention and management of fires through early warning mechanisms in eligible areas, for which digital tools will be used to contribute to the tracking and monitoring of properties linked to the project. The objective of these actions is to identify hot spots through GIS tools and generate timely communication to the owners about these eventualities, initially confirming whether they correspond to the presence of fire in their properties or thermal anomalies.
Fulfillment of the interests of rural communities.	The project participants are interested in this activity since it allows them to have an early warning mechanism and thus be able to prevent and manage possible forest fires. They consider that monitoring critical points and the respective early warnings is a positive strategy. Since it contributes significantly to the safeguarding and protection of the strategic ecosystems present on its properties.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.x.x.x.x Initial meetings). Manifestation of the will of the owners of be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See x.x.x.x.x. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This in the context of adaptive management in the face of the particular conditions of each era.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization in charge of monitoring hot spots as an early warning mechanism. **Project participants:** They are the owners of the properties and are in charge of reporting any anomaly related to forest fires, as well as attending to and responding to alerts generated by Cataruben.
Implementation timeline	Permanently, from the beginning of the project start date.
Indicators to report the progress of the activity	

Name	Type	Meta	Unit of measure	Measurement Manager
Tracking number	Impact	35	Tracking number	Cataruben Foundation

ID	R4
Component	Forest Management
Description	Promotion of the establishment of eco-efficient stoves and wood energy banks
Applied methodology	RCB 0002
Relationship with direct or underlying cause	This activity is directly oriented to the protection of forests, and at the same time proposes mechanisms that allow the generation of energy in a sustainable manner. In addition, this activity is projected to provide tools that provide beneficiaries with a better quality of life.
Fulfillment of the interests of rural communities.	Ignorance of other sources of energy or materials, added to the lack of economic income, causes forests to degrade due to the pressure exerted on them, especially on the properties of owners who carry out subsistence activities. Therefore, promoting the establishment of wood energy banks and eco-efficient stoves reduces forest degradation and contributes to improving community health.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.x.x.x.x Initial meetings). Manifestation of the will of the owners of be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See x.x.x.x.x. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This in the context of adaptive management in the face of the particular conditions of each era.
	Cataruben Foundation Organization in charge of promoting and

Responsibility and role of the actors participating in the implementation of the activity.	training in the establishment of eco-efficient stoves and wood energy banks. **Project participants:** They are the owners of the properties and their responsibility is to actively participate in the training, and promote the establishment of eco-efficient stoves and wood energy banks on their properties.
Implementation timeline	From the start date of the project.

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measure**	**Measurement Manager**
Number of properties that implement wood energy banks	Impact	10	Number of properties that implement wood energy banks	Cataruben Foundation
Number of properties with eco-efficient stoves	Impact	20	Number of properties with eco-efficient stoves	Cataruben Foundation

ID	R5
Component	Forest Management
Description	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally.
Applied methodology	RCB 0002
Relationship with direct or underlying cause	This project, which brings together multiple private owners, requires a governance framework that guides and guarantees long-term sustainability and mechanisms to establish procedures and tools, the relationships between the three parties of the project. This enables and sustains an alternative market that encourages conservation, restoration and sustainable production and directly impacts the reduction of deforestation, forest degradation and land use change in natural savannahs.
Fulfillment of the interests of rural communities.	The project participants are interested in achieving, thanks to the efforts of the Cataruben Foundation, a project governance model that guarantees that the activities they carry out can continue to be carried out in the long term.

Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.x.x.x.x Initial meetings). Manifestation of the will of the owners of be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See x.x.x.x.x. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This in the context of adaptive management in the face of the particular conditions of each era..
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** body responsible for designing, promoting, implementing and monitoring the governance table, where it ensures the participation and continuous improvement of the activities proposed in this tool. **Project participants:** They are the owners of the properties and their responsibility is to actively participate at the governance table, providing feedback, suggesting and ensuring the representation of the ecosystem managers.
Implementation timeline	From the start date of the project.

Indicators to report the progress of the activity

Name	Type	Meta	Unit of measure	Measurement Manager
Number of operational governance instances with effective participation of key actors	Impact	34	Number of participation spaces	Economic benefits - Cataruben Foundation

ID	R6
Component	Forest Management
Description	Promote the delimitation and signaling in strategic ecosystems and natural protection areas

Applied methodology	RCB 0002
Relationship with direct or underlying cause	Promoting delimitation and signaling actions in the strategic ecosystems present in the properties linked to the project will positively impact the protection and safeguarding of natural resources, which will contribute to the governance and protection of natural areas. Which is related to the protection of forests and environmental balance.
Fulfillment of the interests of rural communities.	This activity is of interest to some owners, as it strengthens the planning and governance structures of the property and guarantees the sustainability of the strategic ecosystems present on their properties.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.x.x.x.x Initial meetings). Manifestation of the will of the owners of be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See x.x.x.x.x. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This in the context of adaptive management in the face of the particular conditions of each era.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Agency responsible for promoting, training and strengthening delimitation and signaling issues in strategic ecosystems and natural protection areas. **Project participants:** They are the owners of the properties and their responsibility is to actively participate in training, as well as implement methods and tools for signaling and delimiting areas of biological importance.
Implementation schedule	From the start date of the project.

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measure**	**Measurement Manager**
Properties with strategic	Product	20	Number of properties	Cataruben

ecosystems identified, delimited and signposted			with strategic ecosystems identified, delimited and signposted	Foundation

ID	R7
Component	Forest Management
Description	Promote the recognition of conservation areas and figures for the sustainable management of ecosystems.
Applied methodology	RCB 0002
Relationship with direct or underlying cause	Achieving the recognition of conservation areas and figures such as civil society natural reserves is an activity that directly impacts the planning of assets based on conservation, restoration and sustainable productive development. Which directly reduces the uncontrolled expansion of the agricultural frontier, reduces deforestation and forest degradation.
Fulfillment of the interests of rural communities.	This activity is of interest to some landowners, as it strengthens the potential economic, social and environmental benefits derived from conservation and sustainable production.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.x.x.x.x Initial meetings). Manifestation of the will of the owners of be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See x.x.x.x.x. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period. This in the context of adaptive management in the face of the particular conditions of each era.
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization in charge of training owners in the recognition of conservation areas and figures such as civil society natural reserves. **Project participants:** They are the owners of the properties and

	their responsibility is to actively participate in the training, and with clear and transparent information, proceed to make the free decision to declare their property as a civil society natural reserve.
Implementation timeline	From the start date of the project, with a frequency of every five (05) years.

Indicators to report the progress of the activity				
Name	**Type**	**Meta**	**Unit of measure**	**Measurement Manager**
Number of properties with declared conservation areas and/or figures	Impact	10	Number of properties with declared conservation areas and/or figures	Cataruben Foundation

ID	R8
Component	Information and knowledge management.
Description	Plan to strengthen the technical capacities of the community for sustainable forest management and the conservation of strategic ecosystem services, fire management to prevent forest fires and sustainable production systems and landscape management tools.
Applied methodology	RCB 0002
Relationship with direct or underlying cause	Due to the lack of knowledge of alternative markets, production practices and non-timber products that promote the conservation and efficient use of natural resources, a training plan is proposed that promotes environmental education for owners. This plan seeks to raise awareness and build criteria that support continuity in the protection of ecosystems. In this order of ideas, training aimed at contributing to good water quality is a fundamental piece and an instrument that seeks to mitigate the limitations of water resources and promote sustainable actions on its use. This approach not only strengthens the social fabric, but also serves as a barrier against possible unsustainable activities that could compromise natural resources.
Fulfillment of the interests of rural communities.	This activity is aligned with the interests of the project participants, as indicated by the socialization processes and signing of agreements

	carried out. It is aimed at access to technical knowledge and the incentive for the development of appropriate economic, social and cultural activities to generate sustainable income.
Consultation mechanism for the identification of objectives and the definition of activities	Meetings where the participatory construction of the project's conservation objectives and activities was carried out (See x.x.x.x.x Initial meetings). Manifestation of the owners' willingness to be part of a climate change conservation and mitigation project (See x.x.x Letters of intent). Agreements signed by the owners expressing full consent to be involved in the project, establishing the rights, responsibilities and benefits of all parties involved. (See x.x. Linkage contracts). At the property level, property implementation plans were built in a participatory manner with owners (See x.x.x.x.x. Property Deployment Plans). These plans not only serve as a monitoring tool between Cataruben and the owners, but can also be adjusted in a participatory manner in each monitoring period, in the context of adaptive management in the face of the particular conditions of each period..
Responsibility and role of the actors participating in the implementation of the activity.	**Cataruben Foundation** Organization responsible for designing and planning the training plan to strengthen the capabilities of Project Participants. In addition to acting as facilitators and speakers of the training. **Project participants:** They are the owners of the properties and their responsibility is to actively participate in the training, attending the scheduled sessions and participating in the debates and activities both in person and remotely.
Implementation timeline	Starting from the 2nd year of the project start date and until the 19th year.

Indicators to report the progress of the activity

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

and conservation of strategic ecosystems				
General training plan in Biodiversity	Product	10%	Completion percentage	Cataruben Foundation

2.4 Project location

The Project is located in the Colombian Orinoquia biome and the upper Orinoquia region of the departments of Meta (municipalities), Casanare (municipalities) and Vichada (municipalities).

Figure 1. Project location

Fountain:

2.5 Additional information about the GHG Project

3 Quantification of GHG emissions reduction

3.1 Quantification methodology

The project uses two quantification methodologies, BCR 0002 V 4.0 and BCR 0005 V1.1, with the objective of reducing emissions from deforestation, forest degradation and the conversion of natural savannas.*Conditions of applicability of the methodology.*

The fulfillment of each applicability condition is presented below, broken down by methodology.

3.1.1.1 Conditions of applicability of the BCR 0002 methodology

a. The areas in the geographic boundaries of the project correspond to the forest category according to the national definition of forest for the clean development mechanism (CDM) at the beginning of project activities and 10 years before the project start date:

To meet the IDEAM definition of a forest, which includes land with predominant tree cover and a minimum canopy density of 30%, an eligibility analysis was performed in each project area. Following the BCR 0002 methodology, section 9.1, the analysis focused on the period 2012-2020, identifying areas that have remained stable forest during the 10 years prior to the start of the project. Details of the procedure for determining eligible areas are found in Section 3.7.1.1 of this document.

b. The areas within the project limits do not correspond to the category of wetlands

In reference to the "Terms and Definitions" section of BCR 0002 and the IPCC definition of wetlands, it was verified that the project areas are forest lands and not wetlands. Consequently, they are not classified in category 4 (Wetlands) of Corine Land Cover for Colombia, specifically 411 (Swampy Areas), 412 (Peatlands) and 413 (Aquatic Vegetation on Bodies of Water). This classification is consistent with Article 1 of the Ramsar Convention for the Protection of Wetlands and IPCC guidelines.

The spatial data validating this information is located in the REDD+ Geodatabase under the Feature Class "Validation of Eligible Areas". and annex 1.1.2.1.1.3. Validation of areas.

c. There are no organic soils in the areas within the geographic limits of the project.

The semi-structured soil surveys carried out by the IGAC were reviewed, which serve as the basis for soil carbon maps in Colombia. It was found that the soils have percentages of organic carbon between *1.02% and 7.64%,* which confirms that they are not organic soils. This information was obtained from the Latin American Soil Information System (SISLAC), where the IGAC actively collaborates.

To verify this information, soil samples were taken in eligible forest areas and analyzed in the laboratory. The results showed an average of 1.4% organic carbon, confirming again that these are not organic soils. Details of these results can be found in the *Annex 1.3. Orinoco Forest Soils2 P1 and 1.3.1. Results Laboratory_S2023-231.pdf.*

The spatial information related to these findings is found in the REDD+ geodatabase, Feature Dataset Soil Survey, in the vector files "Semistructured Soil Survey IGAC" and "REDD Soil Survey".

d. Causes of deforestation may include, but are not limited to: expansion of the agricultural frontier, mining, timber extraction, and infrastructure expansion.

Deforestation is mainly caused by the expansion of the agricultural frontier and forest fires. This was determined through an analysis of causes and agents. More information can be found in the section 2.3 and section 2.3.7.

e. Identified causes of forest degradation may include: selective logging, firewood extraction, forest fires, grazing in forest areas, expansion of the agricultural frontier and illicit crops.

The expansion of the agricultural frontier and fires were identified as the main causes of deforestation and forest degradation, according to the analysis of causes and agents. (See section 2.3 / section 2.3.7)

f. No reduction in deforestation or degradation is expected to occur without the project.

Baseline and additionality analysis *(section 3.3).* shows that current trends of deforestation and forest degradation will continue due to lack of financial incentives for conservation, profitability of other activities and absence of effective control measures.

g. In areas within the project boundaries, carbon stocks in soil organic matter, leaf litter, and dead wood may decline or remain stable.

Carbon reserves decrease due to the influence of agents of deforestation and/or degradation. This occurs by altering the natural cycle of carbon capture and storage, which promotes the acceleration of the decomposition of organic matter and the subsequent release of additional carbon into the atmosphere.

h. The quantification of GHGs other than CO2 must be included in the quantification caused by forest fires (if applicable) during the monitoring period.

The monitoring plan includes the identification of fires in wooded areas within the geographic limits of the project. This is in order to quantify the CH_4 and N_2O emissions generated by the combustion of woody biomass during the monitoring period. In the

event that fires occur, the calculation of other GHG emissions will be carried out as established in the *Section 17.1.3.4.*

3.1.1.2 Conditions of applicability of the BCR 0005 methodology

a. The areas within the geographical limits of the project correspond to natural savannahs

To comply with the criteria of section 7.1.1 of the BCR 0005 methodology, an analysis was carried out to delimit the eligible areas of the natural savanna ecosystem. The analysis contemplated the period 2012-2018 and identified the coverages 3.2.1 Grasslands and 3.2.2 Shrublands, considered as savannahs, within the geographical limits of the project. see section xxx

b. The project activities avoid the change of land use in natural savannahs.

The project promotes sustainable practices and production systems that do not change land use to avoid the conversion of natural savannas to other uses. It also creates economic incentives for conservation by commercializing the project's mitigation results.(section 2.3.8.1).

c. The project activities include biodiversity conservation actions that integrate preservation, restoration and/or management and sustainable use efforts of the savannahs.

The project activities, detailed in section 2.3.8.1, focus on the conservation, restoration and sustainable use of savannahs.

d. The causes of land use changes identified may include, among others: Expansion of the agricultural frontier, mining, extraction and loss of vegetation cover.

Property owners are primarily responsible for the expansion of the agricultural frontier, which is the main cause that has been identified. Ver section 2.3 / section 2.3.7).

e. In areas within the project boundaries, carbon stocks in soil organic matter, litter, and dead wood may decline or remain stable.

Carbon stocks are expected to remain stable or increase in the project scenario, while they will decrease due to the influence of land use change agents in the baseline scenario.

f. The amount of nitrogen-fixing species used in the project activities is not significant, so GHG emissions from denitrification can be considered negligible.

Since species planting will be dispersed in savanna and restoration areas with multiple native species, the resulting GHG emissions will not be significant.

3.1.2 Methodology deviations (if applicable)

No methodological deviation was applied

3.2 Project limits, sources and GHG

3.2.1 Spatial limits of the project.

The project area covers 117.253,0 ha, which include natural forests and savannahs within the limits of the properties linked to the project. TO Next, the project areas, the reference region and the leak area corresponding to each methodology used are specified.

3.2.1.1 Spatial limits of Natural Savannahs

87,396.0 ha of natural savannas located on private property in the department of Meta Casanare and Vichada are part of the project as shown in the Figure XX. This figure also shows that the project boundaries are within the savanna biome and the Llanos ecoregion, according to the WWF classification as well as the reference region and the leak area.. Relevant cartographic data is available in component-specific geospatial databases in the Annex. 1.1.1. Natural Sheets, "Project Areas" feature data set.

Figure x Natural Savannas Project Areas, Reference Region and Leakage Areas

3.2.1.2 REDD+ spatial limits

19,000 hectares of eligible forests located on private property in the department of Meta Casanare and Vichada are part of the project. The project areas The reference region and the leak area are shown in Figure REDD+, "Project Areas" characteristics dataset

Figure x. REDD+ Project Areas, Reference Region and Leakage Area

3.2.2 Carbon stocks and GHG sources

Emission sources and associated GHGs were selected taking into account the guidelines of the BCR 0002 V4.0 (section 8) and BCR 0005 V1.1 (section 7.2) methodologies based on the characteristics of the project areas and activities, in the **Tables 24 and 25**, the identified GHG reservoirs and sources are described.

Table x. REDD+ GHG Reservoirs and Sources

Source or reservoir	***GEI***	***Including***	***Justification***
Aerial biomass	CO_2	*AND*	The change in carbon content in this pool is significant according to the IPCC and is greatly affected by the loss of natural cover, land use change and increasing temperature (FAO. 2017, Kauffman et al. 2016). Furthermore, the loss of forest cover and the consequent release of CO2 can have a considerable impact on the global carbon balance (Brown et al., 1996).
Underground Biomass	CO_2	*AND*	The change in carbon content in this pool, according to the IPCC, is considerable and can be significantly affected by changes in land use (Kauffman et al. 2016). Besides, There is official information from the country applicable to the project.
Dead wood and leaf litter	CO_2	*AND*	A decrease in carbon content is expected in the base scenario. However, the emissions estimate is based only on the dead wood reservoir, due to the availability of official data applicable to the project.
Soil organic carbon	CO_2	*AND*	The reservoir is susceptible to considerable carbon losses in the base case, so the change in carbon content is significant according to the IPCC. Yepes et. al, (2011) recommend its inclusion in REDD+ projects. In addition, there is official information applicable to the project.
Combustion of woody biomass	CO_2	*AND*	According to the BCR 0002 methodology, CO emissions from combustion of woody biomass are not quantified since they are quantified as deforestation.

	CH_4	*AND*	In the event that fire events occur in the tree component (combustion of woody biomass) during the monitoring period, the affected area will be identified and CH emissions will be quantified.
	NO2	*AND*	In the event that fire events occur in the tree component (combustion of woody biomass) during the monitoring period, the affected area will be identified and CH emissions will be quantified.

Source or reservoir	***GEI***	***Including***	***Justification***
Aerial biomass	CO_2	*AND*	The change in carbon content in this pool is significant according to the IPCC and is highly affected by the loss of natural cover, land use change and increasing temperature (Bond-Lamberty et al., 2018, FAO. 2017, Kauffman et al.). Therefore, it is relevant for the quantification of GHG emissions in scenarios with and without a project.
Underground Biomass	CO_2	*AND*	The change in carbon content in this deposit is significant according to the IPCC.
Dead wood and leaf litter	CO_2	*AND*	A decrease in carbon content is expected in the base scenario. However, the emissions estimate is based only on the dead wood reservoir, due to the availability of official data applicable to the project.
Soil organic carbon	CO_2	*AND*	It is considered to be one of the main carbon reservoirs in natural savannah ecosystems, and can also be highly affected by the loss of natural cover, change in land use and increase in temperature (Bond-Lamberty et al., FAO. 2017, Kauffman et al 2016).
Combustion of woody biomass	CO_2	NO	According to the BCR 0002 V4.0 methodology, CO emissions from combustion of woody biomass are not quantified.
	CH_4	YEAH	In the event that fire events occur in the tree component (combustion of woody biomass of shrubs) during the monitoring period, the affected area will be identified and CH emissions will be quantified. Non-woody aboveground biomass is generally burned or decomposed within the same year of its production and is therefore considered in equilibrium with CO2

			uptake, plant respiration and annual decomposition. IPCC, *Grasslands*, in *Guidelines for greenhouse gas inventories*. 2006, IPCC. pp. 1-49.

3.2.3 Temporal Limits and Analysis Periods

3.2.3.1 Project start date

The Orinoco2 P2 project has a start date of February 1, 2020. To define the start date of the project, it was imperative to establish with each owner a common purpose, such as the conservation of the strategic ecosystems of each property. The owner is the primary agent of transformation and the main agent of conservation and protection of forests against forest fires, therefore, the intention to conserve and incorporate part of a mitigation project is an essential step to generate the change intended by the project. (See annex of Letters of Intent)

Thus, another important milestone is established when all the properties linked to the project began the execution of project activities and the adoption of practices, covering:

a. *Activities to reduce emissions from deforestation and forest degradation, which were agreed upon through the Property Implementation Plans. (See attachment x)*
b. *Implementation of project activities to generate emissions reductions by avoiding land use changes in eligible project areas. These activities were agreed upon through the Property Implementation Plans (See attachment x)*

3.2.3.2 Quantification period of GHG emissions reductions/removals

Taking into account that the project implements REDD+ activities and activities that prevent land use change in natural savannahs, the following duration and quantification periods of the project are established:

a. Project Duration: 40 years from the project start date
b. Quantification periods: renewable quantification periods every 10 years

3.2.3.3 Monitoring periods

These are monitoring periods planned during the execution of the project within the quantification period. As a result of monitoring, monitoring reports are prepared in each

monitored period. An initial follow-up period of 4 years is established and every 2 years thereafter.(see section 17). However, it may be modified and carried out annually or at least once every 5 years.

3.3 Identification and description of the base or reference scenario

The tool (AR-TOOL-02 - Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities) is used to identify the baseline scenario and demonstrate additionality, in compliance with section 12.2 of the BCR standard, section 10 of the BCR 0002 methodology, section 8 of the BCR 0005 methodology and section 7 of the BCR Baseline and Additionality tool. Analysis for REDD+ activities and activities that prevent land use change in natural savannahs is carried out independently.

Step 0 of the "Preliminary selection based on start date of project activities" tool is shared between the two activities like this:

a. ***Evidence of start date:*** The project began on February 1, 2020 with the start of group activities aimed at reducing emissions in the project areas. This date is based on letters of intent submitted by participants during that year.

The project areas are located within private properties, whose owners are primarily responsible for the transformation, conservation and protection of forests and natural savannahs. Your intention to preserve these areas and incorporate them into a mitigation project is critical to achieving the desired change. This intention, along with the development of implementation plans and subsequent practical actions, marks the beginning of project execution.

b. ***Impact of the generation and sales of CCVs:*** The project addresses the practices and factors that threaten the forests and savannahs of the region, managing the reduction of GHG and avoiding deforestation and degradation of these areas. Through certification and registration, the project reduces the impact of identified barriers to the implementation of activities, and efforts to mitigate climate change are translated into verified carbon certificates (VCC). The commercialization of these certificates becomes an important source of income that promotes the implementation of project activities.

   In order to provide economic benefits to landowners and encourage ecosystem conservation, a financial analysis was conducted covering the project monitoring period and the GHG reductions quantification period. Using a financial modeling

tool, macroeconomic projections, investment items, costs and expenses were detailed. The CCV inventory and the income generated were also projected. The results, based on financial indicators such as the income statement and cash flow, demonstrated positive economic performance and the financial viability of the project.

The estimated financial model of the project, based on the investment period and future monitoring, supports the continuity and sustainability of project activities. Clear guidelines on carbon rights and ownership are established through a contractual agreement with landowners, regulating the distribution of economic benefits. 70% of the resources are allocated to the owners for conservation and mitigation activities, while 30% is managed by the Cataruben Foundation for the direction and execution of the project.

In conclusion, the project generates direct economic income for participants through the reduction of GHG emissions, ensuring the continuity of actions to reduce deforestation and promote ecosystem conservation.

3.3.1 Identification and description of the base or reference scenario BCR 0005 activities

3.3.1.1Step 1 Identification of land use alternatives

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

Table XX Step 1a. Identify alternative and credible land use scenarios for the proposed project activities.

Script	Description
Continuation of the pre-project land use scenario	This alternative represents a likely scenario where landowners seek their livelihood and maximum financial gains per hectare through economic activities, primarily agriculture, resulting in the transformation of natural savannahs and the expansion of the agricultural frontier. The trends observed in the reference region support the probability of this scenario, with crops such as corn, rice and clean pastures being the most probable alternatives within this scenario. See annex causes and agents of sheet transformation

Reduction of land use change in the Natural Savannah within the project boundary, carried out without being registered as an activity of the BCR project	This alternative establishes the voluntary participation of property owners in activities that reduce the transformation of natural savannahs within their properties. It also encourages the establishment of new agricultural systems that do not damage the natural cover of the savannas, without the need for financial incentives.

And the result of the List of credible alternative land use scenarios that would have occurred on the land within the limit of the BCR 0005 project activity is:

- Continuation of the pre-project land use scenario
- Reduction of land use change in the Natural Savannah within the project boundary, carried out without being registered as an activity of the BCR project

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

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

Script	**Activities BCR 0005**
Continuation of the pre-project scenario in natural savanna lands	It is consistent and aligned with all applicable laws, statutes, regulatory frameworks or policies in the savanna areas. It represents a typical state of many lands in the plains of the departments of Casanare, Meta and Vichada, where the vegetation is preserved to some degree, before conversion to agricultural use. The Orinoquia presents a favorable scenario for the implementation of agricultural programs, since the surface of private lands is located mostly within the agricultural frontier, which makes the conversion of natural savannahs viable. Furthermore, this historic conversion could be accelerated in accordance with national policies that define the Orinoquia as a Colombian agricultural pantry. Decree 2369 of 2010, which regulates Law 1152 of 2007 (Rural Development Statute), empowers the National Government to plan and

	manage land use in agricultural frontier areas, including the Orinoquia. This decree seeks to promote agricultural production in underutilized or unexploited areas.. Resolution 128 of the Ministry of Agriculture and Rural Development establishes the criteria for the expansion of the agricultural frontier. This resolution allows the change of land use from non-forest areas to commercial agricultural, livestock and forestry activities, as long as special management areas are respected and natural reserve areas are not violated. Therefore, the change of land use is allowed in areas of the Orinoquia. In conclusion, the current legal framework of the Orinoquia allows the change of land use, which supports the additionality of projects that seek the conservation or restoration of areas susceptible to being transformed for agriculture or livestock. Therefore, it is assumed that this scenario is likely and may continue in the future..
Reduction of land use change in the Natural Savannah within the project boundary, carried out without being registered as an activity of the BCR project	The natural savannas of the Colombian Orinoquía are strategic ecosystems that require management based on conservation and sustainable use, according to Law 99 of 1993, which establishes the country's environmental framework. This law promotes that any intervention in these areas be planned to preserve their biodiversity and ecosystem services, particularly those related to water regulation and carbon storage. Decree 2372 of 2010, which regulates areas for the protection and sustainable use of biodiversity in Colombia, establishes that sheets, although susceptible to intervention for productive activities, must be managed under management plans that ensure their long-term sustainability. This decree highlights the importance of integrating productive activities such as livestock farming and agroforestry with practices that prevent soil degradation and loss of biodiversity in the savannahs. Thus, changes in land use are allowed in these areas, as long as sustainable management practices are applied that do not compromise the structure and function of the ecosystem. Law 1930 of 2018 promotes the comprehensive and sustainable management of strategic ecosystems, including natural savannahs, and establishes guidelines for their use. This law recommends that any activity developed in these territories must be oriented towards conservation, ecological restoration and rational use of natural resources. In the specific case of natural savannahs, it is recommended that agricultural activities incorporate measures to reduce pressure on soils and maintain vegetation cover, promoting systems such as silvopastoralism that balance production with the conservation of ecosystems. In conclusion, current legislation allows the use of natural savannas, including the implementation of management strategies that

	guarantee their conservation and the maintenance of their ecological functions. Finally, areas within the project located in the Bita River Ramsar site are zoned for agricultural production or natural hazards.

The result of the List of credible alternative land use scenarios that comply with mandatory legislation and regulations taking into account their application in the region or country for BCR 0005 activities is.

- Continuation of the pre-project land use scenario
- Reduction of land use change in the Natural Savannah within the project boundary, carried out without being registered as an activity of the BCR project

3.3.1.2 Step 2 Barrier Analysis

This step serves to identify barriers and evaluate which of the land use scenarios identified in substep 1b are not impeded by these barriers.

Scenery	Reduction of land use change in the Natural Savannah within the project boundary, carried out without being registered as an activity of the BCR project
Barrier	Barriers to investment
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 will be implemented: In human activity, there is a long list of environmental priorities that require large investments, ranging from the atmosphere (to reduce greenhouse gas emissions) to the local conservation of biological and genetic diversity. However, despite the previous premise, there is a restriction in the execution of the project regarding the accessibility of an investment capital market, both nationally and internationally. As an illustration, with regard to the General Royalty System for the year 2021, only 8% of the country's resources have been allocated to the operation of the Ministry of Environment and Sustainable Development, while only 10% has been allocated to the Ministry of Agriculture and Rural Development (National Planning Department, 2022). Consequently, the operational resources assigned to these sectoral ministries distribute income among their various government programs, which does not guarantee full access to this type of public investment. Regarding foreign direct investment in 2021, reports from the Bank of the Republic revealed a notable absence of resource allocation for environmental issues. (Banco de la República de Colombia, 2021). And the quarterly report on foreign direct investment in Colombia in total and by economic activity, (Banco de la República de Colombia, 1996). In the context of domestic or foreign foreign direct investment, access to capital markets for this type of projects represents a significant level of uncertainty. The current uncertainty can be attributed to a number of factors, including the state of the country's economy, the level of security and political stability, the	

transformation of soils and the extraction of raw materials that contribute to climate change.
On the contrary, access to the capital market is driven by direct investments in environmentally harmful sectors, largely made by national and international investors who inject significant financial capital into agricultural activities. The extraction of oil and its derivatives, among other unsustainable practices, is particularly frequent in protected areas or on private properties with abundant exploitation of natural resources, as observed in some cases related to this project. This presents a unique opportunity to open new capital markets and achieve a sustainable economic transition. The objective is to implement GHG projects through the financing of carbon credits and adapt the use of these ecosystems for sustainable productive and conservation activities within the framework of local economic development. (Vázquez Barquero & ECLAC, 2000)[1].

On the other hand, although today sustainable economic growth has accelerated in the world and with it different ways of allocating funds to investments with environmental benefits, such as thematic bond issues. Especially, green bonds refer to fixed income debt for projects that mitigate climate change. It is analyzed that, first, this refers to a debt that, although it means lower rates, is still a debt that needs collection and that projects like this without participation in the European Union or in the carbon market of the European Union could not cancel these portfolios because it does not foresee another way of raising resources. Second, these types of bonds are not so common, "according to the BVC, Colombia has issued 20 bonds with specific allocation of resources between December 2016, when the first green bond from Bancolombia came out (this entity was the second in the market with IFC), until May 2022, with a social bond from Bancóldex" (Capital Inteligente Grupo Bancolombia, 2022); fourth, it represents an underlying portfolio "especially of green projects, due to the high specifications in technological matters, which make them expensive initiatives, so for many companies they become financially unviable, consequently, the great challenge is to see how governments leverage the financial part of these projects"; Fifth, since there are no government policies that exponentialize the lung that exists in Colombia, there are no investors who go to the capital market to buy issues like those mentioned; and sixth, the standards to define how to access are framed in international norms that become difficult to adapt to national legislation. Finally, the lack of access to capital markets associated with foreign and national direct investment can be analyzed by the lack of knowledge of the existence or not of investment mechanisms interested in working with private property communities. These mechanisms aim at the implementation of biodiversity preservation activities accompanied by the establishment of sustainable production practices, so the above could bias the possibility of accessing market diversification, which indirectly also determines a notable investment barrier.

Barrier	*Barriers related to local tradition*

Laws and customs, market conditions and practices

The Orinoquia region has been prioritized by recent governments and the private sector as the new frontier for agroindustrial development 1. In recent decades, exotic grasses and other crops such as rice and soybeans have grown at an accelerated rate. With the increasing demand for food and agricultural products, this land use change trend is expected to continue and intensify in the coming years.

Planning agroindustrial expansion, while guaranteeing the maintenance of ecosystem services and the conservation of biodiversity, is an urgent task for the government, the private sector and the inhabitants

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

of the region. This requires understanding recent changes in land use, as well as possible future trajectories and their socio-environmental implications, to inform decision makers. However, public and open access information on agroindustrial expansion is very limited for this region of the country, especially for natural savanna ecosystems.

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

Likewise, the transformation of natural savannas to anthropic uses in the period 2009-2018 in the department of Meta amounts to 425,314.1 hectares and 346,200.2 hectares in the department of Vichada. See analysis of causes and agents of transformation of the natural savanna section. Direct and indirect impacts

Barrier	*Barriers due to social conditions*

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

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

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

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

According to data from the monitoring of territories affected by illicit crops (2020), carried out by the United Nations Office on Drugs and Crime (UNODC)[2]Coca crops and their subsequent transition to cocaine have shown a progressive decrease in the Orinoquía. Thus, in 2005, around 9,709 hectares of these crops were reported, but in 2020, the surprising sum of 121 hectares was cultivated. Thus showing a decrease of 99%, which means that since 2018 the territories included in the eastern plains contain less than 0.5% of the cocaine crops of the entire country.

Lack of organization of local communities

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

The Orinoquía region is characterized by being a heterogeneous territory both in its geography and in its cultural wealth. And taking this into account, the communities present in the area of influence of the project, that is, the departments of Vichada and Meta, combine the presence of indigenous population or communities, Afro-descendants and Creole llaneros or native llaneros (Piñeros, 2019).[3]. The latter represent the target population of the projects as they are, and this is so, because they imply a private acquisition of land legitimized by the documentation they possess.

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

However, CONPES is not the only tool identified that would aim at the planning of the territory and its inhabitants. Additionally, a second strategy is the Orinoquia Master Plan between the years 2014 and 2018, which was supported by a strategy for the region called "Environment, agriculture and human development: Growth and well-being for the Llanos" of the PND 2014-2018.[4]. This document was prepared with as its main input the information provided during the presentation of the regional dialogues that aim to configure 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 the environment, infrastructure and logistics, and territorial planning (PND, 2016).[5]. Thus trying to create a bridge between legal certainty and possible investments in the region, which includes tourism, transportation, agriculture and, of course, the environment and water resources.
Likewise, a third strategy occurred in 2017 when the "Comprehensive Regional Climate Change Plan for the Orinoquia" (PRICCO) was established.[6], developed in Arauca, Casanare and of course in Vichada and Meta. Document, which reinforced the urgency of achieving integration between climate change and the possible relationship that management processes and the development of the region have with environmental disasters. Likewise, a fourth is the PND 2018-2022 (National Development Plan), which established twenty goals within the framework of commitments called "pacts for the productivity and equity of the regions" among which can be counted precisely the "Llanos-Orinoquía Region Pact: Connect and enhance the sustainable food supply of the region with the country and the world." Basically, the aforementioned document made evident the relationship of said pact with the pact of productivity, legality, equity for ethnic communities (in the area of opportunities), and of course,

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

environmental, economic and social sustainability (DNP, 2019). The most logical barrier detected is the lack of 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 residents the concern for issues such as: climate change, the conservation of ecosystems and the relationship between sustainable development and care for the environment. That is, there is still a way to go.	
Barrier	*Barriers related to land tenure, property, inheritance and property rights*
Lack of adequate land tenure evidence and documentation to support tenure security In the Colombian Orinoquía, about 46% of the properties are presumed informal, which indicates that they meet at least one of the criteria established for their identification. At the departmental level, the department of Vichada is the one with the highest presumption of informality, being in the range of 50% to 75%, while the other three departments are in the range of 25% to 50%.[7] ***- Lack of adequate land tenure legislation and regulations to support tenure security:*** Inequality in land ownership is a major problem in Colombia, especially in the departments of Casanare, Meta and Vichada, where the project is being implemented. A minority of citizens have title to their land, while the majority of the population occupies it irregularly. For almost 40 years, the National Government has tried to implement strategies and agrarian reforms to confront this inequality and provide resources that allow the community to access land ownership. However, this process has slowed down, resulting in irregular land ownership becoming common in the territories. The legal regulation of real estate property in Colombia has its origin in constitutional provisions that initially recognize the fundamental rights to private and collective property with a social purpose, that is, to improve the quality of life of Colombian citizens. In the departments of Vichada and Meta, the right to property has been violated and violated over the years, mainly due to the armed conflict, which has resulted in displacement and lack of government control over the lands. This process has subsequently been intervened by the competent authorities with reparation strategies, which has caused numerous citizens to recover the exercise of ownership and occupation of their lands. In addition to the above, the Colombian Civil Code contains provisions related to the ownership of real estate for both natural and legal persons. This compilation of standards classifies land ownership into ownership, possession and/or possession, establishing guidelines that guarantee the quality of the rights of each person according to the quality of the property. It is essential to address this inequality in land ownership and promote the formalization of property to guarantee the legal security of citizens and the sustainable development of the region. This situation will require continued collaboration between the government, the entities involved and the local community.	

Table XX Step 2a. Barrier analysis BCR 0005

[7]Summary of the diagnosis of the distribution and ownership of rural land in the ORINOQUIA regionhttps://upra.gov.co/Kit_Territorial/2-%20Informaci%C3%B3n%20por%20Departamentos/ARAUCA/Diagnostico%20distribucion%20tenencia%20tierra%20rural%20Orinoquia%20-%20ARAUCA.pdf

3.3.1.3 Elimination of land use scenarios that are impeded by the identified barriers.

Land use alternatives	Barriers	Result of barrier analysis
Continuation of the land scenario prior to the project	NO	Considering the description of the barriers, and comparing it with the previously identified land use scenarios, one of the most probable alternatives to define the project baseline (different from the project activity), is the continuation of the previous land use. This is because none of the barriers prevent the continuity of the activities that have historically been developed in the territory, that is, a constant degradation.. Results: Continue
Reduction of land use change in the Natural Savannah within the project boundary, carried out without being registered as an activity of the BCR project	YEAH	Investment: Without the availability of investment capital, the transition from current productive activities to those that do not affect natural cover does not occur. Social: Considering the economic dependence that current population groups have and that this promotes the development of activities that generate the transformation of areas, if the population does not have a financial mechanism that allows counteracting this dependence, it is unlikely that economic alternatives will be developed that offer income opportunities and mitigate the negative environmental impact. Results: Delete

3.3.1.4 Substep 2c. Determination of the reference scenario

Scenarios that are not impeded by any barrier	Base scenario?
Continuation of the pre-project land use scenario	Yes: Since the list of probable scenarios does not include the implementation of activities to reduce deforestation and forest degradation without being registered as a BCR 0005 activity and there is only one scenario that is not prevented by any barrier, then this is considered a base scenario.

3.3.2 Identification and description of the base or reference scenario BCR 0002 activities

3.3.2.1 Step 1 Identification of land use alternatives

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

Board XX Step 1a. Identify alternative land use scenarios

Scenery	Description
Continuation of the pre-project land use scenario	This alternative corresponds to the scenario of deforestation, forest degradation, this is because the owners seek natural resources for their subsistence, the satisfaction of their basic needs. This alternative establishes that the scenario within the project areas corresponds to the trends that occur in the reference region (which includes the project areas), regarding the increase in deforestation and forest degradation.
Reduction of deforestation and forest degradation within the project boundaries carried out without being registered as a BCR project activity.	This alternative highlights the active and voluntary participation of property owners in the control of activities that cause deforestation and degradation of the forests present on their properties. Through environmental awareness and a vision of sustainable development, property owners take specific measures to prevent the expansion of the agricultural frontier, prevent forest fires and reduce timber extraction.

The result of the List of credible alternative land use scenarios that would have occurred on the land within the BCR 0002 project activity limit is.

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

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

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

scenario	Description
Continuation of the pre-project scenario In forest land	Regarding forest areas in the Colombian Orinoquia, national legislation establishes clear restrictions on changes in land use, protecting these ecosystems due to their environmental importance. Law 99 of 1993, which created the Ministry of the Environment, establishes that natural forest areas must be conserved and that the change in land use for agricultural, livestock or infrastructure activities is prohibited, except in exceptional circumstances and with express authorization from the competent environmental authorities. Decree 1791 of 1996, which regulates the use of forests in Colombia, reinforces this protection by stipulating that natural forests are subject to a sustainable management regime. This means that forested areas can only be intervened under a controlled use scheme and for specific purposes such as conservation, restoration or sustainable use of forest products. In this context, the change of land use in forest areas to convert them into agricultural or urban areas is explicitly prohibited without an approved forest management plan and the corresponding environmental license. In the case of REDD+ areas, although deforestation and forest degradation do not comply with current regulations, the population established in the project area and in the reference region develops them extensively and habitually, as evidenced in the analysis of causes and agents. Likewise, forest fires are commonly of natural or anthropogenic origin. This is called unplanned deforestation and degradation. As evidence that this phenomenon of unplanned deforestation and degradation exists in Colombia, the Government of Colombia, through the Ministry of Environment and Sustainable Development, presents to the country "Forest Territories of Life" Comprehensive Strategy for the Control of Deforestation and Forest Management, as an intersectoral policy instrument that involves the co-responsibility of the different sectors of the Colombian State, with the purpose of stopping deforestation and forest degradation, addressing the complexity of the causes that generate it, based on the recognition of the strategic significance of these ecosystems for the country, for their sociocultural, economic and environmental importance, for their potential as a development option within the framework of the peacebuilding process,

	and for their contribution to the mitigation and adaptation to climate change. For all of the above, it is assumed that this scenario can be maintained over time and constitutes a probable scenario.
Reduction of deforestation and forest degradation within the project boundaries carried out without being registered as a BCR project activity.	Regarding forest areas in the Colombian Orinoquia, national legislation establishes clear restrictions on changes in land use, protecting these ecosystems due to their environmental importance. Law 99 of 1993, which created the Ministry of the Environment, establishes that natural forest areas must be conserved and that the change in land use for agricultural, livestock or infrastructure activities is prohibited, except in exceptional circumstances and with express authorization from the competent environmental authorities. Decree 1791 of 1996, which regulates the use of forests in Colombia, reinforces this protection by stipulating that natural forests are subject to a sustainable management regime. This means that forested areas can only be intervened under a controlled use scheme and for specific purposes such as conservation, restoration or sustainable use of forest products. In this context, the change of land use in forest areas to convert them into agricultural or urban areas is explicitly prohibited without an approved forest management plan and the corresponding environmental license.

3.3.2.2 Step 2 barrier analysis

Scenario	Reduction of deforestation and forest degradation within the project boundaries carried out without being registered as a BCR project activity.
Barrier	Barriers to investment

Debt financing not available

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

For this purpose, it is important to keep in mind that public entities do not represent stable, governable and direct financing for the implementation of GHG project activities. This is due to

institutional weakness caused in part by the country's balance of payments deficit. This is evidenced by the reports on the behavior of Colombia's balance of payments published quarterly by the Banco de la República (Banco de la República de Colombia, 2021).[8]; and the lack of political will that is represented in the citizen vision by the high index of institutional distrust, as confirmed by the methodology and protection of the Social Capital Barometer (BARCAS) in its fourth and last study carried out.[9], which shows that 79.6% of those surveyed have little or no trust in the national government (CONTRIAL, 2017); However, the Colombian government, through the Ministry of Environment and Sustainable Development and the Ministry of Finance, has implemented different programs and mechanisms, such as the PSA (Payment for Environmental Services Program) to manage and encourage conservation and restoration actions for various strategic ecosystems, where the beneficiary can become a creditor of the resource directly or indirectly, in cash or in kind. However, this program does not guarantee the direction of these exclusive resources for the reduction of greenhouse gas emissions. the commercialization of carbon certificates and the compensation of the carbon footprint of natural and legal persons; and such as the national carbon tax, which, although it responds to the need to "have economic instruments to encourage compliance with greenhouse gas (GHG) mitigation goals at the national level" (Ministry of Environment and Sustainable Development, 2022)[10], there only 30% of the resources obtained are allocated to conservation areas and strategies, of which 25% are for the management of coastal erosion where the project reference area is not included and the other 5% to strengthen the National System of Protected Areas, which does not ensure the availability and possibility of access to this financing for the properties of the linked Ecosystem Administrators and does not determine tools that ensure and monitor the correct allocation of money and implementation of actions in specific cases.

Likewise, at the national level there is no evidence of specific financing strategies for forestry activities "appropriate for sustainable forest management, because existing local resources cannot be applied to the management of native forests, due to the lack of operating mechanisms such as a bank or forestry fund" (United Nations Development Program and Viteri, 2010).[11], as reflected in the analysis document of the forestry sector in the context of adaptation and mitigation to the change of the land use sector, soil change and forestry (forestry) in Ecuador, but which to a large extent reflects the Latin American context and is not far from the national

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

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

[10] Ministry of Environment and Sustainable Development (Ed.). (2022). ABC DECREE 926 OF 2017 [Frequently asked questions about the national carbon tax and non-causality tax treatment for carbon neutrality]. Frequently asked questions about the national carbon tax and non-causality tax treatment for carbon neutrality. Retrieved on 06 09, 2023, fromhttps://www.minambiente.gov.co/wp-content/uploads/2022/01/ABC_DECRETO_926_de_2017.pdf

[11] United Nations Development Program & Viteri, A. (2010, August). ANALYSIS DOCUMENT OF THE FOREST SECTOR IN THE CONTEXT OF ADAPTATION AND MITIGATION TO CLIMATE CHANGE OF THE LAND USE, LAND CHANGE AND FORESTRY SECTOR IN ECUADOR. 05_ecuador_nip_forestry_mitigation-libre.pdf. Retrieved 2022, fromhttps://d1wqtxts1xzle7.cloudfront.net/30236413/05_ecuador_nip_forestry_mitigation-libre.pdf?1390881517=&response-content-disposition=inline%3B+filename%3DSECTOR_FORESTAL_EN_EL_CONTEXTO_DE_ADAPT.pdf&Expires=1686360152&Signature=CuXdabS9eNoNgF2QaAvrUWHYEAuon

reality.

Therefore, under this perception there is poor management of resources, allies and ecosystem managers. On the other hand, private financing sources imply having a strong financial and administrative muscle for both the organization implementing the project and the owners of the land that belongs to it. This forces potential implementers of greenhouse gas (GHG) REDD+ projects that do not meet the financial support requirement to refrain from carrying out environmentally beneficial actions. This forces the project implementer to sectorize the community, benefiting it for its economic capacity but not for the environmental impact it mitigates. Furthermore, the conservation activities carried out by the owners of these properties to guarantee the reduction and/or removal of CO_2 emissions and protection of the biodiversity they house do 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 rather an outflow of money, that is, there is no internal rate of return, which reduces the possibility of financial leverage with a third party. Therefore, the alternative is open to implement other types of activities other than GHG projects that represent profitability in search of governance in their finances.

Lack of access to credit

Although in Colombia there are special credit lines with subsidies at the interest rates required by the government and aimed at agricultural sustainability and green businesses, their financing does not frame the fulfillment of GHG project activities such as REDD+, nor does it frame the characteristics of all the linked properties that do not carry out 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. Furthermore, because financial entities seek to reduce the risk of their financial capital, they do not support applications that do not demonstrate sufficient solidity to respond to the medium and long-term collection obligation, even when there are subsidiary rates, thus avoiding a sinister portfolio. Therefore, they look for figures that support the credit, such as co-signer, credit history, gross equity, cash flow, financial projections based on modeling, title documents, among others, which in most cases are not available to the owner of the property.

On the other hand, the increase in usury percentages in Colombia has had an increase of up to 58.8% in the interest rate of microcredits for the first quarter of 2023, with respect to the Current Bank interest 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; Likewise, ignorance of a correct financial evaluation can lead to poor debt decisions and therefore not provide sustainability to owners who wish to finance their conservation activities.

It is evident that there is discrimination in access to credit due to the systemic barriers present within the banking system. Furthermore, the time, conditions and behavior of the projects in

terms of operation and guarantee of the permanence of the areas subject to conservation prevent the implementation of conservation activities from an economic point of view. This despite the fact that it requires a significant increase in income to ensure the conservation of the ecosystems and biodiversity that live there. Additionally, banking represents a high index of institutional distrust among Colombians, with a percentage of 69.6% according to the latest BARCAS report (CONTRIAL, 2017). This indicates that citizens cannot access these financial products and services due to a general negative perception about this type of offer.

Barrier	**Institutional barriers**

Lack of enforcement of legislation related to land use

Although deforestation or forest degradation is not allowed in the region, according to the analysis of changes in land use, in the period 2009-2019, 271,184.5 hectares of forest have been lost in the department of Meta and 48,191.2 hectares in the department of Vichada. See section 2.3.5. Direct and indirect impacts.

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

As evidence that this phenomenon of unplanned deforestation and degradation exists in Colombia, the Government of Colombia, through the Ministry of Environment and Sustainable Development, presents to the country "Forest Territories of Life" Comprehensive Strategy for the Control of Deforestation and Forest Management, as an intersectoral policy instrument that involves the co-responsibility of the different sectors of the Colombian State, with the purpose of stopping deforestation and forest degradation, addressing the complexity of the causes that generate it, based on the recognition of the strategic significance of these ecosystems for the country, for their sociocultural, economic and environmental importance, for their potential as a development option within the framework of the peacebuilding process, and for their contribution to the mitigation and adaptation to climate change.

Barrier	Barriers due to local ecological conditions

Natural and/or man-induced catastrophic events

Due to the natural conditions of the Orinoquia highlands, forest fires are an important barrier to maintaining intact forest areas.[12] To corroborate the risk, Hot Spot Monitoring was carried out through the "Surface Hot Spot Monitoring System Detected by Satellite-IDEAM" for the period 2016-2020.

[12]Fires threaten the diversity and structure of tropical gallery forests.https://doi.org/10.1002/ecs2.3347

Barrier	Barriers due to social conditions

Widespread illegal practices (illegal grazing and logging)

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Lack of organization of local communities

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

[14] National Development Plan 2014-2019National Planning Departmenthttps://colaboracion.dnp.gov.co › CDT › PND

during the presentation of the regional dialogues that sought to configure 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 the environment, infrastructure and logistics, and territorial planning (PND, 2016).[15]. Thus trying to create a bridge between legal certainty and possible investments in the region, which includes tourism, transportation, agriculture and, of course, the environment and water resources.

Likewise, a third strategy occurred in 2017 when the "Comprehensive Regional Climate Change Plan for the Orinoquia" (PRICCO) was established.[16], developed in Arauca, Casanare and of course in Vichada and Meta. Document, which reinforced the urgency of achieving integration between climate change and the possible relationship that management processes and the development of the region have with environmental disasters. Likewise, a fourth is the PND 2018-2022 (National Development Plan), which established twenty goals within the framework of commitments called "pacts for the productivity and equity of the regions" among which can be counted precisely the "Llanos-Orinoquía Region Pact: Connect and enhance the sustainable food supply of the region with the country and the world." Basically, the aforementioned document made evident the relationship of said pact with the pact of productivity, legality, equity for ethnic communities (in the area of opportunities), and of course, environmental, economic and social sustainability (DNP, 2019).

The most logical barrier detected is the lack of 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 residents the concern for issues such as: climate change, the conservation of ecosystems and the relationship between sustainable development and care for the environment. That is, there is still a way to go.

Barrier	*Barriers related to land tenure, property, inheritance and property rights*

Lack of adequate land tenure evidence and documentation to support tenure security

In the Colombian Orinoquía, about 46% of the properties are presumed informal, which indicates that they meet at least one of the criteria established for their identification. At the departmental level, the department of Vichada is the one with the highest presumption of informality, being in the range of 50% to 75%, while the other three departments are in the range of 25% to 50%.[17]

[15] National Development Plan 2018-2022National Planning Departmenthttps://colaboracion.dnp.gov.co › CDT › Press

[16] The Orinoquia already has a Comprehensive Regional Plan for...Ministry of Environment and Sustainable Developmenthttps://archivo.minambiente.gov.co › index.php › 285...

[17]Summary of the diagnosis of the distribution and ownership of rural land in the ORINOQUIA regionhttps://upra.gov.co/Kit_Territorial/2-%20Informaci%C3%B3n%20por%20Departamentos/ARAUCA/Diagnostico%20distribucion%20tenencia%20tierra%20rural%20Orinoquia%20-%20ARAUCA.pdf

3.3.2.3 Elimination of land use scenarios that are impeded by the identified barriers

Land use alternatives	Barriers	Barrier type	Result of barrier analysis
Continuation of the pre-project land use scenario	NO	-	Taking into account the description of the barriers mentioned above, in comparison with the land use scenarios identified in substep 1a, one of the most probable land use alternatives to define the baseline of the project (different from the project activity), is the continuation of the previous land use, given that none of the barriers prevent the continuity of the activities that have historically been developed in the territory, that is, constant degradation. **Result: Continue**
Reduction of deforestation and forest degradation within the project boundaries carried out without being registered as a BCR project activity.	YEAH	Investment Social	**Investment:** Without the availability of investment capital, the transition from current productive activities to those that do not affect natural cover does not occur. **Social:**Considering the economic dependence that current population groups have and that this promotes the development of activities that generate the transformation of areas, if the population does not have a financial mechanism that allows counteracting this dependence, it is unlikely that economic alternatives will be developed that offer income opportunities and mitigate the negative environmental impact. **Results: Delete**

3.3.2.4 Substep 2c Determination of the reference scenario

Scenarios that are not impeded by any barrier	Base scenario?

Continuation of the pre-project land use scenario	Yes: Since the list of probable scenarios does not include the implementation of activities to reduce deforestation and forest degradation without being registered as a BCR 0002 activity and there is only one scenario that is not prevented by any barrier, then this is considered a base scenario.

3.4 Additionality

https://biocarbonstandard.com/tools/additionality.pdf.

3.4.1 Step 4 Analysis of common practice activities BCR 0005:

Practices such as sustainable livestock farming, tree planting in natural savannahs, pasture rotation and conservation of natural savannahs are not yet common in the Altillanura region of the departments of Casanare, Meta and Vichada. This reinforces the additionality of the project.

Sustainable livestock farming and pasture rotation: Although some model farms have implemented sustainable livestock farming practices in savannahs, such as the Tréquina farm in Arauca, where rotational grazing and the use of native forage species are promoted, these practices are not yet widely adopted in the Altillanura region. Many livestock activities in the Orinoquía continue to be extensive and have negative impacts on soils and biodiversity, contributing to the degradation of ecosystems.[18]

Planting trees in natural savannas: The implementation of silvopastoral systems, which involve planting trees in natural savannahs to improve forest cover and provide shade for livestock, is an emerging practice but not widely implemented in the region. These systems are mainly developed through pilot projects in specific areas, such as flooded savannahs, and are not part of traditional livestock practices in the Altillanura, where extensive livestock farming continues to dominate.[19]

Conservation of natural savannahs: Although efforts are being made to conserve natural savannahs through livestock reconversion and productive conservation initiatives, these activities are not yet the norm in the Altillanura. Conservation integrated with

[18] https://cipav.org.co/sdm_downloads/sabanas-inundables/
[19] https://www.contextoganadero.com/cronica/trequina-un-modelo-de-ganaderia-sostenible-en-sabanas-inundables

production is a recent approach that has not achieved widespread adoption in the region, where agricultural expansion remains a constant threat to these ecosystems.[20]

On the other hand, in section 2.3.4. Economic Activities and Their Importance shows that the main economic activities in the region correspond to activities that involve change in land use of natural savannah lands, such as rice, corn, palm crops or clean pastures.

In conclusion, the activities proposed for the natural savannah in the mitigation project are not common in the region, which justifies their additionality. Sustainable livestock farming practices, tree planting, pasture rotation and savanna conservation are still in the early stages of adoption, reinforcing the innovation and impact of the project in the Altillanura region.

3.4.2 step 4 Analysis of common practice activities BCR 0002

Zero Deforestation Agreements: Although there are initiatives such as Zero Deforestation Agreements in sectors such as palm, livestock and cocoa, their implementation is still limited in terms of coverage and effectiveness. For example, in the livestock sector, only 20% of the market is covered by zero deforestation agreements, and these agreements focus on aspects of production traceability rather than on the effective reduction of deforestation on private lands in the mountains. This context shows that zero deforestation agreements on private lands like those in the project are innovative and are not part of common practices in the region.[21].

Prevention of forest fires and use of alternative energies: In the Orinoquía, forest fires are a constant threat, but preventive actions are still in early stages of development and are not part of a widely adopted approach in territorial management practices. Likewise, the use of alternative energies for cooking, such as replacing forest firewood with cleaner energies, is an emerging activity, but its implementation is limited and is not widespread at the level of small farms or private farms.[22]

Forest governance and knowledge management: Forest governance activities on private lands in the mountains are scarce. Although there are specific initiatives to strengthen local capacities, knowledge management and the implementation of organized forest governance systems are not common, especially in territories where private property

[20] https://www.elespectador.com/ambiente/bibo/producir-y-conservar-el-caso-de-la-ganaderia-en-las-sabanas-inundables-de-la-orinoquia/

[21] https://www.elespectador.com/ambiente/bibo/acuerdos-cero-deforestacion-la-apuesta-por-producir-protegiendo-la-biodiversidad/

[22] https://cerodeforestacioncolombia.co/

predominates. This gap in management and governance reinforces the innovation of the activities proposed in the project.[23]

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

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

"Article 37 Criteria for Additionality of Sectoral GHG Mitigation Projects: Those reductions in GHG emissions or removals that the owner of the Sectoral GHG Mitigation project demonstrates that would not have occurred in the absence of the GHG Mitigation initiative, and that generate a net benefit to the atmosphere with respect to its baseline, are considered additional."

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

- In this sense, it is clarified that ORINOCO2 P2 is an emissions reduction project.

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

In this sense, the project verifies with each of the property owners that the areas linked to the project are not within any compensation commitment for the biotic component. Additionally, the cartographic base information provided by Ecopetrol was corroborated.

"Reductions in GHG emissions or removals as a result of presentation and restoration activities in strategic ecosystem areas for which payments for GHG reduction and capture environmental services are accessed will not be considered

[23] https://medioambiente.uexternado.edu.co/politica-de-deforestacion-en-colombia-conpes-4021-de-diciembre-de-2020/

additional in accordance with the provisions of Chapter 8 of Title 9 of Part 2 of Book 2 of Decree 1076 of 2015."

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

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

3.5 Uncertainty management

Under the guidelines of the BCR 0002 (section 13.1) and BCR 0005 (section 12) methodologies, "Uncertainty management is determined by the precision of the maps used to estimate activity data and the application of discounts in emission factors."

For activity data, a precision greater than 90% is required in the maps used. In this context, maps of non-forest forest of national origin in the reference region were used for the REDD+ component. The validation of the non-forest forest maps corresponding to the years 2005, 2019 and 2022 was carried out through AcATaMa, a QGIS plugin designed specifically for this purpose (AcATaMa Instructions; Inventory Design Procedure and the validation of a classification model based on field data). This validation process involves a comparison between the results of the forest-non-forest classifications and a set of reference data, ranging from in situ observations to high-resolution images, or failing that, a resolution higher than those used to generate the classification.

For each year evaluated, AcATaMa generated a confusion matrix that facilitates the calculation of various classification evaluation metrics, including Accuracy, which determines the level of precision achieved in the classification of each of the identified coverages. The accuracy results for the forest-non-forest maps were as follows: Lb 2005 (95.0%), 2008 (94%), Lb 2017 (94.0%), 2018 (95%) and 2022 (96%).

The confusion matrix that facilitates the calculation of various classification evaluation metrics, including Accuracy, was also used in the savannas component, especially in the 2022 land cover map, because the 2012 and 2018 inputs (used to determine eligibility) come from the 2012 and 2018 national land cover maps. Computer-aided interpretation

with contrast from in situ observations and high-resolution images from sensors such as WorldView 2 (Spatial resolution 0.30 m/pixel) and Sentinel 2 (Spatial resolution 10 m/pixel).

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

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

Where:

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

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

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

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

n_i Number of sampling plots in stratum i

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

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

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

3.6 Leaks and lack of permanence

3.6.1 Leaks

*https://biocarbonstandard.com/wp-content/uploads/BCR_risk-and-permanence.pdf*The leak zone was defined as a buffer zone.[24]1 km from the edge of properties and limits of eligible areas. (see section 3.2.1.3 Leakage area)

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

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

3.6.2 Non-permanence

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

These risks are identified and tracked in the monitoring tool. Risk analysis and management Finally, the monitoring of project activities, through verifications, must evaluate the permanence of the project activities.

3.7 Mitigation results

Below (sections 3.6.1 a and 3.6.8) it is demonstrated that the mitigation results, obtained as a consequence of the execution of the project activities, are verifiable within the framework of the ISO 14064-3:2019 Standard. In this sense, strict use is made of the guidelines and criteria established in section 13 (reduction of GHG emissions from

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

REDD+ activities) of the BCR 0002 methodology and section 11 Quantification of the reduction of GHG emissions of the BCR 0005 methodology.

3.7.1 Eligible areas within GHG project boundaries

3.7.1.1Eligible areas of activities BCR 0005

*BCR*To identify eligible savanna areas, it is shown that the geographic limits of the project correspond to the savanna biome and correspond to the Los Llanos Ecoregion, according to the WWF classification.[25](geodatabase_savannahs\Biome_Ecoregion).

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

According to the BCR 0005 methodology, the covers identified as 3.2.1 are considered natural savannahs. grasslands and 3.2.2. Thickets. In this order, the savanna coverage for the year 2012 and 2018 is identified. Eligible areas are considered to be those areas that have remained in the aforementioned categories at the beginning of the project activity and five years before the start date of the project (geodatobase_sabanas\Project_Area)

3.7.1.2 Eligible areas of activities BCR 0002

The REDD+ eligible areas of the project correspond to the stable forest that is within the boundaries of the properties for a period of at least ten years prior to the start date of the project (Geodatabase_REDD+\Project_Areas). According to the definition of forest adopted by Colombia and used by the SMByC, that is, lands occupied mainly by trees that may contain shrubs, palms, guaduas, grasses and lianas, in which tree cover with a minimum canopy density of 30% predominates. A minimum in situ canopy height of 5 meters at the time of identification and a minimum area of one hectare (IDEAM, 2014)[26]. To identify the forests present on the properties, the classification process was generated through the Google Earth Engine (GEE) platform with images from the Landsat constellation, which has a spatial resolution of 30 meters/pixel, Temporal resolution—revisit time of 16 days.

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[25] WWF, 2012. Terrestrial ecoregions of the world. Available in: htpps://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world

[26] IDEA (2014a). Monitoring of the area covered by natural forest. Obtained from IDEAM:http://www.ideam.gov.co/web/ecosistemas/superficie-cubierta-por-bosque-natural?p_p_id=110_INSTANCE_dqBGIv6hKQrD&p_p_lifecycle=0
&p_p_state=normal&p_p_mode=vista&p_p_col_id=columna-2&p_p_col_pos=1&p_p_col_count=2&_110_INSTANCE_dqBGIv6hKQrD_struts_action=%2Fdo

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

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

Once the different satellite images are obtained, they are merged to create a mosaic on which the analysis will be carried out. Forest classification using digital image processing (DIP) requires training samples/observations to distinguish between forest and non-forest areas. To do this, training areas are verified through field observations, high resolution images (WorldView 2, Geoeyes, Planet) and visual interpretation.

The random forest algorithm[27]It is used to classify forest and non-forest mosaics.[28]from the training samples. Random Forest is a supervised learning technique that generates multiple decision trees (group of observations or random training samples) on a set of training data, the results obtained are combined to obtain a single, more robust model.

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

Finally, after review and supervised adjustment, the model is validated for each year using the AcATaMa plugin of the QGIS software (REDD+\AcATaMa Geodatabase). Validation using the AcATaMa plugin constitutes a fundamental measure to verify the

[27] *Breiman, L. (2001). Random forests. Machine Learning, 45, 5-32 https://doi.org/10.1023/A:1010933404324.*
[28] *https://developers.google.com/earth-engine/apidocs/ee-classifier-smilerandomforest*

coherence and precision of the classification, reinforcing the integrity of the results obtained during the process

3.7.2 Stratification

The project is divided into two components according to the methodologies and coverage to be managed for forest and natural savannah, respectively: 1. Natural savanna, 2. Natural forests. Natural savannas are not stratified and forests are stratified according to the national reference level between Edge forest and Core forest.

3.7.2.1 Forest Stratification - Deforestation

The Forest is stratified according to the methodology included in the NREF for the period 2023-2027[29]. An approach based on morphological analysis is used using Morphological Spatial Pattern Analysis (MSPA) algorithms.

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

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

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

The MSPA algorithm was run with the following parameters:

- **Connectivity:**8
- **Border Width:**4 pixels (120 meters)
- **Transition:**1

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

- **In the background:**1

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

Table 31. MSPA Post Stratification

Original MSPA class	Post Stratification
Core	central forest
The same	edge forest
curls	edge forest
Bridge	edge forest
Drilling	edge forest
Should	edge forest
Rama	edge forest

Fountain: Cataruben Foundation, 2025.

In this way, the natural forest or forest area is stratified thanks to the MSPA algorithm into Core Forest and Edge Forest. Cartographic information is found in 1.1.2.1. Geodatabase REDD+ Feature Dataset Reference Region, Project Areas and Leakage Areas. The 2010 and 2020 national forest inputs and stratification according to MSPA are included. 1.1.2.1.1 MSPA Stratification. In each folder are the parameters and a folder called bnb_2005_ttb_mspa that contains the stratification.

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

3.7.2.2 Forest Stratification - Degradation

After stratification of the core and edge forest areas, using the MSPA (Morphological Spatial Pattern Analysis) spatial analysis algorithm, a multi-temporal analysis was carried out both in the reference region and in the project areas for the period in question, with the objective of quantifying forest degradation. This analysis allowed us to precisely

identify the areas where the core forest transforms into edge forest, indicating forest degradation processes. On the other hand, those areas where the core or edge forest changes to the "non-forest" category were identified as deforestation.

The analysis carried out in the reference region made it possible to project the degradation rate in the core forest areas within the project. In this context, it is important to highlight what is described in Annex 1.2.1 Project_Emissions, which presents both the areas eligible for deforestation (30,718.3 ha of forest) and the core forest areas that can be degraded to edge forest (9,166.7 ha).

Although both processes share certain characteristics, the key difference lies in the measurement methodology: forest degradation is defined when an area of core forest is transformed into edge forest, but remains classified as "forest" according to "forest-non-forest" maps. On the other hand, when forest cover is completely lost, the area is classified as deforestation.

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

3.7.3 Reference GHG emissions.

To determine the emissions reduction in the reference scenario, data on deforestation activity, forest degradation and land use change in natural savannahs were first established. This was carried out following the guidelines of the methodological documents BCR 0002 version 4.0, sections 13.3.1 and 13.3.2, and BCR 0005 version 1.0, sections 11.2.2 and 11.2.4.

Then, the emission factors were calculated for each component, according to the selected carbon pools (section 3.2.2) and the procedures established in the BCR 0002, section 13.4, and BCR 0005, section 11.3 methodologies.

Finally, to calculate the GHG emissions resulting from the relationship between the activity data and the defined emission factors, the procedures established in sections 13.5 of the BCR 0002 methodology and 11.4 of the BCR 0005 were followed.

3.7.3.1 Reference emissions from Activities BCR 0005 - Sabana Natural

3.7.3.1.1 Activity Data - Natural Savannah

To record the changes in savanna vegetation cover (Grasslands - Shrubs) identified in 2020, the national land cover maps for the period 2012-2020 were used. This was carried out in accordance with the BCR 0005 methodology, item 11.2 Activity data, and from this a coverage change matrix was developed. This matrix is crucial for evaluating and quantifying transformations in land use and vegetation, as it allows accurate and detailed tracking of changes in land cover, enabling a comprehensive assessment of the associated environmental and carbon impacts..

In order to generate a land use classification for each coverage, the coverages and their uses in the reference region area are classified, as shown in the table below:

Table 32. Land use classes by coverage.

LAND USE BY LAND COVER		
LEGEND	LAND USE	
1.1.1. Continuous urban fabric	URBAN	F1
1.1.2. Discontinuous urban fabric	URBAN	
1.2.2. Network of roads, railways and associated land	INFRASTRUCTURE	F2
1.2.4. Airports	INFRASTRUCTURE	
1.3.1. Mining extraction areas	INFRASTRUCTURE	
2.1.1 Other transition crops	AGRICULTURAL	F3
2.1.2.1. Rice	AGRICULTURAL	
2.2.1.1 Other permanent herbaceous crops	AGRICULTURAL	
2.2.3.2. oil palm	AGRICULTURAL	
2.3.1 Clean pastures	MEAL	F4
2.3.2 Wooded grasslands	MEAL	
2.3.3 Weeded grasslands	MEAL	
2.4.1. Crop Mosaic	AGRICULTURAL	F3
2.4.2. Mosaic of pastures and crops	AGRICULTURAL	
2.4.3. Mosaic of crops, pastures and natural spaces	AGRICULTURAL	
2.4.4. Mosaic of grasslands with natural spaces	AGRICULTURAL	
2.4.5. Mosaic of crops with natural spaces	AGRICULTURAL	
3.1.1.1.1. Tall, dense continental forest	FORESTRY	F5
3.1.1.1.2. Dense floodplain forest	FORESTRY	
3.1.1.1.2.1. High dense forest Heterogeneous flood	FORESTRY	
3.1.1.2.1 Dense lowland forest	FORESTRY	

LAND USE BY LAND COVER		
LEGEND	LAND USE	
3.1.1.2.2. Dense low-lying floodplain forest	FORESTRY	
3.1.2.1.1. Tall open continental forest	FORESTRY	
3.1.2.1.2. High floodplain open forest	FORESTRY	
3.1.2.2.2. Low, open floodplain forest	FORESTRY	
3.1.3 Fragmented forest	FORESTRY	
3.1.3.1 Fragmented forest with grasslands and crops	FORESTRY	
3.1.3.2 Fragmented forest with secondary vegetation	FORESTRY	
3.1.4. Gallery and riparian forest	FORESTRY	
3.1.5. Forest plantation	PRODUCTION	F7
3.2.1.1.1. Dense mainland grasslands	SHEET	F6
3.2.1.1.1.1. Dense upland grassland without trees	SHEET	
3.2.1.1.2. Dense floodplain grasslands	SHEET	
3.2.1.1.2.1. Dense floodplain grassland without trees	SHEET	
3.2.1.1.2.2. Dense, wooded floodplain grasslands	SHEET	
3.2.1.2.1. open sandy grassland	SHEET	
3.2.1.2.2. Rocky open meadow	SHEET	
3.2.2.1. dense thicket	SHEET	
3.2.2.2. open thicket	SHEET	
3.2.3. Secondary or transitional vegetation	RESTORATION	F8
3.3.1. Natural sandy areas	RESTORATION	
3.3.3. Bare and degraded lands	RESTORATION	
3.3.4. Burned areas	RESTORATION	
4.1.1. swampy areas	WATER BODIES	F9
4.1.3. Aquatic vegetation in bodies of water	WATER BODIES	
5.1.1. Rivers (50 m)	WATER BODIES	
5.1.2 Natural lagoons, lakes and swamps	WATER BODIES	

Fountain: Catarubén Foundation, 2025.

Once the land cover has been classified by each land use code for the years 2012 and 2020, an intersection of both layers is made to determine the change in use in the reference region during that period, as shown below:After classifying land covers by land use code for 2012 and 2020, both layers are crossed to determine the change in use in the reference region during that period.

Board xx Matrix of changes in land cover and its use

MATRIX OF CHANGES IN LAND COVER											
		Initial coverage/Use classes (2012), area in hectares									
		Yo1	yo2	Yo3	I4	I5	I6	I7	I8	I9	TOTAL
Class Final Exams Coverage (2018)	F1	732	24	59	46	17	70	25	6	2	981
	F2	1	45	0,00	24	7	209	53	0,00	2	341
	F3	228	187	114670	108443	20683	52581	46855	5405	563	349615
	F4	251	148	36523	156389	19959	115008	11988	3737	436	344439
	F5	39	23	202225	33606	612758	122652	4982	14773	4745	995803
	F6	496	1193	112385	287254	183767	2293287	66034	74398	24919	3043733
	F7	0	0	30	250	20	0	0	0	0	300
	F8	4	5	11025	15665	9491	123815	2558	12237	1458	176258
	F9	8	0	3454	678	8209	7968	9	7125	10610	38061
	TOTAL	1759	1625	480371	602355	854911	2715590	132504	117681	42735	3200728

Fountain: Cataruben Foundation, 2024.

3.7.3.1.1.1 Annual historical changes in the project area

Multitemporal analysis of classified savanna cover in the reference region between 2012 and 2020 was used to calculate the projected annual historical change in the project areas. This was achieved by applying the following equation:

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

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

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

Where:

$CSCN_{year}$	Change in the area with natural vegetation cover in the scenario without project; ha/year
t_1	Beginning year of the reference period in which the changes are analyzed
t_2	Last year of the reference period in which changes are analyzed

A_1 Area with natural vegetation cover in the reference region at t1; ha

A_2 Area with natural vegetation cover in the reference region at t2; ha

A_p Eligible project area; ha

The historical average of land use changes in the reference region served as the basis for calculating a natural transformation rate of the savanna of 4.73%. This is equivalent to an average annual change of 4,181.22 hectares in the project area.

3.7.3.1.1.2 Annual historical changes in land use in the leakage area

Historical annual changes in land use in the leakage area are estimated by multiplying the average rate of cover change in the analysis period by the leakage areas within the leakage belt. Using the following formula.

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

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

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

Where:

$CSCN_{f,year}$ Change in the surface with natural vegetation cover in the leak area, in the scenario without project; ha/year

t_1 Start year of the reference period in which the analysis is carried out

t_2 Last year of the reference period in which the analysis is carried out

A_1 Surface covered with natural vegetation in the leak area t1; ha

A_2 Area covered with natural vegetation in the region of the leakage area at t2; ha

A_f Leakage area; ha

The change in coverage of the leaking area, in the absence of the project, is estimated at 1327.8 hectares.

3.7.3.1.2 Emission factors - Sabana Natural

Due to the limited availability of values applicable to the project, own data were used to define the total biomass emission factor in natural savannahs. The methodology used is based on the National Forest Inventory of Colombia (Olarte et al. 2021).

The number and location of sampling points were selected in accordance with procedure FC-GOP-23, "Design of inventories for monitoring biomass growth", section 7.4. This procedure relates the size or area of each ecosystem to the variation in biomass content, established from reference data for the study region (Orozco et.al 2023), using the following equation:

$$n = \frac{S^2}{\overline{and}_{IN}^2 cve^2 + \frac{S^2}{N}}$$

Where:

n	Sample size
S^2	Sample variance
$\overline{and}$	Mean of the guide variable
cve	Sample error (%)
N	Population size. Total number of sampling points within the project boundaries.

Thus, a total of six (6) sampling points were available for monitoring carbon reserves, which were randomly selected in eligible areas of the properties linked to the project (Figure 21, Table 38). Details of the calculations are in the Cluster Calculation Attachments.

Six (6) sampling points were randomly selected in eligible areas of the properties linked to the project for monitoring carbon stocks (Figure 21, Table 38). Details of the calculations can be found in the attached Cluster Calculation file.

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

Add image

Fountain: Catarubén Foundation, 2023.

Tabla xx.Location of the sampling points of the savannah component.

Add table

Fountain: Catarubén Foundation, 2025.

Each sampling unit was established as a group of five circular subplots, each with a radius of 15 meters, organized in the shape of a cross and separated by 80 meters between their centers. This configuration follows the GPP-22 procedure and covers a total area of 3,535 square meters. In the savannas, where there were no trees or shrubs, biomass was calculated from the herbaceous vegetation collected in four quadrats of 1 square meter, located 7.5 meters from the center of each subplot (Figure xx).

Collected herbaceous vegetation samples were sent to the CIAT Analytical Services laboratory. In the laboratory, the samples were prepared and the dry weight of each one was analyzed using gravimetry. The results delivered by the laboratory are attached in Annex 1.2.4. Laboratory results.

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

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

Fountain: Catarubén Foundation, 2025

To calculate the aboveground biomass, a relationship was established between the dry and wet weight data using the information obtained in the field. This relationship was determined using an equation described by IDEAM in 2011.:

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

Where:

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

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

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

Where:

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

Tabla xx.Carbon emission factor in total biomass savannas.

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

Fountain: Cataruben Foundation, 2025

Considering the principles of the BRC V 3.4 standard (Relevance, Precision and Conservative Attitude) and the BCR 005 methodology section 12.1 (Conservative selection of default values), when using default data, the following considerations should be taken into account when selecting the source:

- Values should be as specific as possible, with a selection from the following data sources (in order of priority, highest to lowest):
  1. Local peer-reviewed studies. They must come from areas with climatic and edaphic conditions similar to those of the project area, provided that the most typical, small data sets from local studies are considered sufficiently reliable.
  2. Regional or national forest or GHG inventory for the same ecological zone (i.e. the same broad climatic zone and similar soil fertility and depth).
  3. International or global forest or GHG inventory, including IPCC literature, for the same ecological zone.

In this sense, the project found relevant and precise studies within the reference region

where the project is developed, which can be used.

SOC Xxx Emission Factor Analysis

Scientific article	Data	BCR Compliance
Costa, C. Jr., Villegas, DM, Bastidas, M., Rubio, NM, Rao, I., and Arango, J. (2022). Soil carbon stocks and nitrous oxide emissions from grazing systems in the Orinoquía region of Colombia: potential to develop land-based greenhouse gas removal projects. Front. Climate 4, 916068. Doi: 10.3389/fclim.2022.916068	79.9 tC/ha up to 30 cm.	Adequate data, complies with BCR principles and section 12.1 of BCR 0005.

The study carried out by Costa et al. (2022) on the carbon storage potential of the soils of the Colombian Orinoquia determined a SOC value of 79.9 tC/ha in native savannahs at a depth of 0-30 cm. This value was the one used for the soil organic carbon (SOC) emission factor, defining an emission factor of 12.09 tCO2e/ha for the soil deposit, in order to be conservative in the calculations.

Table 40.Emission factor of natural savannahs

COS*(tC/ha)*	**COS20**(tC/ha)	**Carbon dioxide equivalent in COS***(tCO2e/ha)*	**Carbon dioxide equivalent contained in total biomass***(tCO2e/ha)*	**Total carbon dioxide equivalent***(tCO2e/ha)*
65,94	3,30	14,09	6,51	21,60

3.7.3.1.3 Calculation of Annual Reference Emissions Activities BCR 0005

To calculate annual emissions in the scenario without a project for natural savannahs, the following equation is used:

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

Where:

EA_{lb} Annual issue in the scenario without project; tCO2e/ha/year

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

CBF_{eq} Equivalent carbon dioxide contained in the total biomass; tCO2e/ha

COS_{eq} Soil carbon content; tC/ha

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

3.7.3.2 Reference emissions from BCR 0002 Activities

3.7.3.2.1 Activity Data - Deforestation

The activity data, based on the BCR 0002 methodology, reflects the alterations in the forest surface within the project area and period. Following the guidelines of the BCR 0002 methodology, item 13.3, forest maps from the Forest and Carbon Monitoring System (2005-2017) were used. These maps were stratified into Core Forest and Edge Forest using the MSPA algorithm (see section 3.7.2). To determine deforestation, the Core Forest and Edge Forest areas that became non-forest were identified. The degradation was established by the Core Forest areas that became Edge Forest.

An approach based on historical averages was applied to estimate deforestation activity.

3.7.3.2.1.1 Annual historical deforestation in the project area

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

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

$$CSB_{f,year} = \left(\frac{1}{2017 - 2005}\right) x \left(21679 - 19937\right)$$

$$CSB_{f,year} = 145,17ha$$

Where:

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

*D*Since the period 2023-2027 contemplates the stratification of the forest in Core and Edge areas, the analysis was repeated considering this stratification in the following way

- ***For the central forest layer:***

$$CSB_{R,Core,\,year} = \left(\frac{1}{2017-2005}\right) x\ (40.334\ -\ 33.206)$$

$$CSB_{R,Core,\,year} = 594.00\ ha$$

- ***For the edge forest layer:***

$$CSB_{R,Edge,\,year} = \left(\frac{1}{2017-2005}\right) x\ (179.046\ -\ 164.443)$$

$$CSB_{R,Edge,\,year} = 1,216.92\ ha$$

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

$$CSB_{A,year} = \left(\frac{CSB_{R,year}}{A_{R1}} x100\right) x\left(A_{At}\right)$$

Where:

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

In accordance with the national reference levels, the adjustment for national circumstances was applied to the CSBA, year for the quantification period calculated from the historical average, according to the most conservative scenario of the logistic model developed for this purpose (Ministry of Environment and Sustainable Development – IDEAM, 2020; Ministry of Environment and Sustainable Development – IDEAM, 2024).

The adjustment for national circumstances, based on the most conservative scenario of the logistic model developed for this purpose, was applied to the annual CSBA for the quantification period calculated from the historical average. This was carried out in accordance with national reference levels (Ministry of Environment and Sustainable Development – IDEAM, 2020; Ministry of Environment and Sustainable Development – IDEAM, 2024).

3.7.3.2.1.2 Annual historical deforestation in the leak area

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

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

$$CSB_{f,year} = (\frac{1}{2017 - 2005}) \; x \; (21679 \; - \; 19937)$$

$$CSB_{f,year} = 145,17 ha$$

Where:

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

To project the change in forest cover in the base scenario for the period 2023-2027, the analysis was carried out considering the defined strata: core and forest. Presenting the following values

- **For the core forest layer:**

$$CSB_{f\ Core,\ year} = (\frac{1}{2017 - 2005}) \; x \; (4860 \; - \; 4310)$$

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

- **For the Edge forest layer:**

$$CSB_{f\ Edge,\ year} = \left(\frac{1}{2017-2005}\right) x\ (16819\ -\ 15627)$$

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

The annual change values in the leakage area, calculated from historical averages, represent the expected forest loss in the base scenario.

3.7.3.2.2 Emission factors - Deforestation

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

For the project, the emission factors for deforestation were based on the NREF values for the Orinoquía biome, considering technical specifications such as stratification (Ministry of Environment and Sustainable Development – IDEAM, 2020, 2024). NREF 2024 values were used,

Table 34 Carbon stored in total biomass and detritus

Biome/Strata	Total biomass (t/ha)	Carbon in total biomass (tC/ha)	Carbon in detritus (tC/ha)	Total carbon (tC/ha)
Orinoquía (central forest)	159,58	75,00	4,74	79,74
Orinoquía (forest edge)	104,35	49,04	4,74	53,78

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

Table 35Soil organic carbon (SOC) by stratum

Biome/Strata	COS (tC/ha)	COS20 (tC/ha)
Orinoquía (Forest)	34,73	1,73

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

Table 36 Deforestation emission factors

Biome/Strata	Total carbon (tC/ha)	COS20 (tC/ha)	Deforestation emission factor (tCO2e/ha)[30]

30The emission factor is calculated by converting the value of total carbon and COS20 in tons of CO2e, multiplying them by the stoichiometric ratio between carbon dioxide (CO2) and elemental carbon (44/12)

Orinoquia (central forest)	79,74	1,73	298,76
Orinoquía (forest edge)	53,78	1,73	203,58

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

3.7.3.2.3 Activity Data - Forest Degradation

The guidelines for defining forest degradation activity data were obtained from the NREF proposal (Ministry of Environment and Sustainable Development - IDEAM, 2024). The process of determining forest degradation, which consists of determining the areas of core forest that became Edge Forest, is carried out after the post-stratification process, in which only two categories are defined (Core Forest and Edge Forest) in the Reference Region and the escape areas.

3.7.3.2.3.1 Annual historical forest degradation in the project area

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

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

Where:

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

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

$$DFP_{lb,year} = \left(\frac{1}{2017-2005}\right)x(40334 - (33206 - 6681))$$

$$DFP_{lb,year} = \left(\frac{1}{2017-2005}\right)x(40334 - 33653)$$

$$DFP_{lb,year} = 556,75\ ha$$

3.7.3.2.3.2 Annual forest degradation in the leak area

To estimate the historical degradation in the leak area, the following equation was applied:

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

Where:

$DFP_{lb,f,year}$	Annual primary degradation in the leak area; ha
t_1	Start year of the reference period; year
t_2	Final year of the reference period; year
$A_{core,lb,f}$	Leakage area in the core class in the year of the beginning of the reference period; ha
$A_{core-edge,lb,f}$	Leakage area passing from core to edge in the last year of the reference period; ha

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

$$DFP_{lb,f,year} = \left(\frac{1}{2017-2005}\right)x(4860 - (4860 - 631))$$

$$DFP_{lb,f,year} = \left(\frac{1}{2017-2005}\right)x(4860 - 4.229)$$

$$DFP_{lb,f,year} = 52,58\ ha$$

3.7.3.2.4 Emission factors - Forest Degradation

According to the BCR 0002 V4.0 methodology, the emission factor due to forest degradation is defined from the difference in the average of the total biomass with respect to the transitions between the fragmentation classes; that is, the loss of biomass as part of the transition process from one class to another. Given the proposed methodological deviation (section 3.1.2) and the availability of information on biomass content by fragmentation classes, the emission factor was established for the transition between the core class (intact forest) to the edge class (degraded forest).

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

Table 37.Emission factor due to forest degradation.

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

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

3.7.3.2.5 Calculation of Annual Reference Emissions Activities BCR 0002

GHG emissions correspond to the amount of carbon dioxide (CO_2) to be emitted, as a result of deforestation and forest degradation events, in a scenario without a project. In this way, the procedures applied for its calculation are based on the guidelines of the BCR 0002 methodologies (section 13.5).

3.7.3.2.5.1 Calculation of Annual Reference Emissions - Deforestation

The annual estimate of deforestation in the base scenario is estimated taking into account the following equations:

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

Where:

$EA_{lb,R,year}$	Annual emission in the base scenario in the reference region; tCO2/year
$CSB_{R,year}$	Historical annual deforestation in the base scenario in the reference region; ha
TCO_{2eq}	Total equivalent carbon dioxide; tCO2e/ha.

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

Where:

$EA_{lb,A,year}$	Annual emission predicted in the base case in the project area; tCO2/year
$CSB_{A,year}$	Historical annual deforestation in the base scenario in the project area; ha
TCO_{2eq}	Carbon dioxide equivalent; tCO2e/ha.

and,

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

Where:

$EA_{lb,f,year}$	Annual emission predicted in the base case in the leak zone; tCO2/year
$CSB_{f,year}$	Historical annual deforestation in the base scenario in the leakage area; ha
TCO_{2eq}	Carbon dioxide equivalent; tCO2e/ha.

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

3.7.3.2.5.2 Calculation of Annual Reference Emissions - Forest Degradation

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

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

Where:

$EA_{d,lb,year}$	Annual emission due to degradation, in the base scenario; tCO2/year
$DFP_{lb,year}$	Historical annual primary degradation in the base scenario; ha
$DCBT_{DP}$	Equivalent carbon dioxide contained in the difference in total biomass per hectare in the primary degradation class; tCO2e/ha
$DFS_{lb,year}$	Annual historical secondary degradation in the base scenario; ha
$DCBT_{DS}$	Equivalent carbon dioxide contained in the difference in total biomass per hectare in the secondary degradation class; tCO2e/ha

The annual emissions calculations for the entire quantification period are found in Annex 1. Emissions / 1.2. Quantification of emissions / Annex 1.2.1. Emissions_Project / Sheet 2. Forest_Degradation_LB.

3.7.4 Emissions from GHG projects

*do*To calculate the projected emissions reduction during the project, the BCR 0002 and BCR 0005 methodologies were followed.

First, the activity data of the project scenario were calculated, according to sections 13.3.1 and 13.3.2 of the BCR002 methodology, and sections 11.2.3 and 11.2.5 of the BCR 0005.

The same emission factors detailed in section 3.7.3.2 of this document were then used to calculate GHG emissions in the base scenario.

Finally, GHG emissions were derived from the relationship between activity data and emission factors, following the procedures of sections 13.5 of the BCR 0002 methodology and 11.4 of BCR 0005.

3.7.4.1 Emissions from project activities BCR 0005 - Natural savanna

3.7.4.1.1 Activity Data - Natural Savannah

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

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

Where

$CSCN_{project}$ Change in the surface with natural vegetation cover in the project scenario; ha/year

$CSCN_{lb}$ Change the surface with vegetation cover in the scenario without project; ha/year

$\%DC_{project}$ Projection of decreased changes in coverage due to the implementation of project activities.[31]

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

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

Where

$CSCN_{project,f,yea}$ Change in natural vegetation cover in the leak area, in the project scenario; ha/year

$CSCN_{f,lb}$ Annual change in the area with vegetation cover in the leakage area, in the base scenario; ha/year

$\%AND_{f}$ Percentage of projected increase in emissions in the leak area due to the implementation of project activities.[32]

3.7.4.1.2 Annual issue - Natural Savannah

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

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

Where:

$CSCN_{project,\,y}$ Annual issue in the project scenario; tCO2e/ha/year

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

CBF_{eq} Equivalent carbon dioxide contained in the total biomass; tCO2e/ha

COS_{eq} Carbon dioxide equivalent contained in soils; tCO2e/ha

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

3.7.4.2 *Emissions from project activities BCR 0002 - Deforestation*

3.7.4.2.1 *Activity Data - Deforestation*

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

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

Where:

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

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

3.7.4.2.2 *Annual Emission - Deforestation*

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

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

Where:

$EA_{REDD+project,\ year}$	Annual emission in the project scenario in the project area; tCO2/year
$CSB_{REDD+proy}$	Annual change in forest cover area in the project area, in the project scenario; ha

CT_{eq} Total carbon dioxide equivalent[33]; tCO2e/ha.

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

3.7.4.3 Project Emissions from Activities BCR 0002 - Degradation

3.7.4.3.1 Activity Data - Forest Degradation

The estimation of the projected degradation in the project area was carried out with the following equation:

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

Where:

$DFP_{REDD+project,\,year}$	Annual primary degradation of the project area in the project scenario; ha
DFP_{lb}	Historical annual primary degradation in the scenario without project; ha
$\%DFP$	Projection of decreased degradation due to the implementation of REDD+ activities[34]

3.7.4.3.2 Annual Emission - Forest Degradation

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

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

Where:

$EA_{d,REDD+project,year}$	Annual issue in the project scenario; tCO2/year
$DFP_{REDD+project,\,year}$	Annual historical primary degradation in the project scenario; ha

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

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

$DCBT_{DP}$ Equivalent carbon dioxide contained in the difference in total biomass per hectare in the primary degradation class; tCO2e/ha

3.7.5 *Fugas de GEI.*

Emissions leaks - Activities BCR 0005 - natural savanna

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

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

Where

$CSCN_{project,f,yea}$ Change in natural vegetation cover in the leak area, in the project scenario; ha/year

$CSCN_{f,lb}$ Annual change in the area with vegetation cover in the leakage area, in the base scenario; ha/year

$\%AND_{f}$ Percentage of projected increase in emissions in the leak area due to the implementation of project activities.[35]

To calculate the annual emission in the leak zone, the following equation is used:

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

Where:

$AND_{f,year}$ Annual emission in the leak zone; tCO2e/ha/year

$CSCN_{f}$ Change of land use in the leakage area; ha/year

CBF_{eq} Equivalent carbon dioxide contained in the total biomass; tCO2e/ha

COS_{eq} Carbon dioxide equivalent contained in soils; tCO2e/ha

3.7.5.1 *Emissions leaks - BCR 0002 Activities - Deforestation*

The projected annual deforestation in the leakage area in the scenario with the project was estimated from the following equation:

[35]The use of a default value of 10% is accepted by the BCR 0005 methodology.

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

Where:

$CSB_{REDD+project,f\ year}$	Annual change in the forest cover area in the leakage area, in the project scenario; ha
$CSB_{f,lb}$	Annual change in the forest cover area in the leakage area, in the base scenario; ha
$\%AND_f$	Percentage increase in emissions in the leak area due to the implementation of REDD+ activities[36].

The annual emission from deforestation in the leakage area is calculated as follows:

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

Where:

$EA_{f,year}$	Annual emission in the project scenario in the project area; tCO2/year
$CSB_{f,project,year}$	Projected annual deforestation in the leakage area; ha
TCO_{2eq}	Total equivalent carbon dioxide; tCO2e/ha.

3.7.5.2 Emissions leaks - Activities BCR 0002 - Forest Degradation

To calculate the projected degradation in the leak area, the following equations were used:

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

Where:

$DFP_{f,year}$	Annual primary degradation in the leak area in the scenario with the project; ha
DFP_{lb}	Historical annual primary degradation of the leakage area in the scenario without project; ha
$\%AND$	Percentage increase in emissions in the leak area due to the implementation of REDD+ activities[37]

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

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

[37] In accordance with the BCR 0002 methodology, the use of a default value of 10% is accepted..

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

Where:

$EA_{d,f,year}$	Annual emission in the leak zone; tCO2/year
$DFP_{f,year}$	Annual historical primary degradation in the leakage area; ha
$DCBT_{DP}$	Equivalent carbon dioxide contained in the difference in total biomass per hectare in the primary degradation class; tCO2e/ha

3.7.6 Ex ante project emissions quantification

Year	GHG emissions in the baseline scenario (tCO2e)	GHG emissions in the scenario with Project (tCO2e)	GHG emissions attributable to leaks (tCO2e)	Estimated Net GHG Reduction (tCO2e)
2020	139.883,5	20.592,7	3.530,7	115.761,0
2021	190.127,8	38.049,0	7.582,1	144.496,0
2022	193.514,0	38.455,2	7.582,1	147.476,0
2023	169.690,5	35.596,9	7.582,1	126.511,0
2024	169.690,5	35.596,9	7.582,1	126.511,0
2025	169.690,5	35.596,9	7.582,1	126.511,0
2026	169.690,5	35.596,9	7.582,1	126.511,0
2027	169.690,5	35.596,9	7.582,1	126.511,0
2028	61.213,9	22.581,7	5.401,9	33.230,0
Total	1.433.191,5	297.662,9	62.007,5	1.073.518,0
Annual average	154.939,6	32.179,8	6.703,5	116.056,0

3.7.6.1 ANDEx ante missions Natural Savannahs

Year	GHG emissions in the baseline scenario (tCO2e)	GHG emissions in the scenario with Project (tCO2e)	GHG emissions attributable to leaks (tCO2e)	Estimated Net GHG Reduction (tCO2e)
2020	12.112,2	5.613,5	1.166,6	5.332,0
2021	48.448,9	22.454,1	4.666,6	21.328,0
2022	48.448,9	22.454,1	4.666,6	21.328,0
2023	48.448,9	22.454,1	4.666,6	21.328,0

2024	48.448,9	22.454,1	4.666,6	21.328,0
2025	48.448,9	22.454,1	4.666,6	21.328,0
2026	48.448,9	22.454,1	4.666,6	21.328,0
2027	48.448,9	22.454,1	4.666,6	21.328,0
2028	48.448,9	22.454,1	4.666,6	21.328,0
Total	**399.703,0**	**185.246,0**	**38.499,2**	**175.956,0**
Annual average	**43.211,1**	**20.026,6**	**4.162,1**	**19.022,3**

3.7.6.2 Ex ante Emissions Deforestation

Year	GHG emissions in the baseline scenario (tCO2e)	GHG emissions in the scenario with Project (tCO2e)	GHG emissions attributable to leaks (tCO2e)	Estimated Net GHG Reduction (tCO2e)
2020	124.580	14.947	2.180	107.453
2021	128.914	15.467	2.180	111.266
2022	132.300	15.874	2.180	114.246
2023	108.477	13.015	2.180	93.281
2024	108.477	13.015	2.180	93.281
2025	108.477	13.015	2.180	93.281
2026	108.477	13.015	2.180	93.281
2027	108.477	13.015	2.180	93.281
2028	-	-	-	-
Total	**928.177,2**	**111.363,7**	**17.442,2**	**799.370,0**
Annual average	**100.343,5**	**12.039,3**	**1.885,6**	**86.418,4**

3.7.6.3 Ex ante Emissions Forest Degradation

Year	GHG emissions in the baseline scenario (tCO2e)	GHG emissions in the scenario with Project (tCO2e)	GHG emissions attributable to leaks (tCO2e)	Estimated Net GHG Reduction (tCO2e)
2020	3.191,2	31,9	183,8	2.976,0
2021	12.765,0	127,6	735,3	11.902,0

2022	12.765,0	127,6	735,3	11.902,0
2023	12.765,0	127,6	735,3	11.902,0
2024	12.765,0	127,6	735,3	11.902,0
2025	12.765,0	127,6	735,3	11.902,0
2026	12.765,0	127,6	735,3	11.902,0
2027	12.765,0	127,6	735,3	11.902,0
2028	12.765,0	127,6	735,3	11.902,0
Total	**105.311,2**	**1.053,1**	**6.066,1**	**98.192,0**
Annual average	**11.385,0**	**113,8**	**655,8**	**10.615,4**

4 *Compliance with Laws, Statutes and Other Regulatory Frameworks*

In the process of planning, execution and monitoring of the objectives and goals of ORINOCO2 P2, a project led by the Catarubén Foundation, an analysis of the current national regulations was carried out, since both natural and legal persons are obliged to respect and comply with the set of regulations that regulate individual or community activities within the Colombian territory.

This legislation regulates social, environmental, economic and cultural situations, among others. The laws are modified according to the changes that occur day by day. With this in mind, the information is controlled and updated in a document called <<Legal Regulation Matrix>>(Folder 6.5.1.3.1. Safeguard A). This document is created, organized and updated according to the procedure established in the foundation's document management system, called <<Procedure GJP-14 Management of Legal Requirements>> (Folder 7. Others/annex 7.1), which establishes parameters for its effective compliance within the project areas and their activities.

In addition to complying with applicable legislation, once the eligible project areas have been identified, Cataruben carries out the process of requesting determination and opportunity for prior consultation before the Ministry of the Interior. Through this process, the entity is requested to indicate in writing if there are requests in process regarding the expansion of areas of indigenous communities or a definitive overlap with private lands of the project, in order not to intervene in special jurisdiction processes, since the development of Orinoco 2 is only focused on private areas. If this occurs, these areas would be excluded.

In accordance with all of the above, below are the regulatory provisions that were considered at the time of starting the project.

Table 44. Regulatory provisions of the project.

Area	Norm or law	Features	Compliance
APPLICABLE LEGISLATION ON CLIMATE CHANGE	Decree 2811 of 1974 — Environmental protection	By which the National Code of Renewable Natural Resources and Environmental Protection is dictated	The Catarubén Foundation, in compliance with Decree 2811 that regulates comprehensive environmental management, has adopted a proactive approach and is committed to the conservation of natural forest and savanna ecosystems, as an integral part of the ORINOCO2 P2 project, recognizing the fundamental importance of conserving the natural resources present in the areas linked to the project. It is committed to implementing effective measures to preserve biodiversity, the quality of soil, water and other elements that make up local ecosystems.
	Law 164 of 1994 – Climate Change	United Nations Framework Convention on Climate Change Through which the commitment to adopt measures to reduce GHG emissions into the atmosphere is ratified.	The main objective of the ORINOCO2 P2 project is to develop activities aimed at achieving the goal of reducing deforestation and forest degradation, as well as preventing the transformation of land use into natural savannahs. This initiative proposes to achieve a significant reduction of 1,695,656 tons of CO2 equivalent, during the period 2019-2027. The execution of these activities is aligned with the principles of Law 164 of 1994, reaffirming our commitment to the norms and standards established for the preservation of the environment and the sustainable management of natural resources.
	National Policy for the Comprehensive Management of Biodiversity and its ecosystem services of 1996	Prevent and control the loss and accelerated transformation of Biodiversity, as well as reduce and mitigate the negative effects that it generates on the quality of life.	The implementation of monitoring of globally threatened species and the promotion of actions for their conservation within the framework of the project are concrete manifestations of prevention against the accelerated loss of biodiversity, attributable to the same economic dynamics of the territory.

Area	Norm or law	Features	Compliance
	Forest Policy-Conpes 2834 of 1996	Its general objective is to achieve the sustainable use of forests, in order to conserve them, consolidate the incorporation of the forestry sector into the national economy and contribute to the improvement of the quality of life of the population.	With the implementation of the ORINOCO2 P2 project, conservation activities are carried out on the forest areas identified in each of the private properties formally linked to the project, represented in 33,960.9 hectares, to contribute to joint work to the preservation of these areas and their biodiversity between the project owner and the Ecosystem Manager.
	Law 629 of 2000 - Approval of the Kyoto Protocol in Colombia	Quantification and reduction of greenhouse gases, climate change mitigation strategies	With the implementation of the ORINOCO2 P2 project, the aim is to manage the reduction of emissions by 1,695,656 tCO2e and thus add efforts through the purchase of carbon credits generated by climate change mitigation projects in compliance with law 629 of 2000.
	National Plan for Prevention, Control of Forest Fires and Restoration of Affected Areas of 2002	Strengthen the global response to the threat of climate change by keeping global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and pursue efforts to further limit temperature rise to 1.5 degrees Celsius. Furthermore, the agreement aims to increase the capacity of countries to address the effects of climate change and ensure that financing flows are compatible with low greenhouse gas (GHG) emissions and a climate resilient trajectory.	The implementation of the ORINOCO2 P2 project includes key activities aimed at strengthening the knowledge of private property owners. One of the important focuses of this strengthening is focused on the prevention of forest fires that involve (controlled burning practices, firebreaks, adequate waste management), through these actions we seek to contribute significantly to the protection of the forests and savannahs preserved within the framework of the project.

Area	Norm or law	Features	Compliance
	National policy on climate change, 2016	Strategies and actions to manage knowledge about climate change and its potential consequences on communities, biodiversity, their ecosystem services and the country's economy.	Within the framework of the project's execution, strategies are proposed for the management of climate change, among which are the prevention of forest fires, the monitoring of hot spots, the implementation of landscape management tools, the monitoring of biodiversity and restoration actions for degraded ecosystems. All of these actions are coherently aligned with the national climate change policy.
	Decree 298 of 2016.- National Climate Change System – SISCLIMA.	Establish the National Climate Change System SISCLIMA, in order to coordinate, articulate, formulate, monitor and evaluate policies, standards, strategies, plans, programs, projects, actions and measures for adaptation to climate change and mitigation of greenhouse gases, whose intersectoral and transversal nature implies the necessary participation and co-responsibility of national, departmental, municipal or district public entities, as well as private and non-profit entities.	The related regulations establish criteria for the management of climate change projects, which allow impact not only on the environment, but also on social and economic aspects related to the people who represent the direct actors in their implementation, with a common objective that is the mitigation of Greenhouse Gases. The ORINOCO2 P2 project aligns with this requirement and contributes to this objective, implementing forest and savanna conservation actions on private properties in the departments of Meta and Vichada.
	Decree 926 of 2017- Carbon Tax	By which the heading of Part 5 is modified and Title 5 of Part 5 of Book 1 of Decree 1625 of 2016 Single Regulatory Regime on Tax Matters and Title 11 of Part 2 of Book 2 of Decree 1076 of 2015 Single Regulatory Regime of the Environment and Sustainable Development Sector is added, to regulate the paragraph 3 of article 221 and paragraph 2 of article 222 of Law 1819 of 2016.	The national carbon tax was created through article 221 of Law 1819 of 2016 (Structural Tax Reform) in response to the country's need to have economic instruments to encourage compliance with Greenhouse Gas (GHG) mitigation goals at the national level. The ORINOCO2 P2 project is aligned with this legal requirement, as it seeks to contribute to climate change through 146 private properties where activities will be carried out to contribute to the fulfillment of the objectives of reducing the effects of Greenhouse

Area	Norm or law	Features	Compliance
			Gases (GHG) and thus, open the possibility that all people who must incur the carbon tax can compensate it in accordance with what is permitted by law.
	Decree 298 of 2016 - National Climate Change System	By which the organization and operation of the National Climate Change System is established and other provisions are dictated	The ORINOCO2 P2 project is aligned with what is established by the national climate change system (Sisclima) and guarantees compliance with the national climate change policy through the active and effective participation of civil society.
	Law 1844 of 2017- Paris Agreement	Colombia adopts the Paris agreement for all countries that are part of it	In accordance with the goals established for the reduction of emissions, the non-deforestation of 179,212.3 hectares contractually linked to the project, the empowerment of associated communities, the impact on SDGs 6 and 15 show a clear alignment with the Paris Agreement.
	Law 1447 of 2019 - Monitoring, reporting and verification system for mitigation actions at the national level	Regulate the Monitoring, Reporting and Verification System of mitigation actions at the national level, in relation to the Accounting System for the Reduction and Remopulation of Greenhouse Gas Emissions and the National Registry for the Reduction of Greenhouse Gas Emissions (GHG), which includes the National Registry of Programs and Projects of actions for the Reduction of Emissions from Deforestation and Forest Degradation in Colombia (REDD+)	ORINOCO2 P2 is a project that seeks to mitigate the effects of Greenhouse Gas (GHG) emissions through the development of activities to contribute to the objectives and commitments regarding climate change. This joint work is carried out with property owners, private companies and Ecopetrol as a strategic ally. The reference scenario is the compensations measured in tons of CO2e that would be produced during the monitoring period. The project is aligned with the provisions of Law 1447, given that it is aligned with the guidelines established there regarding REDD initiatives and contributes to the goals and objectives of climate change. This initiative will be registered in RENARE once it comes into operation, through which control is kept of all the information regarding the development of these projects at the national level.

Area	Norm or law	Features	Compliance
	Law 1931 of 2019 - Guidelines on Climate Change	It establishes guidelines, mainly in actions to adapt to climate change, as well as in mitigation of greenhouse gases, with the objective of reducing the vulnerability of the population and the country's ecosystems to its effects and promoting the transition towards a competitive, sustainable economy and low-carbon development.	Taking into account that the ORINOCO2 P2 project has 146 owners of private properties that guarantee the reduction of emissions on their properties, Law 1931 is complied with, which establishes that all natural or legal persons have the responsibility of participating in the management of climate change and developing their own actions to contribute to its management; These owners linked to the Catarubén Foundation carry out actions to adapt and mitigate greenhouse gas emissions.
	CONPES 3918 of 2019-Strategy for the Implementation of the Sustainable Development Goals (SDG) in Colombia	Consolidate sustainable alternatives for production, conservation, recovery of goods, ecosystem services and improve the management of information on the state and pressures of the resource forestry, for the development of actions aimed at the administration and sustainable management of the country's forests.	The ORINOCO2 P2 project complies with and is aligned with the guidelines established in the regulatory document of goals against climate change, the environment and the Sustainable Development Goals (SDG) in Colombia. This document, which establishes clear guidelines for achieving environmental and development objectives, serves as a fundamental reference for our approach and implementation of each of the activities established in the project.
	Law 2169 of 2021 - Carbon Neutrality	Through this standard, minimum goals and measures are established to achieve carbon neutrality, climate resilience and low-carbon development in the country in the short, medium and long term, and other provisions are dictated.	ORINOCO2 P2 during the development of the project activities implemented by the Catarubén Foundation and Ecopetrol as a strategic ally, contributes significantly to the fulfillment of the goal set in Law 2169 throughout the Colombian territory, according to which a 51% reduction of greenhouse gas emissions caused by different aspects, including the consumption of fossil fuels, coal mining, electric energy, etc., must be generated by 2030. These reduction activities must be measured and monitored, for which a system will be established that allows it.

Area	Norm or law	Features	Compliance
	Resolution 849 of 2022 - Comprehensive Management Plans for Territorial Climate Change - PIGCCT	Establish the "Guide for the formulation and implementation of Comprehensive Management Plans for Territorial Climate Change – PIGCCT"	Resolution 849 addresses fundamental aspects such as the analysis of vulnerability to climate risk, strategies to achieve carbon neutrality in the short, medium and long term, the development of mitigation scenarios, the development of measures and actions to be implemented in the territory for each of the local authorities; The project develops a matrix of social and economic environmental risks to measure and mitigate the impacts caused by the project in the territory, at the same time generating a base scenario based on the temporal and spatial history of the ORINOCO2 P2 project.
SOFTWARE	Law 2294-2023 NATIONAL DEVELOPMENT PLAN 2022-2026 "COLOMBIA WORLD POWER OF LIFE	Lay the foundations for the country to become a leader in the protection of life through the construction of a new social contract that promotes the overcoming of historical injustices and exclusions, the non-repetition of conflicts, the change in our relationship with the environment and a productive transformation based on knowledge and in harmony with nature. This process must lead to total peace, understood as the search for an opportunity so that we can all live a dignified life, based on justice; that is, in a culture of peace that recognizes the sublime value of life in all its forms and that guarantees the care of the common home.	During the first monitoring period (2019-2022), the ORINOCO2 P2 Project has implemented activities in accordance with the special protection and territorial planning figures established. These actions have been fundamental to advance our conservation and sustainability objectives. However, in order to remain aligned with the most recent standards and evolutions in territorial planning guidelines, the project has decided to consider reviewing updates to the monitoring reports. These updates will focus mainly on the changes or modifications of the municipal Development Plans and the Action Plan of the CAR (Regional Autonomous Corporation), thus guaranteeing that our activities remain consistent with current policies and regulations, with which the ORINOCO2 P2 project reaffirms its commitment to environmental management.

Area	Norm or law	Features	Compliance
	Forest Policy Territory of Life 2019	Comprehensive Strategy for the Control of Deforestation and Forest Management, as an intersectoral policy instrument that involves the co-responsibility of the different sectors of the Colombian State, with the purpose of stopping deforestation and forest degradation, addressing the complexity of the causes that generate it, starting from recognizing the strategic significance of these ecosystems for the country, for their sociocultural, economic and environmental importance, for their potential as a development option within the framework of the peace-building process, and for their contribution to mitigation and adaptation to climate change.	ORINOCO2 P2 is aligned with the strategy of forest territories of life, they already share the general objective of contributing to the sustainable development and preservation of natural forests, in addition to strengthening the knowledge of the owners of the properties linked to ORINOCO2 P2, on forest governance, environmentally sustainable activities, in order to conserve the existing ecosystems on each property and join efforts in the mitigation of Greenhouse Gases (GHG).
	Colombia Nationally Determined Contribution (NDC) Update - 2020	The NDC incorporates three components: i) Greenhouse Gas (GHG) mitigation, ii) adaptation to climate change, and iii) means of implementation as an instrumental component of policies and actions for low-carbon, climate-adapted and resilient development.	The NDC is a document in which countries assume roles and strategies to reduce greenhouse gas (GHG) emissions and confront climate change; In the implementation of the ORINOCO2 P2 project, its main function is to reduce Greenhouse Gas (GHG) emissions and promote carbon absorption, including activities or strategies in sectors such as renewable energy, energy efficiency, reforestation, sustainable forest management, strengthening forest governance, impact on local communities regarding the activities they carry out on their properties and other efforts to reduce greenhouse gas emissions.

Fountain: Catarubén Foundation, 2025.*Carbon ownership and rights*

4.1 Holder of the project

Individual or organization	**CATARUBEN FOUNDATION**
contact person	María Fernanda Wilches Fonseca
jin position	General manager
ADDRESS	Race 20 #36-04
Phone number	
Email	ORINOCO2@cataruben.org; gerencia@cataruben.org

4.2 Other project participants

Individual or organization	
contact person	
jin position	
ADDRESS	

Phone number	
Email	

4.3 Agreements related to carbon rights

The project areas correspond to private properties with identifiable owners as described in the land ownership section, with whom a contract has been signed to bind the project. Each agreement contains:

- Object
- Contract and project duration
- GHG project name
- Responsibilities, obligations and rights of each of the signatory parties
- Signatory parties to the agreement
- Agreements for the parties according to the parameters established by the Biocarbon Standard
- Notifications

Agreement that was previously socialized with each of the project participants, ensuring that they agree with the management of carbon rights. In it ANNEX 2.1 PROPERTY DOCUMENTS The documents for each property are found. Within which are the legal documents that demonstrate the ownership and rights over the carbon of each one.

4.3.1 No Origin of the Prior Consultation

A layer overlap analysis was carried out between the project areas and the areas of indigenous reservations, black communities and other collective communities, which determined that the project is only developed within the limits of private properties. However, to ensure that the project areas are not within the territory, certification of non-origin was requested. Certificate of determination of origin and opportunity for prior consultation for the execution of projects, works or activities, before the Ministry of the Interior. (ANNEX 2.2. NOT FROM PRIOR CONSULTATION)

4.4 Land tenure (Projects in the AFOLU sector)

The Catarubén Foundation's legal team carried out a study of the ownership of each property based on the documentation provided by each owner. It was established that all project participants certify the ownership of the land on the formally linked properties, where the project areas are located and project activities are monitored. This analysis is detailed in a document called "Title Study" that contains information on both the property and its owner.

Every time the project is verified, the current state of land ownership is monitored and followed up to check if there has been any modification or if, on the contrary, it remains in its initial state. To do this, the update of the Certificate of Tradition and Freedom or document that determines the ownership, possession or tenure of the property is requested. In the ANNEX 2.1 PROPERTY DOCUMENTS folder, within each property folder, there is the "LEGAL DOCUMENTS" subfolder where the legal documents that prove ownership of the land and the analysis document carried out where the percentage of participation of each type of property identified in the group of linked properties can be validated. *Adaptation to climate change*

*BCR Standard**Risk management*

Based on the BioCarbon Standard, section 14 Risk Management and Permanence and Risk Management tools, Version 1.1 of March 19, 2024, section 4 Reversal Risk Management, in addition to the Sustainable Development Safeguards Tool (SDSs Tool), Version 1.0 of April 2024; The project evaluated the risks related to the implementation of the activities in the environmental, financial and social dimensions.

From an environmental point of view, the possible natural and anthropogenic risks that GHG mitigation actions may face were identified and measures to mitigate them were determined.

From a financial point of view, potential risks related to expected costs and investments, as well as project cash flows, were identified and the necessary measures to mitigate them were defined.

From the social point of view, the risks associated with the participation of local communities and interested parties (Ecopetrol) in the activities of the concerted project, in the medium and short term, were determined.

The risk assessment was carried out based on the PMBOK (Project Management Fundamentals Guide) and considered mitigation measures, within the framework of adaptive management. This means that project actions can be adapted to future conditions to ensure achievement of project objectives, reducing uncertainty in generating results. To this end, a re-evaluation of these risks will be carried out in each verification period.

Tabla xx.Risk classification system.

Classification (Probability x Impact)	Risk classification	
	Value	Level
9	3	High
6	3	High
4	2	Half
3	2	Half
2	1	Low
1	1	Low

Fountain: Catarubén Foundation, 2023.

The Sustainable Development Safeguards Tool (SDSs Tool), Version 1.0 April 2024, developed by BioCarbon Standard, was used to improve the risk analysis. This tool allowed the identification of additional environmental, financial and social risks that are important for the project. The impact of each event was evaluated, taking into account its potential to affect the fulfillment of project activities and the reduction of emissions.

The probability of environmental risks was determined from official sources (IDEAM, UNGRD, Colombian Geological System) and analysis of deforestation, degradation and transformation of forests. The probability of financial risks was based on the project's financial model, market trends and Cataruben's experience. A workshop with Ecopetrol raised the risk analysis. The probability of social risks was estimated from the historical and social context of the communities, observations during the socialization of the project and the social and cultural dynamics identified on the properties, evidenced in questionnaires. The 2023 Displacement Report was used to assess displacement risk.

The impact was calculated considering the effect that the materialization of the risk would have on the execution, sustainability of the project and the generation of carbon credits. To interpret the evaluation, the tool establishes that a high risk means that the reversal risk associated with the variable can impact more than 10% of the carbon

benefits accumulated by the project until the moment of verification. A medium risk represents a reversal risk of releasing between 5% and 10% of the VCCs issued, and a low risk represents the risk of releasing less than 5% of the VCCs. Every risk classified as medium or high includes a mitigation measure and is monitored.

Table 50. Risk management

Cod	Dimension	Risk	Impact (I)	Probability (P)	Rating (IxP)	Value	Qualification	Mitigation actions
A1	Environmental	Catastrophic Fires, of natural or anthropogenic origin	3	3	9	3	High	1. Design of project activities involving fire management education 2. Execution of forest fire prevention measures, 3. Preventive monitoring of project activity in summer (Early warnings)
A2	Environmental	Mass removal events, landslides or floods	1	1	1	1	Low	
F1	Financial	Emerging regulation, regulations or changes in established standards or methodologies New conditions for the management of carbon projects	2	2	4	2	Half	1. Constant monitoring of applicable regulations, regulations and national standards. 2. Project design with an adaptive model involving the owners, Catarubén and the strategic ally in such a way that it can adapt to the circumstances.
F2	Finance	Lack of resources to implement, validate and verify the project	3	2	6	2	Half	1. Design of a project activity based on the search for a strategic ally that allows generating the enabling conditions of the Monitoring, Reporting and Verification system
F3	Financial	Increase or decrease in the price of the carbon certificate that exceeds or is lower than the expected cost per ton in the future. (sensitivity to market prices).	3	1	3	1	Low	
F5	Financial	Possible overlaps not compatible with other climate change mitigation initiatives	3	2	6	2	Half	1. Register on the RENARE platform 2. Search and track carbon program databases
S1	Social	Lack of security in land tenure and, consequently, property and carbon rights	2	2	4	2	Half	1. Legal analysis of carbon ownership and rights prior to verifications

S2	Social	Increase in conflicts between indigenous communities and private owners, due to non-compliance with project activities	2	2	4	2	Half	1. Generation of spaces for dialogue with indigenous communities near the project areas
S3	Social	Little active participation of property owners in project activities	3	2	6	2	Half	1. Liability agreements clearly set out in binding contracts
S4	Social	Disputes over land tenure or claims about participation mechanisms (tutela, (demands, prior consultations)	2	1	2	1	Low	
S5	Social	Forced displacement due to security conditions	2	1	2	1	Low	
S6	Social	Materialization of facts contrary to ethics and compliance (bribery, deception, others) in the project.	3	1	3	1	Low	
S7	Social	Loss of efficient communication between project participants	3	2	6	2	Half	1. Establishment of a project monitoring platform with access for all project participants. 2. Design of a governance model between the three main actors of the project
S8	Social	Non-permanence of some properties in the project due to a change in economic activity, sale, rental or transaction that generates greater income or dissatisfaction with the project activities	3	2	6	2	Half	1. Establishment of permanence clauses within the binding contract 2. Strengthening the PQRS mechanism 3. Establishment of a governance model between the three project actors

Fountain: Catarubén Foundation, 2024.

The monitoring and evaluation of risks within the framework of management adapted to knowledge can be consulted in the Annex Risk analysis and management. A tool that allows risks to be periodically reassessed and mitigation actions updated within the framework of adaptive management.

4.5 Reversal risk

The BioCarbono Standard establishes a reserve of 20% of verified carbon credits as a mechanism to guarantee risk reversal during the accreditation and verification periods. This reserve, maintained by the project certifier, ensures that conservation areas are not reduced or transformed during the life of the project. The project owner can only access 10% of the reserve in the following monitoring, reporting and verification period.

Among the barriers to the execution of the Cataruben Foundation's climate change mitigation project is the risk of reversal in the project areas. To mitigate this risk, the project contract includes clauses obligating the parties to conserve eligible areas and restrict human intervention. Compliance with these obligations is monitored through on-site visits and/or satellite monitoring, thus guaranteeing the continuous conservation of the area throughout the project.*Loss Event Report*

THAT

5 Safeguards for Sustainable Development (SDS)

The ORINOCO2 P2 project is based on conservation, restoration, sustainable production and generation of economic benefits to achieve positive environmental and socioeconomic impacts.

To ensure positive outcomes, safeguards will be implemented through key tools, such as compliance with the requirements of the Tool to Demonstrate Compliance with REDD+ Safeguards, version 1.1 (January 26, 2023), developed by BioCarbon Standard, and the guidelines of the National Interpretation of Environmental and Social Safeguards for REDD+ in Colombia. These tools allow us to anticipate and mitigate impacts on the rights of communities and the environment during REDD+ activities.

In addition, the criteria of the Sustainable Development Safeguards Tool (SDSs Tool) of the BioCarbon Standard, version 1.1 (July 4, 2024), will be used to comprehensively evaluate the environmental and socioeconomic impacts of the project and ensure that it contributes to the sustainable development of the region.

The Catarubén Foundation will carry out an environmental assessment using the Sustainable Development Safeguards Tool (SDSs Tool), version 1.1 (July 4, 2024), developed by BioCarbon Standard. This tool requires that the impacts of the project be evaluated in terms of land use, efficiency in the use of resources, pollution prevention and management, as well as the components of water, biodiversity, ecosystems and climate change.

To meet these requirements, the Catarubén Foundation will address each component through a specific questionnaire provided by the tool (FDS). Each question will be answered with precision and justification, and the necessary preventive, corrective or mitigation measures will be taken if risks are identified.

The monitoring of these measures will be carried out through the project Monitoring Plan, which will allow a continuous evaluation of the results of the preventive and mitigation actions, providing a clear view of the progress and effectiveness of the actions implemented.

He theThe main objective of this process is to guarantee that all project activities are carried out in a sustainable and responsible manner, both with the environment and with local communities. The results of the environmental assessment will be documented in detail and included in Section 8 of the Monitoring Report, which will be essential to ensure transparency and compliance with national and international guidelines.

The Cataruben Foundation will carry out a socioeconomic assessment using the Sustainable Development Safeguards Tool (SDSs Tool), version 1.1 (July 4, 2024), developed by BioCarbon Standard. This tool assesses project impacts in key areas such as human rights (labour, working conditions, gender equality, women's empowerment), land acquisition, land use restrictions, involuntary displacement and resettlement, indigenous peoples, cultural heritage, community health and safety, corruption, economic impact and forest governance.

To meet these criteria, the Catarubén Foundation will use a specific questionnaire provided by the tool (FDS) to address each component. Each question will be answered with precision and justification. Remedial actions will be implemented for risks related to human rights, and preventive, corrective or mitigation measures will be established for the other components.

The monitoring of these measures will be carried out through the project's Monitoring Plan, which will continuously evaluate the results of the preventive and mitigation

actions. The goal is to ensure that all project activities are carried out in a sustainable and responsible manner with local communities. The results of the socioeconomic assessment will be documented in Section 9 of the Monitoring Report, ensuring transparency and compliance with national and international guidelines.

6 Stakeholder participation and consultation

During the stakeholder identification phase, a database of stakeholders potentially interested in the development of the project was built. Annex 4.1.1 Stakeholders to whom the letter containing information on the project design and the potential impacts identified was sent (Annex 4.1.2 Letters sent). Likewise, an invitation was made to make comments, suggestions or recommendations through official channels (telephone and emails), and if necessary, establish a virtual or in-person meeting if requested. *Summary of comments received*

Once the letters were sent, 1 comments were received via email, which were responded to respectively.*Consideration of comments received.*

Once the letters were sent, 2 comments were received via email, which were responded to respectively. All three comments were due to doubts about the implementation of the project. Annex 4.1.1 Stakeholders Column T and U respectively.Table 51The comments and their consideration are summarized.

Table 51.Comments received

Name	Comment	Considerations
Henry Walforth Sánchez S. Agricultural Operations Manager. Agrocacay SAS	Good day Thank you very much for sharing the document with us. I have two questions. Among the activities developed during the project cycle, I do not see research work that measures carbon capture in reforestation with Non-Timber Forest Products. The issue of monitoring threatened species (IUCN) is	Good afternoon Henry Answering your questions 1. The main objective of the project is the conservation of natural areas based on a REDD+ model (reduction of emissions caused by deforestation and forest degradation), which differs slightly from the AR project type (afforestation or reforestation). 2. The model we manage within the project is that the owners

	planned in the project areas, but it is not seen if there is any type of strengthening for the development of this work. Thank you so much	carry out the conservation activities and, together with us, the monitoring activities. To this end, the Catarubén Foundation carries out periodic monitoring of the project areas, using satellite and sampling. I hope I have clarified your doubts, however, if you require an extension of the project we could schedule a virtual meeting.

7 Sustainable Development Goals (SDG)

BIOCARBON https://biocarbonstandard.com/es_en/ods/ REDD+ Safeguards (For REDD+ projects)

In Colombia, a process of interpretation of the social and environmental safeguards of Cancún began in 2013. From the beginning, this process was part of a literature review that addressed the national regulatory framework and the most relevant international agreements on the matter. Furthermore, thanks to the support of WWF-Colombia, the Forests and Climate/REDD+ program, the Cooperative Fund for Carbon and Forests and the UN-REDD Program, the conditions were generated to develop meetings and work tables that included the most representative rural communities of the national territory, such as indigenous, black and peasant communities.

This process is in continuous evolution, with the participation each year of more strategic actors committed to strengthening respect and application of these safeguards at the national level. The main objective is to guarantee that REDD+ projects do not generate negative social or environmental impacts in the intervention areas. To achieve this, the guide established by the BCR Standard has been used in the tool. Safeguards Tools for Sustainable Development (SDSs Tool), Version 1.0 April 2024.

In line with the above, the project addresses these safeguards following the approach of the document "Social and Environmental Safeguards for REDD+ in Colombia". This document offers a detailed interpretation of fifteen operational and coherent elements for the national context, which guide the activities proposed within the framework of the project. These fifteen elements are grouped into seven safeguards, organized into three major themes: institutional, social and cultural, and environmental and territorial.

(Camacho A, LaraMe and Guerrero, 2017)[38].

Table 53.Thematic organization of Environmental and Social Safeguards for REDD+.

THEMATIC	SAFEGUARDS IN CANCUN	NATIONAL SAFEGUARD ELEMENT
Institutional	Safeguard A	A1. Correspondence with national legislation.
	Safeguard B	B2. Transparency and access to information.
		B3. Responsibility.
		B4. Recognition of forest governance structures.
		B5. Capacity strengthening.
Social and cultural	Safeguard C	C6. Free, prior and informed consent.
		C7. Respect for traditional knowledge.
		C8. Distribution of benefits.
		C9. Territorial rights.
	Safeguard D	D10. Stake.
Environmental and Territorial	Safeguard E	E11. Conservation of forests and their diversity
		E12. Provision of environmental goods and services.
	Safeguard F	F13. Environmental and territorial planning
		F14. Sector planning.
	G Safeguard	G15. Forest control and surveillance to avoid the displacement of emissions.

Fountain: Catarubén Foundation, 2023.

Following this same line, the project activities are based on respecting, attending to and complying with these seven (7) social and environmental safeguards. However, to continue with the positive and compliance approach, in addition to the national reading and interpretation, which focuses on the implementation of policies, measures and affirmative actions that guide the gradual reduction of deforestation and land use change, it is necessary to favor, in parallel, access to material and symbolic benefits to local communities and their territory. (Camacho A, Lara I & Guerrero. 2017). A second document and as the main guide I appeal to the document called "Tool to demonstrate compliance with REDD+ safeguards" Version 1.1 of January 26, 2023 developed by BioCarbon Registry. This text offers clarity in both the indicators and the criteria (the type of evidence) that must demonstrate the percentage of compliance with each of these safeguards in the previously mentioned period, basically representing an articulated

[38] Camacho A., Lara I., Guerrero RD 2017. "National Interpretation of Social and Environmental Safeguards for REDD+ in Colombia" MADS, WWF Colombia, UN REDD Colombia. Bogota Colombia.

approach between the vision of the BCR and the local one. , that is, the context and the individuals that inhabit it (Brigard & Urrutia, 2023)[39].

Starting from the previous context, and the ORINOCO2 P2 project, compliance, addressing and respect for each of the seven safeguards is projected as follows:

Table 54. *Projection of the Safeguarding approach A.*

SAFEGUARD: A "The complementarity or compatibility of the measures with the objectives of the national forestry programs and the international conventions and agreements on the subject"			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
A1 Correspondence with National legislation	**G1**	Improved homeowner income generated by the sale of carbon credits	The activities proposed within the framework of ORINOCO2 P2 must strictly comply with national regulations and international agreements ratified by Colombia. This requirement goes beyond a simple administrative procedure; It requires exhaustive knowledge of the territory to intervene in its environmental, social, economic and political dimensions. The long-term positive impact sought by the project, such as the mitigation of climate change, and the collateral benefits, such as the improvement of the living conditions of the local population, the adoption of conservation as a habit and duty, the preservation of endangered species and the sustainable management of water resources, would be effectively materialized. This approach not only guarantees the legitimacy of the project in the region in accordance with Colombian regulations, but also provides the necessary support to a historically marginalized territory, ensuring a dignified and sustainable stay for its inhabitants.
	G2	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	
	G3	Management of alliances that allow financial generation of the enabling conditions for the validation and first verification of the project	
	G4	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally.	
	G5	Promote the delimitation and signaling in strategic ecosystems and natural protection areas	
	G6	Promote the recognition of conservation areas and figures for the sustainable management of ecosystems	
	R1	Implementation of sustainable management practices for the use of fire for the prevention of forest fires	
	R2	Monitoring of critical points as an early warning mechanism	

[39] Brigard & Urrutia, BioCarbon Registry. 2023. TOOL TO DEMONSTRATE COMPLIANCE WITH REDD+ SAFEGUARDS. Version 1.1. January 26, 2023. Bogotá, Colombia. 20 p.http://www.biocarbonregistry.com

	R3	Promotion of the installation of eco-efficient stoves and wood energy banks	
	B1	Identification and monitoring of HCVs present in the project area	
	B2	Monitor the presence of globally threatened species and take actions to conserve them	
	B3	Restoration actions in degraded ecosystems	
	EG1	Strengthening access and management of financial goods and services with a gender equity approach	

Fountain:*Catarubén Foundation, 2023.*

Table 55*Projection of the Safeguard approach B.*

SAFEGUARD: B **"The transparency and effectiveness of national forest governance structures, taking into account national legislation and sovereignty. Provide transparent and consistent information that is accessible to all stakeholders and regularly updated. Be transparent and flexible to allow for improvements over time. Leverage existing systems, if any."**			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
B2 Transfer and access to information	**G2**	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	Access to information will be guaranteed through a mechanism adapted to the characteristics of the territory to be intervened. Given that the ORINOCO2 P2 reference region covers the departments of Meta and Vichada, a territory with precarious access to traditional means of communication, land access roads in poor condition and considerable distances between municipalities, properties, paths and inspections/paths; Hybrid communication channels must be enabled and created that adjust to the conditions of the territory. Therefore, we have designed the following mechanism: The Transparency and Access to Information Mechanism of the P2 ORINOCO2 is made up of the following tools: a. **Communication system:**A comprehensive communication system will be established that will include various modalities to facilitate the exchange of information, such as telephone lines, email, social networks and in-person attention. These channels will guarantee direct communication with everyone involved in the project and will be designed to ensure easy access to information and promote transparency at all stages of the project.

			b. **Digital platforms:**We will develop digital platforms to offer updated and first-hand information about the project, accessible to all interested parties. These platforms will allow fluid and transparent communication. c. **PQRS System:**This is an essential tool that allows us to receive and manage requests and comments from those interested in the project in a transparent and effective way. This system guarantees that all concerns and suggestions are addressed in a timely and appropriate manner. d. **Governance model:**A governance model will be developed with the aim of promoting the active and meaningful participation of all stakeholders in the project. This model will focus on establishing structures and processes that facilitate collaborative and transparent decision-making, ensuring that all voices are heard and considered in the planning and execution of actions.
B3 Responsibility.	G3	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally.	ORINOCO2 P2 has the responsibility of offering clear information at all stages of the project, from pre-feasibility to the delivery of results. For this last phase, spaces will be established that allow ecosystem managers to know first-hand the impact that the project is having on the reality of their properties and nearby territories. These spaces will be defined with the balanced participation of all parties involved.
B4Recognition of governance structures.			The governance structure can be described as: the instance that related actors have to negotiate, make or execute conscious decisions related to the conservation, use and management of natural resources. For this same reason, ORINOCO2 P2 considers the need to create and consolidate a governance table for the project. This table will be made up of representatives of each of the allies (ecosystem managers, Ecopetrol and Catarubén), and will be the setting for conscious and informed decision-making, and active, equal and symmetrical participation in all aspects that affect the project to a greater or lesser degree.
B5 Capacity strengthening.	EG1	Strengthening access and management of financial goods and services with a gender equity approach	Having the ability to exercise the right to make, execute or negotiate conscious decisions requires clarity of thought and, especially, competent capabilities. Thus, we understand by capacity that prior knowledge, learned and perfected over time, that allows survival in a specific environment. Based on the above, workshops, knowledge exchange or capacity building are proposed as part of the activities so that forest planning is effective. So that ecosystem managers fully understand that this intangible

			good is not represented only by the carbon certificate, but by this change in thinking regarding the environment and the territory itself.

Fountain:*Catarubén Foundation, 2023.*

Table 56*Projection of the Safeguarding approach C.*

SAFEGUARD: C "Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into account relevant international obligations and national circumstances and legislation, and bearing in mind that the United Nations General Assembly has adopted the "United Nations Declaration on the Rights of Indigenous Peoples"			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
C6 Free, prior and informed consent	G2	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	To address this free, full and informed consent, each of the communities or groups that inhabit the reference region (ethnic or creole) of the project must be identified and mapped. And this, to define, delimit and secure its eligible area (strategic ecosystems), without causing environmental, economic or social fabric damage due to the implementation of the activities. In short, this identification and mapping indicates which communities (interested or not in the project) to approach, expose, listen to and clarify the generalities of ORINOCO2 P2, not represented in this way, a misconception of Catarubén.
C7. Respect for traditional knowledge			Indigenous reservations, ancestral territories or collective properties are not considered part of the P2 ORINOCO2, because it is not designed to intervene in the territory of ethnic communities. However, it must be ensured that activities do not trigger collateral damage that affects said groups (directly or indirectly). For this reason, the respective mapping and identification will be carried out, and if necessary, due approaches will be made with the respective traditional authorities, thus guaranteeing respect for their uses and customs, thoughts and territory.
C8. Profit distribution			To be clear that the distribution of benefits is fair and equitable, we must first define and understand the type of benefits to which beneficiaries will have access. Ecosystem managers. And second, that these benefits respond to affirmative measures and actions that will help reduce GHG emissions. Thus, the main benefits are divided into economic (sale of certificates) and symbolic (strengthening of environmental knowledge

			and practices). These agreements will be reached jointly and with the approval of all interested parties.
C9. Territorial rights			The knowledge and recognition of the territory, through not only the identification and mapping of the communities present in it, is complemented with a sociohistorical and cultural analysis. Thus, more precisely recognizing the traditional practices of conservation and administration of local ecosystems, which implies an approach from the activities, where these are the ones that must adjust to the territory and not the other way around, hence the importance of the active, conscious and informed participation of ecosystem managers in the construction of these.

Fountain:*Catarubén Foundation, 2023.*

Table 57*Projection of the safeguarding approach D.*

SAFEGUARD: D "The full and effective participation of interested parties, in particular indigenous peoples and local communities, in the measures mentioned in paragraphs 70 and 72 of this decision"			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
D10. Stake	**G2**	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	Full and effective participation is a right that will be guaranteed by the activities of ORINOCO2 P2. Among them, we can highlight the spaces proposed from the beginning such as (1) consultations with interested parties, socio-environmental characterizations. At this point, local criteria, concerns and ways of thinking are defined. (2) Socialization where doubts are clarified and questions are answered according to the particularities of the project. (3) knowledge exchanges, workshops and capacity building that correspond to scenarios that enable decision-making, agency and most importantly, how these agreements are executed at all levels of ORINOCO2 P2 (4) referring to property implementation plans (PIP). Now, the above, in which it will strengthen the governance model, consolidating itself at the governance table of the ORINOCO2 P2 project. It will represent, in some way, the legitimation of the interested parties through representatives chosen in a clear and impartial manner.
	G4	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally.	

Fountain:*Catarubén Foundation, 2023.*

Table 58*Projection of the Safeguard E approach.*

SAFEGUARD: AND "The compatibility of the measures with the conservation of natural forests and biological diversity, ensuring that those indicated in paragraph 70 of this decision are not used for the conversion of natural forests, but rather serve to encourage the protection and conservation of said forests and the services derived from their ecosystems and to enhance other social and environmental benefits."			
ELEMENT NATIONAL INTERPRETATION	**ID**	**PROJECT ACTIVITY**	**APPROACH**
E11. Conservation of forests and their biodiversity	**G2**	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	The properties linked to ORINOCO2 P2 must be spaces where conservation is an already defined, internalized practice or at least where the conservation intention of the rancher can be evidenced. That is, the project is aligned from the beginning with current environmental regulations, which means that it cannot go against the preservation and care of animal species present in strategic ecosystems. Under this scenario, contingency measures will be developed to address possible impacts on native biodiversity, and in addition, monitoring will be carried out to account for important biological corridors, strengthening the sustainable use of ecosystem services.
	G5	Promote the delimitation and signaling in strategic ecosystems and natural protection areas	
	G6	Promote the recognition of conservation areas and figures for the sustainable management of ecosystems	
	R1	Implementation of sustainable management practices for the use of fire for the prevention of forest fires	
	R2	Monitoring of critical points as an early warning mechanism	
E12. Supply of goods and Environmental services	**R3**	Promotion of the installation of eco-efficient stoves and wood energy banks	So that the activities of the P2 ORINOCO2 can be translated into affirmative actions for the conservation of strategic ecosystems, it is important to ensure that they will not affect in any way, social, environmental or economic, the territory or its inhabitants. Therefore, the proposed activities will ensure the conservation of water flows, biodiversity, etc., projecting possible impacts and addressing them as appropriate.
	B1	Identification and monitoring of HCVs present in the project area	
	B2	Monitor the presence of globally threatened species and take actions to conserve them	
	B3	Restoration actions in degraded ecosystems	

Fountain:*Catarubén Foundation, 2023.*

Table 59*Projection of the safeguarding approach F.*

SAFEGUARD: F "Adoption of measures to address reversal risks"			
ELEMENT	**ID**	**PROJECT ACTIVITY**	**APPROACH**

NATIONAL INTERPRETATION			
F13. Environmental and territorial planning	G2	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	Mitigate or directly cancel the investment risk It is one of the main objectives of ORINOCO2 P2, since it is not enough for the project to comply 100% with its validity period and its goals, if the intervened territory returns to the same level of threat prior to the intervention. Thus, the activities create or become a collective habit, prioritizing that intangible value for conservation, that respect for the environment, and not only the material or economic value.
F14. Sector Planning.	G4	Design and implement a project governance model that allows the sustainability of the project by linking the ecosystem managers, the project owner and the strategic ally.	Being consistent with the previous point, the form of intervention of the activities in the territory, or more specifically in the eligible area, must demonstrate a deep appropriation in the ecosystem manager, the initial agreements, contractual, socialization, spaces for discussion, distribution of economic benefits, etc., would not be sufficient if the change is not structural, but rather the way of linking with the territory can be transformed, at this point, the consolidation of the governance framework gains strength.

Fountain:*Catarubén Foundation, 2023.*

Table 60*Projection of the Safeguard G approach.*

SAFEGUARD: G "The adoption of measures to reduce the displacement of emissions"			
ELEMENT NATIONAL INTERPRETATION	ID	PROJECT ACTIVITY	APPROACH
G15. Forest control and surveillance to prevent the displacement of emissions	G2	Plan to strengthen the technical capacities of the community for the sustainable management and conservation of strategic ecosystem services, fire management to avoid forest fires, sustainable productive systems and landscape management tools.	Greenhouse gas (GHG) leaks are one of the most important obstacles for any climate change mitigation project, however, it is Catarubén's responsibility to create the best strategy, which not only projects where deforestation will move, and although it is not a simple task, several tools can be used such as: forestry and carbon monitoring, early warning systems, community monitoring (between

			neighbors), the transformation of harmful economic practices, etc., apart from generating alliances so that environmental authorities regional, articulate efforts, these are the components of the strategy that will be established.

Fountain:*Catarubén Foundation, 2023.*

In summary, some of the most relevant aspects related to compliance with social and environmental safeguards for REDD+ include compliance with the regulatory framework, free access and transfer of information, full and effective participation of interested actors, conservation and restoration of key ecosystems, respect and recognition of local communities, protection of biodiversity and responsible management of water resources. Each of these safeguards will have a specific section that details the requirements, components, approaches and evidence that demonstrate compliance, adapted to the context, territory and target population.*Special categories, related to co-benefits (optional)*

*BCR STANDARD**Grouped projects (if applicable)*

*BCR STANDARD*It is not a grouped project

8 Another GHG program

BCR STANDARDBIOCARBONBIOCARBON[*https://biocarbonstandard.com/wp-content/uploads/BCR_Standard-Operating-Procedures.pdf*](https://biocarbonstandard.com/wp-content/uploads/BCR_Standard-Operating-Procedures.pdf)Not applicable, the project does not come from other GHG programs, nor is it registered in other GHG programs.

A systematic search of carbon standards was carried out, and it was confirmed that no project area is within another project (see section 15.2 Review of other projects).*Avoid double counting*

The project is framed, accepts and applies the requirements and mechanisms implemented by the Biocarbon Standard defined in the BCR Tool "Avoid Double Counting V2.0.

In this sense, to apply the requirements related to avoiding double counting that depend on the project, specifically in terms of avoiding non-compatible overlaps, the registration procedure in RENARE is carried out in accordance with Resolution 1447 of 2018 article 10. It is the technological platform that aims to manage national information on GHG

mitigation initiatives, however taking into account the state of inactivity of said platform (section 15.1.), projects are also monitored registered in the different registration platforms from the project (section 15.2). *Monitoring plan*

8.1 Description of the monitoring plan

*BCR STANDARD*The monitoring plan adheres to the BCR regulations and the BCR 0005 and BCR 0002 methodological guidelines, and follows the guidelines of the Monitoring, Reporting and Verification (MRV) tool. Monitoring procedures for each project component, along with data and parameters established during validation and ongoing monitoring during verifications, are detailed below.

8.1.1 Monitoring project boundaries and quantifying project emissions reductions/removals

Project boundary monitoring includes monitoring GHG activities and emissions that occur within the project area, as well as identifying any potential GHG emissions that may occur outside the project boundaries as a result of project activities (leakage).

The baseline will be updated 7 years after the start date and every 10 years thereafter. Therefore, monitoring the quantification of emissions will initially be carried out from 2020 to 2027. Likewise, additional data and information to establish the base or reference scenario are detailed in the section *3.7.3 Reference GHG emissions.*

The limits and emissions of the project are controlled following the guidelines of the BCR 0002 and BCR 0005 methodologies. The monitoring process is detailed in section 16.1, Monitoring Project Limits and Emissions. As part of this process, the monitoring tools, the geographic information system (GDB) and the quantification Excel document are updated.

- Annex 1.1. GDB REDD+ AND SABANAS
- Annex 1.2.1. PROJECT EMISSIONS / Sheet 4. EMISSIONS MONITORING

This section also includes the data and information necessary to calculate the reduction in GHG emissions and leakage during the project crediting period. In addition, the procedure for the periodic calculation of the reduction of GHG emissions and leaks is described.

8.1.1.1 Data monitoring of project areas and leaks - Sabanas Naturales

To monitor the geographic limits of the project, constituted by the eligible areas of natural savannas on which the project activities are carried out, remote sensors such as Sentinel and high-resolution sensors such as Planet Images and Worldview-2 will be used, complemented by in situ observations. The detection of changes in eligible areas will be carried out through the application of the Corine Land Cover methodology and the Computer Assisted Interpretation Procedure – PIAO.

The estimation of changes in land use in the project area and the leakage area during the monitoring period is carried out with the following equations:

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

and,

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

Where:

$CSCN_{project,ye}$	Change in the surface with natural vegetation cover in the project area; ha/year
$CSCN_{f,year}$	Change in the surface covered by natural vegetation in the leak area; ha/year
t_1	Year of start of the monitoring period; year
t_2	Final year of the follow-up period; year
A_1	Surface with natural vegetation cover in the project area at the beginning of the monitoring period; ha
A_2	Surface with natural vegetation cover in the project area at the end of the monitoring period; ha
$A_{f,1}$	Surface with natural vegetation cover in the leak area at the beginning of the monitoring period; ha

$A_{f,2}$	Surface with natural vegetation cover in the leak area at the end of the monitoring period; ha

8.1.1.2 Emissions reduction monitoring - Sabanas Naturales

The reduction of emissions due to avoiding changes in land use, in natural savannahs, during the monitoring period is estimated according to the equation:

$$REpros, pm = (t2 - t1)\ x\ (EAlb - EApros, pm - EAf)$$

Where:

REproy, pm	Reduction of emissions by avoiding changes in land use in the monitoring period; tCO2e/year
t2	Last year of the follow-up period
t1	Start year of the monitoring period
EAlb	Emissions derived from changes in land use in the reference scenario; tCO2e
EAproy, pm	Emissions due to changes in land use in the project area during the monitored period; tCO2e
EAf	Emissions due to changes in land use in the leakage area during the monitored period; tCO2e

8.1.1.3 Monitoring of project areas and leaks - Deforestation

The estimation of forest deforestation in the project area and the leakage area during the monitoring period is carried out with the following equations:

$$CSB_{project,\,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{REDD+proy,1} - A_{REDD+proy,2}\right)$$

and,

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

Where:

$CSB_{project,\,year}$	Annual change in forest cover area in the project area; ha
$CSB_{f,\,year}$	Annual change in forest cover area in the escape area; ha
t_1	Year of start of the monitoring period; year
t_2	Final year of the follow-up period; year
$A_{REDD+proy,1}$	Forest area, in the project area at the beginning of the monitoring period; ha
$A_{REDD+proy,2}$	Forest area, in the project area at the end of the monitoring period; ha
$A_{f,\,1}$	Surface in forest, in the escape area at the beginning of the monitoring period; ha
$A_{f,2}$	Surface in forest, in the leakage area at the end of the monitoring period; ha

8.1.1.4 Emissions reduction monitoring - Deforestation

The annual GHG emissions from deforestation in the project area and leakage area are calculated following the equations:

$$EA_{REDD+project,\,year} = DEF_{REDD+project,\,year} \times tCO_{2eq}$$

and,

$$EA_{f,\,year} = (EA_{f,\,year} \times tCO_{2eq}) - EA_{lb,\,f,\,year}$$

Where:

$EA_{REDD+project,\,year}$	Annual emission in the project area; tCO2e/ha
$EA_{f,\,year}$	Annual emission in the leak zone; tCO2e/ha
$DEF_{REDD+project,\,year}$	Annual deforestation in the project area; ha

$DEF_{f,year}$	Annual deforestation in the leak area; ha
tCO_{2eq}	Total equivalent carbon dioxide; tCO2e/ha
$EA_{lb,f,year}$	Annual emission from deforestation in the leakage area in the reference scenario; tCO2e

Finally, the reduction in emissions from avoided deforestation, in the monitoring period, is calculated according to the equation:

$$REDEF, REDD{+}proy = (t2 - t1)\ x\ (EADEF, lb, \text{year} - EADEF, REDD{+}proy, \text{year} - EADEF, f, \text{year})$$

Where:

REDEF, *REDD+proy*	Reduction of emissions derived from deforestation avoided in the monitoring period; tCO2e
t2	Final year of the follow-up period; year
t1	Year of start of the monitoring period; year
EADEF, *lb*, year	Annual emissions from deforestation in the base scenario; tCO2e
EADEF, *REDD+proy*, year	Annual emission of deforestation in the project area during the monitored period; tCO2e
EADEF, *f*, year	Annual emission from deforestation in the leakage area during the monitored period; tCO2e

8.1.1.5 Monitoring project areas and leaks - Forest Degradation

The estimation of forest degradation in the project area during the monitoring period is carried out with the following equation:

$$DFP_{REDD+project,year} = \left(\frac{1}{t_2 - t_1}\right) x \left(A_{core} - A_{core-Edge}\right)$$

Where:

$DFP_{REDD+project,\,year}$	Annual primary degradation in the project area; ha
t_1	Year of start of the monitoring period; year
t_2	Final year of the follow-up period; year
A_{core}	Project surface in the main class, in the year of the beginning of the monitoring period; ha
$A_{core-edge}$	Project area changing from core to edge, in the last year of the monitoring period; ha

On the other hand, the estimation of the degradation in the leak zone is carried out with the following equations:

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

Where:

$DFP_{f,\,year}$	Annual primary degradation in the leak area; ha
t_1	Year of start of the monitoring period; year
t_2	Final year of the follow-up period; year
$A_{core,\,f}$	Leakage area in core class, in the year of the beginning of the monitoring period; ha
$A_{core-edge,\,f}$	Leakage area changing from core to edge, in the last year of the monitoring period; ha

8.1.1.6 Emissions reduction monitoring - Forest Degradation

The estimate of emissions in the monitoring period is estimated from the relationship between the recorded degradation and the emission factors by class, following the equations:

$$EAREDD+proy, \text{ year} = (DFPREDD+proy, \text{ year } xDTBCO2eq,1)$$

and,

$$EAf, \text{year} = (DFPf, \text{year} \; xDTBCO2eq,1)$$

Where:

EAREDD+proy, year	Annual emission in the project area during the monitored period; tCO2e
EAf, year	Annual emission in the project area during the monitored period; tCO2e
DFP REDD+proy, year	Annual historical primary degradation in the project area; ha
DFPf, year	Annual historical primary degradation in the leakage area; ha
Domo 2.1	Equivalent carbon dioxide contained in the difference in total biomass per hectare in the primary degradation class; tCO2e ha-1

Finally, the reduction of emissions due to degradation, in the monitoring period, is estimated according to the equation:

$$REDEG, REDD+proy = (t2 - t1) \; x \; (EADEES, -bb \; \text{year} \; EADEG, REDD+project, \text{year} - EADEG, \text{year})$$

Where:

REDEG, REDD+proy	Reduced emissions due to avoided degradation; tCO2e
t2	Final year of the reference period; year
t1	Start year of the reference period; year
EADEG, lb, year	Annual degradation of emissions in the reference scenario; tCO2e
EADEG, REDD+project, year	Annual degradation emission in the project scenario; tCO2e
Slave, D, year	Annual degradation emission in the leak area during the monitored period; tCO2e

8.1.2 Monitoring the execution of project activities and Co-Benefits

The project activity monitoring plan was created to monitor project activities and additional co-benefit actions. This plan meets the requirements of section 14.2 of the BCR 0002 Methodology and section 13.1.2. of the BCR 0005 Methodology. In this sense,

the activity implementation monitoring tool is created that contains the following information.

- Activity identification
- Indicator identification
- Indicator name
- Type[40]
- Meta[41]
- Unit of measure
- Monitoring methodology
- Monitoring frequency
- Responsible for measurement
- Indicator result in the reporting period
- Documents to support information
- Observations

Activities BCR 0002, BCR 0005 are described in section 2.3.8.1 Design of project activities.

Actions to qualify for the wax palm category are described in section 12. Special categories related to co-benefits. In this sense, the matrix includes the criteria and indicators defined to demonstrate the additional benefits and the measurement of co-benefits and the specific category, as appropriate.

For monitoring, a comprehensive tool is developed that includes project activities and co-benefit actions. The tool differentiates BCR 0002, BCR 0005 activities and co-benefit actions. Procedures associated with the monitoring of co-benefits of the wax palm

[40]Result, product or impact.
[41]Expected value and fulfillment time

category are similar to the monitoring procedures of project activities to ensure articulation and efficiency in the monitoring processes.

Monitoring matrix 6.1 is attached. PROJECT ACTIVITY MONITORING PLAN

8.1.3 Procedures, criteria and indicators to evaluate the project's contribution to the Sustainable Development Goals (SDGs);

The evaluation of the contribution to the sustainable development objectives under the identified indicators will be carried out using the tool defined by the BCR, which is described in section 10. Sustainable development objectives.The contribution to the sustainable development objectives, under the identified indicators, will be evaluated with the tool defined by the BCR, described in section 10: Sustainable development objectives.

- Annex 6.3. TOOL-ODS-2025.XLSX

8.1.4 Quality control and assurance procedures

8.1.5 Verification of field data

8.1.6 Review of information processing

8.1.7 Data recording and archiving system

8.1.8 information related to the evaluation of the environmental impact of GHG project activities;

8.1.9 e) established procedures for the management of GHG emissions reductions or removals and associated quality control for monitoring activities;

8.1.10 the assignment of functions and responsibilities for the monitoring and notification of variables relevant to the calculation of reductions or absorptions of GHG emissions;

8.1.11 The participation of communities, as project participants, in its design and implementation

8.1.12 Detailed information necessary to monitor project activities, evaluate preventive and mitigation results and perform quality control of measurements and quantifications related to the evaluation of the Sustainable Development Safeguards (SDS) tool

8.2 Data and parameters determined in the registry and not monitored during the quantification period, including predetermined values and factors.

Data/Parameter	
data unit	
Description	
Data source used	
Values)	
Indicate what the data is used for (Baseline/Project/Leak Emissions Calculations)	
Justification of the choice of data or description of the measurement methods and procedures applied	

Additional comments	

8.3 Monitored data and parameters

Data/Parameter	
data unit	
Description	
Measured/Calculated/Default:	
Data source	
Value(s) applied	
Indicate what the data is used for (Baseline/Project/Leak Emissions Calculations)	
Monitoring frequency	
Measurement/reading/recording frequency	
Measurement/calculation method (if applicable)	
Quality control procedures applied	

Appendix 1. Summary of post-registration changes.

BCR STANDARD,