



**CO₂Bio 2 PROJECT DESIGN DOCUMENT
PDD**

**MONITORING PERIODS
WETLANDS (2016-2020)
and REDD+ (2018-2020)**

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CHAPTER 1. GENERAL

1. ABBREVIATIONS AND ACRONYMS.

- **CARBON DEPOSITS:** Compartments where carbon is stored in terrestrial ecosystems (above and below ground biomass, dead organic matter including detritus and dead wood, soil organic carbon, as defined in the IPCC guidelines for national GHG inventories.
- **CARBON DIOXIDE (CO₂):** Is the main anthropogenic greenhouse gas that affects the planet's radiative balance. It is also the reference gas against which other GHGs are measured, and therefore has a global warming potential 1.
- **CARBON DIOXIDE EQUIVALENT (CO₂e):** It is the unit of measurement that compares the global warming potential of each GHG to carbon dioxide.
- **GHG EMISSION:** Release of GHG mass into the atmosphere.
- **GHG REMOVAL:** Mass of GHG removed from the atmosphere.
- **GREENHOUSE GASES (GHG):** Are those gaseous components of the atmosphere, both natural and anthropogenic, that absorb and transmit infrared radiation, as defined by the UNFCCC.

- **DEFORESTATION:** Direct or induced conversion of forest cover to another type of land cover in a given period of time.
- **BASELINE:** The scenario that represents the GHG emissions that would occur in the absence of a GHG mitigation initiative.
- **ADDITIONALITY:** A characteristic that allows demonstrating that GHG emission reductions or removals resulting from the implementation of a GHG mitigation initiative generate a net benefit to the atmosphere in terms of reduced or removed GHG emissions.
- **LEAKS:** Net change in anthropogenic emissions from GHG sources occurring outside the project boundary.
- **PERMANENCE:** Longevity of a carbon Reservoir and its stability, taking into account the management and alteration of the environment in which it occurs.
- **PROJECT AREA:** Area in which project activities that demonstrate net climate benefits are implemented.
- **FOREST:** Land occupied mainly by trees, which may contain shrubs, palms, guadua bamboo, grasses and vines, in which tree cover predominates with a minimum canopy density of 30%, a minimum canopy height (in situ) of 5 m at the time of identification, and a minimum area of 1.0 ha.
- **WETLANDS:** According to IDEAM (2010, National Legend Land Covers, Chapter 4) Wetlands: "includes those coverages constituted by waterlogged lands, which can be temporarily flooded and partially covered by aquatic vegetation, located on the marine borders and in the interior of the continent".
- **DEGRADED WETLAND:** A wetland that has been altered and shows evidence of deterioration of physical, chemical and biological properties, and consequently results in a reduction of species diversity, soil carbon or the complexity of other ecosystem functions.

2. SUMMARY.

CO₂Bio Project 2 is a biodiversity conservation strategy that leverages economic incentives for demonstrating CO₂ removals or reductions to mitigate the threat of habitat loss associated with natural ecosystems on private land in the Colombian Orinoquia.

This is a grouped project, which aims to conserve biodiversity in **167,518** total hectares grouped in **141** private properties in the Orinoquia, based on **83,534.5** eligible hectares at the beginning of the project for certificate issuance, distributed in **forest ecosystems (20,206 ha) and wetlands (63,328.5 ha), by avoiding deforestation, degradation and transformation of these natural ecosystems from the implementation of conservation and climate change mitigation activities, ensuring the conservation and mitigation of climate change.206 ha) and Wetlands (63,328.5 ha), by avoiding deforestation, degradation and transformation of these natural ecosystems through the implementation of conservation and climate change mitigation activities, guaranteeing the provision of ecosystem services and reducing the factors and threats to these ecosystems.**

The impact at the socio-ecological level will allow the people who participate in the implementation of the project to receive environmental, social and economic benefits that will guarantee them an improved quality of life, contribute to guaranteeing their fundamental human rights and generate sustainable rural development in a region of recent economic growth due to the advance of the agricultural frontier.

The work area includes rural properties located in the departments of Arauca, Casanare, Meta and Vichada, whose ownership is distributed in the following context **112** properties show ownership, **28** properties show occupation and **1** property shows possession. The predominant landscape is flood plains and non-flood plains in the lower areas of the Meta river basin, known nationally as the eastern plains.

Finally, for the 30-year period, a total emissions reduction of **7,257,996.8** tCO₂e is projected (**3,535,179.1** from forests and **3,722,817.75** from inland wetlands), considering only phase 1, with new areas to be added to the project in subsequent phases after validation.

3. INTRODUCTION.

The CO₂Bio 2 Project has the characteristics of being clustered and of using two methodologies. The clustering characteristic allows the addition of areas after validation, and the use of two methodologies allows the quantification of emission reductions and/or increased removals in two different ecosystems (Forests and Inland Wetlands). The project was structured under the framework of the ProClima standard (ProClima, 2021. Certification and Registration Program for GHG Mitigation Initiatives and Other Greenhouse Gas Projects. Version 3.0) and methodologies:

- Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions from ProClima REDD+ Projects. Version 2.2. February 5, 2021.
- Methodological Document AFOLU Sector / Quantification of GHG Emissions Reduction and Removals - Activities that avoid land use change in inland wetlands. Version 1.0 27 October 2021.

Following the guidelines of the aforementioned documents, the project was structured and the activities and monitoring plans were defined. To facilitate general understanding, the project was structured in 5 sections

1.) General: The first section lists 16 numerals, which bring together similar aspects for the two ecosystems in terms of; abbreviations, summary, project name, project proponents, environmental authority, project location, project characteristics, uses of methodologies, normative references, carbon ownership and rights, risk management, stakeholder consultation, baseline and additionality scenario, sustainable development objectives and co-benefits related categories.

2.) Wetlands: The second section lists 8 items directly related to the wetland ecosystem in terms of: carbon reservoirs and GHG sources, project boundaries, temporal limits, causes and agents of land use change, project activities, emissions, biological component, monitoring plan and

report regarding project boundaries, implementation of activities, socio-environmental effects, permanence, emissions and changes in biodiversity.

3.) REDD+: The third section lists 8 items directly related to the forest ecosystem in terms of; carbon reservoirs and GHG sources, project boundaries (spatial and temporal), causes and agents of deforestation and degradation, REDD+ activities, REDD+ safeguards, emissions, monitoring plan and reporting regarding to project boundaries, SDGs, co-benefits, permanence and emissions.

4.) Monitoring report: In the fourth section, the results obtained from the first monitoring (2018-2020) for the eligible areas for the Forest ecosystem, in terms of CO₂ emission reductions and compliance with REDD+ activities are listed. As well as the results of the first monitoring (2016-2020) for the wetland ecosystem, in terms of CO₂ emission reductions and removals and compliance with conservation and mitigation activities.

5.) Quality management: Finally, the quality control and assurance procedure applied to the project is related, in terms of information management, registration and data filing system.

In this context, the general structure of the project is presented within the framework of the development of the PDD, whose development is distributed in 5 chapters that facilitate the orientation and review of the project.

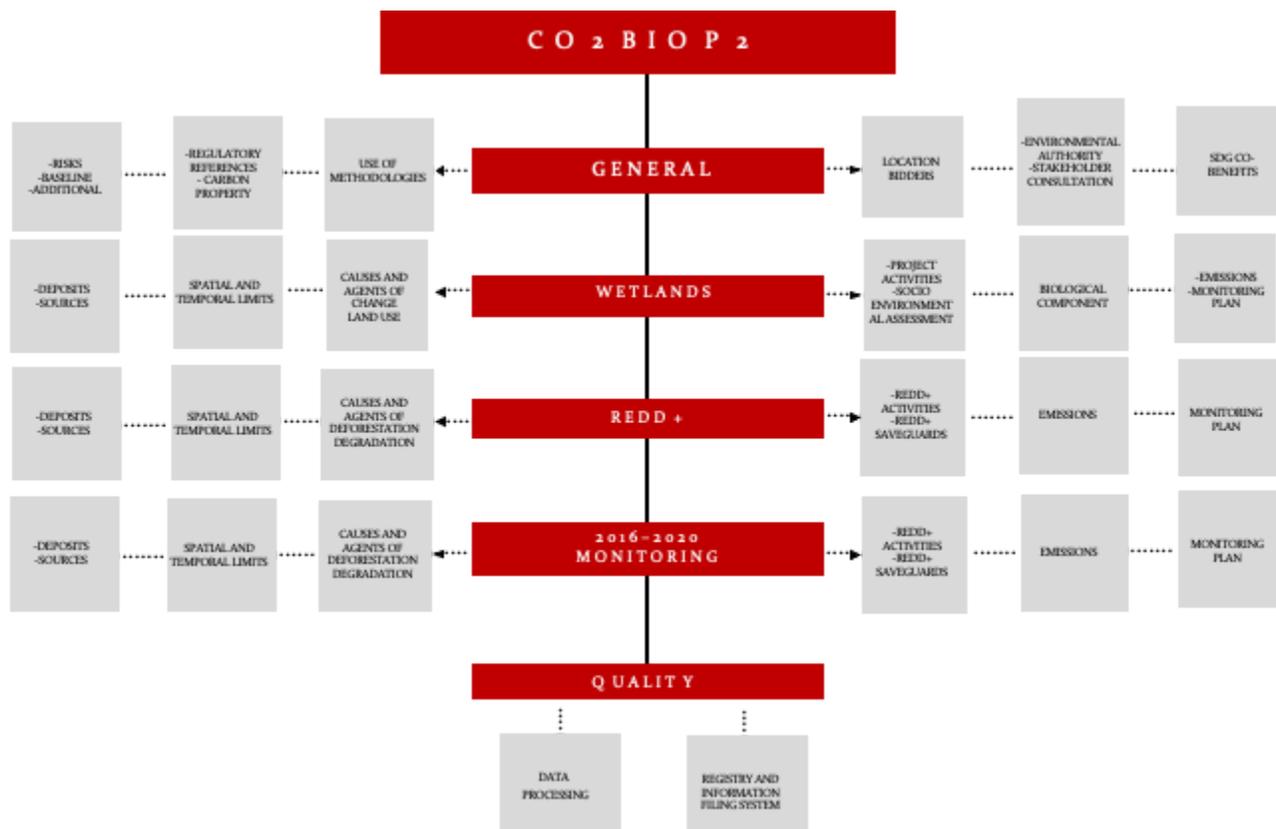


Figure 1. General structure of PDD CO₂Bio Project 2.

Source: Cataruben Foundation

4. PROJECT NAME

CO₂Bio Project 2 is a grouped biodiversity conservation strategy that leverages the implementation of economic incentives for carbon sequestration to mitigate the threat of habitat loss associated with forests and wetlands in private properties in the departments of Casanare, Arauca, Meta and Vichada.

5. PROJECT PROPONENTS

The project holder is the Cataruben Foundation in alliance with the Natural Wealth program of the United States Agency for International Development (USAID) and the owners of the private properties in the Colombian Orinoquia.

5.1. CATARUBEN FOUNDATION.

Cataruben Foundation is an environmental organization with more than (8) years of presence in the Colombian Orinoquia that promotes the conservation of biodiversity through the implementation of climate change mitigation projects associated with forest and wetland ecosystems, demonstrating removals and reductions of GHG, governance in the territory, social and economic impact to private properties and biodiversity conservation.

Specifically, the Foundation has more than 5 years of experience in the operation of climate change mitigation projects, which through a molecular type of organizational structure of self-directed groups and strategic alliances, executes the operation of the projects. It is currently legally constituted and in this case it is the owner of the project. [\(1.1. LEGAL DOCUMENTS OF THE CATARUBEN FOUNDATION\)](#)

Table 1. Data Cataruben Foundation

ORGANIZATION	CATARUBEN FOUNDATION
NIT	900634522 - 9
LEGAL REPRESENTATIVE	MARIA FERNANDA WILCHES FONSECA
RESPONSIBLE	EDUWIN ANTONIO HINCAPIE SHIRLEY ROJAS MOLANO SANDRA DUARTE CHAPARRO
CONTACT	YOPAL - CASANARE CRA 20 #36 04 TEL_3204435972/ 3203108839
E-mail	ecoemprende@cataruben.org operativa@cataruben.org orinoco2@cataruben.org

Source: Cataruben Foundation

5.2. USAID'S NATURAL WEALTH PROGRAM

“Riqueza Natural” is a five-year program funded by USAID that seeks to support the Government of Colombia in meeting the goals of conservation and sustainable integrated rural development to achieve a stable and lasting peace. Its efforts are focused on the protection and sustainable management of ecosystems in order to implement activities aimed at addressing the three components of the Program: a) effective protection of priority ecosystems and species, b) development of financial incentives for conservation, and c) land use planning and management to reduce threats to biodiversity. This through the establishment of alliances that link producer associations, community organizations, non-governmental organizations, private companies, universities with regional presence and applied research institutes that promote biodiversity conservation, income generation and the improvement of the living conditions of the population through conservation, agricultural and livestock activities and transformation, commercialization and/or provision of services. [\(1.2. USAID LEGAL DOCUMENTS\)](#).

Table 2. Data from the United States Agency for International Development (USAID).

ORGANIZATION	USAID (Chemonics International)
NIT	900480566-1
LEGAL REPRESENTATIVE	Ricardo Sanchez
RESPONSIBLE	Harold Arango
CONTACT	Natural Wealth Program
	Address: Calle 76 No. 11 - 17
	Torre los Nogales Building, Bogotá
	Telephone: 3144020058
E-mail	harango@riquezanatural.org

Source: Cataruben Foundation

5.3. OWNERS OF THE PROPERTIES

Group of people formed by the owners of private properties located in the Colombian Orinoquia, who have voluntarily decided to join forces in order to implement conservation activities of natural ecosystems in their properties to ensure the conservation of carbon stocks and the permanence of biodiversity, implementing sustainable activities that allow access to alternative income over time. The landowners will be the main executors of the conservation commitments and project activities in the future, and will be the direct beneficiaries of the sale of carbon certificates by the Cataruben Foundation.

For phase 1 of the project, the owners who expressed their desire to be part of the project through letters of intent and who, after the applicability evaluation, signed a binding contract, are part of the project.

In [ANNEX 1.3 BINDING DOCUMENTS](#) in the PHASE 1 folder are the letters of intent and the legal documents that include the contract and the supports that demonstrate the ownership of the carbon.

Table 3. Owners of the properties

DEPARTMENT	MUNICIPALITY	VEREDA	PROPERTY	OWNER
Arauca	Arauca	Altamira	Altamira	Adriana Camila Caroprese Camejo
		Corocoro	Pastora Vieja	Gerlis Antonio Caroprese Colmenares
		La Bendición	Patevaco	Hugo Alberto Caroprese Galvis
		Mategallina	Las Mercedes	Ines Amelia Quenza De Rodriguez
	Cravo Norte	Juripe	Potosi	Alba Lucia Gaitan Gomez & Ramon Del Carmen Garces
Casanare	Hato Corozal	El Café	Cuatro Vientos	Libardo Sogamoso Parales
			Llano Lindo	Juan Carlos Sogamoso Parales
			Flor Amarillo	Francisco Alberto Sandoval Rodriguez
		San Nicolas	Palma Ralas	Flor Angela Sierra
			Canta Claro	Julio Enrique Fernández Delgado
			Suni	El Cristal
		Nome Nome		Norberto Tocaría Sarmiento
		Santa Trinidad		Sandra Maria Delgado Rodriguez
		Mani	El Socorro	Miralindo
	Poyata, Guamal		Bramaderos	Agrobrasilvia S.A.S - Claudia Maria Gomez Gomez
	Orocue	El Algarrobo	Guadalupe	Integrated Real Estate Services S.A.S.

			Guadalupe 2	Sociedad Quinta Generación S.A.S. (Osaeny S.A.S.)
		Esmeralda	Lote 5(Hato La Palmita)	Martha Beatriz Zambrano Tovar - German Tovar Zambrano
		Mariara	Guafitas 1	Agroindustrial De Palma Aceitera S.A Sucursal De Colombia - Jaime Alberto Gómez Muñoz
			San Felipe 1	Agroindustrial De Palma Aceitera S.A Sucursal De Colombia - Jaime Alberto Gómez Muñoz
		Orocue	Palmarito 1	Fernando Wilches Gonzalez
	Paz De Ariporo	Camorucos	Las Brisas (Pza)	José Antonio Betancourt Barrera
		Caño Chiquito	a Ilusión	Benavides Ruiz Elias Harvey
			San Andrés	Martha Cecilia Rincon Silva
		Centro Gaitán	Canaguay	Clemente Delgado Abril
			Villa Esperanza	Hermelinda Delgado Abril
		El Desierto	Corocoro	José Rubio Pirateque Chaparro
			Enmanuel	Maria Del Carmen Gonzalez Lizcano
			Guayanas	Julian Eduardo Baron Castro
			Israel	Soledad Berroteran
			La Victoria	Jose Demetrio Hernandez Agudelo
			Lejanías	Rosa Helena Castro Berroterán
			Los Cañofistol	Jaime Macias Guio
			Sinaloa	Johana Patricia Grimon Guzman
		La Hermosa	Canarias	Jose Antonio Cantor
			San Pablo	Sonia Rivera Garcia
			Toraiba	Gustavo Adolfo Rueda Garcia
		La Veremos	Hato Sinai	Oswaldo Omaña Garcia
		Las Guamas	Planeta Rica	Ivonne Castro Berroteran
	Los Camorucos	El Salvador	Justa Rubiela Montealegre Girón / Oliverio Varón	
		La Gaitana Uno	Germán Gustavo Gaitan Gomez	

			La Gaitana Dos	Germán Gustavo Gaitan Gomez
			La Gaitana Tres	Rafael Alberto Gaitan Gomez
		Morichales	Curimagua	Aida Lorenza Hidalgo Florez / Dumar Fracsedis Abril Hidalgo
			La Esperanza	Luis Alfonso Abril Hidalgo
			La Estación	Fidel Dario Solorzano Perez
		Paz De Ariporo	El Eden	Mauricio Lopez Barrera & Rigoberto Lopez Barrera
			La Vigia	Mauricio Lopez Barrera & Rigoberto Lopez Barrera
		Puerto Brasilia	Baraki	Daniel Cifuentes Soto
		San Esteban	Chaviripa	Ana Mercedes Pelayo De Hernandez
			El Rubi	Carlos Alexi Hernandez Pelayo
		Varsovia	Agua Luna	Mauricio Lopez Barrera & Rigoberto Lopez Barrera
			El Alcornoco	Mauricio Lopez Barrera & Rigoberto Lopez Barrera
			El Canario	Walter Rincón
			Penjamo I	Mauricio Lopez Barrera & Rigoberto Lopez Barrera
			Playa Blanca	Mauricio Lopez Barrera & Rigoberto Lopez Barrera
	Vecia	Corocoras	Yolanda Moya De Varón	
	San Luis De Palenque	Algodonal	Albania	Lina Maria Barragan Ramirez
			Palmitas	Lina Maria Barragan Ramirez
		El Tigre	El Diamante	Rodrigo Leal Cuevas - Bohorquez Carmen Sobeida
		Maporal	Cañabravas	Santiago Barragan Florez
		Palmarito	El Tautaco	Bonilla Alvarez Ludy, Plata Bonilla Leidy Yuliana
		San Francisco	Rnsc Rancho Nuevo	Omaira Torres De Duarte
		Santa. Theresa	Rnsc Maturin	Edgar Yecid Angel Avila
			Villa Hermosa	Julio Yovany Angel Riaño

	Tauramena	Carupana	La Perla - El Trebol	Alberto Hoyos Mejia
			San Felix	Agrobrasil S.A.S - Claudia Maria Gomez Gomez
		El Guira	Barley 1 - Guarataros 1 - Revancha - Diamante - Alelies	José Luis Felipe Carreño Calixto - Eliana Del Carmen Carreño
		Tunupe	Villanueva	Diogenes Martinez Romero
	Trinidad	Bocas Del Pauto	La Montaña	Alberto Arenas Riaño
			Cañada	La Palmita
		El Loro	El Retiro	Oscar Gonzalez Valcarcel
			La Ciega - Los Caracoles	Oscar Gonzalez Valcarcel
		Porvenir De Guachiria	El Boral	Libia Arismendy Martinez
			La Campechana	Huber Efren Garcia and Karina Garcia
			Macarena	Sonia Arismendy Martinez
			Rnsc Quinto Patio (Del Lagunazo)	Libia Arismendy Martinez
		Santa Maria Del Loro	El Campin 2	Luis Eduardo Arenas
			El Peligro	Angelica Maria Arenas Castro
			Padrote 4	Gisela Arenas Oropeza
			Villa Rica 2	Fernando Arenas Riaño
			Villa Rica Lote 8	Huber Efren Garcia Parada
		Trinidad	Rnsc Algarrobo (Del Lagunazo)	Yady Paola Arismendy Martinez
			Rnsc Betania (Del Lagunazo)	Yanire Arismendy Martinez
			Rnsc Buenaventura	Maria Tomasa Garcia Montilla,
Rnsc El Lagunazo	Magdiel Arismendy Martinez			
Rnsc Los Matapalo	Libia Arismendy Martinez			
Rnsc Valledupar 1 Y 2	Olga Lucia Parada Vargas			
Yopal	Punto Nuevo	Rnsc El Madroño	Helena Sofia Chaparro Soler	

		La Vega	Paratebueno	German Chaparro Vaca	
Meta	Puerto Gaitan	Manacacias	El Siare #2	Marta Cristina Anzola Nuñez	
		Porvenir	El Morrocoy	El Morrocoy Meta S.A.S. - R/L. Carlos Arturo Llano Henao	
			El Tolima	El Tolima Meta S.A.S. - R/L. Carlos Arturo Llano Henao	
			Finca Palmarito	Palmarito Meta S.A.S. - Carlos Arturo Llano Henao	
			Guarataro	Guarataro Meta S.A.S. - Carlos Arturo Llano Henao	
			Puerta Colorada	Puerta Colorada Meta S.A.S. - Carlos Arturo Llano Henao	
			Arecua Ranch	Arecua S.A.S. - R/L. Carlos Arturo Llano Henao	
		Santa Catalina	Aipe	Ligia Gutierrez De Diaz	
			Deva	Carlos Alberto Diaz Gutierrez	
			El Mirador	José Esteban Díaz Gutierrez	
	Galicia		Agroforestales De Colombia E.U - Esteban Diaz Cabana		
	Vichada	Cumaribo	Cumaribo	Berlin	Sabadel S.A.S - Luis Alfonso Cacino Lorza
				La Reforma	Sanan S.A.S - Luz Piedad Villegas Mejia
Villa Castin				Cumagro S.A.S - Nicolas Correa Rolz	
Yaritahua				Ropalu S.A.S - Elejandro Guido Castañeda Carvajal	
Malicia			Chihuahua	Luparo S.A.S - Fernando Guido Juan Castañeda Pinasco	
			La Amistad	Malin S.A.S. - Rodrigo Lince Villegas	
			La Esperanza	Lfab S.A.S - Luis Fernando Angel Borrero	
		Palmeras	Cumagro S.A.S - Nicolas Correa Rolz		
La Primavera		La Ladera	La Comarca	El Triunfo Vichada S.A.S - Jean Paul Regnier Bozzetti	
		La Primavera	Bonanza	Bonanza Muriva Sas - R/L. Carlos Arturo Llano Henao	

			Chaparral	Chaparral Muriva S.A.S. - R/L Maria Fernanda Builes Estrada	
			El Silencio	Maria Helena Barrera	
			El Turpial	El Turpial De La Sabana S.A.S - Maria Teresa Sanclemente Becerra	
			El Turpial #2	El Arriscado De La Sabana S.A.S - Maria Teresa Sanclemente Becerra	
			El Vaiven	Jaime Achagua Teatin	
			La Hermosa	La Hermosa Vichada S.A.S. - R/L. Carlos Arturo Llano Henao	
			La Niña	La Niña Vichada S.A.S. - R/L. Carlos Arturo Llano Henao	
			La Piscina	Cabal Navia Alvaro Jose	
			Leche Miel	Aceites Y Granos Acegran S.A - Jorge Enrique Becerra Sanchez	
			Los Alcarabanes	Narvago S.A.S. - Ricardo Eliecer Narvaez Garcia	
			Muriva	Muriva Vichada Sas - R/L. Carlos Arturo Llano Henao	
			Yovereña	Yovereña Muriva S.A.S - Maria Fernanda Builes Estrada	
		Mata Redonda	La Esperanza (P)	Valleorient S.A.S. - Luz Stella Garcia De Narvaez	
		San Teodoro	La Esperanza (Sro)	La Esperanza Flor Amarillo S.A.S. - R/L. Carlos Arturo Llano Henao	
			Manav Kendra	Alvaro Enrique Becerra Vergara	
		Puerto Carreño	Las Carmelitas	Agrorinoco S.A.S. - Juan Fernando Olave Arango	
			Yopitos	Beatriz Ortega Ponare - Santos Javier Cisneros Ponare	
		Santa Rosalia	El Triunfo	La Bendición	Jose Enaldo Forero Barreto
			Guacacias	El Condor	El Condor Vichada S.A.S. - R/L. Carlos Arturo Llano Henao
				Flor Amarillo	Flor Amarillo Vichada S.A.S. - R/L. Carlos Arturo Llano Henao
	La Envidia La Española			Alcaravan Vichada S.A.S. - Nicolas Borrero Angel	

		La Ladera	El Caribe	El Caribe Y Los Azulejos S.A.S - R/L Jose Manuel Suso Dominguez	
			El Rubi	Uriel Cordoba Perdomo	
			La Virtud	Januario Ortiz Gamez	
			Los Azulejos	El Caribe Y Los Azulejos S.A.S - R/L Jose Manuel Suso Dominguez	
			Los Merecures	Cisneros Marrero Hernán	
		Nazareth	Tomo Grande	Sergio Estrada Villegas	
		Pavanay	El Borinquen	Villa Lorena Vichada S.A.S - R/L. Jose Luis Osorio Gonzalez	
			La Cascada	Dafne Kamila S.A.S - Angela Maria Suso Dominguez	
		Vichada	Vichada	Las Corocoras	Agroprimavera S.A.S - Santiago Sanchez Lubo

Source: Cataruben Foundation

6. ENVIRONMENTAL AUTHORITY WITH JURISDICTION IN THE PROJECT'S AREA OF INTERVENTION

The Regional Autonomous and Sustainable Development Corporations with jurisdiction in the project are: Corporación Autónoma Regional de la Orinoquia¹ (Corporinoquia) and Corporación para el Desarrollo Sostenible del Área de Manejo Especial de La Macarena² (Cormacarena). These agencies perform their functions in accordance with Article 31 of Law 99 of 1993, which establishes that they must execute national policies, plans and programs defined by the approving law of the National Investment Plan or by the Ministry of the Environment. As well they have to exercise the function of maximum environmental authority in the area under their jurisdiction (Law 99, 1993).

Corporinoquia's jurisdiction comprises 5 departments and 45 municipalities, while Cormacarena's jurisdiction includes 29 municipalities that make up the department of Meta, including the Macarena Special Management Area (See Figure 2 and 3).

¹ <http://www.corporinoquia.gov.co/>

² <https://www.cormacarena.gov.co/>

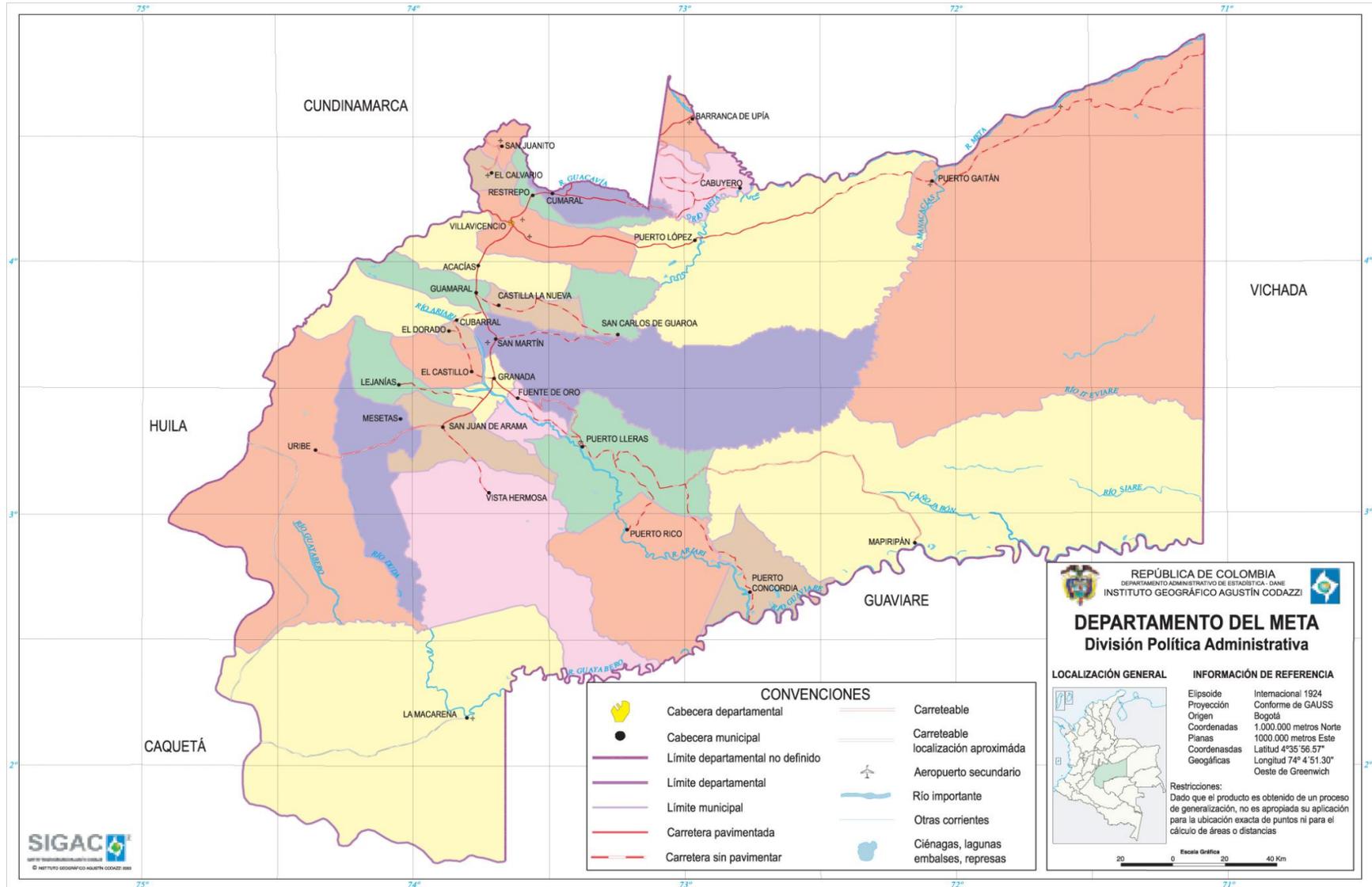


Figure.3 Map of the political division of the jurisdiction of Cormacarena.

Source: Instituto Geografico Agustín Codazzi, 2003.

The CO₂Bio 2 project is linked to the Regional Environmental Management Plan (PGAR in Spanish) of Corporinoquia and Cormacarena for the periods 2013 to 2025 and 2020 to 2031, respectively (Corporinoquia, 2013; Cormacarena, 2020). These are long-term strategic planning instruments that guide management and integrate the efforts of different actors to achieve sustainable development in the regions.

The PGARs promote the implementation of the National Climate Change Policy through REDD+ strategies, the Colombian Low Carbon Development Strategy and the National Climate Change Adaptation Plan. Likewise, the protection of environmental services, activities that prevent deforestation, sustainable management of natural resources and biodiversity conservation are also promoted.

Due to the above, Corporinoquia, Cormacarena, the International Center for Tropical Agriculture³ (CIAT) and Ecopetrol S.A.⁴, have established a strategic alliance to design the Regional Comprehensive Climate Change Plan for the Orinoquia (PRICCO). In which, information is provided on the challenges that the region will face in terms of climate change in the environmental, social and economic sectors and measures or actions to mitigate these effects (CIAT, Cormacarena, Corporinoquia, ECOPETROL, 2017). Challenges that are complemented with the goals of the CO₂Bio 2 project for each of the sectors.

7. PROJECT LOCATION

The project is located in the floodable savannah landscape of the Orinoquia region, in an area of approximately 15 million hectares, distributed in the departments of Arauca, Casanare, Meta and Vichada. The predominant landscape of this area is the floodable and non-floodable plains of the lowlands of the Meta River basin and the eastern mountain range, known nationally as the eastern plains.

³ <https://ciat.cgiar.org/?lang=es>

⁴ <https://www.ecopetrol.com.co/wps/portal>

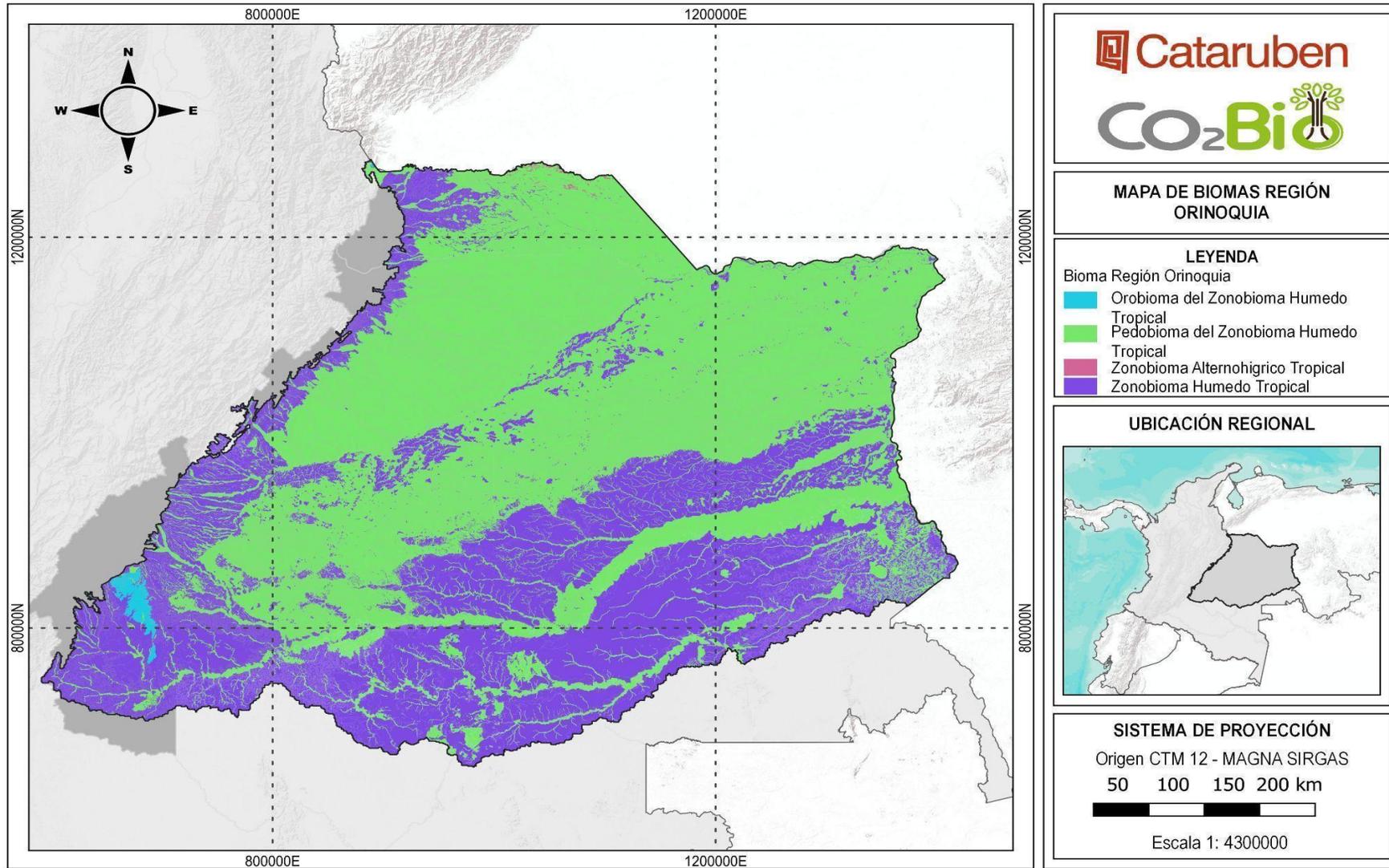


Figure.4 Map of biomes of the Orinoco region where the project is located.

Source: Cataruben Foundation

7.1. CHARACTERISTICS OF THE ORINOQUIA

The Orinoquia is located in the equatorial zone of the planet, in the north of South America, between 60 and 75 degrees longitude and between 2 and 10 degrees north latitude (Bustamante, 2019). Abiotic and socioeconomic aspects for the Orinoquia region are listed below, taking as a reference the Comprehensive Regional Climate Change Plan for the Orinoquia (2017) and the National Development Plan 2018-2022: *Pact for Colombia , pact for equity*.

7.1.1. Geomorphology

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

7.1.2. Soils

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

7.1.3. Climatic aspects

Because the Orinoquia is located in the intertropical zone, the climate of the region is defined by altitude, rainfall, winds, among others (Bustamante, 2019). The climate according to Koeppen-Geiger is Av or savanna climate, precipitation varies from less than 1,800 mm/year in the northwest of the area to about 5,000 mm towards the southwest. Precipitation is distributed between April and November, followed by a short dry period between December and March. The annual average temperature is approximately 18°C and shows very little variation.

7.1.4. Hydrography

This region contains 31.7% of the country's floodable surface, 1.5 million m² of swamps and 22.4 million m² of the country's total swamps. It also has 33.4% of Colombia's water reserves, with 36% of the rivers with a flow of more than 10 m³/s and 38.7% of the country's micro-basins. The main rivers in the region are: Meta river, Arauca river, Casanare river, Vichada river, Guaviare river, Tomo river, Bitá river, Tuparro river and Matavén river.

7.1.5. Vegetation

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

7.1.6. Social

Based on DANE (2011) projections, the population of the region as of 2017 is 1,710,611, 72% in urban areas and 28% in rural areas, with a population density of 6.7 inhabitants/km². Of the total population of the Orinoquia, it is estimated that 51,098 correspond to indigenous communities, located in the departments of Vichada and Meta (INCODER, 2010).

Health coverage varies between 89% (Arauca) and 98% (Vichada), the highest illiteracy rate is for the department of Vichada, with 17% and the lowest for the department of Meta with 8% (DNP, 2017).

According to the national agricultural census, the most representative form of land tenure is of the owner that reaches 51.9% , followed by 5.4% under the form of collective ownership, other forms with 9.8% and without tenure 33.8% (DANE, 2016).

7.1.7. Economic

According to the PND 2018-2022, the four departments contribute 6% to the national GDP, in which Meta accounts for 66%. Although in per capita terms (DANE, 2016), the region's GDP is higher than the national one -\$19,600,000 in 2016, compared to \$13,700,000-, this is due to the high participation of the mining sector and the low population. Agriculture and livestock or manufacturing industry (agro-industry), only contribute 9.9% and 1.1% respectively to the national productive growth.

8. USE OF APPROPRIATE METHODOLOGIES

For the development of the project, the Certification and Registration Program for GHG Mitigation Initiatives and Other Greenhouse Gas Projects of the Proclima program will be used as a basis, which will provide the requirements applicable to the project, as well as the following methodologies:

- For the Forest area, the AFOLU SECTOR METHODOLOGICAL DOCUMENT for the Quantification of GHG Emission Reductions or Removals from REDD+ Projects in its version 2.2 will be used as a reference.
- For the Wetlands area, the METHODOLOGICAL DOCUMENT SECTOR AFOLU / Quantification of GHG Emission Reductions and Removals with Activities that Avoid Land Use Change in Inland Wetlands will be used. Version 1.0.

8.1. CONDITIONS OF APPLICABILITY OF THE METHODOLOGY FOR THE QUANTIFICATION OF GHG EMISSIONS REDUCTIONS AND REMOVALS IN INLAND WETLANDS

Regarding compliance with the applicability conditions of the **AFOLU SECTOR METHODOLOGICAL DOCUMENT. Quantification of GHG Emission Reductions and Removals. Activities that avoid land use change in Inland Wetlands. Version 1.0**, it is concluded that;

a) *The project boundaries correspond to the Inland Wetland category; **Compliance*** / Regarding this condition, the project identified the CORINE Land Cover of the IDEAM Portal that are associated with wetland categories. Establishing eligibility of areas based on the analysis carried out between the period 2009-2015, and subsequently monitoring for the project boundaries (2016-2020).

b) *Project activities prevent land use change in Inland Wetlands in the Orinoquia; **Compliance*** / The activities designed and monitored for the project prevent land use change, which are framed in; Execution of training cycle to strengthen knowledge in wetland conservation and sustainability to prevent the expansion of the agricultural frontier, Characterization and implementation of sustainable production practices, Participatory monitoring of biodiversity and HCVs in stages, Strengthening of governance structures in the territory and Recognition of areas and figures of conservation and environmental management for biodiversity conservation; condition that allows demonstrating GHG reductions/removals in the period 2016-2020 in this first verification, which can be reviewed in numeral 26.2 of the PDD.

c) *Project activities include biodiversity conservation actions that integrate efforts for the preservation, restoration and/or management and sustainable use of inland wetlands; **Compliance*** / Project activities include real biodiversity conservation actions, based on the recognition of conservation and environmental management areas and figures for biodiversity conservation in the project area, highlighting the declaration of AICAS, RHRAP, RNSC and RESNATUR, actions that demonstrate effectiveness in the sustainable management of wetlands and their biodiversity. In addition, the declaration of 19 properties as Civil Society Nature Reserves implies a further strengthening of land management in the project area. These activities can be verified in Table 36 on page 147 of the PDD.

d) *Causes of land use changes include: the expansion of the agricultural/livestock frontier, mining activity, extraction or loss of natural vegetation cover, infrastructure (road and urban) and tourist exploitation (tourist activities that exceed the carrying capacity of the ecosystem); **Compliance*** / The main causes of land use changes identified in the baseline for the Wetland ecosystem, is mainly due to the expansion of the agricultural frontier, given by the planting of dry rice and the implementation of Oil Palm, activities that lead to the loss and extraction of the natural cover of the Wetlands. This information can be reviewed in section 13.1 of the PDD.

e) *Project activities do not lead to the alteration of the water regime of the project area or hydrologically connected areas due to anthropogenic interventions (e.g. irrigation and/or drainage systems); **Compliance*** / Starting with the execution of the activities previously agreed with the landowners through the signing of contractual agreements (numeral 5.3 of the PDD, annex 1.3), the project guarantees the non-implementation of irrigation and drainage systems in the wetlands for industrial production systems, in order to avoid altering the hydrological regime of the wetlands.

f) *Soil disturbance attributable to project activities does not cover more than 10% of the surface area within the project boundaries; **Compliance** / None of the planned activities involve soil disturbance.*

g) *The areas in the geographical boundaries of the project correspond to the categories of Inland Wetlands; **Compliance** / The project took as a basis the categories of inland wetlands determined in the delimitation exercise of wetlands in Colombia prepared by the Alexander Von Humboldt Biological Resources Research Institute scale 1:100,000 (Flórez, C., et al 2016).*

8.2. CONDITIONS FOR THE APPLICABILITY OF THE REDD+ METHODOLOGY.

Regarding compliance with the applicability conditions of the **AFOLU SECTOR METHODOLOGICAL DOCUMENT. Quantification of GHG Emission Reductions from REDD+ Projects. Version 2.2**, it is concluded that;

a) *The areas within the geographical limits of the project correspond to the forest category (according to the definition of the Forest and Carbon Monitoring System) at the beginning of the project activities and ten years prior to the project start date; **Compliance** / It is demonstrated that the areas correspond to the Forest category, taking into account the analysis made to them based on the cartographic inputs "Forest_Not_Forest" obtained from the Forest and Carbon Monitoring System -IDEAM portal.*

b) *The identified causes of deforestation include: expansion of the agricultural frontier, mining, timber extraction and infrastructure expansion; **Compliance** / The causes of deforestation identified for the project's baseline, as stated in the PDD, page 41-50, correspond to: expansion of the agricultural frontier, mainly due to industrial crops (soy, bananas, rice and oil palm), the latter two with a significant increase, from (274.931 hectares - 430,205 cultivated hectares) in the period 1996-2007; the livestock sector also showed a significant increase, going from 4.8 to 6 million head of cattle, between the period 2011-2008. Finally, the oil sector for the period 2000 to 2007 decreased its deposits in two departments (Casanare and Arauca), which means a decrease in the sector from 67% to 47%.*

c) *The causes of forest degradation identified include: selective logging, firewood extraction, forest fires, forest grazing and expansion of the agricultural frontier - illicit crops; **Compliance** / Regarding the causes of forest degradation identified for the project, and stated in the baseline and additionality section page 41-50, they correspond mainly to the expansion of the agricultural frontier, mainly dry rice and oil palm), extensive cattle ranching and the exploitation of fossil fuels.*

d) *Reduced deforestation or degradation is not expected to occur in the absence of the project; **Compliance** / According to the Baseline and Additionality analysis, implementation of REDD+ activities and monitoring of GHG reductions/removals for the period 2018-2020 regarding to the project time window, deforestation and degradation is not expected to occur in the absence of the project.*

e) *It is possible that in deforested areas carbon stocks in soil organic matter, litter and dead wood may decrease or remain stable; **Compliance** / The possibility of this condition occurring is very*

likely under the following scenario. If a passive restoration process is managed for deforested areas, carbon stocks increase or remain stable, a condition that can be demonstrated during project monitoring periods; However, if agricultural activities continue to be carried out in the deforested areas previously identified in the project baseline, these stocks decrease. The latter condition is not present for the project.

f) *The quantification of GHGs other than CO₂ must be included in the quantification of emissions caused by forest fires during the monitoring period; **Compliance*** / The project will quantify the presence of other gases only in the event of forest fires.

g) *The activities that constitute the REDD+ project will not result in the violation of any applicable law. **Compliance*** / The activities contemplated for the project do not constitute any violation, on the contrary they comply with the provisions of the Political Constitution of Colombia, Art 65, 79 and 80, The Development Plan (2018-2022), Law 388 of 1997, National Legislation in force related to REDD+ projects or that which modifies or updates it, Resolution 1447/2018 or that which modifies or updates it, Resolution 471/2020 or that which modifies or updates it, Integral Strategy for Deforestation Control and Forest Management, and other normative references stipulated in numeral 5 of the REDD+ Methodology.

9. NORMATIVE REFERENCES

The project proponents and beneficiaries undertake to fully comply with the established and applicable legal regulations. The following is a list of the different environmental regulations related to the implementation of this project.

Table 4. Standards and their context of application in the CO₂Bio 2 project

REGULATION	APPLICATION CONTEXT
Law 1931 of 2018	It establishes guidelines for the management of climate change in the decisions of public and private persons, the concurrence of the nation, departments, municipalities, districts, metropolitan areas and environmental authorities, mainly in the actions of adaptation to climate change, as well as in the mitigation of greenhouse gases.
Law 1819 of 2016	Adopts the structural tax reform for Colombia, creating through its articles 221 to 223 the "National Carbon Tax", determining its form of causation (and its exception), the taxpayer of the obligation and the destination of the resources obtained from its collection.
Law 629 of 2000	Approving the "Kyoto Protocol to the United Nations Framework Convention on Climate Change", which commits countries to stabilize GHG emissions, based on the principle of common but differentiated responsibilities.
Law 164 of 1994	The "United Nations Framework Convention on Climate Change" is approved, and in accordance with national circumstances, measures are adopted to reduce emissions from deforestation and forest degradation.
The Forest Reserves Law (Law 2 of 1959)	Establishes the protection and use of land (forest reserves) as well as zoning and environmental management.

Decree 926 of 2017	Its purpose is to regulate the procedure to make effective the non-payment of the national carbon tax.
Decree 3570 of 2011	Establishes functions for the Ministry of Environment and its dependencies and affiliated institutions. Determines that the Directorate of Forests, Biodiversity and Ecosystem Services is responsible for developing and coordinating the implementation of the National Forestry Development Plan.
Decree 2811/1974	The principles for the management of natural resources are established to promote a balance between economic development, environmental protection and the efficient use of resources.
Resolution 0831 of 2020	Modifies and clarifies the methodological procedure for GHG initiatives, in terms of registration and certification.
Resolution 1447 of 2018	By which the system for monitoring, reporting and verification of mitigation actions at the national level is regulated, in relation to the GHG Emissions Reduction and Removal Accounting System, which includes REDD+ actions.
RAMSAR Convention 1971	Its objective is to promote national actions and international cooperation for the cooperation and wise use of wetlands.
Forestry Policy (CONPES 2834 of 1996)	The overall objective is to achieve a sustainable use of forests to conserve them, consolidate the incorporation of the forestry sector into the national economy and improve the population's standard of living.
Strategic Plan for Ecological Restoration and Forest Establishment in Colombia - (Plan Verde, 1998).	Its objective is to generate the basis for involving ecological restoration, reforestation for environmental and commercial purposes, and agroforestry in environmental land use planning.

Source: Cataruben Foundation

10. OWNERSHIP AND CARBON RIGHTS

Cataruben Foundation, as the initiative holder, verifies that it is the owner, possessor or occupant, depending on the case, of the property to be linked to the project, in accordance with the provisions of articles 669, 673 and 762 of the Colombian Civil Code, at least during the period of quantification of GHG reductions or removals.

Therefore, in the process of linking land to the project, a legal study of the conditions of ownership or tenure is carried out, through an analysis of the documents provided by the applicant, such as: Public Deed of real estate, Certificate of Tradition and Freedom, Resolution of Adjudication of vacant property (issued by INCODER, now National Land Agency), request for adjudication of vacant property (before the ANT), payment of property tax, Public Deed of Succession, Executed Judgment of Succession, Civil Registry of Death, among others.

In addition, the Land Restitution Unit verified that none of the properties to be linked to the project are in the restitution process, as shown in Table 4; it was determined that the properties do not have conflicts of dispossession or abandonment due to the armed conflict.

Upon establishing legal certainty regarding the quality of the applicant's ownership or tenure rights to the land, a binding contract is signed with the purpose of incorporating the total eligible area of the real estate under study in the project and also the conditions for acquiring carbon credits and the respective benefit from the sale of such carbon certificates. In this sense, the sixth clause of that instrument establishes the imperative obligation of the applicant (later beneficiary) to demonstrate ownership or tenure of the land on which the climate change mitigation and conservation of natural ecosystems activity is being developed, for a period of time greater than or equal to the duration of the project. The foregoing in accordance with the provisions of Article 45 of Resolution 1447 of 2018. In addition, the fifth clause determines the obligations of the beneficiary to be able to acquire the carbon certificates and the respective benefit for the sale of the same, which is regulated in the tenth and eleventh clause of that contract.

Finally, Table 4 shows the list of properties and the identification of each domain, according to the real estate registration number designated in the Certificate of Tradition and Freedom or the number of the Resolution by which it was awarded by the Colombian Institute for Rural Development (Incoder), now National Land Agency. The supports can be evidenced in [ANNEX 1.3. DOCUMENTS OF ATTACHMENT](#)

Table 5. List of properties, with their real estate identification, respective owners and consultation of land restitution processes.

Nº	DEPARTMENT	MUNICIPALITY	PROPERTY	FORESTS	WETLAND	REAL ESTATE REGISTRATION /INCODER	OWNER	LAND RESTITUTION PROCESSES
1	Casanare	Paz De Ariporo	Corocoras	X		475-32122	Yolanda Moya De Varón	Not Applicable
2	Casanare	Yopal	Paratebueno	X		470-21321	German Chaparro Vaca	Not Applicable
3	Arauca	Arauca	Pastora Vieja	X		470-43934	Gerlis Antonio Caroprese Colmenares	Not Applicable
4	Arauca	Arauca	Patevaco	X		410-62877	Hugo Alberto Caroprese Galvis	Not Applicable
5	Arauca	Arauca	Altamira	X		410-66192	Adriana Camila Caroprese Camejo	Not Applicable
6	Casanare	Paz De Ariporo	Canaguay	X		475-14101	Clemente Delgado Abril	Not Applicable
7	Vichada	Santa Rosalia	El Rubi	X		Application to the National Land Agency	Uriel Cordoba Perdomo	Not Applicable
8	Casanare	San Luis De Palenque	Villa Hermosa	X		475 - 11526	Julio Yovany Angel Riaño	Not Applicable
9	Casanare	Trinidad	La Montaña	X		Paz Y Salvo Predial	Alberto Arenas Riaño	Not Applicable
10	Meta	Puerto Gaitan	Deva	X		234-12744	Carlos Alberto Diaz Gutierrez	Not Applicable
11	Meta	Puerto Gaitan	Aipe	X		234 - 12745	Ligia Gutierrez De Diaz	Not Applicable
12	Meta	Puerto Gaitan	El Mirador	X		234 - 12746	José Esteban Díaz Gutierrez	Not Applicable
13	Meta	Puerto Gaitan	Galicia	X		234-12743	Agroforestales De Colombia E.U - Esteban Diaz Cabana	Not Applicable
14	Casanare	Trinidad	Padrote 4	X		Incoder Resolution	Gisela Arenas Oropeza	Not Applicable
15	Casanare	Tauramena	Villanueva	X		Property Tax Receipt	Diogenes Martinez Romero	Not Applicable
16	Vichada	Santa Rosalia	Tomo Grande	X		Application to the National Land Agency	Sergio Estrada Villegas	Not Applicable
17	Casanare	San Luis De Palenque	El Tautaco	X		475-21938	Jovani Alberto Plata Plata	Not Applicable
18	Casanare	Paz De Ariporo	Toraiba	X		475-7332	Gustavo Adolfo Rueda Garcia	Not Applicable
19	Casanare	Trinidad	La Ciega - Los Caracoles	X		Property Tax Receipt	Oscar Gonzalez Valcarcel	Not Applicable
20	Vichada	Santa Rosalia	La Cascada	X		540 - 5693	Dafne Kamila S.A.S - Angela Maria Suso Dominguez	Not Applicable

21	Vichada	Santa Rosalia	La Envidia La Española	X		540-762	Alcaravan Vichada S.A.S. - Nicolas Borrero Angel	Not Applicable
22	Vichada	La Primavera	La Esperanza	X		540-1734	La Esperanza Flor Amarillo S.A.S. - R/L. Carlos Arturo Llano Henao	Not Applicable
23	Vichada	Santa Rosalia	El Condor	X		540-714	El Condor Vichada S.A.S. - R/L. Carlos Arturo Llano Henao	Not Applicable
24	Vichada	La Primavera	The Alcarabanes	X		540-5623	Narvagro S.A.S. - Ricardo Eliecer Narvaez Garcia	Not Applicable
25	Vichada	Vichada	Las Corocoras	X		540-4349	Agroprimavera S.A.S - Santiago Sanchez Lubo	Not Applicable
26	Vichada	La Primavera	La Esperanza	X		540-3375	Valleoriente S.A.S. - Luz Stella Garcia De Narvaez	Not Applicable
27	Vichada	Cumaribo	Yaritagua	X		540-4439	Ropalu S.A.S - Elejandro Guido Castañeda Carvajal	Not Applicable
28	Vichada	Cumaribo	La Reforma	X		540-2541	Sanan S.A.S - Luz Piedad Villegas Mejia	Not Applicable
29	Vichada	Cumaribo	La Esperanza	X		540-2540	Lfab S.A.S - Luis Fernando Angel Borrero	Not Applicable
30	Vichada	Cumaribo	Chihuahua	X		540-630	Luparo S.A.S. - Fernando Guido Juan Castañeda Pinasco	Not Applicable
31	Vichada	Puerto Carreño	Las Carmelitas	X		540-1345	Agrorinoco S.A.S. - Juan Fernando Olave Arango	Not Applicable
32	Vichada	Cumaribo	La Amistad	X		540-2539	Malin S.A.S. - Rodrigo Lince Villegas	Not Applicable
33	Vichada	Cumaribo	Berlin	X		540-730	Sabadel S.A.S - Luis Alfonso Cacino Lorza	Not Applicable
34	Vichada	Cumaribo	Villa Castin	X		540-5032	Cumagro S.A.S - Nicolas Correa Rolz	Not Applicable
35	Vichada	Cumaribo	Palmeras	X		540-3376	Cumagro S.A.S - Nicolas Correa Rolz	Not Applicable
36	Vichada	La Primavera	Manav Kendra	X		540-2066	Alvaro Enrique Becerra Vergara	Not Applicable
37	Casanare	Trinidad	El Campin 2	X		Sales Letter	Luis Eduardo Arenas	Not Applicable
38	Vichada	Puerto Carreño	Yopitos	X		540-2475	Beatriz Ortega Ponare - Santos Javier Cisneros Ponare	Not Applicable
39	Casanare	Paz De Ariporo	Los Cañofistol	X	X	Application to the National Land Agency	Jaime Macias Guio	Not Applicable
40	Casanare	Paz De Ariporo	La Gaitana Uno	X	X	475-14951	Germán Gustavo Gaitan Gomez	Not Applicable
41	Casanare	Paz De Ariporo	La Gaitana Dos	X	X	475-14950	Germán Gustavo Gaitan Gomez	Not Applicable

42	Casanare	Paz De Ariporo	La Gaitana Tres	X	X	475-14928	Rafael Alberto Gaitan Gomez	Not Applicable
43	Casanare	Paz De Ariporo	Planeta Rica	X	X	475-31829	Ivonne Castro Berroteran	Not Applicable
44	Casanare	Hato Corozal	Flor Amarilo	X	X	475-14899	Francisco Alberto Sandoval Rodriguez	Not Applicable
45	Casanare	Hato Corozal	Cantaclaro	X	X	Property Tax Receipt	Julio Enrique Fernández Delgado	Not Applicable
46	Casanare	Hato Corozal	Nome Nome	X	X	Sales Letter	Norberto Tocaría Sarmiento	Not Applicable
47	Casanare	Paz De Ariporo	Las Brisas	X	X	Sales Letter	José Antonio Betancourt Barrera	Not Applicable
48	Casanare	Paz De Ariporo	Eden	X	X	475-14028	Mauricio Lopez Barrera & Rigoberto Lopez Barrera	Not Applicable
49	Casanare	Paz De Ariporo	La Vigia	X	X	475-14145	Mauricio Lopez Barrera & Rigoberto Lopez Barrera	Not Applicable
50	Casanare	Paz De Ariporo	Penjamo I	X	X	475-10798	Mauricio Lopez Barrera & Rigoberto Lopez Barrera	Not Applicable
51	Casanare	Paz De Ariporo	Agua Luna	X	X	475-14025	Mauricio Lopez Barrera & Rigoberto Lopez Barrera	Not Applicable
52	Casanare	Hato Corozal	Santa Trinidad	X	X	475-27245	Sandra Maria Delgado Rodriguez	Not Applicable
53	Casanare	Paz De Ariporo	Playa Blanca	X	X	475-16402	Mauricio Lopez Barrera & Rigoberto Lopez Barrera	Not Applicable
54	Arauca	Cravo Norte	Potosi	X	X	410-40165	Alba Lucia Gaitan Gomez & Ramon Del Carmen Garces	Not Applicable
55	Casanare	Paz De Ariporo	Las Estación	X	X	Healthy Possession	Fidel Dario Solorzano Perez	Not Applicable
56	Casanare	Paz De Ariporo	Israel	X	X	Incoder Resolution	Soledad Berroteran	Not Applicable
57	Casanare	Orocue	Guadalupe	X	X	086-1927	Integrated Real Estate Services S.A.S.	Not Applicable
58	Casanare	Paz De Ariporo	Guayanas	X	X	Application to the National Land Agency	Julian Eduardo Baron Castro	Not Applicable
59	Casanare	Trinidad	La Palmita	X	X	475-3585	Mora Fernandez Carolina - Mora Fernandez Catalina - Mora Fernandez Flavio Cesar	Not Applicable
60	Casanare	Yopal	Rnsc El Madroño	X	X	470-79041	Helena Sofia Chaparro Soler	Not Applicable
61	Casanare	Tauramena	Barley 1 - Guarataros 1 - Revancha - Diamante -	X	X	470-16329 / 470-14916 / 470-43202 / 470-15116 / 470-10903	José Luis Felipe Carreño Calixto - Eliana Del Carmen Carreño	Not Applicable

			<i>Aleliés</i>					
62	Casanare	Trinidad	Rnsc Buenaventura	X	X	475-3820	Maria Tomasa Garcia Montilla,	Not Applicable
63	Casanare	Paz De Ariporo	Villa Esperanza	X	X	475-14291	Hermelinda Delgado Abril	Not Applicable
64	Casanare	Trinidad	Rnsc Quinto Patio (Del Laqunazo)	X	X	475 - 3903	Libia Arismendy Martinez	Not Applicable
65	Casanare	Trinidad	El Boral	X	X	475 - 3515	Libia Arismendy Martinez	Not Applicable
66	Casanare	Trinidad	Macarena	X	X	475 - 3523	Sonia Arismendy Martinez	Not Applicable
67	Vichada	La Primavera	El Silencio	X	X	540 - 1287	Maria Helena Barrera	Not Applicable
68	Casanare	Trinidad	Villa Rica Lot 8	X	X	475-28463	Huber Efren Garcia Parada	Not Applicable
69	Casanare	Tauramena	San Felix	X	X	470 - 96948	Agrobrasil S.A.S - Claudia Maria Gomez Gomez	Not Applicable
70	Casanare	Orocue	Lot 5 (Hato La Palmita)	X	X	Paz Y Salvo Predial	Martha Beatriz Zambrano Tovar - German Tovar Zambrano	Not Applicable
71	Casanare	San Luis De Palenque	El Diamante	X	X	475 - 11575	Rodrigo Leal Cuevas - Bohorquez Carmen Sobeida	Not Applicable
72	Casanare	Trinidad	El Peligro	X	X	475 - 17345	Angelica Maria Arenas Castro	Not Applicable
73	Casanare	Trinidad	El Retiro	X	X	475 - 3668	Oscar Gonzalez Valcarcel	Not Applicable
74	Vichada	Santa Rosalia	La Bendición	X	X	Application to the National Land Agency	Jose Enaldo Forero Barreto	Not Applicable
75	Goal	Puerto Gaitan	El Morrocoy	X	X	234-7504	El Morrocoy Meta S.A.S. - R/L. Carlos Arturo Llano Henao	Not Applicable
76	Goal	Puerto Gaitan	El Tolima	X	X	234-7497	El Tolima Meta S.A.S. - R/L. Carlos Arturo Llano Henao	Not Applicable
77	Goal	Puerto Gaitan	Puerta Colorada	X	X	234-7501	Puerta Colorada Meta S.A.S. - Carlos Arturo Llano Henao	Not Applicable
78	Goal	Puerto Gaitan	Finca Palmarito	X	X	234-7507	Palmarito Meta S.A.S. - Carlos Arturo Llano Henao	Not Applicable
79	Goal	Puerto Gaitan	Rancho Arecua	X	X	234-7505	Arecua S.A.S. - R/L. Carlos Arturo Llano Henao	Not Applicable
80	Vichada	La Primavera	La Hermosa	X	X	540-3796	La Hermosa Vichada S.A.S. - R/L. Carlos Arturo Llano Henao	Not Applicable
81	Vichada	La Primavera	La Niña	X	X	540-3563	La Niña Vichada S.A.S. - R/L. Carlos Arturo Llano Henao	Not Applicable

82	Vichada	La Primavera	Chaparral	X	X	540-1260	Chaparral Muriva S.A.S. - R/L Maria Fernanda Builes Estrada	Not Applicable
83	Vichada	La Primavera	Muriva	X	X	540-1239	Muriva Vichada Sas - R/L. Carlos Arturo Llano Henao	Not Applicable
84	Vichada	La Primavera	Yovereña	X	X	540-1242	Yovereña Muriva S.A.S - Maria Fernanda Builes Estrada	Not Applicable
85	Vichada	Santa Rosalia	Flor Amarillo	X	X	540-845	Flor Amarillo Vichada S.A.S. - R/L. Carlos Arturo Llano Henao	Not Applicable
86	Vichada	La Primavera	Leche Miel	X	X	540-3374	Aceites Y Granos Acegran S.A - Jorge Enrique Becerra Sanchez	Not Applicable
87	Vichada	Santa Rosalia	Los Merecures	X	X	540-8281	Cisneros Marrero Hernán	Not Applicable
88	Casanare	San Luis De Palenque	Rnsc Rancho Nuevo	X	X	475-10877	Omaira Torres De Duarte	Not Applicable
89	Casanare	Orocue	Palmarito 1	X	X	086-2164	Fernando Wilches Gonzalez	Not Applicable
90	Casanare	Paz De Ariporo	Chaviripa	X	X	Property Tax Receipt	Ana Mercedes Pelayo De Hernandez	Not Applicable
91	Casanare	Paz De Ariporo	El Rubi	X	X	Property Tax Receipt	Carlos Alexi Hernandez Pelayo	Not Applicable
92	Casanare	Trinidad	Villa Rica 2	X	X	Writing	Fernando Arenas Riaño	Not Applicable
93	Casanare	San Luis De Palenque	Albania	X	X	Property Tax Receipt	JLina Maria Barragan Ramirez	Not Applicable
94	Casanare	San Luis De Palenque	Palmitas	X	X	475-2711	Lina Maria Barragan Ramirez	Not Applicable
95	Casanare	Orocue	Guadalupe 2	X	X	086-3166	Sociedad Quinta Generación S.A.S. (Osaeny S.A.S.)	Not Applicable
96	Casanare	Paz De Ariporo	Hato Sinai	X	X	Application to the National Land Agency	Oswaldo Omaña Garcia	Not Applicable
97	Casanare	Paz De Ariporo	San Pablo	X	X	475-15636	Sonia Rivera Garcia	Not Applicable
98	Casanare	Paz De Ariporo	El Salvador		X	475-24480	Justa Rubiela Montealegre Girón / Oliverio Varón	Not Applicable
99	Casanare	Hatocorozal	El Cristal		X	Property Tax Receipt	Norberto Tocaria Sarmiento	Not Applicable
100	Casanare	Paz De Ariporo	La Esperanza		X	Sales Letter	Luis Alfonso Abril Hidalgo	Not Applicable
101	Casanare	Paz De Ariporo	Curimagua		X	Incoder Resolution	Aida Lorenza Hidalgo Florez / Dumar Fracsedis Abril Hidalgo	Not Applicable
102	Casanare	Paz De Ariporo	Canarias		X	475-7913	Jose Antonio Cantor	Not Applicable
103	Casanare	Paz De Ariporo	El Alcornoco		X	475-16403	Mauricio Lopez Barrera & Rigoberto Lopez Barrera	Not Applicable

104	Casanare	Paz De Ariporo	Baraki		X	Application to the National Land Agency	Daniel Cifuentes Soto	Not Applicable
105	Casanare	Trinidad	Rnsc Algarrobo (Del Lagunazo)		X	475-3986	Yady Paola Arismendy Martinez	Not Applicable
106	Casanare	Trinidad	Rnsc Los Matapalo		X	475-3797	Libia Arismendy Martinez	Not Applicable
107	Casanare	Trinidad	Rnsc Betania (Del Lagunazo)		X	475-3841	Yanire Arismendy Martinez	Not Applicable
108	Casanare	Trinidad	La Campechana		X	475-31496	Huber Efrén Garcia	Not Applicable
109	Casanare	Hato Corozal	Cuatro Vientos		X	Incoder Resolution	Libardo Soqamoso Paraes	Not Applicable
110	Casanare	Hato Corozal	Llano Lindo		X	Incoder Resolution	Juan Carlos Soqamoso Paraes	Not Applicable
111	Casanare	Trinidad	Rnsc Valledupar 1 Y 2		X	475-31494 / 475-31498	Olga Lucia Parada Vargas	Not Applicable
112	Casanare	Trinidad	Rnsc El Lagunazo		X	475-3514	Magdiel Arismendy Martinez	Not Applicable
113	Casanare	Paz De Ariporo	El Canario		X	Application to the National Land Agency	Walter Rincón	Not Applicable
114	Casanare	Paz De Ariporo	Enmanuel		X	Application to the National Land Agency	Maria Del Carmen Gonzalez Lizcano	Not Applicable
115	Casanare	Paz De Ariporo	Sinaloa		X	Sales Letter	Johana Patricia Grimon Guzman	Not Applicable
116	Casanare	Paz De Ariporo	La Victoria		X	Application to the National Land Agency	Jose Demetrio Hernandez Agudelo	Not Applicable
117	Casanare	Paz De Ariporo	Lejanías		X	Application to the National Land Agency	Rosa Helena Castro Berroterán	Not Applicable
118	Casanare	Paz De Ariporo	Corocoro		X	475-0016330	José Rubio Pirateque Chaparro	Not Applicable
119	Casanare	Hato Corozal	Palma Ralas		X	475-31166	Flor Angela Sierra / Alexis	Not Applicable
120	Casanare	Paz De Ariporo	La Ilusión		X	475-13624	Benavides Ruiz Elias Harvey	Not Applicable
121	Casanare	Paz De Ariporo	San Andres		X	475-13623	Martha Cecilia Rincon Silva	Not Applicable
122	Arauca	Arauca	Las Mercedes		X	410 - 28443	Ines Amelia Quenza De Rodriguez	Not Applicable
123	Casanare	Peanuts	Bramaderos		X	Property Tax Receipt	Agrobrasil S.A.S - Claudia Maria Gomez Gomez	Not Applicable
124	Casanare	Tauramena	La Perla - El Trebol		X	470-104372	Alberto Hoyos Mejia	Not Applicable
125	Casanare	Peanuts	Miralindo		X	470 - 86018	Claudia Maria Gomez Gomez	Not Applicable
126	Casanare	San Luis De Palenque	Rnsc Maturi		X	475 - 3738	Edgar Yecid Angel Avila	Not Applicable

127	Casanare	Orocue	Guafitas 1		X	086 - 7188	Agroindustrial De Palma Aceitera S.A Sucursal De Colombia - Jaime Alberto Gómez Muñoz	Not Applicable
128	Casanare	Orocue	San Felipe 1		X	086 - 7186	Agroindustrial De Palma Aceitera S.A Sucursal De Colombia - Jaime Alberto Gómez Muñoz	Not Applicable
129	Vichada	Santa Rosalia	El Caribe		X	540 - 3146	El Caribe Y Los Azulejos S.A.S - R/L José Manuel Suso Dominguez	Not Applicable
130	Vichada	Santa Rosalia	El Borinquen		X	540 - 1318	Villa Lorena Vichada S.A.S - R/L. Jose Luis Osorio Gonzalez	Not Applicable
131	Vichada	Santa Rosalia	Los Azulejos		X	540 - 3143	El Caribe Y Los Azulejos S.A.S - R/L José Manuel Suso Dominguez	Not Applicable
132	Vichada	La Primavera	La Comarca		X	540 - 7032	El Triunfo Vichada S.A.S - Jean Paul Regnier Bozzetti	Not Applicable
133	Goal	Puerto Gaitan	Guarataro		X	234-7502	Guarataro Meta S.A.S. - Carlos Arturo Llano Henao	Not Applicable
134	Vichada	La Primavera	Bonanza		X	540-1240	Bonanza Muriva Sas - R/L. Carlos Arturo Llano Henao	Not Applicable
135	Goal	Puerto Gaitan	El Siare #2		X	234-8249	Marta Cristina Anzola Nuñez	Not Applicable
136	Vichada	Santa Rosalia	La Virtud		X	540-3175	Januario Ortiz Gamez	Not Applicable
137	Vichada	La Primavera	La Piscina		X	540-1755	Cabal Navia Alvaro Jose	Not Applicable
138	Vichada	La Primavera	El Turpial		X	540-1733	El Turpial De La Sabana S.A.S - Maria Teresa Sanclemente Becerra	Not Applicable
139	Vichada	La Primavera	El Turpial #2		X	540-6897	El Arriscado De La Sabana S.A.S - Maria Teresa Sanclemente Becerra	Not Applicable
140	Vichada	La Primavera	El Vaivén		X	540-722	Jaime Achagua Teatin	Not Applicable
141	Casanare	San Luis De Palenque	Cañabravas		X	475-2712	Santiago Barragan Florez	Not Applicable

Source: Cataruben Foundation

11. RISK MANAGEMENT

For the project, physical, economic and social risks were evaluated, identifying a medium risk level in the 3 physical, economic and social categories, which means a higher incidence in the mitigation measures to be implemented and their compliance monitoring in each of the verifications managed by the project.

Therefore, a classification was made according to the possible risks that may occur throughout the project, with a measurable indicator and finally with a risk classification in 3 lines: high, medium or low, and at the same time one or several mitigation actions were determined. ([SEE ANNEX 1.4. RISK MANAGEMENT](#)).

12. STAKEHOLDER CONSULTATION

Cataruben Foundation carried out the respective consultation on the implementation of the project, in accordance with the provisions of paragraph 10.16 of the Program for Certification and Registration of GHG Mitigation Initiatives and Other Greenhouse Gas Projects. Version 3.0; notifying the representatives of the territorial, governmental and non-governmental entities of the 4 departments of the Orinoquia, resulting in 43 agencies notified for the 4 departments mentioned and 4 responses issued according to the requests made in the framework of the consultation ([SEE ANNEX 1.5. CONSULTATION OF INTERESTED PARTIES](#)).

13. IDENTIFICATION OF THE BASELINE AND ADDITIONALITY SCENARIO

The CERTIFICATION AND REGISTRATION PROGRAM FOR GHG MITIGATION INITIATIVES AND OTHER GREENHOUSE GAS PROJECTS establishes that the **baseline** represents the GHG emissions that would occur in the absence of a GHG mitigation activity, in order to comply with the methodologies applicable to the initiative.

Regarding the **additionality** criterion, the methodologies determine how the effect of the project activity to reduce anthropogenic GHG emissions below the level that would have occurred in the absence of the GHG mitigation initiative or project activity.

The aspects for determining the baseline and additionality scenario are listed below, taking as a reference the AFOLU SECTOR METHODOLOGICAL DOCUMENT for the Quantification of GHG Emission Reductions or Removals from REDD+ Projects in its version 2.2 and the AFOLU SECTOR METHODOLOGICAL DOCUMENT / Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands.

13.1. BASELINE SCENARIO

To build the baseline scenario, item c (changes in carbon stocks at the project boundaries, identifying the most likely land use at the start of the project) shall be take into account; according to the methodologies, Quantification of GHG Emission Reductions or Removals from REDD+ Projects version 2.2. and Quantification of GHG Emission Reductions and Removals / Activities that avoid land use change in inland wetlands.

13.1.1. Step 0. Project start date

The start date of the project is May 6, 2016, the date on which conservation and mitigation activities that will result in effective reductions/removals of GHG emissions begin to be designed and implemented. This is supported by the letters of intent signed by the landowners for the two ecosystems in reference. ([SEE ANNEX 3.1. - LETTERS OF INTENTION](#)), although the letters of intent at the same time are taken as a reference date, taking into account that the Cataruben Foundation formalized contracts with professionals who would carry out the initial phases of implementation of conservation actions, marking the beginning of compliance with the established goals. This demonstrates that the start date of the project is within the 5 years prior to the beginning of the validation. The supports that demonstrate the investment of resources in the 2016 payroll can be found in the folder of annexes [See Annex 3.3.](#)

Under the above context, although the activities were promoted from 2016; for the Forest ecosystem they become effective in terms of reduction/reduction of emissions from deforestation and degradation from 2018, taking into account the multitemporality analysis regarding the changes in cover, the conservation status of forested areas and finally, the implementation of activities by the project owners. Regarding the wetland ecosystem, the start date of its activities and its effectiveness in terms of emissions reduction is from 2016 and coincides with the temporality analysis carried out to natural coverages in wetland ecosystems within the project boundaries, information that can be verified in section 26 - Monitoring report.

13.1.2. Identification of land use alternatives

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

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

Between 1964 and 2008, the population of the Orinoco region increased fivefold, from 266,000 to 1.45 million inhabitants, 63% of whom lived in the piedmont zone. The annual population growth rate was 4% compared to 2% at the national level. Population growth was boosted by the boom in agricultural colonization since the mid-20th century, as well as the oil boom in the departments of Arauca, Casanare and Meta (Viloria de la Hoz, 2009).

Taking into account the most relevant national and/or sectoral circumstances and policies and considering historical uses of the area of influence of the project, as well as the economic trends of the region, the main activities developed that correspond to realistic and credible land use alternatives in the without-project scenario are presented and described below.

- **Illicit crops**

According to the observatory of the National University, in the period 2005-2010, coca cultivation was reported in five departments, with the departments of Meta (2005 / 17,305 ha - 2010 / 2,864 ha) and Guaviare (2005 / 8,658 ha - 2010 / 5,427 ha) being the largest producers, followed by Vichada (2005 / 7,826 ha - 2010 / 2,666 ha); and Casanare which reported a cultivation of 10 hectares only for the year 2010.

- **Agricultural sector**

In the 1980s, the agricultural sector dominated the four departments of the Orinoquia; however, the region's soils have low fertility, associated with physical and chemical problems. Acidity, aluminum saturation, susceptibility to erosion and, in general, the fragility of their physical structure make the soils unsuitable for agriculture. For this reason, extensive cattle ranching is one of the few forms of commercial exploitation in the region (Viloria de la Hoz, 2009). According to the Rural Agricultural Planning Unit, 55% of the area is used for grazing, 5% for agricultural production, 1.3% for water, 0.04% for forestry production and 38.6% for other uses (UPRA, 2015a, 2015b, 2015c, 2015d).

Between 2001 and 2008, the pasture area increased by more than 1.5 million hectares and the number of head of cattle increased from 4.8 to 6 million, with a greater increase in Casanare. During this period, the carrying capacity in Meta remained constant at 1.8 heads per hectare, while in Casanare it went from 2.1 to 1.7 heads per hectare (Viloria de la Hoz, 2009). For the period 2009 - 2014, FEDEGAN reported for Casanare a high growth going from 1.6 to 1.9 million head of cattle, while in the period from 2001 to 2014, 1.3 to 1.6 million head of cattle are reported for Meta (DANE, 2014).

In contrast, the department of Vichada had an average ratio of 0.10 head per hectare (Viloria de la Hoz, 2009) and in 2010 the department of Arauca represented a large percentage of the Orinoco economy, slaughtering 242,665 head of cattle, which obeys to 6.7% of the national total (CIAT & Cormacarena, 2018).

To continue, according to Viloria de la Hoz, 2009 the Orinoco also has an extensive agricultural area dominated by rice, oil palm, corn, soybean and banana crops. Between 1996 and 2007, the cultivated area in the four departments of the Orinoco grew by 56% and production by 51%. In 2007, the region had a planted area of 430,000 ha, of which 63% was in the department of Meta and 25% in Casanare (Table 5). Rice in its different modalities occupied the largest cultivated area with 147,000 ha and 756,000 tons produced. Oil palm was the second largest crop in terms of area planted, with 125 thousand ha (Table 6).

Table 6. Area (ha) cultivated in the Orinoquia in 1997 and 2007 (Viloria de la Hoz, 2009).

Departments	1996	2007
Arauca	41.100	53.188
Casanare	58.880	105.715
Meta	173.450	270.184
Vichada	1.501	1.118
Total Orinoquia	274.931	430.205

Source: Cataruben Foundation

Table 7. Area (ha) and tons cultivated of the main agricultural products of the Orinoco region (Viloria de la Hoz, 2009).

Products	Cultivated Hectares	Tons
Rice	146.931	764.523
Palm	125.391	295.449
Corn	47.082	125.045
Banana	32.435	423.645
Soy	23.529	42.725
Yucca	15.275	191.028

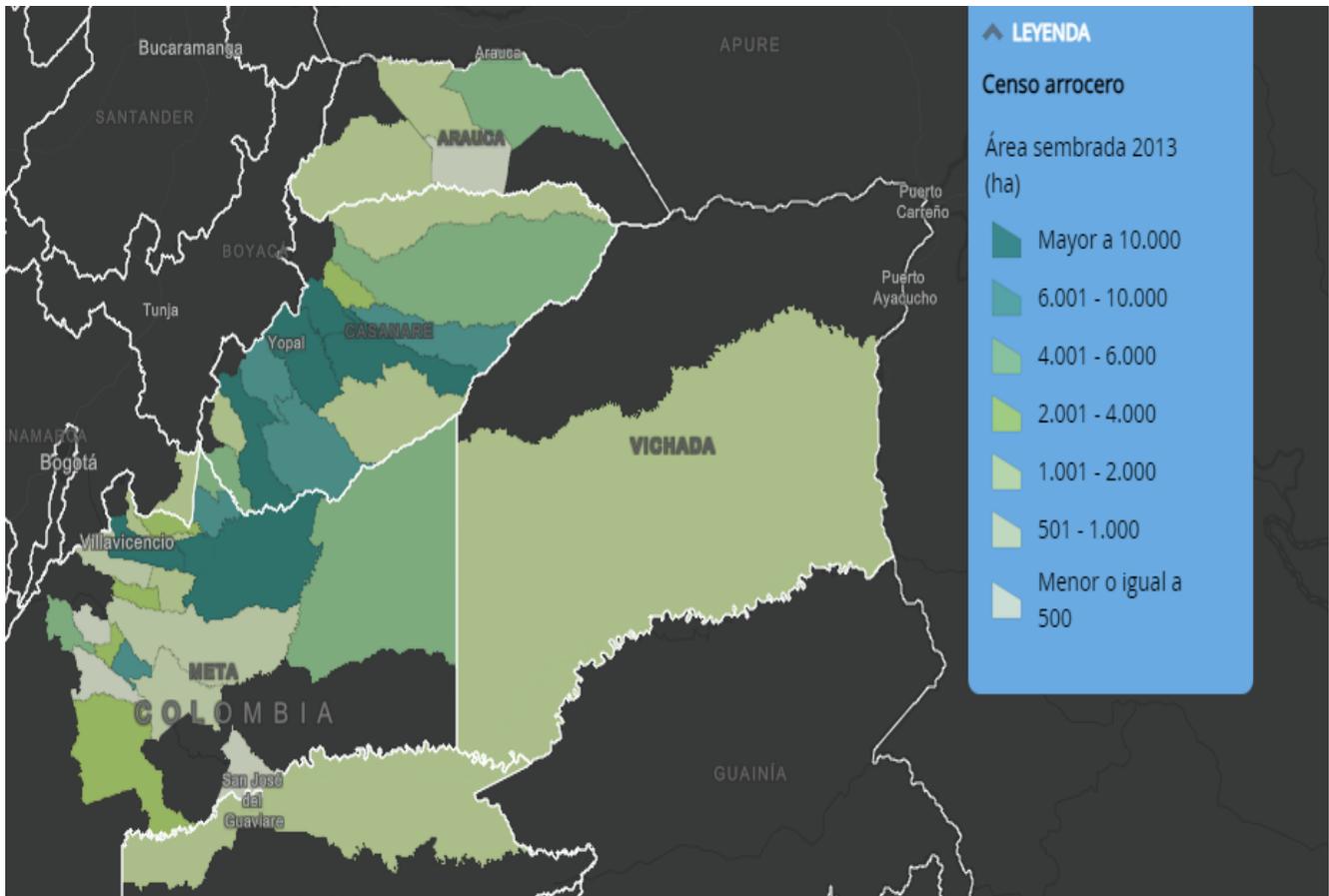
Source: Cataruben Foundation

Between 2000 and 2007, the area planted with rice fell by 15%, from 473,000 to 400,000 ha, due to the substitution of rice cultivation to plant oil palm or sugarcane to produce biofuels. In the period from 2000 to 2016, the department of Casanare became the first rice producer in Colombia going from 55,838 ha to 157,428 ha (FEDEARROZ & DANE, 2017). As for palm, between 2003 and 2007, from 207 to 327 thousand ha were cultivated, however, the departments Casanare and Meta doubled the crop from 57 to 125 thousand ha, with Meta being the largest producer.

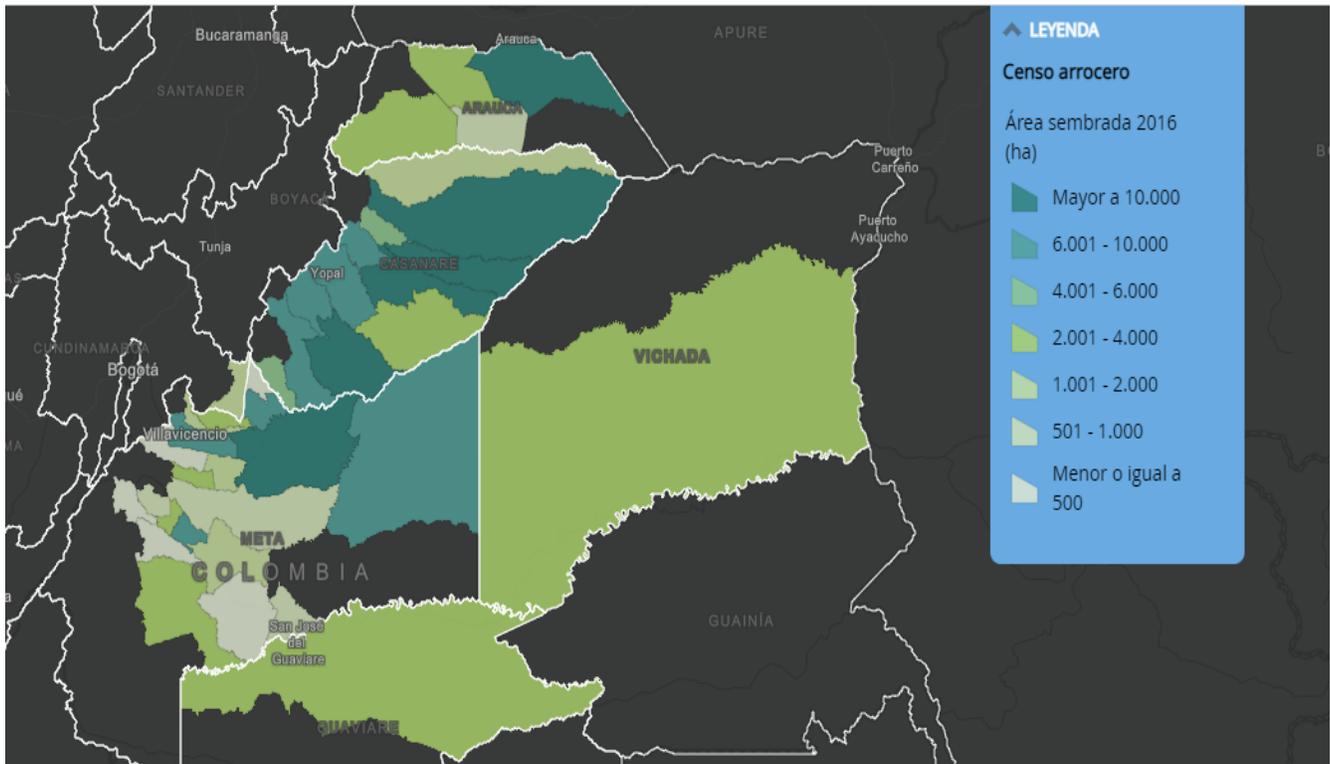
According to DANE figures reported for the period (2011-2016) as evidenced in the following table, it is possible to identify an upward behavior for rice cultivation for the departments of Arauca, Casanare and Vichada as follows; for the year 2011 the department of Arauca went from cultivating 3.423 hectares to 16,747 hectares for the year 2016, representing an increase of 489% and for the department of Casanare went from cultivating for the year 2011 65,390 hectares to 139,097 hectares for the year 2016, representing an increase of 212%. However, the department of Meta went from cultivating 80,700 hectares for the year 2011 to 63,311 hectares for the year 2016, representing a decrease of 7.89% respectively.

Area planted with mechanized rice in the Llanos rice-growing area, by department							
Department	Area planted (ha)						
	2010	2011	2012	2013	2014	2015	2016
Total	151.789	175.505	138.686	164.465	121.403	169.943	219.155
Meta	80.700	86.983	56.719	61.640	31.083	47.263	63.311
Casanare	65.390	83.236	77.209	93.879	81.326	112.857	139.097
Arauca	3.423	3.251	4.758	8.946	8.994	9.823	16.747

Source: DANE - FEDEARROZ Agreement



Source: DANE - FEDEARROZ Agreement



Source: DANE - FEDEARROZ Agreement

According to the INSTITUTO GEOGRÁFICO AGUSTÍN CODAZZI - IGAC, 2016, socializes that, 15.9% of the Orinoquia has soils suitable to support the presence of cattle, i.e. 4.02 million hectares have "green light" for cattle; the second productive use imposed in the region is agriculture, with 11.3% of the total of the Orinoquia (2.8 million hectares); Vichada and Meta are those that contribute the most to the amount of land to cultivate.

The other uses that could be developed in the Orinoquia are forestry with 5.07% (1.2 million hectares) and agroforestry with 4.6% (1.1 million hectares). "20.9% of the region has the capacity for agricultural, forestry or agroforestry development, while 15.9% is livestock. This would put an end to the myth that the lands of the Orinoquia only support the trampling of cattle, since due to the variety of its soils, other uses that have less impact on natural resources can be implemented," said Juan Antonio Nieto Escalante, Director General of the IGAC, at the Orinoquia Soils Forum, held on August 4, 2016 in the city of Villavicencio.

The Regional Comprehensive Climate Change Plan for the Orinoquia in 2018 describes livestock as one of the main economic sources for the region, occupying 50% of the productive territory and therefore continues to occupy an important cultural line. According to a report from (ICA,2016) this region reports 21.9% of the national inventory referring to milk and meat production in the Country.

According to the Orinoquia Master Plan, 2016. It reports the cultivation of cocoa and banana with outstanding yields worldwide, but also rice and corn crops showing an increase and participation in the domestic market, representing a great opportunity for the supply of the domestic market. This plan establishes long-term milestones, in which it plans to increase from

0.7 million cultivated hectares to 3.3 million hectares and the concentration of livestock in suitable areas to achieve a sustainable supply.

- **Petroleum**

According to Viloría de La Hoz, petroleum production in the Orinoco region began until the 1980s in Arauca through the exploitation of the Caño Limón field and in the 1990s for the department of Casanare in the Cusiana and Cupiagua wells. As for the other departments in the region, petroleum production for Meta was lower for this period of time, while Vichada did not take part in petroleum exploitation.

Until 1996, Arauca was the largest oil producer at the national level, being displaced to second place by the department of Casanare, which remained in first place until 2008, when Meta had a higher production. These three departments reported production of 132 and 139 million barrels of oil in 2005 and 2008, respectively.

In general, between 1990 and 2007, the mining sector in Casanare, basically represented by oil, had an average annual growth rate close to 17%, in Meta 4.3%, while in Arauca it had negative rates. In the period from 2000 to 2007, with the decline of oil deposits in Arauca and Casanare, the Orinoquia decreased its dependence on mining from 67% to 47%.

The Regional Comprehensive Climate Change Plan for the Orinoquia, reports for 2015 as the main economic activity the extraction of crude oil and natural gas, achieving a contribution to the national sectoral GDP of 74% for the same period, with a departmental distribution as follows; Arauca (7%), Casanare (28%) and Meta (65%).

According to the Orinoco Master Plan, 2016. This region has a great potential in this nature, the Orinoco hydrography has a potential of 13,700 megawatts of energy, which corresponds to 83% of the current installed capacity of the country. In the long term, the PMO is betting on the development of the PERS (in Spanish) Sustainable Rural Energy Plans, PPPs for the provision of electricity services, hydroelectric generation in the Orinoco and the production of biomass that can be used as fuel for power generation, where it could be competitive in non-interconnected areas. Also to new transmission project circuits in the Orinoquia.

Hydrocarbons are very important for the region's economy. Oil production in the Orinoquia represents 74% of the national production, this makes it necessary to identify options for the development of the economy of the region and the country without leaving aside the dynamics of this sector and the importance it has in the country's economy. The most important thing is to establish clear rules of the game regarding the development of this sector and the considerations it should offer to the country.

- **Continuation of previous land use:**

Based on the economic trends mentioned above, categorized as the expansion of the agricultural frontier, industrialization and fossil fuel extraction in the reference region and in the project area, these have driven land use change, biodiversity loss and GHG emissions due to deforestation, degradation and the transformation of natural ecosystems in a considerable manner.

- **Projects without emission reduction certification:**

This alternative is very likely to occur in the project's reference region, since there is a lack of knowledge on the part of the Corporations, territorial entities and private entities regarding the operation of climate change mitigation projects and the steps that precede to certify GHG reductions and/or removals.

Among the types of projects without certification, the following are identified: forced investment of no less than 1%, mechanisms for payments for environmental services for watershed supply and/or conservation agreements.

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

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

In addition to the above context, the Master Plan of the Orinoquia, In 2016 Tourism is established as a potential economic activity in the region, taking into account the demand for nature tourism in the world; identifying several lines in which efforts can be focused and boost its implementation (ecotourism, adventure tourism, rural tourism and bird watching).

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

Continuation of the previous land use: This historical land use alternative in the project area, complies with historical laws and regulations promoted by the national government, which start from The Political Constitution of Colombia, the National Development Plan (2018-2022), "Pact for Colombia, Pacts for productivity and equity in the regions", specifically the Plains-Orinoquia region, to connect and strengthen the region's sustainable pantry with the country and the world, and finally the development plans for each of the departments (Arauca, Casanare, Meta and Vichada), which promote the development of agribusiness, livestock and green markets in the region.

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

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

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

Law 388 of 1997 establishes that the purpose of municipal land use planning is to complement economic and social planning with the territorial dimension, rationalize interventions on the territory, and guide its development and sustainable use through the definition of territorial

strategies for land use, occupation, and management. In 1997, the Ministry of the Environment issued the National Cleaner Production Policy, which seeks to solve the environmental problems of the productive sectors by preventing pollution at its source.

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

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

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

Projects without emission reduction certification: This land use alternative complies with regulations and laws issued by the national government.

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

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

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

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

Other land use alternatives in the project area: This land use alternative complies with the regulations and laws issued by the national government; however, production techniques are not ideal in the Orinoquia region, resulting in the transformation of strategic ecosystems, excessive use of agrochemicals, water contamination, and GHG emissions.

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

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

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

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

13.2. ADDITIONALITY.

Taking into account the guidelines established in numeral 9 of the AFOLU SECTOR METHODOLOGICAL DOCUMENT for the Quantification of GHG Emission Reductions or Removals of REDD+ Projects in its version 2.2 and numeral 11.2 of the AFOLU SECTOR METHODOLOGICAL DOCUMENT / Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands, additionality is established through the steps "Barrier Analysis" and "Impact of the project registry".

13.2.1. Sub-step 2a. Identify barriers to project implementation

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

- **Investment barriers, among others:**

- a) *Debt financing is not available for this type of project:* one of the main barriers to accessing financial capital for this type of project is that it is a mechanism that behaves differently from the productive sector and/or any other sector; additionally, the owners of the land do not have a current credit history and the backing of a third party with economic capacity makes the process more complex; and finally, the developers do not meet the requirements for accessing this type of financing.
- b) *No access to capital markets due to real or perceived risks associated with domestic or foreign direct investment in the country where the project is to be implemented:* These types of projects do not have access to capital markets, given the risks of permanence of the areas subject to implementation, the costs of validation, verification and certification, and the limited knowledge of the private sector in this area.
- c) *Lack of access to credit:* One of the most important barriers in the financial sector, due to compliance with requirements, time, conditions and behavior of the projects in terms of operability and guarantee in the permanence of the areas subject to conservation; limiting land owners and project developers.

- **Institutional barriers, among others:**

- a) *Risk related to changes in government policies or laws:* Projects that choose to demonstrate GHG removals and/or reductions are supported by regulations issued by the national government, which ultimately translate into guarantees for the financial and technical sustainability of the projects; currently there are guarantees from Law 1819 of 2016, Decree 926 of 2017, Law 1844 of 2017, Law 1931 of 2018 and Resolution 1447 of 2018; however the normative regulations are changeable, and can significantly affect the projects, in case they are repealed, substituted or annulled.
- b) *Lack of enforcement of legislation on inland wetlands or related to land use:* Currently the forest ecosystem has methodological guidelines supported by current legislation, however efforts towards the wetland ecosystem are not reflected in scientific studies, prioritization in legislation, carbon storage data, levels of transformation, stratification at the level of cover. However, the existence of a methodology that allows the quantification of GHG removals and/or reductions in inland wetlands, promotes the effective management, conservation and planning of these strategic ecosystems.

- **Barriers due to social conditions, among others:**

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

The barriers due to social conditions that would prevent the implementation of the project in demographic terms are the massive migration of workers that has developed since the 1990s to the Orinoco departments where hydrocarbons are produced, such as Arauca, Casanare, and Meta. According to the National Administrative Department of Statistics (DANE) for 2005, the participation of the value of mining and quarrying production in the departmental Gross Domestic Product (GDP) for the three departments that make up the Orinoco region was 10.9% for Arauca, 24% for Casanare and 11.4% for Meta, 11.4% for Meta, with Casanare having the highest share at the national level, for 2019 after the fall in oil prices for Arauca the share of mining and quarrying production in GDP decreased to 4.1%, for Casanare to 11.7% and for Meta to 31.9%.

The fall in oil prices at international level has stimulated industrial production, which has also brought a migration of workers to enter to support the oil palm agroindustry, according to statistical data from Fedepalma for 2019 there were about 200,000 hectares of production in the Eastern Zone. The importance gained by the production of hydrocarbons and oil palm caused the massive migration of workers from the interior of the country and the Pacific coast, according to statistical data from DANE for 2005 in Casanare there were 281,294 people registered in the census in 2005. In the same way for Meta in 2005 there were 713,772 people registered in the census and 919,129 people, 153,028 in 2005 and 239,503 in 2018, this shows an exponential increase in population, related to the expansion of urban centers.

b) Social conflict between interest groups in the region where the project is developed:

Social conflicts in the Orinoquia region over the last decades have been related to the Colombian armed conflict between military forces and insurgent organizations, especially guerrilla groups and paramilitary groups. According to Nieto-Matiz (2012), the strengthening of the actions of self-defense or paramilitary groups, as well as the political and economic power they achieved in departments such as Casanare, can be explained by the relations between these groups and the political elites. The intensification at the beginning of the 20th century of the illegal and violent actions of the self-defense groups against the guerrilla groups and among the paramilitary groups themselves, was motivated by the search for political and economic control through alliances with the political elites of the department that allowed them to obtain large amounts of money illegally, through the transfer of high percentages of royalties from oil exploitation to the departmental administrations.

On the other hand, cattle ranching has a wide dominance in the rural space of the country, occupying more than 34 million hectares of which 16 million have an agroecological vocation, which generates a significant ecological and territorial conflict (IGAC 2012). This conflict has also gone beyond environmental issues and has generated strong social and political problems (Fajardo 2002), associated with the high concentration of rural property, economic and political control, and armed conflict.

- c) *Widespread illegal practices (e.g. illegal grazing, extraction of non-timber products, logging):* This barrier has been identified in the project area, considering that there is a lack of knowledge of the scope in terms of domestic forest harvesting and the transformation of cover (forests to pastures) in the project area; practices that prevent access to economic incentives and participation in the project. However, the implementation of the initiative will guarantee the adoption of good environmental practices, the restoration of areas, ongoing training in applicable regulations, and the conservation of ecosystems.
 - d) *Lack of skilled and/or properly trained labor:* This barrier takes center stage in the project area, since the lack of these initiatives does not generate the need to promote training processes by higher education and job training institutions in the region. In this context, the project has generated technical capacities in the professionals and governance in the owners in order to guarantee the project's operability and generation of results.
 - e) *Lack of community organization:* This barrier is identified in the project area, however the presence of other environmental organizations has boosted governance in the territory, which guarantees the success of this type of initiative; currently the project groups block of private landowners, who through continuous training processes have internalized the dynamics of the project and their long-term commitment.
- **Barriers related to land tenure, ownership, inheritance and property rights, among others:**
 - a) *Land ownership, with a hierarchy of rights for different stakeholders, limits the incentives to undertake the project;* ownership is a right that is acquired in accordance with established legal provisions. In that sense there are legal figures such as possession (civil property) and occupation (State property) regulated by the civil code that also grant rights and therefore ownership. In this sense, one could not speak of a hierarchy of rights for the interested parties, but rather of the quality that each beneficiary holds in order to be linked to the project and therefore to enjoy the incentives granted within the framework of the initiative. The barrier materializes when the quality of owner or holder (possessor or occupant) is not met, for which the project owner provides advice and assists the person to initiate the necessary procedure in order to acquire the quality to which he/she is entitled according to the provisions of the Colombian Civil Code, Law 160 of 1994 and other regulations.
 - b) *Lack of adequate land tenure legislation and regulations to support security of tenure:* Although the regulations in place, especially for the adjudication of vacant properties (which represent 80% of the real estate linked to the project) are structured, they are not fully known or understood by the peasant population, which is why the adjudication application process to which the occupants of these properties are entitled is not carried out. Thus, the peasants have only a mere expectation of their right to occupancy, for which the project owner advises and assists each of the occupants to make the respective adjudication request, on the occasion of Law 160 of 1994 and Decree 1071 of 2015 and subsequently their linkage to the project.

- c) *Absence of clearly defined and regulated property rights in relation to natural products and services:* As mentioned in paragraph a, the project owner, prior to linking a real estate property to the initiative and within the framework of the provisions of Resolution 1447 of 2018, conducts a study and analysis of the ownership and tenure of the land and therefore of the rights held with such prerogative. Thus, by having legal certainty of the quality that the beneficiary has, it is possible to determine the legal capacity to dispose of the use of the land.
- d) *Formal and informal tenure systems that increase the risk of land fragmentation:* Land tenure occurs on the occasion of the possession or occupation of the land (as mentioned in literal b) figures legally established in the Colombian Civil Code; However, depending on the type of location where the land is located, situations may arise or occur that violate the acquired rights of the people who inhabit it, due to factors such as violence, forced displacement, among others; therefore, the owner of the project makes a detailed analysis of the social impact that is externalized in the municipality where the real estate to be linked in the initiative is located, in order to determine the legal feasibility regarding the linkage of the properties.

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

The land uses identified in the baseline scenario are not affected by the aforementioned barriers, given that national and regional regulations and development plans promote agricultural development in the region. In this context, in the project area, the livestock sector continues to be a very important sector and the source of landowners' main income. In short, the project promotes the implementation of good environmental practices, the effective management of environmentally strategic areas, the declaration of protected areas and territorial planning in order to strengthen this alternative land use.

13.2.3. Step 3. Project registration impact

CO₂Bio project 2, with the certification and registration process, reduces the impact of the barriers identified above; a process that ultimately generates the following incentives;

- a) *Reduction of greenhouse gas emissions by avoiding changes in land use:* The project manages reductions and/or removals by avoiding deforestation and degradation of forest areas and the transformation of inland wetlands; efforts that translate into tCO₂ removed per hectare of forest and tCO₂ removed per hectare of wetlands. Removals that guarantee access to economic incentives for the sale of carbon certificates in the regulated and/or voluntary market, as an effective mechanism to avoid land use change.

- b) *The financial benefit of the income obtained from the sale of CCV, including the certainty and predefined moment of income:* In order to grant economic incentives to owners that make possible the non-transformation of ecosystems and their conservation in the project area, a financial analysis is initially performed, taking into account the project monitoring period (initial investment required by the project) and the period of quantification of GHG reductions and/or removals (action window), thus achieving a financial projection from 2016 to 2045. This analysis is carried out through the financial model tool, which details investment items, costs and expenses as well as projects the CCV inventory and therefore the sale, so that the following results are determined by means of the following calculations:

- Income statement:

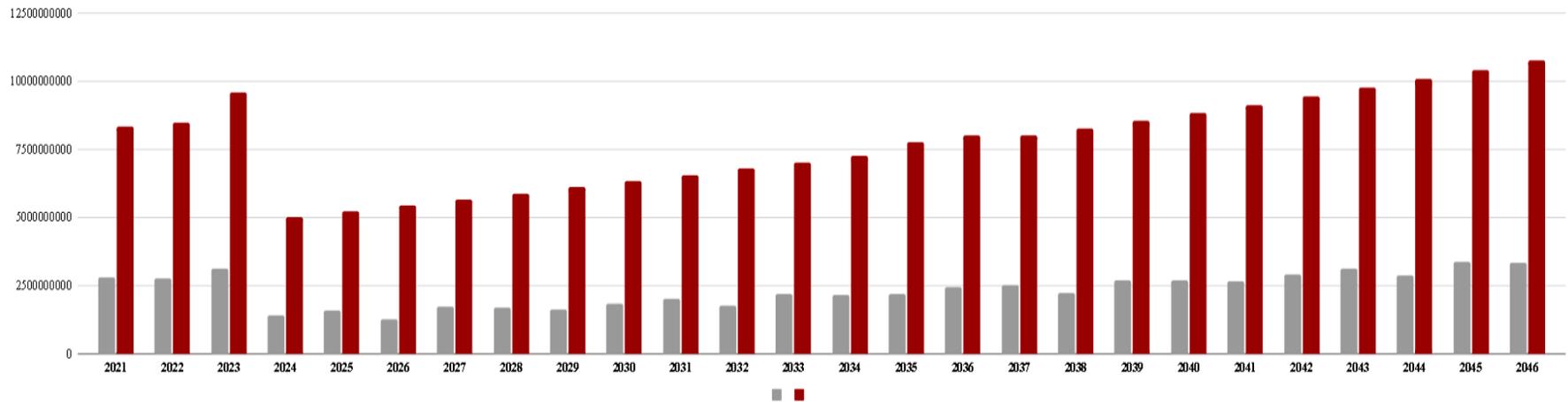


Figure. SEQ Figure. ARABIC 5. Projected income statement project 2 Co2Bio
Figure 5. Projected Income Statement Co2Bio2 Project

Source: Cataruben Foundation

Figure 5 represents the economic performance of the project during its life cycle, showing a positive financial performance both for the beneficiary (red-brown color), thus financing ecosystem conservation activities, and for the sustainability of the project (gray color), with high peaks until the year 2023 and rising trends as of 2024, which demonstrates sustainability and eliminates a loss scenario.

- Cash flow:

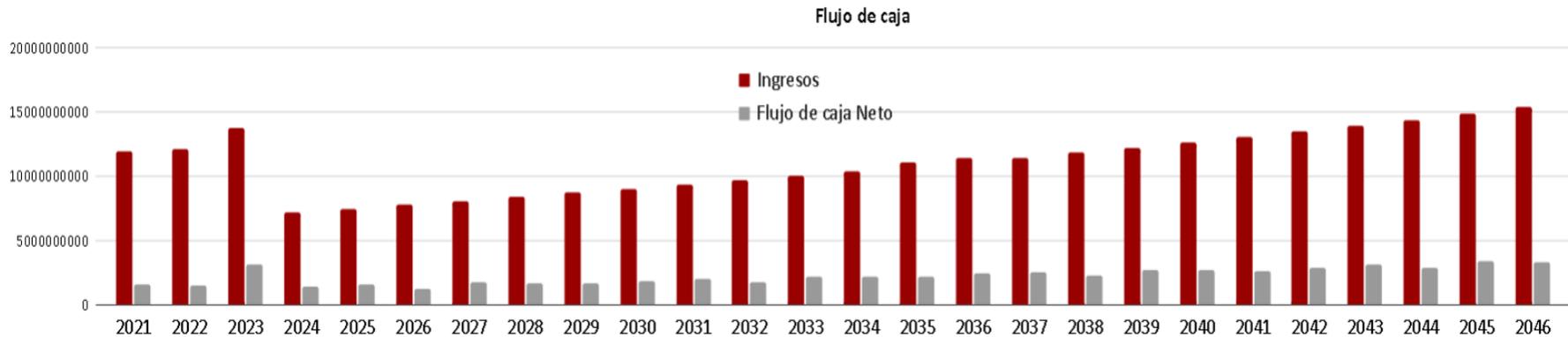


Figure. SEQ Figure_ ARABIC 6. Projected cash flow for project 2 Co2Bio

Figure 6. Projected cash flow for project CO2bIO2

Source: Cataruben Foundation

Like the income statement graph, Figure 6 shows optimistic figures for the CO₂Bio 2 Project, evidencing a financial projection with a positive net cash flow, i.e. Once the total expenditures are projected regarding to the total income during the execution period, it can be concluded that there is sufficient liquidity and solvency to provide continuity and sustainability for the development of this project.

Thus, the economic incentives generated by the sale of carbon certificates as a consequence of the possible non-transformation and conservation of forest and wetland ecosystems, generate sustainability for the landowner, since, of the total retributed as financial benefit, landowners only invest 0.6% in the income to the project, returning 99.4% for conservation activities, as shown in the following graphs:

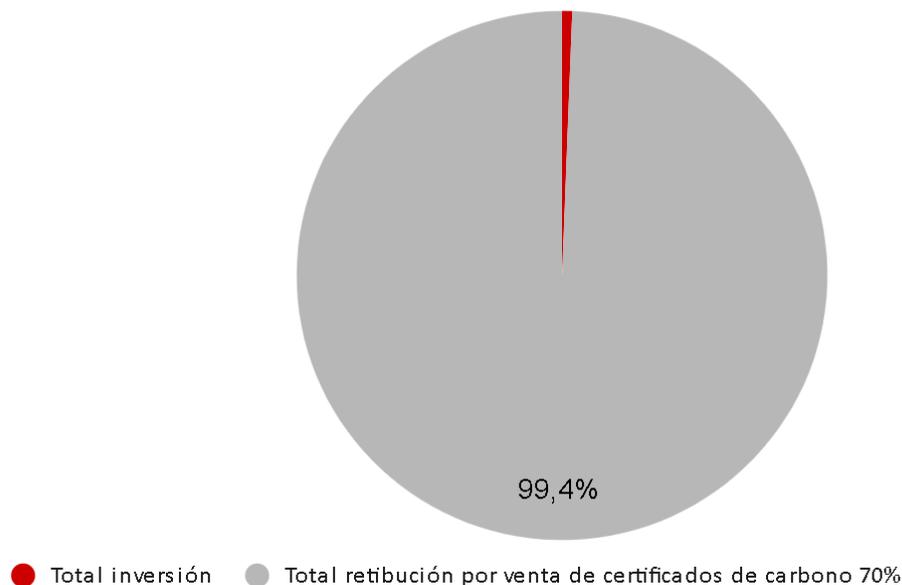


Figure. 7 Investment vs. remuneration for carbon certificate sales.

Source: Cataruben Foundation

Table 8. Investment vs. remuneration for sale of carbon certificates

		PRICE PER HECTARE	TOTAL HECTARES PER YEAR	TOTAL
Beneficiaries	Forest	\$25.245	20,206	\$ 510.100.470
	Wetland	\$7.400	63,326	\$ 468.612.400
		Total, investment		0,6%
		Total, remuneration for the sale of carbon certificates 70%		99,4%

Source: Cataruben Foundation

The above is supported by the mixed financial model estimated for the project, based on the investment period and future monitoring of the project ([SEE ANNEX 1.6. FINANCIAL MODEL](#)).

Finally, the project establishes guidelines regarding the rights and ownership of carbon through a contractual relationship with landowners, in order to regulate the obligations and distribution of economic benefits generated by the project; in this sense, 70% of the resources are granted to landowners for the implementation of conservation and climate change mitigation activities and 30% to cover administrative, operating, validation, verification and certification expenses for subsequent monitoring of the project.

14. SUSTAINABLE DEVELOPMENT GOALS

The project is aligned with the Sustainable Development Goals, which were adopted by the Colombian state as a member of the United Nations, and as part of the 2030 Agenda, which establishes a plan to achieve the goals in 15 years from 2015.

Understanding that investments in sustainable development will help address climate change by reducing greenhouse gas emissions and strengthening climate resilience (UN). Specifically, the project relates to the targets of Goal 5 on Gender Equality, Goal 13 on Climate Action, and Goal 15 on Life of Terrestrial Ecosystems.

The project seeks to contribute to three Sustainable Development Goals, these are: Climate Action (13), Life of Terrestrial Ecosystems (15) and Gender Equality (5). The specific target to which it contributes to the thirteenth goal on Climate Action is: (13.3) Improve education, awareness and human and institutional capacity for climate change mitigation, adaptation, mitigation and early warning.

To contribute to Objective 13, the project will carry out training and support processes with landowners to strengthen sustainable forest and wetland management, as well as training on climate change, declaration of Civil Society Nature Reserves, strengthening governance principles and implementation of the management plan that allows the preservation of these ecosystems. The procedure for the evaluation of this goal will be the follow-up of the attendance record to the training, the evaluation of acquired knowledge and its subsequent implementation in the activities developed in each property.

The goal to which the project contributes to the fifteenth objective on Life of Terrestrial Ecosystems is: (15.1) To ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and the services they provide, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements. To this end, the project will contribute to the declaration of Civil Society Nature Reserves (CSNR) of some properties that meet the necessary conditions or may do so, thus contributing to the protection and sustainable use of ecosystems and the ecosystem services they provide.

The procedure for the evaluation of this goal will be to follow up on the issuance of CSER resolutions, the preparation of management plans or property plans with the identification of ecosystem, biodiversity, socioeconomic and productive conditions, and the monitoring of compliance with conservation activities.

The project will contribute to the fifth objective on Gender Equality, especially to the target: (5.5) Ensure women's full and effective participation and equal leadership opportunities at all decision-making levels in political, economic and public life. This will be carried out through meeting spaces with women owners and women members of the families, as well as their participation in workshops on strengthening project governance and training spaces to strengthen knowledge and skills on climate change mitigation, biodiversity conservation and sustainable production practices. The procedure for the evaluation of this goal will be the monitoring of the participation of women owners and other women beneficiaries, and the fulfillment of the objectives or activities of the project that are led by them. The monitoring plan for the Sustainable Development Goals can be found in item 14 ([See Annex 1.7. SUSTAINABLE DEVELOPMENT GOALS](#)).

15. CATEGORY RELATED TO CO-BENEFITS

The ProClima standard allows the application to special categories, according to the co-benefits generated from the development of the project. Taking into account the proposed activities and goals, the project meets the conditions for the Orchid category, listed in Table 8.

In this sense, related to the project activities, new activities that generate additional benefits to communities, women, biodiversity and towards climate change adaptation will also be implemented according to the Orquídea category.

Table 9. Orchid Category Requirements

Biodiversity conservation	Benefits on communities	Gender equity	Adaptation to climate change
a) Develops effective actions and measures to halt the loss of biological diversity, favoring that ecosystems continue to provide essential services.	a) identifies and strengthens mechanisms for social and community participation at the local and regional level.	a) considers determinants set forth in the normative framework related to gender: (a) Law 731/02 on rural women (b) Women's equity policy guidelines	a) considers some of the activities proposed in the National Policy on Climate Change
	b) the initiative generates short- and long-term benefits, to small-scale productive projects, with members of the communities in the project area		b) implements activities that generate landscapes sustainable and low-carbon production systems
b) Due to project activities, no invasive species have been introduced.	c) the activities within the framework of the GHG mitigation initiative, they produce an average net increase in the income of the local producers	(c) ensures the full and effective participation of women and equality of opportunities for women and men in all aspects of life. opportunities for leadership to all the levels of adoption of decisions in the project scope	c) designs and implements adaptation strategies based on an ecosystem-based approach

Source: PROCLIMA 2021

15.1. BIODIVERSITY CONSERVATION

15.1.1. Biodiversity conservation and ecosystem services.

The project will contribute to halting the loss of biological diversity through the implementation of measures that will directly and indirectly help maintain and improve the biological conditions of natural forests and inland wetlands, ensuring the provision of essential ecosystem services for the well-being of the community. These measures have been designed to correspond with REDD+ activities and safeguards, as well as measures to avoid socio-environmental risks and project activities related to the conservation of biodiversity associated with wetlands.

- **Declaration of Civil Society Nature Reserves (RNSC).**

The project will promote and support the declaration of CSERs, which are protected areas whose management is oriented towards the conservation of natural ecosystems and their biodiversity. These areas are part of the National System of Protected Areas (SINAP) and according to Decree 1996 of 1999, which regulates Articles 109 and 110 of Law 99 of 1993 on Natural Reserves of Civil Society, they are defined as "the part or the whole area of a property that conserves a sample of a natural ecosystem and is managed under the principles of sustainability in the use of natural resources. Excluded are areas that industrially exploit timber resources, admitting only timber exploitation for domestic use and always within the parameters of sustainability".

- **Identify and recognize Key Areas for Conservation (KBAs⁵).**

The project will identify and recognize KBAs in the project area, which are understood as sites that contribute significantly to the global persistence of biodiversity. Identifying these areas is important for biodiversity conservation and the provision of ecosystem services, as it recognizes and delimits specific sites that are important for the persistence of biodiversity at the global level. Similarly, the conservation of KBAs is complementary to landscape-scale management and species management.

15.1.2. Encourage the use of native species

Although the implementation of project activities does not imply the introduction or use of invasive species, the project will evaluate whether these species are present in the natural areas that are part of the project boundaries, and will design measures for their management. In addition, by means of technical advice and support to the landowners, the use of native species will be encouraged in the implementation of best practices, such as agroforestry systems, sustainable cattle ranching, and restoration through revegetation or enrichment of forests, morichales, and other palm groves.

⁵ IUCN (2016). A Global Standard for the Identification of Key Biodiversity Areas (KBAs), Version 1.0. First edition. Gland, Switzerland: IUCN.

15.2. BENEFITS TO COMMUNITIES

15.2.1. Identifies and strengthens mechanisms for social and community participation.

In terms of benefits for the communities, the project will identify and strengthen mechanisms for social and community participation, understanding that these are the means created by individuals or communities to collectively implement actions in search of solutions to their needs. Within the framework of the project, the Cataruben Foundation and the beneficiaries will identify the main mechanisms for social and community participation at the local and regional level in the conservation, sustainable use and promotion of biodiversity and ecosystem services.

Activities will focus on strengthening the social and community mechanisms developed for the implementation of better environmental practices, especially the actions and functioning of the Municipal System of Protected Areas of San Luis de Palenque and Trinidad (SIMAP), as well as those of the Regional System of Protected Areas of the Orinoco (SIRAP). Community organizations in the area will also be identified and strengthened with measures to improve their functioning and coordination with the project's objectives.

15.2.2. Benefits to small-scale production systems

From the income generated by the sales of the project's carbon certificates, economic benefits will be obtained that will optimize and make sustainable the productive projects developed on the properties, including livestock, beekeeping, ecotourism, among others, contributing to the conservation of ecosystem services.

In this sense, the project will also generate strategic alliances between non-governmental organizations and the landowners to accompany them in the improvement of productive activities. In addition, training and strategic alliances will be established with governmental actors to promote and strengthen tourism activities on the properties that are engaged in these activities or wish to participate in them. This is expected to generate short- and long-term benefits for small-scale productive projects, together with the landowners in the project area.

15.2.3. Average net increase in income of local producers

Regarding the average net increase in the income of local producers, the various forest and wetland conservation activities will make it possible to obtain carbon certificates that will be traded in the voluntary or regulated market. 70% of the income from their sale is destined for the owners and families of the project properties, which will generate an additional initial income that will guarantee an average net increase in income that will later be reinvested in improving the quality of life of the owners and their families.

15.3. GENDER EQUITY

15.3.1. Consider determinants set forth in the regulatory framework related to gender: (a) Law 731/02 on rural women^{17.1}.

15.3.1.1 Delimitation of inland wetlands

The identification, delimitation and classification of inland wetlands present in the

The project contributes to and seeks to strengthen the improvement of the quality of life of participating rural women, prioritizing low-income women and enshrining specific measures aimed at accelerating equity between rural men and women. Specifically, it will contribute to Article 6 of Law 731 of 2002, regarding "Dissemination and Training: The funds, plans, programs, projects and entities that favor rural activity, shall effectively support rural women's access to resources, through suitable means that allow their dissemination, adequate training for their use and technical assistance for the productive projects undertaken."

Supporting rural women's access to resources through the strengthening of competencies for social entrepreneurship with a focus on gender. This will allow the use of the economic benefits resulting from the sale of carbon certificates for the improvement of productive projects where women are the protagonists.

15.3.2. Demonstrates that it considers determinants set forth in the normative framework related to gender: (b) Policy Guidelines for Women's Equity 2012.

The project contributes to ensuring the full enjoyment of the rights of Colombian women, guaranteeing the principle of equality and non-discrimination, taking into account the conditions of rural women farmers, specifically contributes to Guideline 13 on strengthening processes that contribute to cultural transformation in favor of non-discrimination, raising awareness through training to eradicate stereotypes about the role of women in rural areas of the Colombian Orinoquia and helping to value the contribution of rural women in strengthening the rural culture.

15.3.3. Ensures women's full and effective participation and equal leadership opportunities at all levels of decision-making at the project level.

The project contributes to full participation and equal opportunities for leadership in all areas of the project, through the call for women owners and their families to participate in decision-making spaces on the project. In addition, the Cataruben Foundation, as owner of the project, implements a gender equity policy to make it an inclusive entity, which aims to strengthen the empowerment of women through their economic activities, and to promote cultural transformation in any natural or legal person related to the Cataruben Foundation that

allows equal participation of men and women in the labor market, thus maintaining equal conditions and opportunities for leadership in every area of the organization.

15.4. ADAPTATION TO CLIMATE CHANGE

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

The project takes into account the provisions of action line E of the National Climate Change Policy on "Management and conservation of ecosystems and their ecosystem services for low-carbon and climate-resilient development". Specifically, the project area will "Evaluate the conservation status of ecosystems associated with areas of water supply, flooding and drought, and sea level rise, such as water sources and watersheds within priority watersheds, and mangroves in coastal areas". This will make it possible to evaluate essential ecosystem services in the water sources within the Orinoco basin and contribute to diagnose and improve their conservation status.

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

The project will promote the implementation of sustainable, low-carbon production systems in the AFOLU sector (agriculture, forestry and land use). This will be done through training and technical assistance aimed at interested beneficiaries, through which knowledge will be shared and skills will be developed according to the productive activity they wish to implement. Two types of scenarios will be considered according to the beneficiary's interest:

- Beneficiaries interested in implementing sustainable low-carbon productive activities.
- Beneficiaries interested in transforming their current production systems to more sustainable and low-carbon ones.

For both scenarios, the implementation of sustainable livestock farming is one of the activities that may be of greatest interest. The development of silvopastoral systems and improved pastures converts extensive unproductive areas used for cattle raising into areas with greater animal carrying capacity and cash crop production. Some of the benefits of this type of production system are nitrogen fixation, shade for livestock, forage with higher protein content and increased soil carbon sequestration (World Bank, 2012). Other low-carbon production systems that are gaining momentum in the region and may be of interest are agroforestry systems, beekeeping and meliponiculture.

15.4.3. Design and implement adaptation strategies based on an ecosystem approach.

In the project area, the beneficiaries are affected by the harsh drought seasons that occur annually (mainly in the months of December and February), which are increased by climate change. These seasons are characterized by the frequency of fires that affect extensive

vegetation cover (such as native savannah and forests) and generate low availability of water resources.

In response to this problem, the project will implement adaptation strategies based on an ecosystem approach that aim to maintain and increase resilience and reduce the vulnerability of ecosystems and people to climate change (Lhumeau & Cordero, 2012). First of all, guardrails will be implemented for fire control, as well as bush and shrub management to prevent forest fires. In addition, water harvesting will be promoted so that beneficiaries will have access to water resources during the dry season, by means of a reserve system to store water during the rainy season.

CHAPTER 2. INLAND WETLANDS

In this chapter 8 numerals are listed based on the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands. Version 1.0 27 October 2021; in order to demonstrate GHG reductions for the issuance of carbon certificates for the wetland ecosystem.

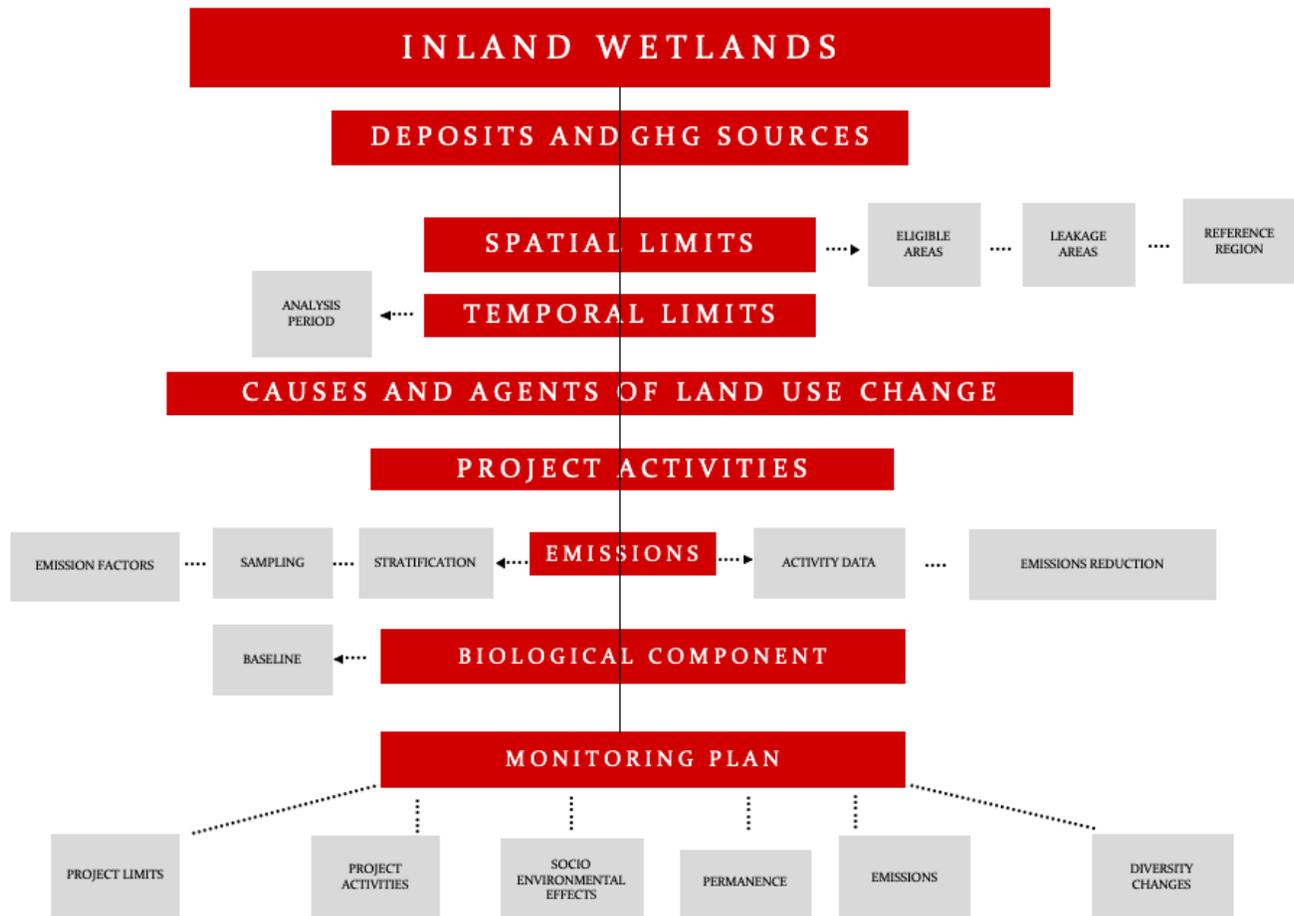


Figure.8 Basic structure of the Wetlands chapter.

Source: Cataruben Foundation

16. CARBON RESERVOIRS AND GHG SOURCES

For the Wetland area, the deposits and sources described in the methodology "Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands" are taken into account.

16.1. CARBON DEPOSITS

The choice of carbon pools and GHG sources applicable to the wetland ecosystem shall take into account the guidelines established in the AFOLU Sector Methodological Document / Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands, as shown in the following table;

Table 10. Carbon deposits

CARBON DEPOSITION	TYPE OF CONTAINER	INCLUSION	JUSTIFICATION
Soil	Soil Organic Carbon - COS or Total Soil Carbon - CTS	Yes	Wetland soils have a large carbon storage capacity and the change in this reservoir is significant.
Total Biomass - BT	Aerial biomass - BA	Yes	Living biomass, both above and below ground, are significant carbon reservoirs. Therefore, the variation in the content of these pools must be quantified.
	Subway biomass - BS	Yes	

Source: Cataruben Foundation

16.2. GHG SOURCES

The emission sources and associated GHGs are presented in the following table;

Table 11. Emission sources and GHG

Source	GHG	Inclusion	Consideration
Woody shrub biomass combustion	CO ₂	NO	CO ₂ emissions due to woody biomass combustion are quantified as changes in carbon stocks.
	CH ₄	YES	Emissions should be included if the presence of fires was identified in the monitoring period.

Source: Cataruben Foundation

17. PROJECT BOUNDARIES

Considering that it is a grouped project, the project boundaries are determined according to the guidelines established by the ProClima standard and the methodology "Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands".

In this context, the limits of the project are described below;

The project area, takes up the exercise of delimitation of wetlands in Colombia developed by the Alexander Von Humboldt Biological Resources Research Institute, scale 1:100,000 (Flórez, C., et al 2016), who classify wetlands according to the criteria of flood pulse, geomorphology, hydromorphic soils and hydrophilic vegetation. This allowed the construction of the inland

wetlands map identifying four categories: permanent open wetland, permanent under canopy, temporary and medium potential.

Flórez, C., et al 2016, identified the land covers associated with floods and wetlands and related them to the national land cover map Corine Land Cover (CLC) produced by IDEAM.

The project started activities in 2016; wetland eligibility was determined based on cartographic overlay to identify the coverages that underwent some change (transformation) or were preserved. The above analysis was based on national information from the CLC 2009 and CLC 2015, the latter prepared according to the methodology and Corine Land Cover Legend adjusted for Colombia.

17.1.1. Eligible areas within the project boundaries

Eligible areas correspond to those classified as natural wetland ecosystems within the project areas, which have not been transformed since the project start date and at least five years before and are not under forest cover.

The following table shows the eligible areas within the project boundaries and Figure 9 shows their spatial distribution.

Table 12. Eligible Wetland Areas

Eligibility	Area (ha)	Percentage (%)
Eligible	63.328,5	51,8
Not Eligible	58.774,5	48,2
Total	122.103	100

Source: Cataruben Foundation

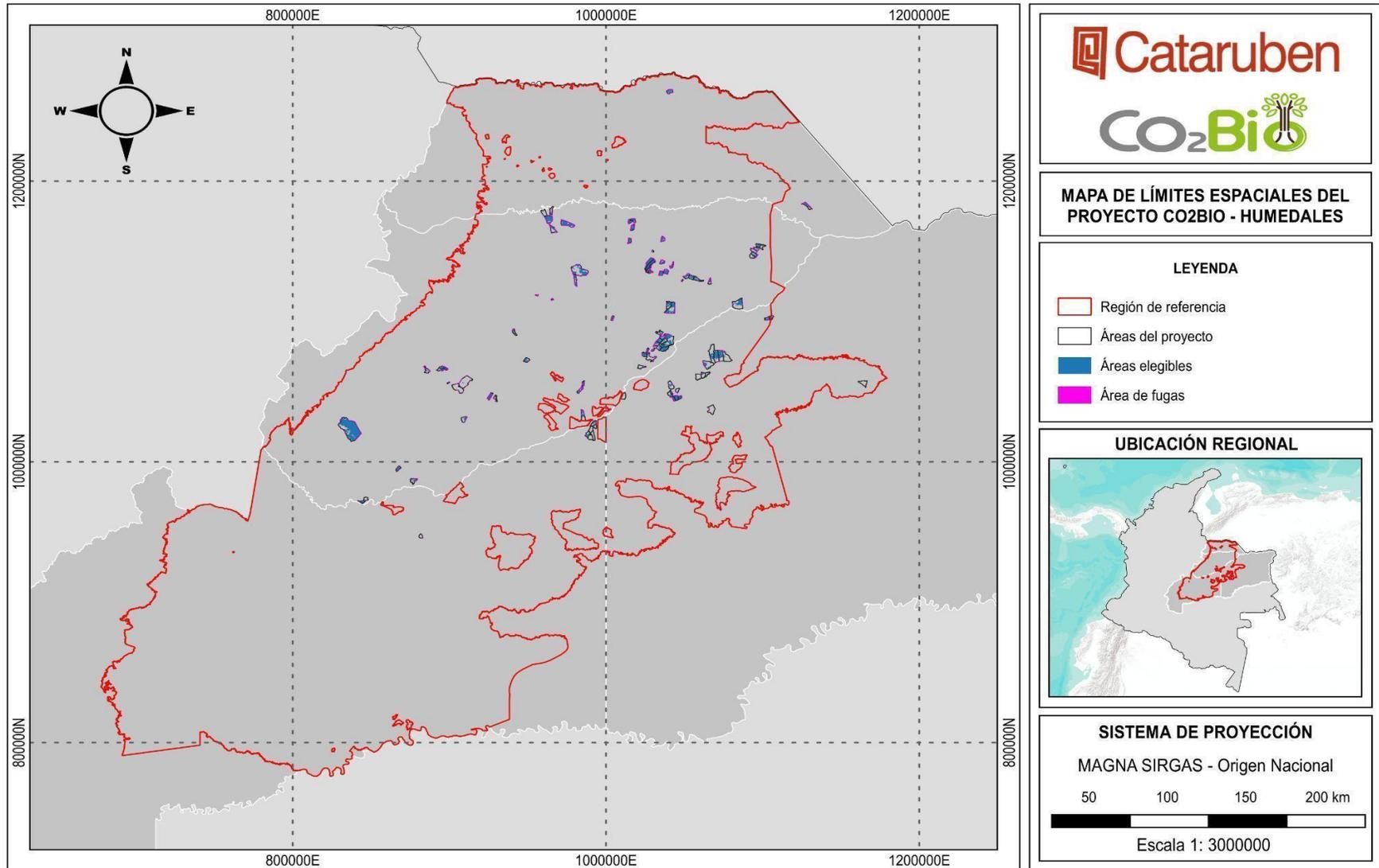


Figure.9 Spatial boundary map Continental Wetlands

Source: Cataruben Foundation

17.1.2. Addition of areas to the project subsequent to validation

For the addition of new Wetland areas eligible for the project (after validation), compliance with the guidelines established in the ProClima V.3.0 standard and the methodology "Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands" version 1.0 must be ensured, following the grouping conditions described below:

- Identify the area of expansion of the initiative or project during the validation process and define the criteria for the addition of new areas;
- Comply with the guidelines of the Certification and Registration Program for GHG Mitigation Initiatives and other Greenhouse Gas Projects, in its most recent version;
- Comply with all applicable PROCLIMA methodological documents, in their most recent version;
- Include emission reductions only for validated project activities;
- Implement the GHG emission reduction or removal activities described in the validated project document;
- Demonstrate that baseline scenario, land tenure and additionality considerations are consistent and valid for new areas;
- Submit evidence of the start date of activities in the new areas, demonstrating that this date is after the start date of GHG removal activities in the areas included in the validation.

17.2. REFERENCE REGION

The reference region corresponds to the area where wetland cover transformation processes occur. The region includes part of the departments of Arauca, Casanare, Meta and Vichada. In terms of biomes, the Pedobiome of the Tropical Humid Zonobiome and the Tropical Humid Zonobiome predominate (BIOMAS MAP). For the ecoregions, it is located in the so-called Bajillanuera and Altillanuera Guayanesa (MAP ECORREGIONS).

The geographic limits of this region were delimited taking into account the criteria established in the PROCLIMA methodology for the Quantification of GHG Emissions and Removals Reduction "*Activities that avoid land use change in inland wetlands*". These criteria are described below:

- a) The reference region and the project area are part of the same ecoregion.
- b) The causes and agents that generate unplanned changes in land use, identified in the reference region, can access the project area.
- c) Land tenure and land use rights in the reference region should be similar to the project areas, after excluding them.
- d) The reference region may include all or part of the project area.

As mentioned, in order to determine the reference region, restricted access areas such as national natural parks and indigenous reserves located in the jurisdictions of the departments in question were excluded, see Figure 10.

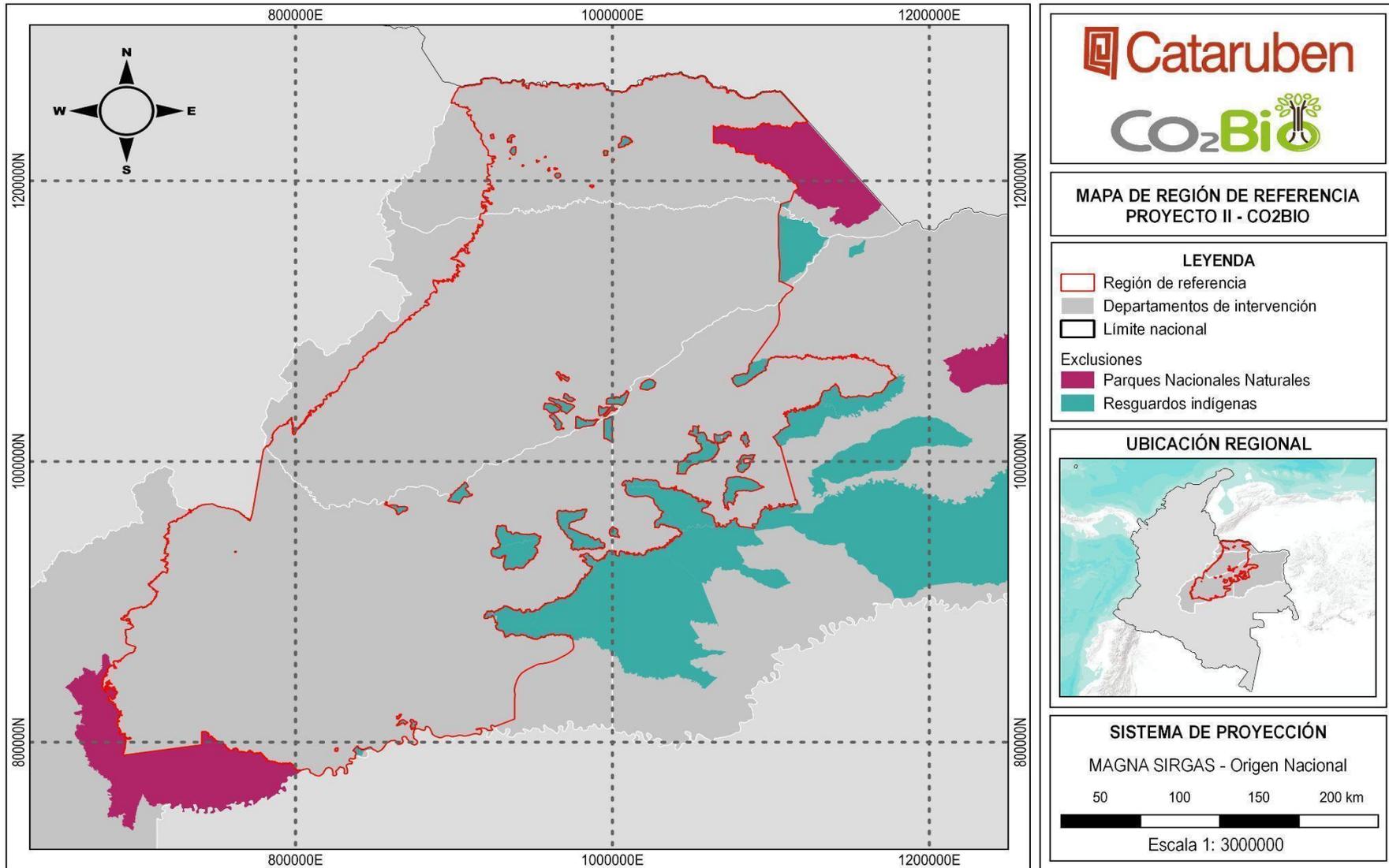


Figure.10 CO₂BIO 2 Project reference region.
Source: Cataruben Foundation

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

17.2.1. Geographic Information

This section describes, at the level of the reference region, characteristics of the terrain such as elevation ranges, slopes and main watersheds that bathe the territory.

- ***Terrain Slopes***

The Terrain Slope is obtained from the *Quantum GIS* Software (QGIS, from now on), using the tool called slope analysis, created from the Digital Elevation Model (DEM, from now on), obtained from the Shuttle Radar *Topography Mission* (SRTM *Shuttle Radar Topography Mission*). It calculates the degree or percentage of slope. For the reference area the Slope is represented in percentage according to FAO (2009), being divided into 5 classes (0% -3%, 3% -15%, 15% -30%, 30% -60% and > 60%). The dominant slope occupies the range of 0 - 3%, with an area of 74% of the territory.

- ***Terrain Elevation***

The DEM determines the height in meters above mean sea level (masl). This product is obtained through the SRTM Downloader Plugin v3.1.15 of the *QGIS* software. The raster values have a cell resolution of 30 m x 30 m, typical of SRTM. According to the DEM, the reference region has an elevation range between 88 and 1000 m asl.

- ***Hydrography***

The region of reference contains part of the great Orinoco river basin, a territory full of diversity of life, landscapes and cultures, extensive plains that change from temporary deserts to large wetlands.

The main hydrographic basins that bathe this portion of the territory are: Cusiana River Basin, Cravo Sur River, Pauto River, Casanare River, Cravo Norte River and Meta River, among others.

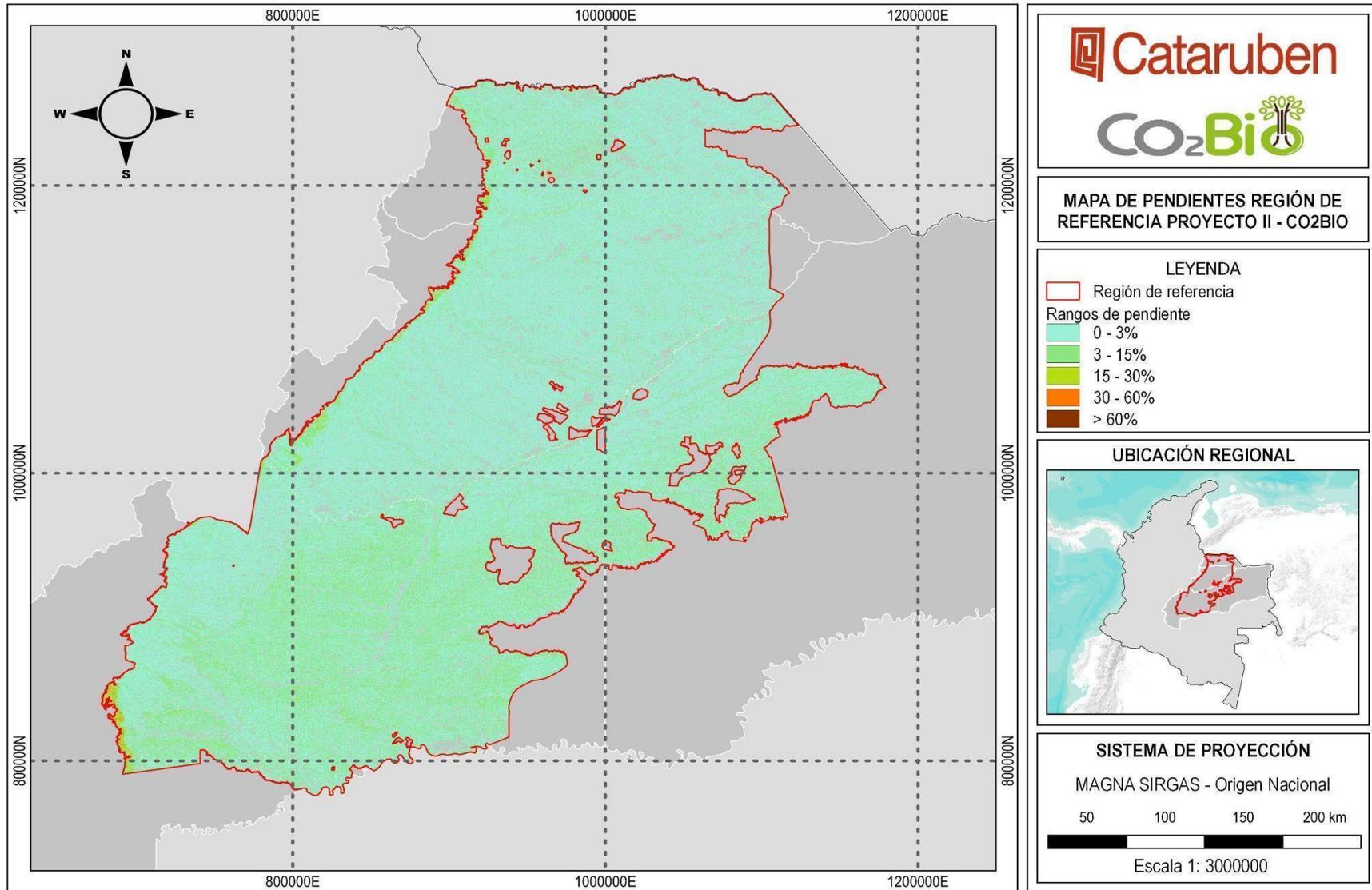


Figure 11. Slopes in percentage of the reference region, according to FAO (2009).

Source: Cataruben Foundation

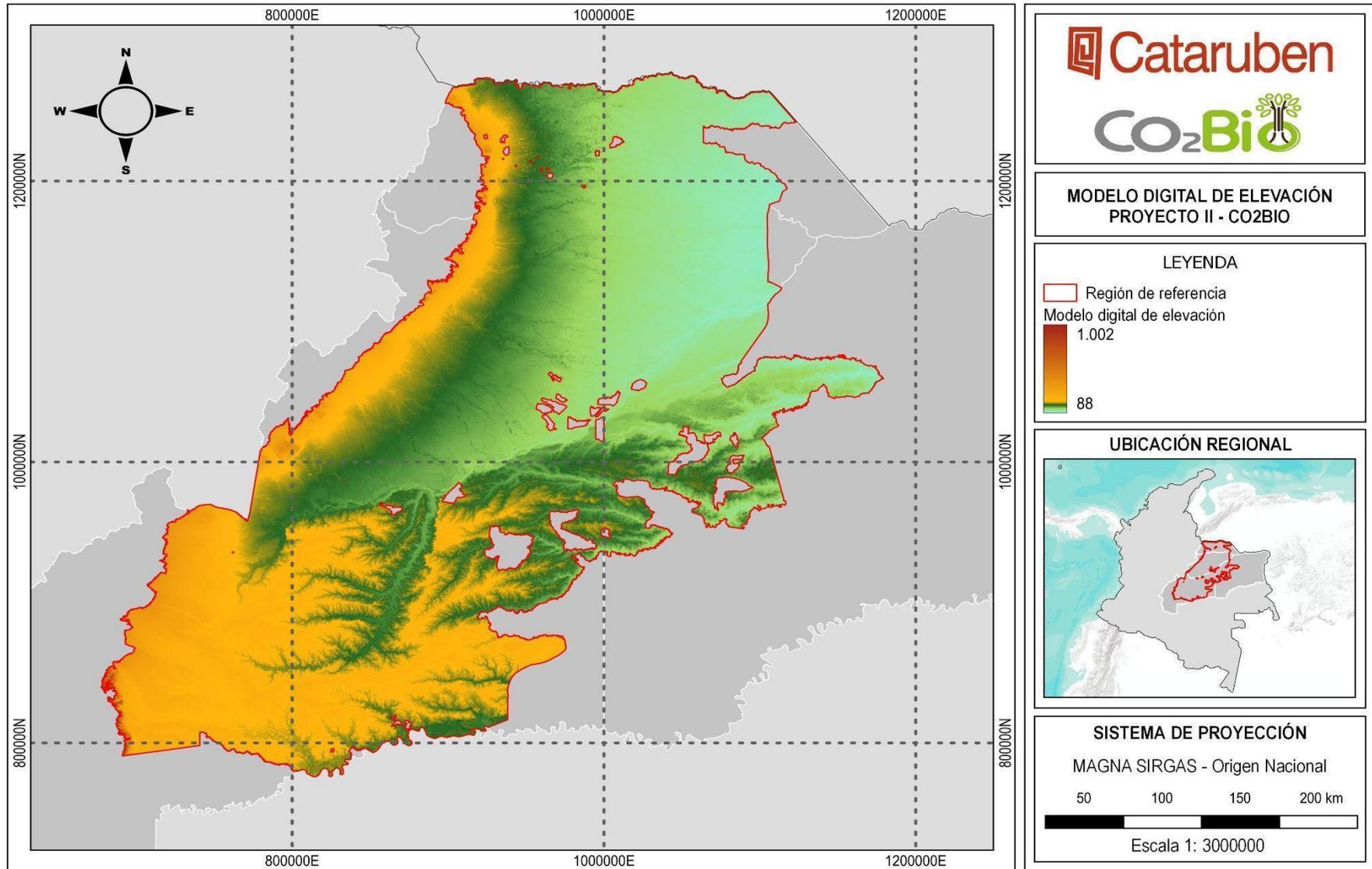


Figure. 12 Digital Elevation Model (DEM).

Source: Cataruben Foundation

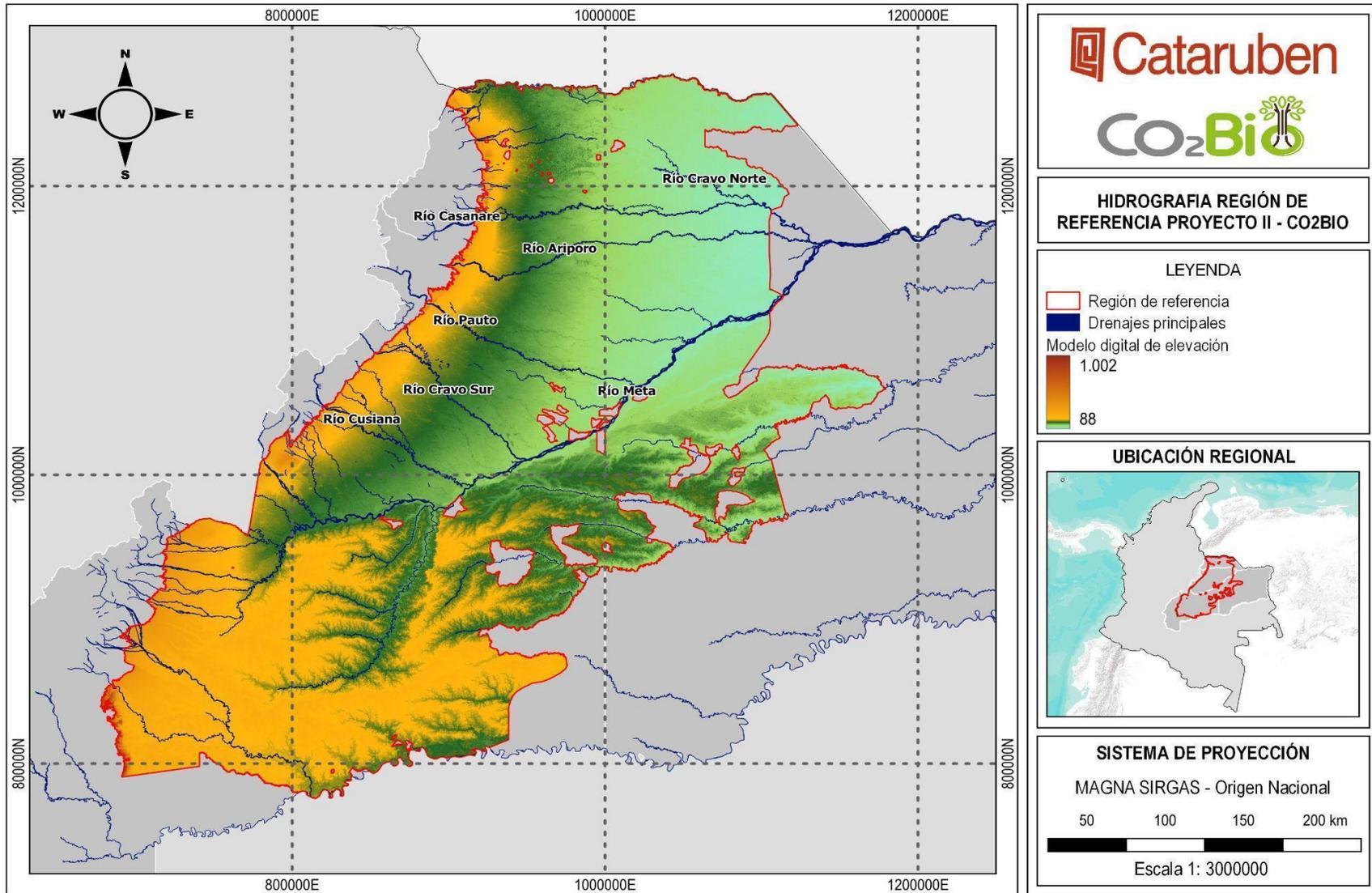


Figure. 13 Water network.
 Source: Cataruben Foundation

17.3. LEAKAGE AREA

The leakage area comprises areas of natural wetland vegetation cover to which displacement of land use transforming agents may occur and which are beyond the control of the project holder.

To define the leakage area, all eligible wetlands within a 100-meter buffer around the project areas should be considered.

Under this scenario, it was determined that the eligible area of the project is 63328.5 Ha and the leakage area is 4953.8 Ha, giving a ratio of 1:12.7 regarding to the total area versus leakage.

The following table shows the hectares corresponding to the wetland ecosystem at the start date of the project and the leakage areas during that period.

Table 13. Eligible and leakage areas of the project

ELIGIBLE PROJECT AREAS (Ha)	LEAKAGE AREAS (Ha)
63,328,5	4953,8

Source: Cataruben Foundation

18. TIME LIMITS AND PERIOD OF ANALYSIS

The project activities began on May 6, 2016, and are valid for 30 years, culminating on December 31, 2045. This first monitoring reports removals and/or reductions for the period 2016-2020.

18.1. HISTORICAL PERIOD OF LAND USE CHANGES IN INLAND WETLANDS

The historical period of land use change for the region of reference must be done for at least two dates: start of the project and ten years ago from the same dates.

The starting year of the project corresponds to May 6, 2016, the historical analysis covers the period from 2009 to 2018, although the methodology requires 10 years, it also recommends using official sources of land cover in order to reduce inconsistencies with official data. For our case we used Corine Land Cover Period 2009 and 2018 according to IDEAM (<http://www.ideam.gov.co/web/ecosistemas/coberturas-nacionales>).

18.2. Estimated project GHG emission reductions and removals.

The estimation of GHG emission reductions will be made according to the monitoring determined by the project, in this case for the period (2016-2020), in order to request the issuance of verified carbon certificates (VCC).

- Accreditation period: May 6, 2016 - December 31, 2045.
- Verification period Inland Wetlands phase 1: 06 May 2016 - 31 December 2020.

19. CAUSES AND AGENTS THAT GENERATE LAND USE CHANGE

The project identified and characterized the causes and agents that generate land use change in the wetlands, taking into account socioeconomic and environmental aspects in the project area ([SEE ANNEX 2.2. CAUSES AND AGENTS OF LAND USE CHANGE](#)).

19.1. DIRECT CAUSES OR ANTHROPIC ACTIVITIES

As a first step, space and time are defined for a period of 10 years prior to the start date of the project, collecting information from primary and secondary sources on the activities that cause land use change in the specified area.

According to (Patiño, 2016) "the main drivers of natural change in wetlands are subsidence, sedimentation, eutrophication, erosion, glaciation, climate change, changes in the water table, temperature rise and sea level changes". In addition to these natural dynamics, human activities have an impact on wetlands.

Wetlands are subject to high pressures, globally by 2005 it was estimated that approximately 50% of the wetland area had disappeared (Zedler and Kercher, 2005, in Patiño, 2016). In Colombia there is a general trend documented by Camargo (2012, in Patiño, 2016) of loss encouraged by national government policies in the second half of the 20th century with the support of international institutions such as the International Bank for Reconstruction and Development (now the World Bank) to stimulate economic development based on livestock production and the expansion of extensive agriculture.

This economic development trend is also evident in the Orinoco region, where the CO₂Bio 2 project area is located. The direct causes of wetland transformation are the expansion of the agricultural and livestock frontier and infrastructure; in relation to these, the main activities or those with the greatest impact on the transformation of wetland areas are cattle ranching, agriculture and deforestation, in that order. The latter is related to the expansion of the agricultural and livestock frontier. In the Orinoco, wetland transformation has occurred mainly along the eastern foothills of the Eastern Cordillera (Patiño, 2016).

19.2. IMPORTANCE OF THESE ACTIVITIES

As mentioned, cattle ranching as one of these engines has generated a high concentration of rural property, overexploitation of the soil and this has contributed to the low population density in the countryside. Cattle ranching in the Orinoco region is one of the most profitable activities and is believed to be more profitable than the conservation of wetlands and other natural ecosystems.

In addition, cattle ranching is an important activity in the project area because it is part of the traditions of the llanera culture; it has been the foundation of the culture since it was structured

by the Jesuit missions in the eastern plains and what is known as "llano work" was practiced, according to Reyes (2004):

To be a "llanero" always has to do with working the Llano; with knowing the cattle; with riding a horse; with knowing how to chop a "rejo"; with composing a cow and knowing the name of each one of its parts; with making "cacheras" and "sueltas marotas" and knowing how to use them; With dawn seeing savannah, and this in most cases is made possible in the herds, because the llanero far from owning land, cattle and beasts on a large scale that allow him to subsist economically, was formed since the seventeenth century as a laborer, resigned to not find the plain dedded to his name and therefore not to find elements held as the basis of their culture and therefore not being able to exercise in their properties by small or nonexistent, all those things that make them feel llaneros" (p.44).

On the other hand, the expansion of the agricultural frontier is a relatively recent activity, although rice crops have been developed for decades in the Orinoco region, as stated by Fedearroz (2008) "the rice sector in the Eastern Plains began to develop in the 1980s, but it was the adaptation and subsequent paving of the Bogotá-Villavicencio highway that really boosted rice plantings in the department of Meta in the 1990s".

Recently, the Orinoco region has seen the expansion of agro-industrial crops such as oil palm and other emerging crops such as soybeans and corn, and to a lesser extent, illicit crops such as coca, which is reported in the department of Meta. Regarding coca crops, according to the Colombian Drug Observatory "the Orinoquia region and part of the Amazon, Caquetá and Putumayo, represented 33% (47,633.75 ha) of the total coca crops at the national level (146,140.13 ha). Of this percentage, 53% corresponds to Putumayo, 20% to Caquetá, 14% to Guaviare and 12% to Meta" (Medrano, 2017).

According to Medrano (2018) of the Center for Orinoco Studies "for the year 2016 the total agricultural production of the Orinoco was 6,021,872 tons, corresponding to 28% of the national agricultural production. Not bad for a region that covers 33% of the Colombian territory. Among the most outstanding products are: oil palm (1,341,027.38 ton), sugar cane (1,242,931.20 ton), plantain (919,222.35 ton), mechanized rainfed rice (718,679.30 ton), technified corn (548,838.00 ton) and cassava (331,717.00 ton)".

This expansion of the agricultural and livestock frontier has developed mainly due to the promotion of government policies, which see in the Orinoco one of the last agricultural frontiers and the potential to turn this region into another great agricultural pantry of Colombia. Some of the policies in that sense is Law 1776 of 2016 by which the declaration of Zones of Rural, Economic and Social Development Interest, (Zidres) is created and guidelines for the declaration of Zones of Rural, Economic and Social Development Interest, (Zidres) are given.

Associated with this the fall in oil prices in 2014, generated an economic crisis in some departments of the Orinoco that depend on hydrocarbon production, especially for Casanare, Arauca and Meta, this marked some of the guidelines of the economic policy of the

departmental development plans, since it was raised as the main productive line the agricultural sector. In addition to this sector, the importance of conservation for productive purposes, that is, associated with nature tourism, has only recently come to be considered a profitable activity.

19.3. SPATIAL PATTERNS AND IMPACT ON WETLAND TRANSFORMATION (MULTITEMPORAL ANALYSIS, 10 YEARS PRIOR TO PROJECT INITIATION).

In Colombia, the sum of the areas intervened by cattle ranching, agriculture and deforestation due to the expansion of the agricultural frontier account for more than 90% of the wetland areas transformed. Cattle ranching in particular accounts for the use of more than 50% of the wetland area transformed to cover associated with grazing (Patiño, 2016). Following this same study, it can be stated that the transformation of wetlands in the Orinoco plain is in the lowest range of transformed area, according to Patiño (2016) they are between 0 and 20%, i.e. with no or little transformation.

This low transformation could be attributed "to the low population density in these areas and the absence of road infrastructure, which makes access to them difficult, and may have helped to keep them out of the transformation drivers. Population accessibility to natural landscapes has been frequently used to explain anthropogenic impact on ecosystems in other parts of the world (Sheng et al. 2012, in Patiño, 2016).

19.4. AGENTS

The agents associated with the three main causes of land use change are the industrial or traditional agricultural producer for consumption and/or sale, the agents formally associated with oil pipelines, and to a lesser extent in the eastern foothills of the eastern cordillera, the rural and/or urban population in expansion.

The underlying causes that motivate the actions of these agents are related to the cultural traditions of the region, with the migration of people from the traditional rice-growing departments, as well as workers for the oil industry and oil palm workers mainly from the Pacific coast. In this sense, the underlying causes of these productive activities are the need that motivates these agents to improve their living conditions, as well as the idiosyncrasy and tradition associated with the political and economic power of livestock and agricultural production, in addition to the ideas that generalize the Orinoquia region under the same ecosystem, mainly the altillanura ecosystem due to its advantages for agricultural production.

19.5. CAUSAL CHAIN

The causal chain of events is a tool that helps to highlight the events that lead to land use impacts and transformations. For each activity that generates land use change, the causes and responsible agents were identified, as well as the underlying factors that result in the transformation of the territory.

The wetlands of the project's reference region are immersed in three large strata: aquatic, herbaceous and dispersed, within which there are different coverages (Table 13) that suffer transformations that affect the ecosystemic development of the wetland.

Table 14. Coverages that are transformed

STRATUM	CLC COVERAGE
AQUATIC	4.1.1. Swamp Zones
	4.1.3. Aquatic vegetation on water bodies
	5.1.2. Lagoons, lakes and natural swamps
DISPERSO	3.1.2.1.2. High flooded open forest
	3.1.2.2.2.2. Low flooded open forest
	3.2.2.1. Dense shrubland
	3.2.2.2. Open shrubland
HERBACEO	3.2.2.2.2.2. Open mesophilic shrubland
	3.2.1.1.2. Dense floodable grassland
	3.2.1.1.1.2.1. Dense non-forested flooded grassland
	3.2.2.1.1.2.2.2. Dense flooded wooded grassland
	3.2.1.2.2. Rocky open grassland
	3.2.1.1.2.1. Open sandy grassland

SOURCE: Own elaboration, based on (Flórez,C., et al 2016, Patiño, J.E(2016))

After an analysis of land cover changes for the period 2009 - 2018, it was possible to observe that 53% of the wetland areas in the reference region were transformed to clean pasture, wooded or grassed land covers in which livestock activities are carried out in the region.

Another important change occurs in the floodable forest cover that was deforested and in 2018 was in regeneration; this change represents approximately 24% of the hectares of wetlands transformed in the analysis period. Finally, agricultural and livestock activities represent 9% and 7%, respectively, of the activities carried out in the region that lead to wetland transformation.

In terms of infrastructure expansion, the transformation of natural cover to that associated with the construction of civil works represents 0.67%, and for urbanization it is 0.1%. Although it is a small impact compared to other anthropic activities, it also has an impact on floodable savannas. The following is a map of land cover transformation and a graph showing the percentage of land cover transformation for each anthropic activity.

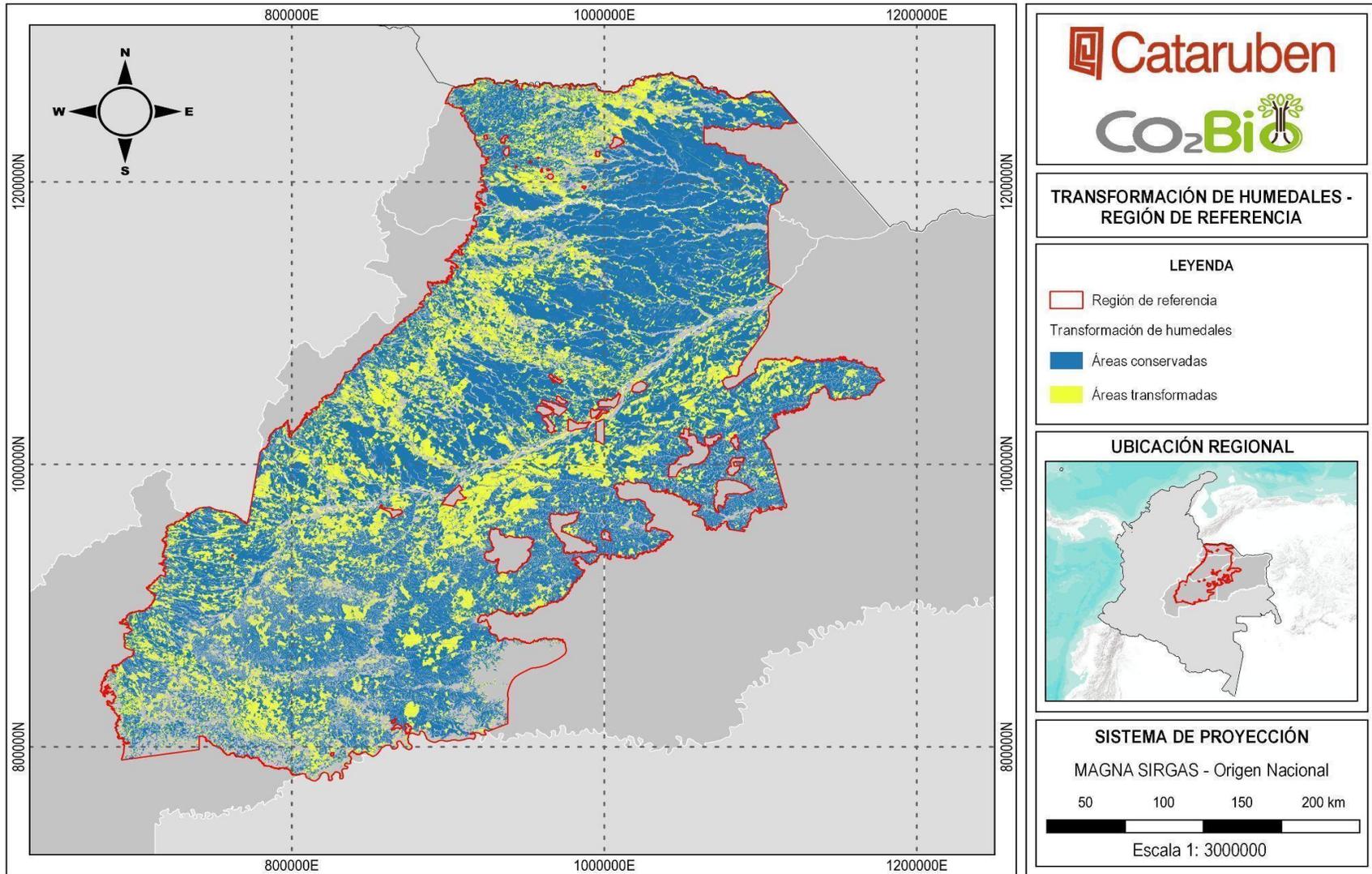


Figure. 14 Transformation of coverages in the reference area of the project.

Source: Cataruben Foundation

The following graph shows the main wetland transformation activities between 2009 and 2018, by the percentage of hectares of wetland-associated natural cover (aquatic, dispersed and herbaceous) transformed.

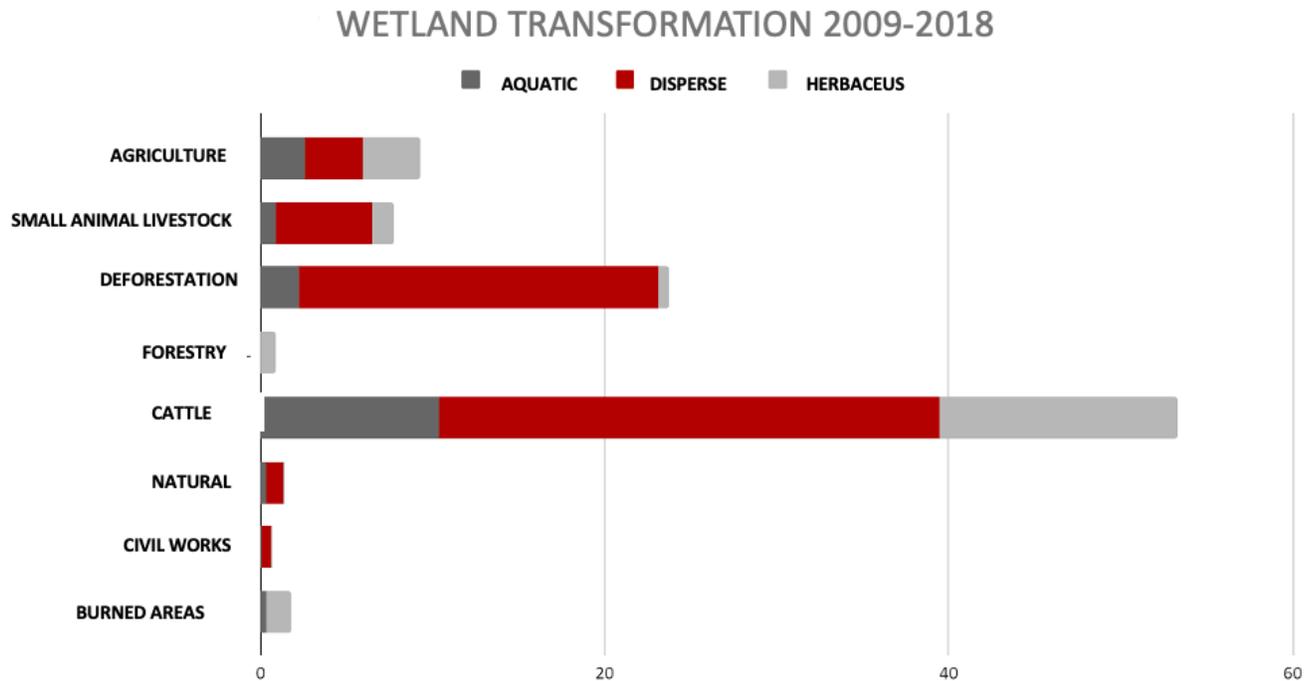


Figure. 15 Transformation of wetlands

Source: Cataruben Foundation

Table 14 summarizes the chain of events where the direct causes associated with each anthropogenic activity practice recorded in the project's reference region are related to the agents that carry them out and the underlying reasons, as well as the level of impact on wetland areas.

Table 15. Chain of land use change events.

LAND USE CHANGE IN WETLANDS	DIRECT ACTIVITIES	DIRECT CAUSES OR ANTHROPIC ACTIVITIES		AGENTS	UNDERLYING FACTORS	DIRECT IMPACT	
	Expansion of the agricultural and livestock frontier	1	Deforestation		Industrial or traditional agricultural and livestock producer for consumption and/or sale	Socio-economic, cultural and political-institutional factors	24% of the wetland hectares were transformed from flooded forest cover that had been deforested and were regenerating as of 2018.
		2	Livestock production				53% of the wetland areas in the reference region were converted to clean pasture cover, wooded or thinned, where livestock farming activities are carried out.
		3	Agricultural production				Agricultural and livestock activities represent 9% and 7%, respectively, of the activities carried out in the region and lead to the transformation of wetlands.
	Infrastructure expansion	4	Transportation		Formal or informal builder of local, regional and national roads	Socio-economic factors; Cultural factors; Demographic factors; Political and institutional factors; Social and economic factors.	0.67% of the wetland areas in the reference region were transformed into civil works. Although it is a small impact compared to other anthropic activities, it also has an impact on floodable savannas.
6		Settlements		Settled rural and/or urban population in expansion	0.1% of the wetland areas in the reference region were converted to urbanization. Although this is a small impact compared to other anthropic activities, it also has an impact on floodable savannas.		

Source: Cataruben Foundation

20. PROJECT ACTIVITIES

Based on the analysis of causes and agents that generate changes in the use of the wetlands, the following 5 activities are proposed to improve environmental and social conditions within the framework of the project implementation. The design of these activities also took into account the identification of pressures on biodiversity so that these activities contribute to mitigate these threats.

Three activities were designed to address deforestation, livestock and agricultural production, unsustainable use of natural resources, habitat loss and pollution. The actors in these activities are the Cataruben Foundation, project beneficiaries and strategic allies, whose responsibility and role varies according to the activity.

1. The Cataruben Foundation must organize and carry out an annual cycle of trainings to strengthen knowledge in wetland conservation and sustainability to prevent the expansion of the agricultural frontier. Project beneficiaries will be required to attend these trainings and implement sustainable activities on their land. Regarding the training cycle, this sub-activity will have as an indicator the number of people trained, which should be monitored every year. On the other hand, the number of farms with sustainable activities implemented will be monitored every five years.
2. The second activity of the project is to characterize and implement sustainable production practices in the project lands. This characterization will be carried out by the Cataruben Foundation and may involve the participation of strategic allies such as NGOs. However, the implementation of sustainable productive practices will be the responsibility of the project beneficiaries. The indicator for this activity is the number of properties characterized, which will be monitored every five years.
3. The Cataruben Foundation should design a phased participatory biodiversity and HCV monitoring program. The idea is that the project beneficiaries actively participate in each stage of the monitoring program, contributing and making decisions regarding the species and areas to be monitored, sampling process and meetings. The indicator for this activity corresponds to the number and progress of the stages of the program implemented during the monitoring period, which will be every five years.

The last two activities were designed to improve environmental and social conditions affected by transportation and settlements. The actors involved in these activities are the Cataruben Foundation, beneficiaries, government institutions, NGOs, regional autonomous corporations and community organizations.

4. Governance structures in the territory will be strengthened through meetings in which the above-mentioned stakeholders will participate. The number of governance structures strengthened will be monitored every five years, the number of governance activities carried out in the project area will be evaluated annually and the number of stakeholders involved will be evaluated every two years.
5. Finally, the recognition of areas, conservation figures and environmental management for biodiversity conservation will be carried out. This activity consists of following up on

the processes of declaring these areas, which are led by different national and international organizations. The indicators to be monitored correspond to the number of environmental management figures declared and the number of properties declared as conservation areas, which will be evaluated every two years.

21. SOCIO-ENVIRONMENTAL ASSESSMENT

The following is a description of the positive and negative effects identified in relation to the design and implementation of the project activities, based on information on the social and environmental conditions of the beneficiaries and the project area ([see Annex: Socioeconomic Evaluation](#)), as well as on the experience during project development. A summary of this description is shown in Table 16;

1. *Training cycle to strengthen knowledge in wetland conservation and sustainability to prevent the expansion of the agricultural frontier:* According to the historical context of land use in wetland ecosystems and the expansion of the agricultural frontier in the Orinoquia region; it is important to generate a process of capacity building regarding environmental, social and cultural dynamics in wetlands, biological interactions, provision of ecosystem services, climate change mitigation and delimitation of wetlands, regulations and figures of wetland conservation, to ensure before and during the operation of the project, able to eliminate social barriers regarding the deficiency of knowledge and thus improving educational skills to address climate change.
2. *Design and technical assistance for the implementation of sustainable productive practices:* This activity is a continuation of the previous process. Once the drivers of change driven by cultural, social and political practices in the territory have been identified, sustainable productive practices capable of generating positive changes in the ecosystems, and that do not represent an economic effort that the landowners cannot afford, will be developed and prioritized.

These practices include beekeeping, passive restoration, water harvesting, regenerative livestock, implementation of agroforestry systems, among others, which should favor the ecological balance in the project area, improving human well-being and sustainable development.

3. *Participatory monitoring for biodiversity conservation and HCVs in the project area:* This activity is essential to maintain the provision of ecosystem services in the project area, therefore the project owner must ensure a monitoring strategy capable of integrating tools such as: social mapping, georeferencing, non-invasive monitoring techniques,

community participation and institutional actors in the framework of the identification of focal species and areas of biological importance in the project area. Thus generating sustainable conservation processes that increase the management of natural resources and increase the quality of life of families.

4. *Strengthening of governance structures in the territory:* This activity is transversal to all the efforts already mentioned, since by holding workshops and meetings to strengthen governance structures in the territory, management and decision making can be improved within the framework of the project's conservation activities. This implies participation in community and state organization spaces for the use and conservation of natural resources, as well as the creation of governance mechanisms to provide sustainability to the project, reduce environmental conflicts and increase coordination of efforts to mitigate climate change.
5. *Recognition of areas and figures of environmental management for biodiversity conservation:* Currently in the project area there are different figures of environmental land use planning, which have undergone a process of updating in the last year by governmental, non-governmental and international cooperation entities, the main ecological structure for the Orinoquia 2021, is a tool that provides guidelines for planning land use, ensuring a more comprehensive vision at the departmental and municipal level.

In turn, the implementation of municipal systems of protected areas in some municipalities of the project area are guiding and facilitating the execution of initiatives that contribute to the protection of biodiversity and the sustainability of the territory, an exercise that will be supported by the project, prioritizing activities that favor the conservation of strategic ecosystems and the improvement of the quality of life of the inhabitants themselves.

Finally, the declaration of Management Districts and Natural Reserves by civil society in the project area, which are configured as environmental planning figures that establish management and conservation guidelines at the property level. In this context, the project must adopt these measures and prioritize their implementation as part of its operations.

Table 16. Summary of socio-environmental effects

ACTIVITY	PRODUCT	RESULT	POSITIVE EFFECT	POSSIBLE NEGATIVE IMPACT
Training cycle to strengthen knowledge on wetland conservation and sustainability to prevent the expansion of the agricultural frontier.	Training and meetings with project beneficiaries	Capacity building in the face of climate change	Increased educational skills of project beneficiaries in the face of climate change.	Possible conflict between traditional and scientific knowledge
Characterization and implementation of sustainable production practices.	Development of sustainable production practices, especially in the area of sustainable livestock farming.	Strengthen the ecological balance in the project area.	Contribute to sustainable rural development	Possible difficulty in improving practices due to lack of financial resources of beneficiaries
Participatory monitoring for the conservation of biodiversity and HCVs in the project area.	Activities for recording and monitoring the status of biodiversity and the provision of ecosystem services.	Maintain the provision of ecosystem services, especially those related to food provision.	Conservation of regulating, provisioning and cultural ecosystem services	Poor management of High Conservation Values
Strengthening of governance structures in the territory	Workshops and meetings to strengthen governance structures	Reducing socio-environmental conflicts with the participation of stakeholders and in the governance structures.	Improvement and creation of governance mechanisms	Low participation of key stakeholders in natural resource management
Recognition of areas and figures of conservation and environmental management for biodiversity conservation.	Articulation of stakeholders and conservation areas	Conservation of strategic ecosystems	Improvement of ecosystemic conditions and quality of life indicators	None

Source: Cataruben Foundation

22. UNCERTAINTY MANAGEMENT

Uncertainty is determined by the accuracy of the maps used to estimate emissions calculations and the use of information reported in the field. In this project, land cover maps were used, Corine Land Cover Methodology, for the years 2009 and 2018, developed by IDEAM, which constitute official data on land cover of the national territory, which is why it is not necessary to calculate the uncertainty.

For the generation of land covers 2015 and 2020, scale 1:100,000, Landsat 8 images of the respective years were used. The technical guidelines are in harmony with the CORINE land Cover methodology and legend adjusted for Colombia at 1:100,000 scale. Where the uncertainty obtained a ratio of 93.75 according to the standards proposed in the wetland methodology.

23. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

The quantification of emission reductions is carried out in the historical and analysis periods, taking into account the following steps;

23.1. STRATIFICATION AND SAMPLE DESIGN

The stratification of the project areas was carried out according to the type of associated vegetation, three strata were defined: Herbaceous, Dispersed, Aquatic, which are directly related to the Corine Land Cover (CLC) coverages in their level 5 and 6, in this way the strata are related to the National CLC coverages. Table 17 lists the strata with the associated coverages and the description of each coverage.

Table 17. Stratification and Sampling Design

ID	STRATUM	DESCRIPTION STRATUM	RELATED COVERAGES	DESCRIPTION COVERAGE
1	Herbaceous	Vegetation units dominated by plants with a height between 0.3 to 1.5 m.	Dense flooded grassland	Corresponds to a natural cover consisting of dense grassland, which develops in areas that are subject to periods of flooding, which may or may not have scattered tree and/or shrub elements. The use of secondary support information is recommended to complement the pictorial analysis for the identification of flood-prone areas.
2	Dispersed	There is no continuous vegetation cover, plants are separated and widely scattered. Include trees, palms, shrubs, herbs and grass	Dense shrubland	Cover consisting of a vegetation community dominated by typically shrubby elements, which form an irregular canopy, representing more than 70% of the total area of the unit. The unit may contain scattered arboreal elements. This vegetation formation has not been intervened or its intervention has been selective and has not altered its original structure and functional characteristics.

		species that do not form a continuous cover or layer.		
2	Shrublands	Open shrubland	Open shrubland	Cover consisting of a plant community dominated by regularly distributed shrub elements, which form a discontinuous canopy layer and whose cover represents between 30% and 70% of the total area of the unit. These vegetation formations have not been intervened or their intervention has been selective and has not altered their original structure and functional characteristics.
3	Aquatic	All types of macrophytes associated with freshwater wetlands	Marshlands	This cover includes lowlands, which generally remain flooded during most of the year, and may be made up of watercourse diversion zones, flood plains, old diversion plains and natural depressions where the water table rises permanently or seasonally. They include hollows where the water collects and naturally stops, with more or less boggy bottoms. Within the marshes there are bodies of water, some with partial cover of aquatic vegetation, less than 25 ha in size and representing less than 30% of the total area of the marsh.
3			Aquatic Vegetation on Water Bodies	Under this category is classified all floating vegetation that is established on water bodies, partially or totally covering them. It includes vegetation biotypologically classified as Pleustophyta, Rizophyta and Haptophyta. In Colombia, this cover is associated with Andean lakes and lagoons in the process of eutrophication and in lowland areas associated with bodies of water located in flood plains or overflows.
3	Continental Wetlands	Aquatic Vegetation on Water Bodies	Lagoons, Lakes and Natural Swamps	Natural water surfaces or deposits of an open or closed nature, fresh or brackish, which may or may not be connected to a river or the sea. In the Andean zone there are bodies of water (lakes and lagoons) located in high mountains that constitute the source areas of rivers. In the alluvial plains, bodies of water called ciénagas are formed, which are associated with the overflow areas of large rivers. The marshes may contain small sandy and muddy islets, with irregular, elongated and fragmented shapes, of small area, which are included in the water body as long as they do not represent more than 30% of the water body area.

Source: Cataruben Foundation

23.2. DIRECT ESTIMATION OF CARBON IN WETLANDS

The estimation in the selected carbon deposits is carried out for the estimation of the emission factors, for which the sampling plan was initially established on the strata of the project. Subsequently, the field and laboratory work and the final data analysis were carried out.

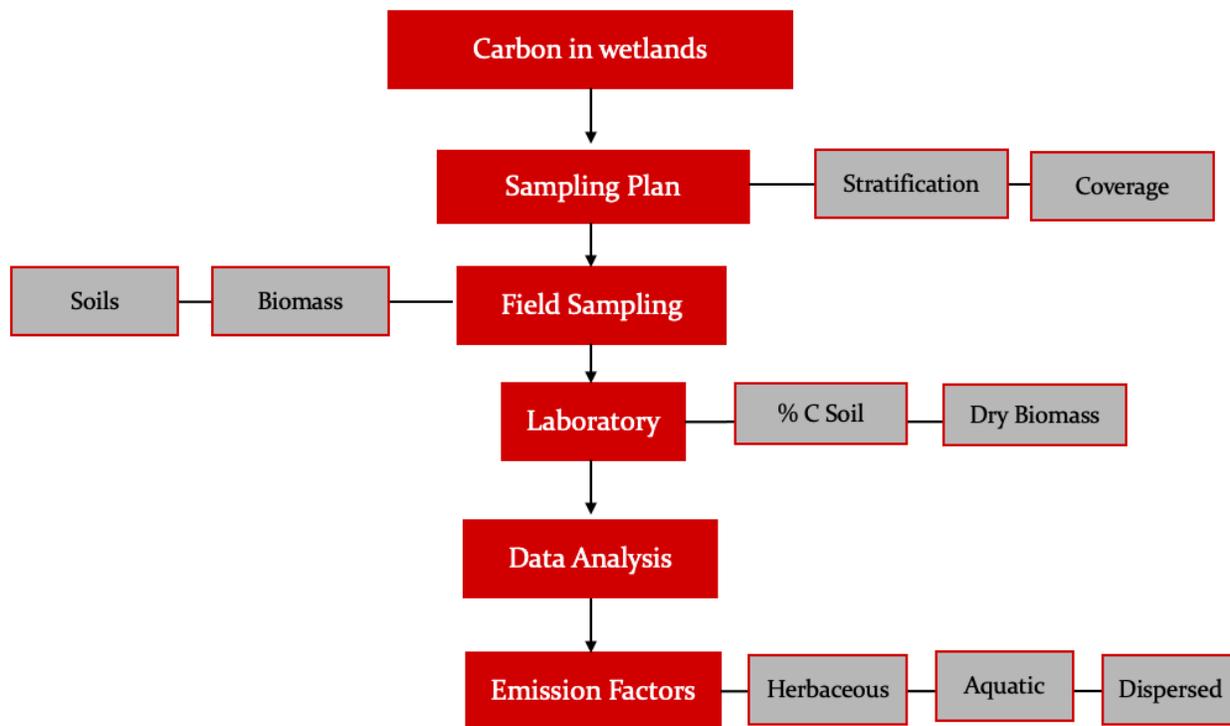


Figure. 16 Process scheme for the determination of carbon stored in the selected reservoirs.

Source: Cataruben Foundation

23.2.1. Measurement Plan and Sampling Points

A measurement plan was established based on the project boundaries, stratification and selected carbon pools.

The number of sampling points was determined from the size in hectares of each stratum and the average biomass according to preliminary data from research in the region, using the Winrock International tool⁶, with an error percentage of 10%, confidence level of 99% and 20% of extra plots to obtain a high accuracy of the data. The detailed calculation can be seen in **Annex 2.5.3.1 Calculations: 2.** "[Winrock Sample Plot Calculator 2014 o](#)".

Given the climatic conditions and access to the project areas, three plots were selected that present all the coverages associated with the three strata. For each stratum, the number of sampling points was previously calculated on a linear transect of 100 meters distance between points as established by the wetland methodology.

For the aquatic and herbaceous strata, samples of herbaceous vegetation were collected at the sampling point. For the dispersed stratum, plots were established for arboreal elements, at each point soil samples were taken at 30, 60 and 100 cm depth. The sampling points are summarized in Table 18.

⁶ <http://www.winrock.org/Ecosystems/tools.asp> (Winrock International 2011).

Table 18. Sampling points Inland Wetlands

Stratum	Item No	ID Point	Location (Lat ; Long)	Type of sampling
Herbaceous	1	S-P 5	6° 15' 35.340" N ; 69° 55' 47.940" W	Sampling Point
Herbaceous	2	S-P 31	6° 14' 50.275" N ; 69° 54' 39.854" W	Sampling Point
Herbaceous	3	S-P 30	6° 14' 50.360" N ; 69° 54' 49.598" W	Sampling Point
Herbaceous	4	S-P 3	6° 15' 25.080" N ; 69° 56' 4.680" W	Sampling Point
Herbaceous	5	S-P 29	6° 14' 50.424" N ; 69° 54' 59.278" W	Sampling Point
Herbaceous	6	S-P 28	6° 14' 50.467" N ; 69° 55' 9.086" W	Sampling Point
Herbaceous	7	S-P 27	6° 14' 50.532" N ; 69° 55' 18.916" W	Sampling Point
Herbaceous	8	S-P 26	6° 14' 50.445" N ; 69° 55' 28.626" W	Sampling Point
Herbaceous	9	S-P 2	6° 15' 19.680" N ; 69° 56' 13.620" W	Sampling Point
Herbaceous	10	S-P 14	6° 16' 21.540" N ; 69° 54' 32.220" W	Sampling Point
Herbaceous	11	S-P 13	6° 16' 16.380" N ; 69° 54' 40.560" W	Sampling Point
Herbaceous	12	S-P 12	6° 16' 11.400" N ; 69° 54' 48.900" W	Sampling Point
Herbaceous	13	S-P 11	6° 16' 6.360" N ; 69° 54' 57.300" W	Sampling Point
Herbaceous	14	S-CM 91	5° 52' 54.790" N ; 70° 44' 34.312" W	Sampling Point
Herbaceous	15	S-CM 700	5° 52' 46.320" N ; 70° 44' 38.400" W	Sampling Point
Herbaceous	16	S-CM 590	5° 53' 24.102" N ; 70° 44' 37.445" W	Sampling Point
Herbaceous	17	S-CM 569	5° 53' 24.377" N ; 70° 45' 45.718" W	Sampling Point
Herbaceous	18	S-CM 483	5° 53' 14.611" N ; 70° 45' 45.757" W	Sampling Point
Herbaceous	19	S-CM 48	5° 52' 55.078" N ; 70° 45' 45.835" W	Sampling Point
Herbaceous	20	S-CM 467	5° 53' 11.185" N ; 70° 45' 3.506" W	Sampling Point
Herbaceous	21	S-CM 394	5° 53' 4.844" N ; 70° 45' 45.796" W	Sampling Point
Herbaceous	22	S-CM 224	5° 52' 45.023" N ; 70° 44' 34.352" W	Sampling Point
Herbaceous	23	S-CM 202	5° 52' 45.311" N ; 70° 45' 45.874" W	Sampling Point
Herbaceous	24	S-CM 0	5° 52' 16.025" N ; 70° 45' 49.242" W	Sampling Point
Herbaceous	25	S-CM 578	5° 53' 24.259" N ; 70° 45' 16.458" W	Sampling Point
Aquatic	26	S-CM 7	5° 52' 19.254" N ; 70° 45' 42.727" W	Sampling Point
Aquatic	27	S-CM 504	5° 53' 14.335" N ; 70° 44' 37.484" W	Sampling Point
Aquatic	28	S-CM 415	5° 53' 4.569" N ; 70° 44' 37.524" W	Sampling Point
Aquatic	29	S-CM 34	5° 52' 25.778" N ; 70° 45' 45.952" W	Sampling Point
Aquatic	30	S-CM 109	5° 52' 35.545" N ; 70° 45' 45.913" W	Sampling Point
Dispersed	31	S-CF 30	5° 45' 58.618" N ; 70° 38' 20.400" W	Plot
Dispersed	32	S-CF 32	5° 45' 48.852" N ; 70° 38' 20.400" W	Plot

Source: Cataruben Foundation

23.2.2. Field measurements

Field data were collected during the dry season, at previously defined points, based on the guidelines of the methodology "Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands".

- **Soil**

Soil samples were taken using a sampler that allows the sample to be taken without leakage or loss of structure (Fig. 17, a)). Because wetland soil normally has a broad organic layer, samples were taken up to 1m depth, segmented as follows: 0-30, 30-60, 60-100 cm, to ensure measurement of the entire organic layer. Three samples were taken for each sample and deposited in plastic bags previously marked with the ID of the point.

Given the soil moisture conditions and the complexity of obtaining samples under these conditions, for the carbon data at depths of 30-60 and 60-100 cm, four one-meter deep calicatas were established (fig.17, b), from where the soil samples were taken.

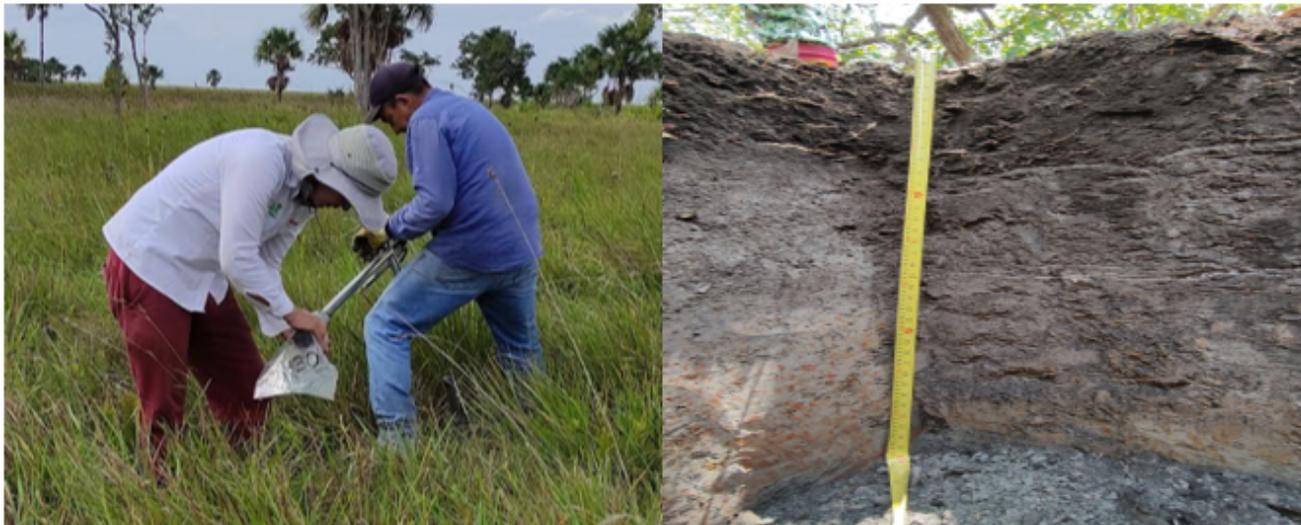


Figure. 17 a) Soil sampler. b) wetland soil profile.

Source: Cataruben Foundation

- **Herbaceous and leaf litter biomass**

A quadrat with an area of 0.25 m² was used, which was thrown at random in the area of the sampling point, all the biomass was collected within the quadrat and placed in plastic bags previously marked with the ID of the sampling point, each sample is composed of three subsamples. In the format [GOF-051 AQUATIC AND HERBACEOUS BIOMASS RECORD](#), the code, ID of the sampling point, stratum, number of the sampling point, location, sample number and a brief description of the point were recorded.



Figure. 18 Metallic quadrat with an area of 25 cm².

Source: Cataruben Foundation

- **Woody, shrub biomass**

The biomass corresponding to woody and shrub vegetation was measured by means of circular plots of 7 m radius, in whose interior were recorded those individuals with a DBH > 5 cm, and an internal subplot of 2 m radius where the individuals with DBH < 5 cm were recorded. In the form FC-GOF-043 VEGETATION SAMPLING WITH CIRCULAR PLOTS, the code or ID of the sampling point, stratum, geographic location, number of plots, number of individuals measured, circumference, diameter, heights, identification of the individual and observations were recorded (See Annex 2.5.3.2. Field Data: [GOF-043 VEGETATION SAMPLING.xlsx](#)).



Figure. 19. Establishment of a circular plot in an area of morichal, dispersed stratum.

Source: Cataruben Foundation

23.2.3. Laboratory analysis

- **Soil**

Soil samples were dried at 60 °C until they were free of moisture to ensure their preservation. They were then passed through a 2 mm sieve to remove the remains of subsurface biomass (>2 mm). The samples were sent to the CIAT laboratory for final preparation and subsequent CNH elemental analysis by combustion. **Annex 2.5.3.3. Laboratory:** "[request-S-2021-84.xls](#)".



Figure. 20 Pre-processing of soil samples to be sent for CNH elemental analysis.

a) The samples are homogenized and preserved by drying, b) and c) They are macerated and sieved at 2 mm to separate the remains of subway biomass from the soil. d) and e) They are weighed and packed to be sent to the Chemical Analysis Laboratory - CIAT.

Source: Cataruben Foundation

- **Herbaceous and leaf litter biomass**

Herbaceous biomass samples had soil residues removed with clean water. They were then dried at 60°C until they reached a constant weight, which corresponds to total biomass. The data were

recorded in **Annex 2.5.3.3. Laboratory: [GOF-051 ACUATIC AND HERBACEOUS BIOMASS RECORD](#)**

23.3. EMISSION FACTORS

Following the guidelines of the methodology, based on the laboratory results, a data analysis was performed in excel tables to determine the carbon stored (tCO₂e/ha) in the reservoirs (aboveground biomass, belowground biomass and soil) in each stratum of the project.

23.3.1. Biomass

The carbon stored in each stratum (herbaceous, aquatic and dispersed) was determined in tCO₂e/ha. For the biomass of the herbaceous and aquatic strata, the average of the three subsamples that make up each sample was found, then the overall average was found and transformed to t/ha, from which the CO₂e was calculated with the formula:

$$CBF_{eq} = (BT)(f) (44/12)$$

- **CBF_{eq}**: carbon dioxide equivalent contained in total biomass (tCO₂e/ha/year). It is assumed that CO₂ emissions from biomass occur in the same year.
- **BT**: total biomass (t/ha).
- **FC**: carbon fraction of dry matter (0.47).
- **44/12= 3.67**: constant of the molecular ratio between carbon and carbon dioxide

For the sparse stratum, with the information from each sampling plot the aboveground biomass was calculated with the allometric equations of (Alvarez 2012)⁷ Subsequently, the belowground biomass value was calculated with the factor of 0.24, from that value with the above equation the *CBF_{eq}* was calculated. Table 19 shows the *CBF_{eq}* of each stratum.

Table 19. Summary of data for the calculation of *CBF_{eq}* for each stratum.

Herbaceous	
Sample ID	AVERAGE of Biomass g/m ²
Rain-CM 48	1514
S-CM 0	1333
S-CM 202	1333
S-CM 224	1530
S-CM 394	1469
S-CM 467	1508
S-CM 48	1441
S-CM 483	1508
S-CM 569	1641

⁷ Álvarez, E., Saldarriaga, J.G., Duque, A.J., Cabrera, K.R., Yepes, A.P., Navarrete, D.A., Phillips, J.F. 2011 Selection and validation of models for the estimation of aboveground biomass in natural forests in Colombia. Institute of Hydrology, Meteorology and Environmental Studies-IDEAM-. Bogotá D.C., Colombia. 26 p. <http://www.ideam.gov.co/documentos/13257/13548/Modelos+alometricos+Carbono.pdf/cc9e929f-50c2-4f6c-90d9-0a9affc20e3c>

S-CM 590	1229
S-CM 700	1574,0
S-CM 91	1469
S-P 11	1223
S-P 12	1229
S-P 13	1599
S-P 14	1481
S-P 2	1259
S-P 26	1503
S-P 27	1530
S-P 28	1373
S-P 29	1366
S-P 3	1393
S-P 30	1441
S-P 31	1599
S-P 5	1530
Biomass g/m2	1443
Biomass T/Ha	14
tCO₂e/ha	25

2. Aquatic	
<i>Sample_ID</i>	AVERAGE of Biomass g/m2
S-CM 109	1336
S-CM 34	1567
S-CM 415	1446
S-CM 504	1617
S-CM 7	1431
Biomass g/m2	1479
Biomass T/Ha	15
tCO₂e/ha	25

3. Dispersed	
<i>Point_ID</i>	SUM of Biomass_Total_Kg
S-CF 30	1483,15
S-CF 32	962,70
Biomass kg/plot	1222,93
Biomass T/Ha	79
tCO₂e/Ha	137

Source: Cataruben Foundation

Details of the calculations and formulas can be found in **Annex 2.5.3.1 CALCULATIONS: "[1. Strata Biomass.xlsx](#)">sheet 3. Herbaceous; 4. Aquatic; 5.**

23.3.2 Soil Organic Carbon

Equation for estimating soil organic carbon content:

$$\text{COS} = \%C \times \text{DA (gr/cm}^3\text{)} \times \text{P(cm)}$$

- **COS** = Soil carbon (gr/m²), which allows conversion to tons/hectare (tCOS/ha), according to the total area sampled.
- **%C** = Carbon content
- **DA** = Bulk density of soil (gr/cm³)
- **P** = Depth of the sample profile (cm)

Calculation of the equivalent organic carbon potentially emitted by the soil in a land use change scenario. It is assumed that COS is emitted in equal proportions for 20 years once the land use change event occurs. Using this assumption for wetland land use change, the annual rate of soil carbon emitted over 20 years is calculated (IPCC, 2006) according to the following equation:

$$\text{coseq} = (\text{cos } 20) (44/12)$$

- **COSeq**: carbon dioxide equivalent contained in soils (tCO_{2e}/ha).
- **COS**: Soil carbon content (tC/ha).
- **44/12=3.67**: molecular ratio constant between carbon (C) and carbon dioxide (CO₂).

The results are consistent with the national document "**Analysis of results of organic carbon content in the soils of paramo and wetland ecosystems in Colombia**"⁸ document that presents the diagnosis of soil organic carbon storage (COS) at 30 cm depth, based on information from semi-detailed soil studies in the areas of influence of paramos and wetlands in Colombia and modeled using digital soil mapping techniques.

For example, for COS up to 30 cm in the Orinoquia region the range is between 94.4 - 175.3 COS t/ha. Our data up to 30 cm for the herbaceous stratum is 140 COS t/ha and up to 1 meter 271.2 COS t/ha.

Table 20 summarizes the results obtained for COS in each of the Project strata at a depth of 1m.

Table 20. COS by stratum

4. Soils		
Stratum	Sample_ID	AVERAGE of COS t/ha
Herbaceous	Rain-CM 48	143,7

⁸ Analysis of results of organic carbon content in soils of paramo and wetland ecosystems in Colombia. Bogota: Instituto Geográfico Agustín Codazzi, Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, 2018. <http://hdl.handle.net/20.500.11761/34979>

	S-CM 0	358,2
	S-CM 202	517,6
	S-CM 224	155,7
	S-CM 394	470,9
	S-CM 467	298,4
	S-CM 48	228,8
	S-CM 483	238,7
	S-CM 569	178,4
	S-CM 590	569,4
	S-CM 700	226,2
	S-CM 91	237,3
	S-P 11	317,1
	S-P 12	275,9
	S-P 13	307,2
	S-P 14	337,3
	S-P 2	159,8
	S-P 26	161,2
	S-P 27	163,0
	S-P 28	150,2
	S-P 29	297,5
	S-P 3	151,6
	S-P 30	405,3
	S-P 31	237,2
	S-P 5	194,5
Total 1. Herbaceous		271,2
2. Aquatic	S-CM 109	927,3
	S-CM 34	706,4
	S-CM 415	859,2
	S-CM 504	563,2
	S-CM 7	760,0
Total 2. Aquatic		763,2
3. Dispersed	S-CF 30	283,0
	S-CF 32	405,2
Total 3. Dispersed		344,1

Source: Cataruben Foundation

For depths of 30-60 and 60-100 cm, four calicatas of 1 cubic meter were made and samples were taken to be sent to the laboratory. From the results of these three sampling points, a correlation factor was established for each depth and this was used to calculate the carbon contents at these depths at each sampling point. Details of the calculations can be found in **Annex 2.5.3.1 CALCULATIONS: "1. Strata Biomass.xlsx">sheet 6.**

Based on the analysis of laboratory data and calculation of the biomass of the plots, emission factors were determined for each stratum of the project Table 21.

Table 21. Emission factors for each project stratum.

Stratum	CO ₂ e t/ha	CO ₂ e t/ha	CO ₂ e 20 years	Emission factor
Herbaceous	25	274,2	50,26	75,13
2. Aquatic	25	767,9	140,78	166,28
3. Dispersed	137	350,3	64,23	201,14

Source: Cataruben Foundation

The details of the calculations can be found in **Annex 2.5.3.1 Calculations: 1.**

23.4. ACTIVITY DATA

23.4.1. Historical annual changes in the reference region, project area and leakage area

Based on the delimitation of the wetlands and their stratification, the land cover to which the analysis of natural vegetation cover change was made in the reference region was defined. Table 22 shows the natural covers associated with the wetlands and the covers defined as Transformed.

Table 22. Natural covers associated with wetlands and covers defined as Transformed.

TYPE	STRATUM	CORINE LAND COVER
NATURAL HEDGING	Herbaceous	Open rocky grassland
		Dense flooded grassland
		Dense Flooded Flooded Grassland Wooded
		Dense Non-Tree Dense Flooded Flooded Grassland
	Dispersed	Open shrubland
		Dense shrubland
		High Flooded Open Forest
		Low Flooded Open Forest

	Aquatic	Lagoons, Lakes and Natural Swamps
		Aquatic Vegetation on Water Bodies
		Marshlands
TRANSFORMED	TRANSFORMED	Rocky Outcrops
		Cotton
		Arenales
		Rice
		Fragmented Forest
		Fragmented Forest with Pasture and Crops
		Fragmented Forest with Secondary Vegetation
		Cane
		Panelera Cane
		Artificial Water Bodies
		Agroforestry Crops
		Open sandy grassland
		Recreational facilities
		Oxidation Lagoons
		Corn
		Crop Mosaic
		Pasture and Crop Mosaic
		Other Permanent Tree Crops
		Other Permanent Shrub Crops
		Other Permanent Herbaceous Crops
		Other Transient Crops
Palm Oil		
Wooded Pastures		
Pastures Grubbed		

		Clean Pastures
		Pastures and Planted Trees
		Conifer Plantation
		Forest Plantation
		Banana and Plantain
		Road and Railway Network and Associated Lands
		Sorghum
		Soy
		Continuous Urban Fabric
		Discontinuous Urban Fabric
		Bare and Degraded Lands
		High Secondary Vegetation
		Low Secondary Vegetation
		Secondary or transitional vegetation
		Waste disposal areas
		Industrial or Commercial Zones
		Urban Green Zones

Source: Cataruben Foundation

A multitemporal analysis of land cover change was performed using as input the land covers according to the Corine Land Cover Methodology Period 2009 - 2018, the different land covers, were grouped as established in the previous Table, and negative changes were quantified as the strata that were transformed into any of the covers of the stratum called Transformed, while changes in the other strata, were always positive.

To determine the annual historical changes in the reference region and project them in the project area, the steps established in the methodology "Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands" were followed. The results can be seen in Table 23 and in the project spreadsheet.

Table 23. Historical annual changes Without Project Scenario

Historical annual changes No Project Scenario							
Stratum	16.3.2. Historical annual changes Reference Region					Project Area	
	Transformation Rate	t ₁	t ₂	A ₁	A ₂	CSCN _{ib}	Ap (Project Area)
<i>Herbaceous</i>	0,0260459993	2009	2018	6.467.869	5.116.306	1537,5	59.029,8
<i>Aquatic</i>	0,0000893058	2009	2018	111.752	93.331	0,4	3.951,7
<i>Dispersed</i>	0,0578414819	2009	2018	53.297	31.668	41,0	709,3

Source: Cataruben Foundation

Likewise, for the leakage area, the historical natural cover change was projected from the wetland areas at the project start date multiplied by the transformation rate of the reference region.

Table 24. Changes in the leakage area

Historic change in the leakage area without project		Change in leakage area scenario with project		
Leakage area				
CSCN _{ib,f} (ha)	A _f	CSCN _{proy,f,year} (ha)	CSCN _{ib,f} (ha)	%E _f
122	4692,6	37	122	-69,7%
0,024	267,4	-17	0,024	-73046,9%
2,76	47,7	0	2,76	-100,0%

Source: Cataruben Foundation

Detailed calculations can be found in **Annex 2.5.3.1**. Calculations : "[3.Emisiones Humedales.xlsx](#)" > Sheet1. Transformation_Lb

23.5. GHG EMISSION REDUCTIONS EXPECTED WITH THE IMPLEMENTATION OF THE PROJECT

Table 25. Projected emission reductions from avoided transformation of natural wetland cover.

Table 25. Emission reductions from avoided transformation of inland wetlands.

Period	Year	Emissions Reduction
1	2016	82.446,6
2	2017	123.590,4
3	2018	123.524,4

4	2019	123.472,8
5	2020	123.436,5
6	2021	123.416,4
7	2022	123.413,5
8	2023	123.429,0
9	2024	123.463,9
10	2025	123.519,5
11	2026	123.597,1
12	2027	123.698,1
13	2028	123.823,9
14	2029	123.976,3
15	2030	124.156,8
16	2031	124.367,2
17	2032	124.609,5
18	2033	124.885,8
19	2034	125.198,1
20	2035	125.548,9
21	2036	125.940,6
22	2037	126.375,8
23	2038	126.857,5
24	2039	127.388,5
25	2040	127.972,2
26	2041	128.611,8
27	2042	129.311,1
28	2043	130.074,0
29	2044	130.904,6
30	2045	131.807,2
TOTAL		3.722.817,7

Source: Cataruben Foundation

24. ASSESSMENT OF THE BIOLOGICAL COMPONENT IN INLAND WETLANDS

24.1. Establishment of biodiversity baseline

The Orinoquia region has a high diversity of species and ecosystems as a result of the interaction of multiple factors. These factors can be physical, chemical, biological and even social, and their interactions determine the environmental conditions of the region. Landscape, climate and hydrology correspond to types of physical factors that condition the available resources and therefore the distribution of species populations.

In order to establish the biodiversity baseline in the project area, the above aspects were taken into account in the understanding that they are directly related to biological diversity. The following is a general description of the natural ecosystems, geomorphology and hydrology of the Orinoquia region and more specifically of the project area. Next, the results of the characterization of the fauna and flora associated with inland wetlands are presented, as well as the identification of important areas for biodiversity conservation.

First, the Orinoquia region has been recognized as a strategic ecosystem for humanity, due to its high biological diversity associated with 156 types of natural ecosystems. Among these, natural savannas, gallery forests, morichales, piedmont, estuaries, rainforests, among others stand out (CIAT, *et al.*, 2018). Figure 21, **shows** the map of natural ecosystems in the project reference area, in which the distribution of 65 types of natural ecosystems grouped into secondary vegetation, high low or medium dense forests (BAD, BBD and BMD respectively), savannas and swamp vegetation can be observed.

On the other hand, hydrology is considered an important physical aspect related to the region's biodiversity. This is due in the first place to the fact that 41% of Colombia's subterranean water reserves are found in the subsoil of the Orinoco region. In addition, the large Orinoco basin has 750 rivers, thousands of streams and creeks that represent a large number of smaller basins and micro-basins. beekeeping

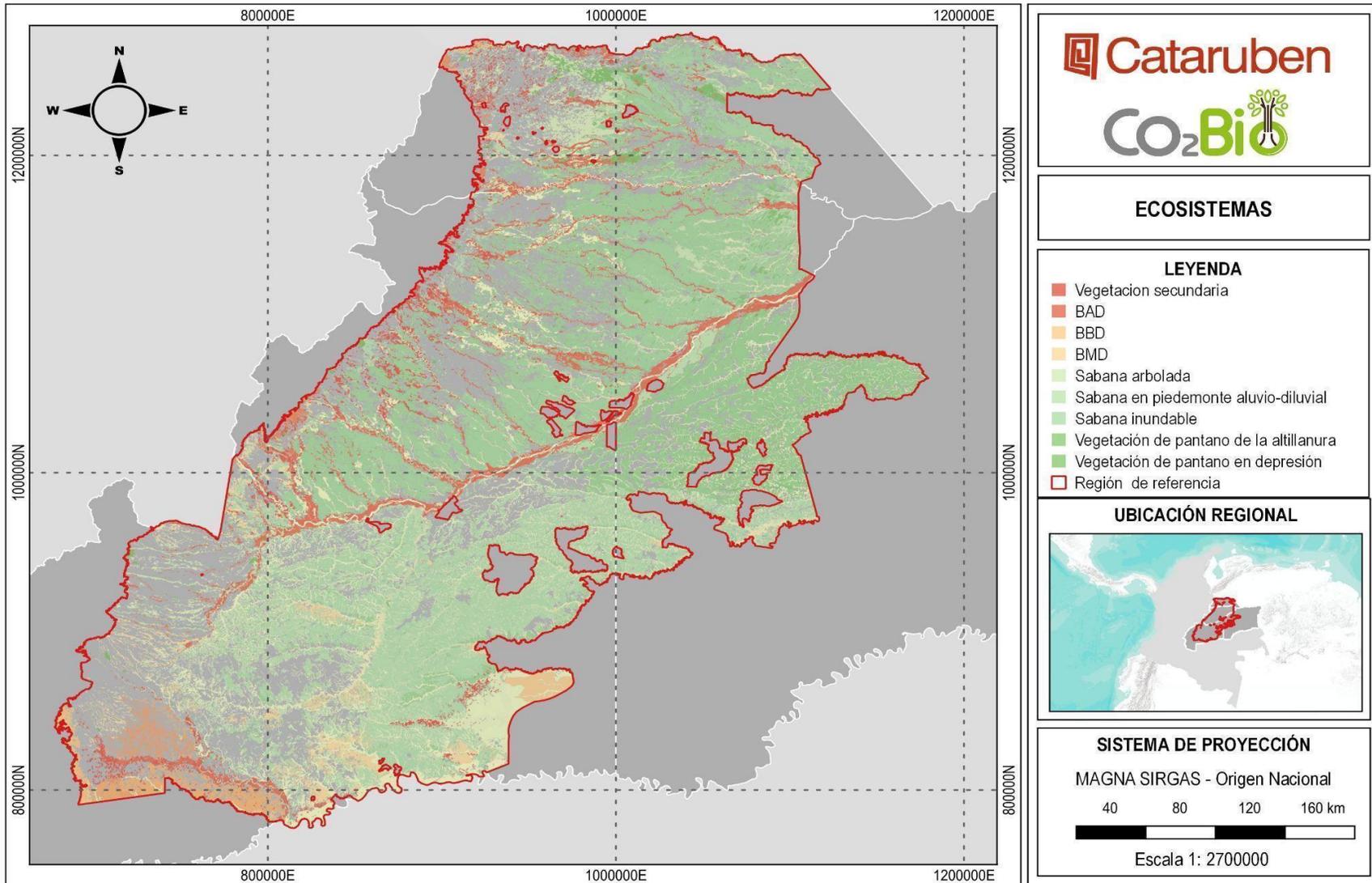


Figure. 21 Natural ecosystems of the project's reference region.

Source: (Romero, Galindo, Otero & Armenteras, 2004).

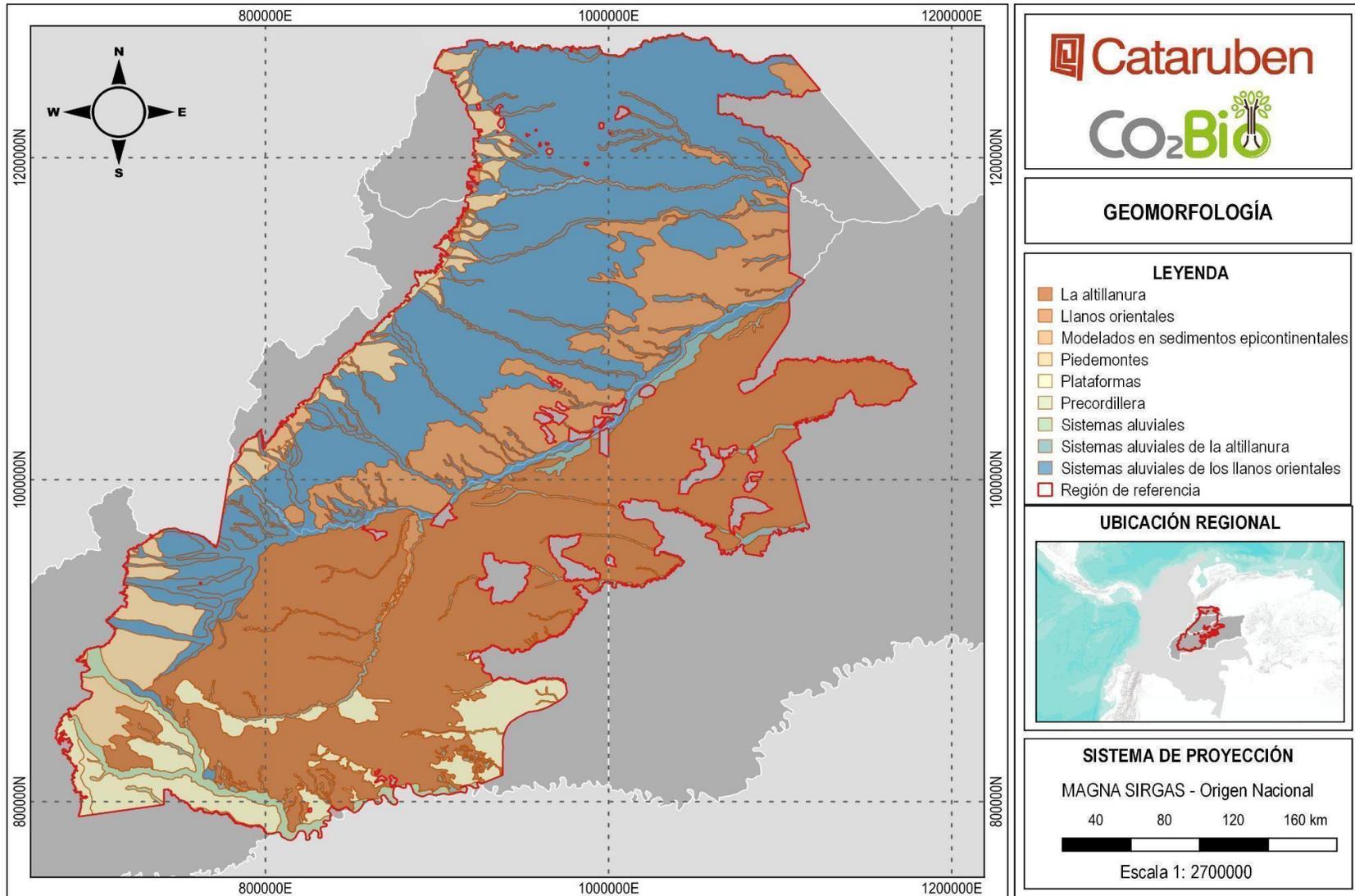


Figure. 22 Geomorphology of the project reference area.

Source:(INGEOMINAS, s.f.)

To continue, the region's watersheds are associated with the following landscapes,

- a. Eastern slope of the Eastern Cordillera;
- b. Sedimentary basins of the Andean rivers Duda, Lozada, Guayabero and Guaviare;
- c. Depositional piedmont in Casanare and Meta, derived from Tertiary and Cretaceous rocks;
- d. Low flood plains in Arauca and Casanare;
- e. High plains in Meta and Vichada;
- f. Shield of Vichada, Guainía and Vaupés and pericratonic structural plain;
- g. Sierra de la Macarena.

These are grouped into three large zones that are characterized by the shape of the relief: mountain range, sedimentation plain and Guiana shield. The project area is located within the sedimentation plain, also known as the Eastern Plains, which occupies the largest area of the Orinoquia and includes the floodplain north of the Meta River, the highlands in the south, and a jungle landscape with Amazonian characteristics that connects with the tropical rainforest areas.

Floodplain soils have developed influenced by humidity and are less evolved than soils in other areas of the region. These soils are highly acidic, have low fertility, and are compacted due to livestock grazing. For their part, the soils of the “altillanura” present high iron and kaolin content related to low fertility (Bustamante, 2019). The geomorphology map of the project reference area is shown in Figure 22.

As mentioned earlier, the interactions between environmental conditions such as the richness of water, the different physiographic landscapes, and soil characteristics can be related to the region's high biological diversity. In terms of numbers, the region has 156 natural ecosystems and 49 intervened ecosystems, 1043 species of birds, 155 species of reptiles, 254 species of mammals, 663 species of fish, 191 species of amphibians, 5411 species of plants and 680 species of insects, of which 274 are endemic species (Bustamante, 2019) are reported.

This great biodiversity is also explained by the fact that the Orinoquia is one of the wilderness areas with the most wetlands in the world. The region's wetlands total 14,725,346 ha and are divided into natural (49) and artificial (7) wetlands, distributed as follows,

- h. Orinoquía llanera, 38 types;
- i. Orinoquía guayanesa, 28 types;
- j. Delta or River mouth, 19 types;
- k. Andean Orinoco, 11 types of wetlands.

In relation to the above, the project area is dominated by flooded savannas that have been recognized as a large mosaic of seasonal wetlands. The environmental conditions in this area

determine the diversity of species, as the latter have undergone long adaptation processes related to seasonality and fire dynamics, among other conditions. Likewise, the distribution of biodiversity has been affected by the change in land use that generates the transformation of natural vegetation cover, which was presented in section 18.1.

24.1.1. Flora and Fauna Characterization

In order to estimate the species richness of the project area, lists of samplings, inventories, etc., from the departments of Casanare and Arauca and the records of Sib Colombia up to December 2019 were consulted (Lasso *et al.*, 2014; Trujillo & Anzola, 2019; Usma & Trujillo, 2011; SiB Colombia, 2020). Thus, [Annex 2.4.1.2. Biodiversity of the project area - Wetlands](#) lists 59 species of amphibians, 403 species of birds, 22 species of crustaceans, 18 species of mammals, 29 species of mollusks, 608 species of fish, 259 species of aquatic plants and 101 species of reptiles. Additionally, the threat status, distribution and scientific name of the species were identified and verified in the IUCN Red List⁹ , iNaturalist¹⁰ , eBird¹¹ , Tropics¹² and GBIF¹³ , as shown in Table 26 below.

⁹ <https://www.iucnredlist.org/>

¹⁰ <https://www.inaturalist.org/observations>

¹¹ <https://ebird.org/home>

¹² <http://legacy.tropicos.org/Home.aspx?projectid=33&langid=66>

¹³ <https://www.gbif.org/>

Table 26. Summary of the biodiversity list showing the number of families and species registered in the project area, as well as their status according to the IUCN Red List.

Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CE), Extinct in the Wild (EW) and Extinct (EX).

Taxonomic Group	No. of records										No Information
	Families	Species	DD	LC	NT	VU	EN	CE	EW	EX	
Amphibians	12	59	0	54	0	0	0	0	0	0	5
Birds	64	403	0	382	13	7	1	0	0	0	0
Crustaceans	3	22	3	19	0	0	0	0	0	0	0
Mammals	10	18	2	12	1	1	2	0	0	0	0
Mollusks	6	29	2	6	0	0	0	0	0	0	21
Fish	51	608	12	119	1	6	1	1	0	0	468
Aquatic plants	74	259	0	60	0	0	0	0	0	0	199
Reptiles	23	101	4	80	0	3	1	2	0	0	10
Total	243	1499	23	732	15	17	5	3	0	0	703

Source: Cataruben Foundation

As can be seen in the table above, 49% of the species are in the LC category, 47% have no information in the IUCN and the other threat categories represent less than 5% of the species. It is important to highlight mammal species such as *Pteronura brasiliensis* (EN), *Tapirus bairdii* (EN), *Tapirus terrestris* (VU) that are threatened mainly by habitat degradation. Similarly, in the group of birds, species such as *Oressochen jubatus* (NT), *Calidris subruficollis* (NT) and *Patagioenas subvinacea* (VU) are threatened by agricultural expansion. Threats to biodiversity (including invasive species) are described in greater detail in the following section: 24.2.

Some of the species found in the project area are considered indicator, flag or umbrella species. This is the case of *P. brasiliensis*, which is a top predator and bioindicator of the integrity of aquatic ecosystems and has been considered as a flag and umbrella species in local management programs (Velasco, 2004). Figure 23 shows that this species has a restricted distribution compared to other threatened species, such as *Panthera onca* (NT).

The latter is a feline species that is in the NT category due to forest degradation, which in the case of the Orinoquia usually corresponds to flooded gallery forests during the rainy season. This species has been recognized as a focal species in some conservation initiatives in the region because it is also a very important top predator in the food web (Ruiz, Orozco, Payan & Castellanos, 2003).

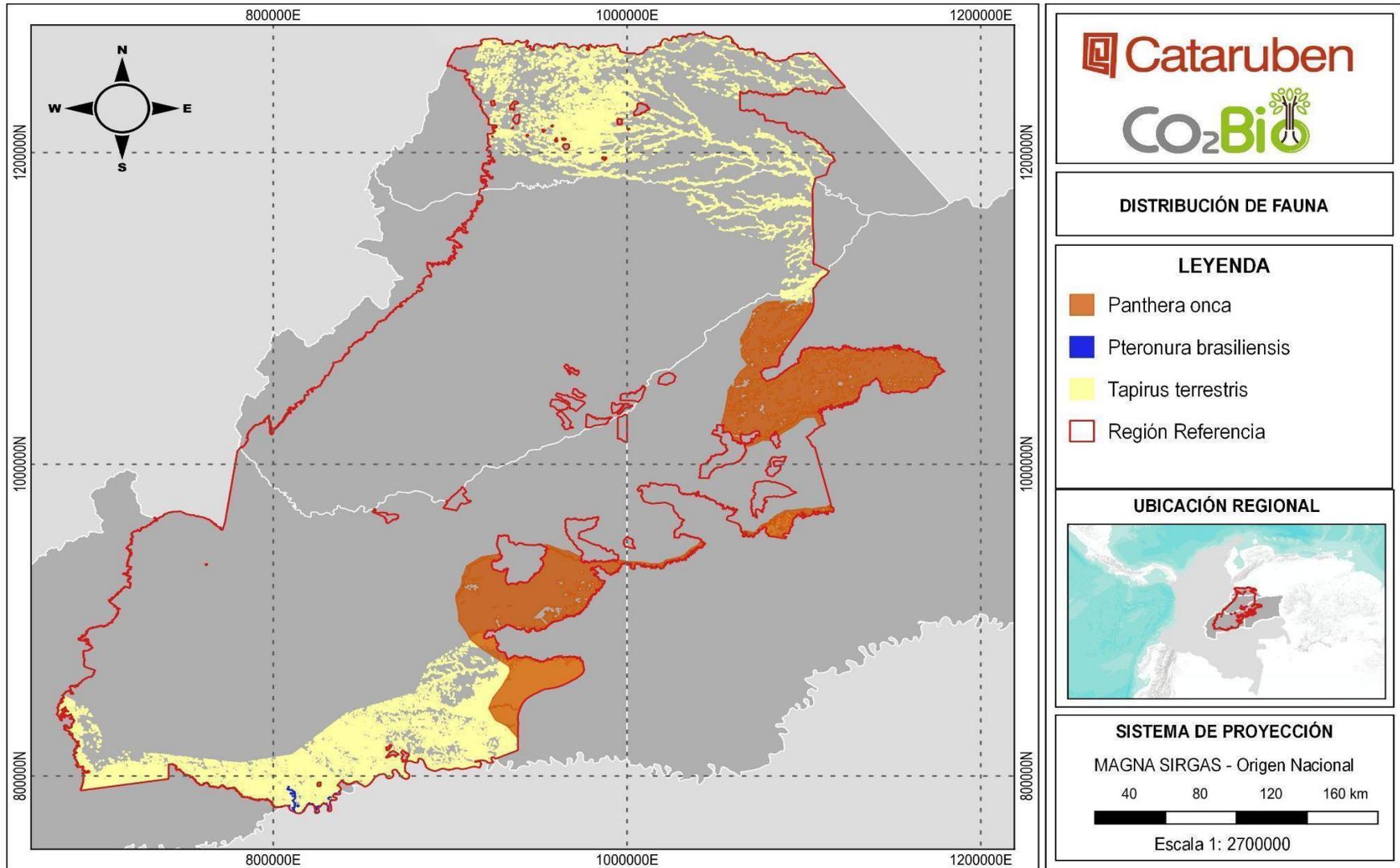


Figure. 23 Distribution of threatened species

Source:(IAvH, n.d.)

On the other hand, the fauna of the Orinoco is generally not endemic due to several factors (Defler, 1998). In the first place, the eastern plains are of relatively recent origin and the soils are poor, formed by sedimentation of the Andes Mountains and the eolian sands of the Guiana Shield to the east. In addition, many of the species of the Orinoco are shared with the Amazon region, such as birds, mammals and fish.

Some of the amphibian and reptile species that can be considered endemic are the frogs *Scinax wandae* and *Physalaemus fischeri*, the Orinoco caiman *Crocodylus intermedius*, the turtle *Podocnemis vogli*, the lizards *Gonatodes vittatus*, *Hemidactylus palaichthus* (Defler, 1998). For the fish group, 22 species endemic to the Meta River are reported, 46% of which are found in Casanare (Usma and Trujillo, 2011). As for birds, six endemic species were identified, three near endemics including *Odontophorus strophium* and *Brachygalba goeringi*.

To continue, it is important to mention that within the group of plants there are key species for the conservation of floodable savannas such as *Mauritia flexuosa*, *Acosmium nitens*, *Vochysia lehmannii*, *Attalea maripa* and *Attalea insignis*. In relation to this, the Departmental Conservation Corridor floodable savanna located in the municipality of Trinidad, El Porvenir del Guachiría, Finca El Lagunazo and other properties, was identified as a proposed area for the conservation of plant ecosystems in the department of Casanare (Usma and Trujillo, 2011). Similarly, areas have been identified for the conservation of birds, especially *Oroscochen jubatus*, *Phacellodomus rufifrons*, *Brachygalba goeringi* in the project area (Municipality of Paz de Ariporo, Hato Corozal, Trinidad, among others).

24.1.2. Identification of HCVs and other conservation areas.

- **High Conservation Value (HCVs)**

In the project area and at the national level in general, there is very little information and initiatives to assess and identify HCVs. However, the palm oil sector has implemented efforts to develop sustainability and biodiversity conservation activities. Among these is the assessment of HCVs under the *Roundtable on Sustainable Palm Oil (RSPO)* certification scheme.

Regarding the above, the San Felipe I and Guafitas project properties are part of the company Agroindustrial de Palma Aceitera S.A. Sucursal Colombia, located in the municipalities of Orocué and San Luis de Palenque - Casanare, in which an HCV Assessment was conducted in 2018 ([See ANNEX 2.4.1.3. HCV Assessment AIPA](#)). The above, as part of a strategy of sustainability and environmental compensation against the impact of oil palm cultivation on the natural ecosystems of the area.

For these two properties, the natural areas associated with the Cravo Sur river and the Aceite and Güirripa streams, as well as the floodable savannah, were identified as important areas for biodiversity conservation (see Table 27). The Cravo Sur river was also identified as an important

element for the supply of water resources and to meet the needs of the surrounding community. This exercise makes evident the importance of carrying out this type of recognition in other areas of the project that are already recognized as important areas for conservation but are not yet categorized as HCVs.

It is important to mention regarding HCV 6, that the cultural resource of the llano work songs, was recognized in 2017 by UNESCO as Intangible Cultural Heritage of Humanity, and that it is located in the Orinoco region, specifically in the departments of Arauca, Casanare, Meta and Vichada, which are associated "with the traditional activities of extensive cattle ranching in the Colombian-Venezuelan plains. They are composed of four oral and sonorous variants: milking songs, cabrestero songs (llanerismo for cabestrero), candle songs and domestication songs (whistles, shouts, calls, japeos), all interpreted a capella in the work tasks with the cattle in the estates, farms and herds" (Mincultura, November 1, 2021).

These practices associated with traditional livestock farming have been valued both for their uniqueness worldwide and for their importance in safeguarding an activity that contributes to maintaining the ecosystem balance in the flooded savannas while providing basic income to the local communities that are part of the project.

Table 27. HCV Assessment Results.

AVC CATEGORY	PRESENCE	LOCATION
<p>HCV 1. Species diversity: Concentrations of biological diversity that contain endemic species or species that are rare, threatened or endangered, and that are of significant global, regional or national importance.</p>	Yes	Ecosystems associated with the fertile plains of the Cravo Sur river and the gallery forests of the Caños Aceite and Güirripa.
		Under the precautionary principle, the ecosystem area was identified as a floodable savannah.
<p>HCV 2. Landscape-scale ecosystems and mosaics. Ecosystems and ecosystem mosaics that are large at the landscape scale and important at the global, regional or national scale, and that contain viable populations of the vast majority of naturally occurring species under natural patterns of distribution and abundance.</p>	Yes	<p>The floodplain that lies within and outside the spatial boundaries of AIPA corresponds to a continuum of natural savanna ecosystems important for waterfowl and boreal migratory birds. Despite its ecological importance, due to its extent, information gaps and land use changes, the floodplain is categorized as HCV 2 and HCV 3 under the precautionary principle.</p>
<p>HCV 3. Rare, threatened, or endangered ecosystems, habitats, or refugia. Rare, threatened, or endangered ecosystems, habitats, or refugia.</p>	Yes	
<p>HCV 4. Ecosystem services. Basic ecosystem services in critical situations, such as protection of water catchment areas and erosion control of vulnerable soils and slopes.</p>	No	If there are ecosystem services, however, none of them were considered critical at least within the AIPA boundaries.
<p>HCV 5. Community needs. Sites and resources critical to meeting the basic needs of local communities, indigenous groups (for livelihoods, health, nutrition, water, etc.), identified through dialogue with these communities or indigenous peoples.</p>	Yes	The Cravo Sur River is a natural element of great importance, mainly for water supply, since for part of the community that is part of AIPA this is their only source of water.
<p>HCV 6. Cultural Values. Sites, resources, habitats and landscapes of global or national cultural, historical or archaeological significance, or of critical cultural, ecological, economic, or religious or sacred importance to the traditional culture of local communities or indigenous peoples.</p>	Yes	The "plain work songs" of the Orinoco region can be considered as cultural resources of significant global or national importance within the area, taking into account that they have been declared Intangible Cultural Heritage of Humanity.

Source: Cataruben Foundation, 2021.

- **CSNR**

The declaration of protected areas is key to biodiversity conservation, as it contributes to the permanence of natural ecosystems. According to the National Registry of Protected Areas (RUNAP), the region has 150 Civil Society Natural Reserves (CSNR), distributed in the departments of Casanare (97), Arauca (7), Vichada (18), and Meta (28). In this regard, 19 properties within the project have already been declared as CSERs ([See Annex: Civil Society Nature Reserves](#)), figures that will increase given the accompaniment and advice that will be given to the other owners in this process of declaration, within the framework of the project.

An example of these CSERs are the El Boral, Maturín and Rancho Nuevo properties, which are part of the Municipal System of Protected Areas (SIMAP) of San Luis de Palenque, Casanare. These reserves carry out conservation activities for endangered species such as *O. jubatus*, *M. tomentosum*, *P. brasiliensis* and *Puma concolor*, restoration of natural cover, fire mitigation in natural savannas, among others.

- **AICAS**

The Buenaventura property is part of the group of Natural Reserves of the Civil Society of the Altagracia district that were recognized worldwide as Important Bird Areas (IBAs) (Birdlife International, 2021). At least 154 species of birds have been recorded in these areas, 15 of which are migratory, such as the wigeon (*Anas discors*), the lesser sandpiper (*Calidris minutilla*), and the scaled sandpiper (*Calidris subruficollis*), among others. This AICA represents one of the most important sites for the conservation of the wigeon (*O. jubatus*) in the Americas, due to the fact that an estimated number of individuals equivalent to 31% of the entire global population of the species (Calidris, U.S. Fish and Wildlife Service, Birdlife International, Fundación Cunaguaro, Fundación Palmarito, *n.d.*).

Another AICA in the project area is Chaviripa - El Rubí, located in the municipality of Paz de Ariporo, Casanare, which is also part of the Western Hemisphere Shorebird Reserve Network (WHSRN). The avifauna of this site consists of 156 species, including 14 migratory species such as the spotted sandpiper (*Actitis macularius*), the white-faced duck (*A. discors*), and the eared swallow (*Hirundo rustica*), among others. This AICA has registered a species that is almost endemic to Colombia, the spectacled parakeet (*Forpus conspicillatus*). It also has the highest concentration of spoonbill (*Platalea ajaja*) individuals in Colombia and provides nesting habitat for the wigeon duck (*O. jubatus*) (Calidris, *et. al.*, *n.d.*).

To continue, Hato Sinai and Flor Amarillo are in the process of being declared as AICAS. As for Hato Sinai, through the implementation of photo-trapping, 202 species of birds, ten species of mammals and ten species of reptiles and amphibians were recorded. The supports for the recognition of these properties as AICAS can be found in [Annex 2.4.1.1: AICAS](#).

The location of the HCVs, CSRNs and KBAs within the project reference area are shown in Figure 24. This map includes the Key Biodiversity Areas (KBAs) and the rivers and main streams that may correspond to HCVs because they meet community needs and are home to species important for conservation.

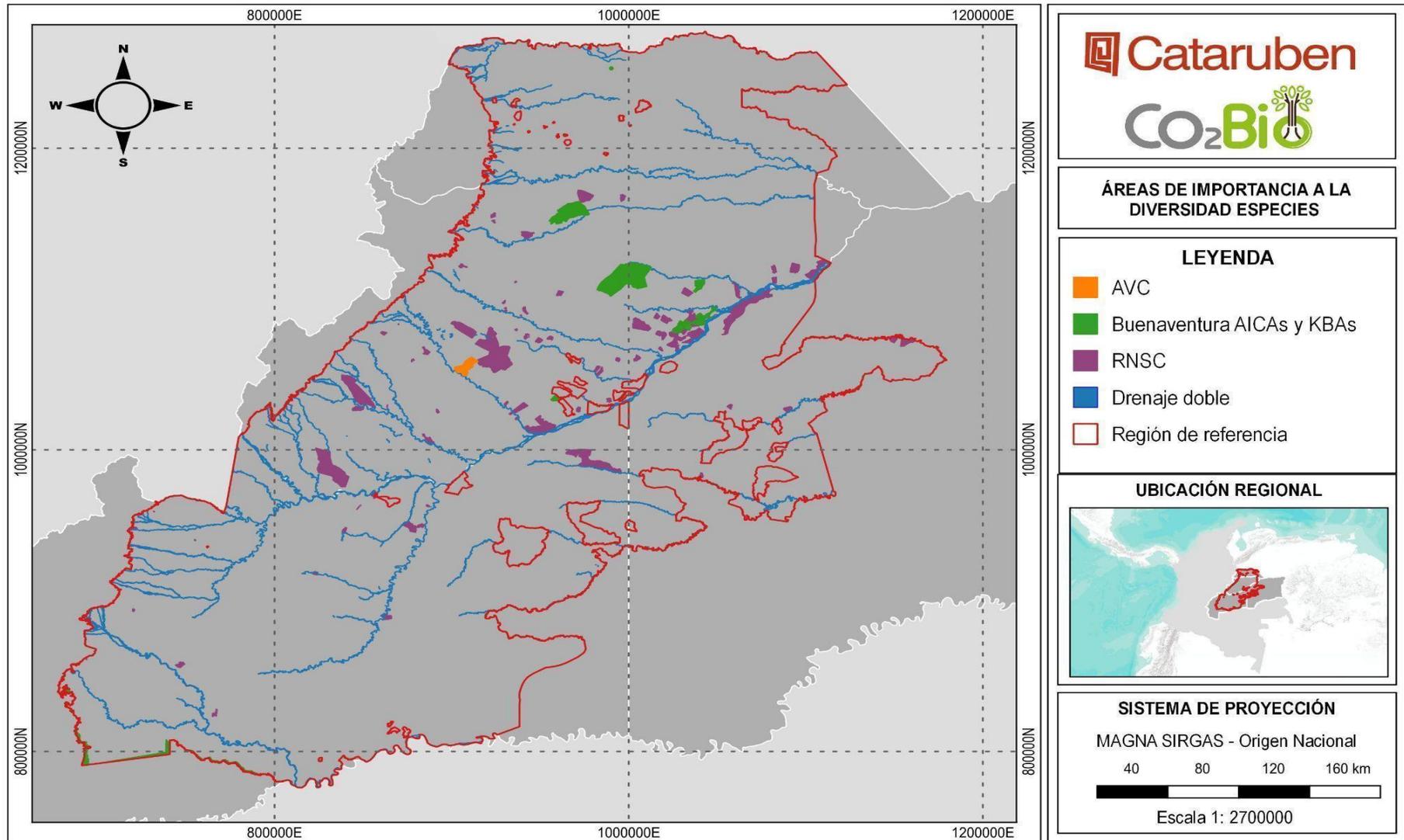


Figure 24 . Areas of importance to species diversity.

Source: Cataruben Foundation, 2021.

24.2. Identification of pressures on biodiversity

According to the Convention on Biological Diversity, five main pressures that generate biodiversity loss have been identified worldwide. These correspond to i) habitat loss and degradation, ii) climate change, iii) pollution and nutrient loading, iv) overexploitation and unsustainable use, and v) invasive exotic species (CBD, 2010). These pressures are related to economic activities in the region and can affect the ecological integrity of inland wetlands.

The following is a brief description of the effect of these pressures on wetlands and their associated biodiversity in the project area, and Table 28 presents more detailed information from some studies conducted in the project area.

24.2.1. Habitat loss and degradation

This is one of the main pressures on biodiversity at the global and regional levels, as it is related to the conversion of natural cover for agricultural uses, including deforestation. In the Orinoco region, natural cover conversion is generated by the expansion of the agricultural frontier, mainly by rice and palm cultivation and extensive cattle ranching (see Figure 25). In addition, one of the pressures commonly identified by landowners is the burning of natural savannas to adapt the land for crops such as rice and cattle ranching (with the exception of spontaneous fires that are intensified by wind during drought seasons).

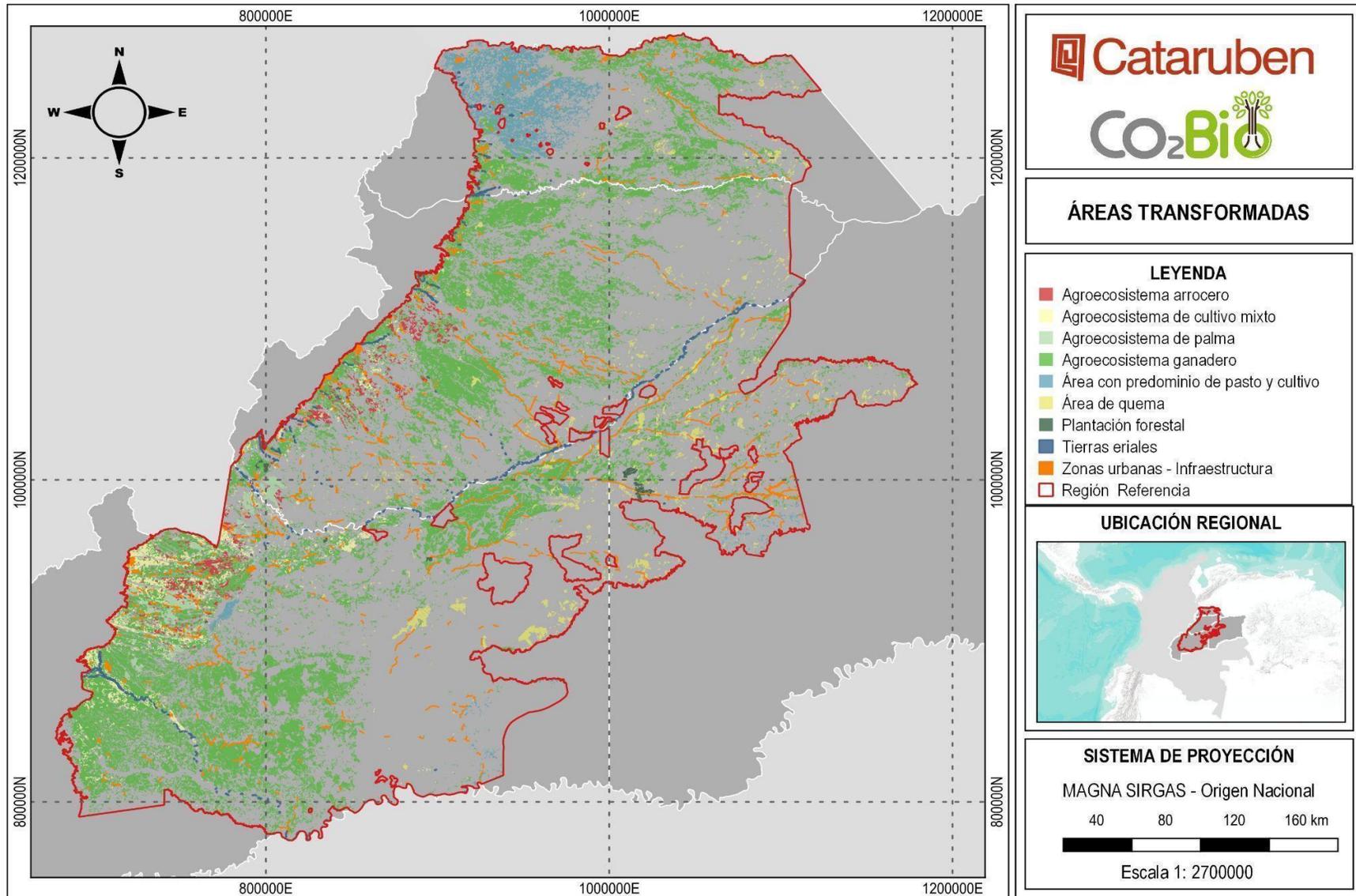


Figure.25 Transformed areas in the project reference region.
 Source: (Romero, Galindo, Otero & Armenteras, 2004).

24.2.2. Climate change

Climate change is already having an impact on biodiversity and future projections show that these effects will be increasingly greater. At the local level, variations in temperature and seasonality (rainy and dry seasons) are some of the effects that will have the greatest impact on biodiversity by affecting ecosystem processes and functions.

24.2.3. Contamination and nutrient loading

The burning of fossil fuels and agricultural practices in which fertilizers are used have doubled the amount of reactive nitrogen that stimulates plant growth. This generates changes in the plant composition of wetlands because it favors the growth of certain highly competitive invasive species that benefit from the added nutrients.

24.2.4. Overexploitation and Unsustainable Use

In this category, the main pressure corresponds to productive practices mentioned in the category of habitat loss and degradation, because their development implies the implementation of unsustainable activities that jeopardize the permanence of wild populations, as well as the provision of ecosystem services. It is important to mention that in the project area there are different conflicts with wildlife because some species are consumed by the communities and others are stigmatized as species that are very dangerous for the integrity of people or for economic activities (felines and reptile species).

24.2.5. Invasive Exotic Species

Invasive exotic species represent a worldwide threat to ecosystems and native species, as well as causing economic damage. The management of invasive exotic species prevents the loss of biodiversity by reducing the probability of extinctions of native and endemic species that are affected by the competition generated. However, studies are insufficient to estimate the magnitude of the effect of these species.

It is evident that the measures designed to mitigate these pressures should be aimed at promoting the implementation of good practices that are sustainable alternatives for the economic development of the region. These measures were integrated into the design of project activities presented in section 20.

Table 28. Studies conducted in the project area describe the effect of pressures on biodiversity.

No.	Type of pressure	Effect on biodiversity according to research conducted	Source
1	Loss and degradation of habitats	Some productive activities such as the cultivation of oil palm, rice and pasture correspond to the main causes of land use change and habitat loss and are related to the stress factors of water demand and the decrease in the provision of ecosystem services.	Ricaurte <i>et al</i> , 2017
		Under the scenarios of oriented production and agroindustrial development, oil palm expansion by 2020 could generate a biodiversity loss of 0.08% (± 0.04) and 0.25% (± 0.13) respectively.	Garcia-Ulloa, Sloan, Pacheco, Ghazoul & Pin-Koh, 2012.
		The expansion of palm cultivation may reduce the biodiversity of the northern and eastern sector of the country by 21.8% according to the index of biodiversity change using mammal diversity.	Vargas, Laurance, Clements & Edwards, 2015.
		In the Orinoco region, approximately 25% (3626 ha) of the land planted with oil palm between 2001 and 2005 corresponds to gallery or riparian forests, wetlands, foothills or natural savannahs.	
		The oil palm cultivation areas overlap or overlap with 4.9% of the ecosystems whose remnants were classified in the Endangered category (Magdalena valley forests and Orinoco flooded savannas). However, the areas suitable for palm cultivation show a low congruence with areas where endangered species are concentrated. According to trends, the expansion of palm cultivation could threaten biodiversity by encompassing areas with 26-35 threatened species (birds, mammals and amphibians).	Ocampo-Peñuela, Garcia-Ulloa, Ghazoul & Etter, 2018.
		It is important to mention that in recent years efforts have been made to design sustainable strategies for oil palm cultivation. Among these strategies is the identification, valuation and management of High Conservation Values (HCVs) carried out by different institutions in some of the country's oil palm production areas.	Vargas, Laurance, Clements & Edwards, 2015; Inter-American Development Bank (IDB), Global Environmental Facility (GEF), FEDEPALMA, CENIPALMA, WWF & IAvH, 2014.
		The conversion of natural areas such as flooded savannahs to productive systems, such as oil palm, rice and livestock systems generates a change in the richness and composition of taxonomic groups, such as birds. This is due to changes in the structure of the ecosystem, from a natural ecosystem dominated by grasses to a productive palm oil system with a tree structure. However, the results of these comparative analyses are determined by the habits (generalist or specialist species) of the groups evaluated.	Gómez - Zuluaga, Espinosa & García - Azuero, 2019.
		Very little information has been published on the effects of rice cultivation in the region. However, it is known that this type of cultivation has a great environmental impact because it modifies the structure of the landscape and soils (mechanization of fields), causes the loss of microorganisms, changes the composition of flora, and in some cases contributes to deforestation.	Botana & Schnake, 2011.

2	Climate change	Twenty-five percent of the region's bird species are related to climate-mediated migration phenomena.	Gómez - Zuluaga, Espinosa & García - Azuero, 2019.
		Variations in temperature, humidity and precipitation will generate changes in the geographic distribution of species due to the reduction and loss of habitats. Since these variations will occur in a short period of time, species will have less chance of adapting to the new circumstances and will therefore migrate to regions with suitable conditions for their development.	CIAT & CORMACARENA, 2018
3	Contamination and nutrient loading	Due to human activities, a large amount of reactive nitrogen (N) has been introduced into natural ecosystems. Reactive N is used as a fertilizer, however, as it is used in large quantities it can cause a cascade of problems in ecosystem functions and contributes to global warming.	Subbarao, <i>et al.</i> , 2012
		The upstream phase of the hydrocarbon industries is in this category as a consequence of discharges of drilled rock cuttings into water systems, contaminated with toxic drilling fluids and the generation of produced waters containing high levels of hydrocarbons and chemical additives, due to their discharge into water bodies or injection into the subsoil.	Mendoza, 2018
		According to water quality indices, water resource degradation occurs mainly due to the increase of nitrogen and phosphorus from agriculture and animal production. The variation of nutrients in wetlands generates the growth of algae and aquatic plants that decrease the capacity to dissolve oxygen in the water, resulting in a negative impact on the ecosystem. The variation of natural ecosystem conditions compromises the provision of ecosystem services.	Trevisan, <i>et al.</i> , 2020.
4	Overexploitation and unsustainable use	It is clear that the aforementioned agricultural activities also correspond to pressures of overexploitation and unsustainable use. However, there are other pressures in the region, such as wildlife hunting for consumption. This practice is difficult to detect on each property because sometimes the landowners prohibit hunting in their areas, but outsiders illegally enter the natural areas and extract mammals such as white-tailed deer, armadillos, "marrano de monte", birds such as the roadside duck, some species of turtles and even lizards (for food consumption, sale of skins). On the other hand, there is a conflict with the feline group because the latter consume domestic animals, which affects the landowners economically and they decide to hunt the felines as a solution. Similarly, the snake group is also affected because they have historically been stigmatized as dangerous species.	Castro, Merchán, Gárces, Cárdenas & Gómez, 2013A.
			Castro, Merchán, Gárces, Cárdenas & Gómez, 2013B.
			Montes-Peréz, Escobar-Bernal, Albarracín-González, Y., Adame-Erao & Camacho, Reyes (2016).
			Sarmiento, Monroy & Sanchez, (2017).
			Garrote, Rodríguez-Castellanos, Trujillo, Mosquera-Guerra & Castaño - Uribe (2017).

			Guerra, Trujillo, Cuero, Bolivar, Valencia, Arboleda & Meluk, 2019.
5	Invasive exotic species	For the department of Casanare, 26 species of flora are recognized as invasive. 19 are introduced, 4 are cryptogenic and 3 are wild; 14 of these species are in invasion risk A (high), 7 in category M (moderate), one in category B (low) and 4 in category R (require further analysis). Among these species, there are common aquatic plants of the Orinoco wetlands such as: <i>Eichornia crassipes</i> , <i>Pistia stratiotes</i> , <i>Salvinia auriculata</i> , <i>Limnobium laevigatum</i> , <i>Andropogon bicornis</i> , <i>Panicum maximum</i> and <i>Ludwigia helmithoriza</i> .	Córdoba-Sánchez, Miranda-Cortés, Avila, Avilán & Pérez-Rojas, 2011.
		The conversion to extensive grazing for livestock and the introduction of exotic pastures represents 5.5% of the total hectares of agricultural land in Colombia.	Rincon, 2018.

Source: Cataruben Foundation

25. MONITORING PLAN

The following is the monitoring plan designed to evaluate changes in the project boundaries, the execution of activities, socio-environmental effects, permanence and emissions of the project, based on the established methodological guidelines, in order to generate accurate and quality information in the verification process.

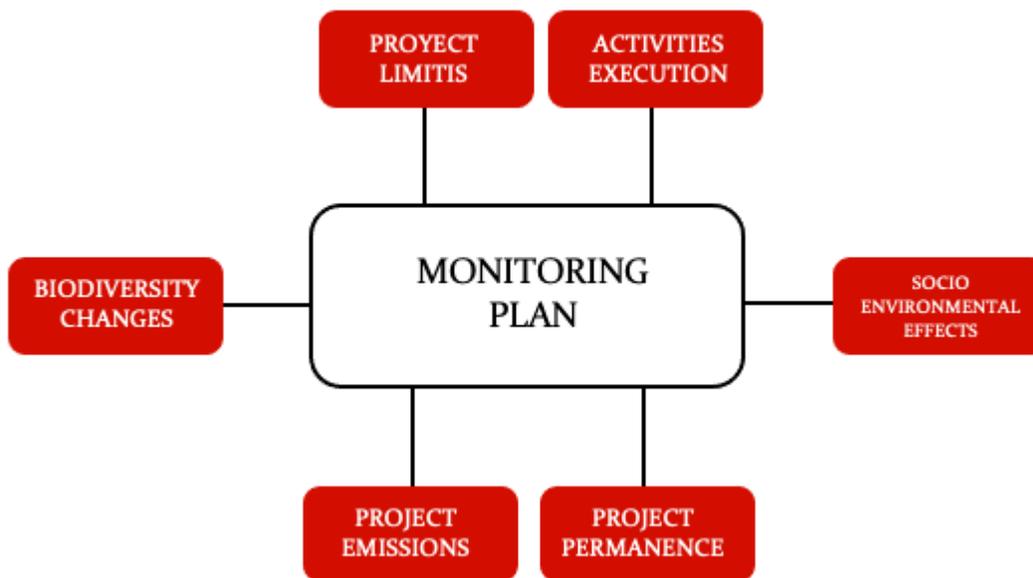


Figure.26 Wetland ecosystem monitoring plan

Source: Cataruben Foundation, 2021.

25.1. PROJECT BOUNDARY MONITORING

The methodology establishes the monitoring of the geographical limits of the project for the executed activities, which must be included in a robust and organized geographic information system, georeferencing the total areas of the project and including the reference region and the leakage area.

Periodic verification of changes in land use in the project area should be carried out using the procedure described in section 16.3.1 of the methodology.

25.1.1. Reference Region

According to the methodology, the reference region should not be monitored.

25.1.2. Project area

Monitoring for boundaries and eligible areas will be conducted for the project areas.

25.1.3. Eligible areas

Eligible areas will be monitored on an annual basis identifying changes in land cover associated with wetlands. The land covers should be in harmony with the Corine Land Cover classification methodology.

Table 29. Eligible properties

PROPERIES	ELIGIBLE AREAS (HA)	PROPERTIES	ELIGIBLE AREAS (HA)
Aigualuna	291,0	El Borinquen	412,6
Albania	459,7	The Canary	370,0
Baraki	641,1	The Caribbean	745,3
Barley	10987,1	El Cristal	250,7
Bonanza	1470,6	El Diamante	363,8
Bramadero	446,7	Eden	492,4
Cañas bravas	53,0	El Morrocoy	527,3
Canarias	852,9	The Danger	595,0
Canta Claro	731,8	El Retiro	49,5
Chaparral	290,2	El Rubi	798,4
Chaviripa	1906,7	El Salvador	399,0
Corocoro	713,2	El Siare 2	35,5
Cuatro Vientos	582,8	El Silencio	717,3
Curimagua	484,4	Tolima	308,2
El Alcornoco	269,8	El Turpial 1	235,4
El Boral	2888,4	El Turpial 2	37,3
El Vaivén	386,2	La Hermosa	436,0
Enmanuel	867,7	The Illusion	100,4
Finca Palmarito	11,4	La Niña	79,6
Flor Amarillo HTC	777,4	La Palmita TRN	311,4
Flor Amarillo SROS	48,6	La Perla - El Trébol	338,0
Guadalupe-Palmarito	155,8	La Piscina	109,4
Guadalupe II	802,9	La Victoria	402,3

Guafitas 1	81,3	La Vigía	279,0
Guarataro	20,1	La Virtud	134,2
Guianas	194,8	Las Brisa PZA	11,5
El Sinaí	2951,4	Las Mercedes	699,8
Israel	627,5	Leche Miel	8,5
La Bendición	7,7	Lejanías	1032,8
La campechana	138,7	Llano Lindo	615,1
La Comarca- Yari	418,5	Los Azulejos	405,8
La Esperanza April	73,7	Los Cañafistol	60,2
La Estación	614,5	Los Merecures	77,4
La Gaitana Dos	570	Lote 5- La Palmita	677,3
La Gaitana Tres	550,8	Macarena	260,8
La Gaitana Uno	549,5	Miralindo	515,6
Nome Nome	75,9	Muriva	905,6
Palmarito 1 - Orocue	7,2	San Andrés	123,8
Palmas Ralas	2012,7	San Felipe 1	117,7
Palmitas SLP	519,1	San Felix	6,2
Penjamo 1	379,5	San Pablo	1417,6
Planeta Rica	1338,2	Santa Trinidad	2172,3
Playa Blanca	155,9	Sinaloa	89,4
Potosi	742,9	Sinaloa	89,4
Puerta Colorada	78,4	Villa Esperanza	378,4
Rancho Arecua	53,3	Villa Rica 2	411,0
RNSC Algarrobo	162,6	Villa Rica Lot 8	79,6
RNSC Betania	636,1	Yovereña	1372,7

CSNR Buenaventura	428,1	CSNR Valledupar	218,5
CSNR El Madroño	368,6	CSNR El Lagunazo	550,1
CSNR Los Matapalo	774	CSNR Rancho Nuevo	304
CSNR Maturín	621,7	CSNR Quinto Patio	401,5

Source: Cataruben Foundation, 2021.

25.1.4. Leakage Areas

For leakage areas, a report on the change of natural vegetation cover identified as wetland to transformed cover will be made each verification.

25.2. MONITORING OF THE IMPLEMENTATION OF PROJECT ACTIVITIES

In accordance with the design of the project activities for the reduction of GHG emissions and the conservation of the biodiversity of inland wetlands, a monitoring plan was established with measurable time periods for the following activities; Cycle of training to strengthen knowledge in wetland conservation and sustainability to prevent the expansion of the agricultural frontier, Characterization and implementation of sustainable production practices, Participatory monitoring for the conservation of biodiversity and HCVs in the project area, Strengthening of governance structures in the territory, and Recognition of areas and figures of conservation and environmental management for the conservation of biodiversity. The above, in order to guarantee the non-transformation of cover and the additionality of the project ([See Annex monitoring of project activities](#)).

Table 30. Monitoring plan for the execution of project activities.

No.	ID Activity	ID Indicator	Indicator name	Type	Goal	Unit of Measurement	Monitoring methodology	Frequency of monitoring
1	Training cycle to strengthen knowledge on wetland conservation and sustainability to prevent the expansion of the agricultural frontier.	1.1	Number of people trained	Capacity building and environmental education	56	Unit	Attendance records and photographic evidence	One cycle per year
		1.2	Number of properties with implemented activities		21	Properties		Every five years
2	Characterization and implementation of sustainable production practices.	2.1	Characterized properties	Accompaniment and support in best practices	141	Properties	Preparation of property plans, socioeconomic data sheets, management plan sheets, visit logs and photographic registers	Every five years
		2.2	Productive practices implemented			Properties		
3	Phased participatory biodiversity and HCV monitoring	3.1	Number of stages implemented	Inland Wetlands Biodiversity Conservation	3	Stages	Progress report on the execution of the stages of the biodiversity monitoring program.	Every five years
4	Strengthening of governance structures in the territory	4.1	Number of governance structures strengthened	Governance	3	Unit	Technical committee meetings or meetings	Every five years
		4.2	Number of governance activities carried out in the project area		6	Activities	Visit to properties, recording of governance activities	Each year
		4.3	Number of stakeholders involved		6	Unit	Committee meetings or meetings	Every two years
5	Recognition of areas and figures of conservation and environmental management for biodiversity conservation.	5.1	Number of environmental management figures declared	Strengthening of Land Management	4	Unit	Documents	Every two years
		5.3	Number of properties declared as conservation areas		27	Properties		

Source: Cataruben Foundation, 2021.

25.3. SOCIO-ENVIRONMENTAL EFFECTS MONITORING PLAN

The following are the positive and negative effects obtained from the evaluation based on the socioeconomic, land and environmental information of the project area. In addition, corrective actions were designed to mitigate and avoid the possible negative effects of the project's activities. [Socioeconomic Evaluation](#). This evaluation shows the analysis of a sample that represents 41% of the properties that make up the project.

Table 31. Socio-environmental effects monitoring plan.

Project activities	Positive effect	Indicator	Possible negative effect	Corrective action (negative effect)	Indicator
Training cycle to strengthen knowledge on wetland conservation and sustainability to prevent the expansion of the agricultural frontier.	Increased educational skills of project beneficiaries in the face of climate change.	Number of people with characterized socioeconomic level	Conflict between traditional and scientific knowledge	To learn about cultural traditions in production and design strategies for dialogue between knowledge that include traditional techniques that are positive for sustainable production.	Number of beneficiaries with new knowledge on climate change mitigation and natural ecosystems conservation
Characterization and implementation of sustainable production practices.	Contribute to sustainable rural development	Number of farms with improved sustainable production practices as a result of technical assistance	Difficulty in improving practices due to lack of economic resources of the beneficiaries.	Finding suitable and simple ways to make productive practices sustainable, as well as generating strategic alliances to help their insertion in these models.	Number of sustainable practices implemented
Participatory monitoring for the conservation of biodiversity and HCVs in the project area.	Conservation of regulating, provisioning and cultural ecosystem services	Number of hectares conserved	Poor management of High Conservation Values	Identification of High Conservation Values in the project area and establishment of a management plan for them together with key stakeholders.	Number of hectares assessed as having High Conservation Values
Strengthening of governance structures in the territory	Improvement and creation of governance mechanisms	Number of governance mechanisms	Lack of stakeholder participation for natural resource management	Participate in decision making through the mechanisms that manage natural resources.	Number of governance mechanisms strengthened
Recognition of areas and figures of conservation and environmental management	Improvement of ecosystemic conditions and quality of life	Number of families characterized and users of ecosystem services	None	Not applicable	Not applicable

for biodiversity conservation.	indicators				
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Source: Cataruben Foundation, 2021

25.4. MONITORING OF PROJECT PERMANENCE

In accordance with the PROCLIMA standard (Version 3.0-2021), a reserve of 15% of the total GHG reductions or removals quantified for each verified period is deducted and maintained. This reserve is made in order to guarantee that if events occur that require the replacement of credits placed in the market, this 15% will be used to cover those affected.

Project permanence monitoring will be carried out at each periodic verification previously stipulated by the Project Owner, under the following indicators and following the established procedures:

25.4.1. Biophysical risks

- **Fires:** Taking into account the geographic location and climatic characteristics of the project area, and the anthropic activities that take place there, such as the use of fire for burning biomass and expanding the borders for agricultural or livestock purposes, where these uncontrolled fires destroy vegetation cover, especially grasslands, pastures and natural forests and their respective degradation, forest fires are an issue of considerable relevance in the implementation of the CO₂Bio 2 project.

Therefore, in the event of a fire on a property that affects the project's eligible REDD+ conservation areas and wetlands, a written record must be generated and photographs and testimonies must be attached to establish the procedure to be followed, the affected areas must be included and the CO₂ and CH₄ emissions must be estimated and included in the quantification of emissions.

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

1. Removal of biomass that can function as fuel in a fire
 2. Establishment of firewalls
 3. Implementation of guardrails
 4. Avoid burning during critical summer periods
- **Floods:** Although floods are an issue of environmental interest, in the floodable savanna areas they are considered normal considering the behavior of the Orinoquia region, however for this case severe floods are contemplated since these can affect the ecological communities (both flora and fauna), either because they cover them in large percentage or because they drag them. The force of the water carries away part of the substrate and vegetation, as well as shallow seeds, which can affect the species' ability to resprout and therefore colonize. Another of the effects that floods can have on the environment is the dispersion of pollutants when they occur in areas where there are such substances;

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

25.4.2. Socioeconomic Risks.

- **Conservation agreement:** In order to have a contractual relationship between the Cataruben Foundation and the landowners, a contract is signed within the framework of the implementation of conservation and climate change mitigation activities for the certification of GHG removals and/or reductions, generation of carbon certificates and their commercialization, as well as regulating the relationship that exists between the PARTIES in accordance with the implementation and execution of the project, which must be followed up and monitored, regarding the fulfillment of the activities proposed by the 2 parties.
- **Social ownership of the project:** The main prevention measure to avoid conflict between the project stakeholders that are the Owners or beneficiaries, USAID, Cataruben Foundation and subsequent buyers of carbon certificates, is to manage the agreements, linkage contracts or alliances adhering to Colombian regulations, where they are duly socialized, understood and signed by the parties involved, so that there is full knowledge of the different stages and processes of the implementation of the CO₂Bio 2 project; any issues generated outside the regulatory context, will be dealt with strictly by the legal area of each of the parties.
- **Land tenure disputes:** Land tenure and the exercise of forest governance is a priority issue in project implementation, since land tenure enables social, cultural and environmental practices to be centralized, sustainable and equitable, thus regulating the way in which communities relate to each other and to their environment in general. Weak governance has adverse effects on social stability, sustainable use of the environment, investment and economic growth.

As a prevention and mitigation plan in the first place, one of the requirements to be part of the project is compliance with legal requirements; whose main objective is to establish the legality of the properties, demonstrating the land tenure according to the provisions of CONPES 3859 of 2016, as owner (who holds the real right of the domain that appears in a real estate registration folio), possessor (who on a real estate of private nature acts with the spirit of owner with the conviction of being the owner, but without being able to demonstrate compliance with the requirements of the real estate tradition that legally validly accredits him as owner) or holder (who uses and enjoys a real estate property for which the existence of an owner is recognized), at least during the period of quantification of GHG reductions or removals.

The following documents demonstrate the veracity and legality of each of the project participants, as well as their properties, so that the following information can be corroborated in the documents attached to the validation process: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the project.

- **Non-appropriation of project stakeholders:** The main indicator of project execution is compliance with the activities that prevent the transformation of wetland areas, which are described in the binding contracts, clarifying annexes and other legal and technical documents, therefore, any failure to comply with the commitments described therein.
- **Monitoring of indicators:** The Cataruben Foundation, through the quality management system and compliance with the manual of functions of each position, guarantees the availability of qualified and trained personnel for the technical development of the project.
- **Governance Deficit:** All the properties were diagnosed to determine the presence of personnel, whether they have housing, and if it is in good conditions of habitability and sanitation, visits will be made to the properties and the filling out of various forms to see the progress in terms of the different levels of governance carried out in each property.

Table 32 Permanence monitoring Inland Wetlands

NO	Activity	Type of Risk	Risk	Indicator	Impact	Probability	Rating (Probability Impact)	Risk Classification		MITIGATION ACTIONS	PROCEDURE
								Value	Level		
1	Fire	PHYSICAL	Loss of forest or wetland ecosystem due to fire	# of fires present in the eligible project area.	2	2	4	2	Medium	<ol style="list-style-type: none"> 1. Disposal of biomass that can function as fuel in a fire. 2. Establishment of firewalls 3. Implementation of guardrails 4. Avoid burning in critical summer seasons. 	Fire monitoring is carried out with the help of the "Global Forest Watch" platform, which allows us to upload data from the project areas and create alerts for fire detection using VIIRS (Visible Infrared Imaging Radiometer Suite) technology. In addition to satellite monitoring, the impact of the fires was corroborated by field visits.
2	Flooding	PHYSICAL	Substrate and plant material washed away, loss of life, infrastructure, and agricultural crops	# of unusual flooding reports	2	1	2	1	Low	Do not locate houses near water sources, keep control of the maximum flood levels that occur year after year in the properties.	Constant communication is maintained with the owners; in the event of flooding with major impacts, a report will be made by filling out a form, in order to proceed with the measures to be taken.

3	Conservation agreement	ECONOMIC	The owner fails to comply with its obligations under the contract.	# of Reports of non-compliance recalls	2	2	4	2	Medium	Socialize and agree with the owner the contractual obligations in terms of time and commitments, sign it and perform constant follow-up.	Conservation activities are monitored in compliance with the stipulations of the contract signed by the landowners.
4	Social ownership of the project	SOCIAL	That the Cataruben Foundation has no credibility in the project.	# of people reached through social networks and events promoted by the Foundation.	1	2	2	1	LOW	Strengthening the relationship area of the FOUNDATION, in order to ensure the visibility and positioning of the project's brand at national and international level, regarding to the impact results and the commercialization of carbon certificates.	The following documents are verified: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the CO ₂ Bio 2 project.
5	Land tenure dispute	SOCIAL	Loss of the property	# of properties with possession or tenure of the land	1	1	1	1	LOW	Perform title analysis prior to signing the contract, maintain constant communication with the owners regarding the legal status of the property, update the Certificate of Title and Freedom every 5 years.	The following documents are verified: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the CO ₂ Bio 2 project.

6	Non-ownership of project stakeholders	SOCIAL	If either party fails to fulfill its obligations under the contract.	# of conflicts between the different parties involved	2	2	4	2	Medium	Sign the contract jointly, knowing the limitations, commitments and benefits.	PCC management procedure
7	Indicator monitoring	ECONOMIC	Lack of adequate monitoring personnel	# of non-compliance reports in monitoring.	2	1	2	1	Low	The Cataruben Foundation has expert and qualified personnel to guarantee the operability of the project.	PQRS management procedure
8	Governance deficit	SOCIAL	Abandonment of the properties, noncompliance with governance activities	# of acknowledgements of forest governance structures	1	1	1	1	Low	Governance actions are implemented on the properties and their constant monitoring.	Follow-up on the indicator of safeguard #4, which establishes the indicators to determine the level of implementation of governance in the properties.

Source: Cataruben Foundation, 2021

25.5. MONITORING OF PROJECT EMISSIONS

In the project scenario, at a minimum, activity data should be monitored. The validated emission factors can be applied in the estimation of monitored emissions. In this sense, the following are monitored:

- Annual change of land use in the project area
- Annual changes in land use in the leakage area
- GHG emissions in the period of analysis
- Emission reductions from the project

The procedure and formulas established in section 18.5 of the methodological document will be followed for emissions monitoring, as follows:

25.5.1. Annual land use change in the project area.

The estimation of changes in the natural cover of the wetland, in the project area, during the monitoring period is carried out with the equation:

$$CSCNPP = (t_2 - t_1) \times (A_1 - A_2)$$

Where:

- **CSCNPP**: change in the area with natural vegetation cover in the project area (ha/year).
- **t₂**: final year of the monitoring period.
- **t₁**: year of the beginning of the monitoring period.
- **A₁**: area of natural vegetation cover in the project area at the beginning of the monitoring period (ha).
- **A₂**: area of natural vegetation cover in the project area at the end of the monitoring period (ha).

25.5.2. Annual changes in land use in the area of leaks

The estimation of changes in the natural cover of the wetland, in the leakage area, during the monitoring period is carried out with the equation:

$$CSCNF = (t_2 - t_1) \times (AF_{,1} - AF_{,2})$$

Where:

- **CSCNF**: change in the area with natural vegetation cover in the leakage area (ha/year).
- **t₂**: final year of the monitoring period.
- **t₁**: year of the beginning of the monitoring period.

- **AF₁**: area in natural vegetation cover in the leakage area at the beginning of the monitoring period (ha).
- **AF₂**: area in natural vegetation cover in the leakage area at the end of the monitoring period (ha).

25.5.3. GHG emissions in the analysis period

The annual emission from changes in natural wetland cover in the project area is calculated following the equation:

$$EEAP = CSCNP \times (CBFeq + coseq)$$

Where:

- **EAP**: annual emission in the project area (tCO_{2e}/ha/year).
- **CSCNP**: change in the area with natural vegetation cover in the area of the project (ha/year).
- **CBFeq**: carbon dioxide equivalent contained in total biomass (tCO_{2e}/ha).
- **COSeq**: equivalent soil carbon content (tCO_{2e}/ha).
- **The annual emission in the leakage area is calculated following the equation:**

$$EAF = [CSCNF \times (CBFeq + coseq)] - EAF, LB$$

Where:

- **EAF**: annual emission in the leakage area (tCO_{2e}/ha/year).
- **CSCNF**: change in area with natural vegetation cover in the leakage area (ha/year).
- **CBFeq**: carbon dioxide equivalent contained in total biomass (tCO_{2e}/ha).
- **COSeq**: equivalent soil carbon content (tCO_{2e}/ha).
- **EAF, LB**: annual emission in the leakage area in the baseline scenario (tCO_{2e}).

25.5.4. Emission reductions from the project

Reducing emissions by avoiding changes in the natural cover of the wetland, during the monitoring period is estimated according to the equation:

$$RP, pm = (t_2 - t_1) \times (lb - EAp - EAF)$$

Where:

- **REP, pm**: reduction of emissions by avoiding changes in the natural vegetation cover of the wetland, in the monitoring period (tCO_{2e}/ha/year).
- **t₂**: final year of the monitoring period.
- **t₁**: year of the beginning of the monitoring period.

- **EA Ib:** emission from changes in the natural vegetation cover of the wetland in the baseline scenario (tCO_{2e}/ha/year).
- **EAP:** emission from changes in the natural vegetation cover of the wetland in the project area for the monitored period (tCO_{2e}/ha/year).
- **EAF:** emission from changes in the natural vegetation cover of the wetland in the leakage area for the monitored period (tCO_{2e}/ha/year).

25.6. MONITORING CHANGES IN THE BIODIVERSITY ASSOCIATED TO INLAND WETLANDS

The project's monitoring plan responds to the fulfillment of biodiversity conservation objectives associated with inland wetlands. For this purpose, a participatory monitoring program was designed with the beneficiaries that consists of three stages (i. baseline, ii. biodiversity monitoring and iii. closure and socialization of the results). It is important to note that the biodiversity monitoring program is also part of the project activities as mentioned in section 20.

Table 33. Biodiversity monitoring plan

Target		Indicator	Methodology	Frequency of monitoring
Conservation of inland wetlands and their associated biodiversity through a participatory monitoring program with project beneficiaries.	Monitoring of focal groups or species (threatened, flag, umbrella, native, endemic), HCVs and other areas important for biodiversity conservation.	Number of monitoring stages implemented (i. baseline, ii. biodiversity monitoring and iii. closing socialization of results).	<p>i. Baseline (2016 - 2020): Characterization of the biodiversity of the project area, identifying the type of vegetation associated with inland wetlands and the main groups of fauna, estimating species richness and biodiversity, as well as identifying focal species, HCVs and other conservation areas. ii. Biodiversity monitoring (2021 - 2041): Monitoring of identified focal groups and/or species, HCVs and other conservation areas, through sampling in the project area with the participation of project beneficiaries. Each monitoring should have the monitoring design established and socialized with the beneficiaries, as well as the procedures for taking the data measurements or samples. iii. Closure and socialization of results (2042 - 2043): Based on the information recorded during 20 years corresponding to biodiversity monitoring, the results of this activity must be reported, pointing out how the biodiversity of the Inland Wetlands of the project area was conserved and protected during this period of time, as well as the trends or changes recorded.</p>	Every 5 years
	Participation of project beneficiaries in the monitoring of biodiversity associated with inland wetlands.	Number of activities in which the beneficiaries participated	A photographic and documentary record will be kept of the participation of the project beneficiaries during the training meetings, socialization, sampling and reports that will be carried out during each stage of biodiversity monitoring.	Every 5 years

Source: Cataruben Foundation, 2021

26. MONITORING REPORT (2016-2020)

The following is the monitoring report designed to evaluate changes in project boundaries, the execution of activities, socio-environmental effects, project permanence and project emissions, based on the established methodological guidelines, in order to generate accurate and quality information in the verification process.



Figure. 27 Wetland ecosystem monitoring plan design, period 2016-2020.

Source: Cataruben Foundation, 2021

26.1. PROJECT BOUNDARY MONITORING

26.1.1. Project area

The project boundaries were monitored in the period 2016-2020 by means of a CLC cover change analysis, subsequently the categories were grouped according to the project strata following the methodology guidelines. As a result, the change from natural cover to transformed cover was determined for each project stratum. Table 34 summarizes the changes during the analysis period. The negative sign indicates a reduction of areas with regarding to the previous year.

Table 34. Changes in the analysis period in the project area (2016 - 2020).

Stratum or Coverage	Change in land use during the Monitoring Period in the project area				Transformed Area (Ha)
	t1	t2	A1	A2	
<i>Herbaceous</i>	2015	2020	58.678,3	58.061,9	-616,4
<i>Aquatic</i>	2015	2020	3.940,9	3.940,9	0

<i>Dispersed</i>	2015	2020	709,3	709,3	0
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Source: Cataruben Foundation, 2021

26.1.2. Leakage area

For the leakage areas, the same procedure is used as for the project boundaries, where only the areas in the monitoring period, i.e., for the years 2016 - 2020, are quantified. Table 35 summarizes the changes in the analysis period. The negative sign indicates a reduction of areas regarding to the previous year.

Table 35. Changes in the analysis period in the leakage area (2016 - 2020).

Stratum or Coverage	Change in land use during the Monitoring Period in the leakage area				Transformed Area (Ha)
	t1	t2	A1	A2	
<i>Herbaceous</i>	2015	2020	4.692,6	4.507,6	-184,8
<i>Aquatic</i>	2015	2020	267,4	354,5	+87,1
<i>Dispersed</i>	2015	2020	47,7	47,7	0,0

Source: Cataruben Foundation, 2021

26.2. MONITORING THE IMPLEMENTATION OF PROJECT ACTIVITIES

Of the 10 indicators proposed for the execution of project activities, 100% compliance was achieved for 7 indicators, with the following aspects standing out;

For activity 1. Training cycle to strengthen knowledge on wetland conservation and sustainability to prevent the expansion of the agricultural frontier. This activity had an impact on 543 people directly involved in the project, public and private actors in the Orinoquia Region, due to biodiversity conservation strategies based on climate change mitigation projects, regulations applied to the projects and the exchange of successful experiences in generating carbon credits. In addition, 21 properties were identified as promoting sustainable production practices, including sustainable livestock raising, beekeeping, nature tourism, permaculture, forest isolation, nurseries and live fences.

For activity 2. Characterization and implementation of sustainable productive practices. For this activity, 115 properties were characterized at the socioeconomic level linked to the project; as well as the accompaniment in the implementation of sustainable practices to 120 properties, in order to ensure sustainability in terms of GHG reductions and the non-transformation of wetland ecosystem cover.

For activity 3. Participatory monitoring for biodiversity conservation and HCVs in the project area. During the period 2016 - 2020, the first stage of participatory biodiversity monitoring was implemented in which the biodiversity baseline was established, focal groups or species, HCVs and areas of conservation importance (CSNR and AICAS) were identified. In this way, the

biodiversity sampling design was established, having the group of birds and aquatic plants as focal groups for the first field sampling.

For activity 4. Strengthening of governance structures in the territory. Within the project's operational framework, CATARUBEN has managed to lead (2) governance processes at Regional and Departmental level (COTACLIMA¹⁴ & SIRAP¹⁵) of the (3) proposed, which implies greater recognition of the project at public and private level, promotion of the implementation of sustainable practices and the declaration of protected areas. Regarding governance activities and number of participants, 100% compliance was achieved, as evidenced in the annexes: Evidence by property.

For activity 5. Recognition of conservation and environmental management areas and figures for biodiversity conservation. In the framework of compliance with this activity, (4) conservation figures were identified in (8) properties in the project area, highlighting the declaration of AICAS, WHSRN, CSNR and RESNATUR. Additionally, 19 properties have been declared as Civil Society Nature Reserves, which implies a greater strengthening of land management in the project area.

The progress of the activities carried out in the 2016-2020 period can be seen in the following table Monitoring report 2016-2020.

¹⁴ Casanare Climate Change Committee - COTACLIMA

¹⁵ Regional System of Protected Areas

Table 36. Monitoring of project activities

No.	ID Activity	ID Indicator	Indicator name	Type	Goal	Unit of Measurement	Monitoring methodology	Frequency of monitoring	Result of the indicator in the reporting period (2016-2020).	Documents supporting the information	Remarks
1	Training cycle to strengthen knowledge on wetland conservation and sustainability to prevent the expansion of the agricultural frontier.	1.1	Number of people trained	Capacity building and environmental education	56	Unit	Attendance records and photographic evidence	One cycle per year	543	Attendance records and photographic evidence	The proposed goal is 100% met, which indicates a greater strengthening not only for the stakeholders involved, but also for the community in general.
		1.2	Number of properties with implemented activities		21	Properties		Every five years	21	Photographic evidence	100% compliance with the proposed goal, highlighting restoration and conservation processes in ecosystems of interest.
2	Characterization and implementation of sustainable production practices.	2.1	Characterized properties	Accompaniment and support in best practices	140	Properties	Preparation of property plans, socioeconomic data sheets, management plan sheets, visit logs and photographic registers	Every five years	115	Documents: property plans, socio-economic and property records	The proposed goal was met by 83%, highlighting the characterization of 115 properties linked to the project.

		2.2	Productive practices implemented			Properties			120	Visit logs, management plan sheets and photographic evidence	The proposed goal was met by 86%, highlighting the characterization of 120 properties linked to the project.
3	Phased participatory biodiversity and HCV monitoring	3.1	Number of stages implemented	Inland Wetlands Biodiversity Conservation	3	Stages	Progress report on the execution of the stages of the biodiversity monitoring program.	Every five years	1	Document and photographic evidence	The proposed goal of 100% execution of the first stage of the monitoring program has been met.
4	Strengthening of governance structures in the territory	4.1	Number of governance structures strengthened	Governance	3	Unit	Technical committee meetings or meetings	Every five years	2	Committee minutes	67% of the proposed goal has been met, participating in spaces where
		4.2	Number of governance activities carried out in the project area		6	Activities	Visit to properties, recording of governance activities	Each year	6	Photographic record	100% of the proposed goal is met, highlighting governance activities (signage of areas, insulation, sunlight, deep wells, drinking troughs, live fences, among others).
		4.3	Number of stakeholders involved		6	Unit	Committee meetings or meetings	Every two years	6	Committee minutes	100% of the proposed goal is met
5	Recognition of areas and figures of conservation and environmental management for biodiversity conservation.	5.1	Number of environmental management figures declared	Strengthening of Land Management	4	Unit	Documents	Every two years	4	Supporting documents	100% of the proposed goal was met, identifying 4 conservation figures in the project area (AICAS, WHSRN, CSNR, RESNATUR)

											for 8 properties.
		5.3	Number of properties declared as conservation areas		27	Properties			19	Supporting documents	70% compliance with the proposed goal, identifying 19 properties with wetland areas eligible for CSER in the project area.

Source: Cataruben Foundation, 2021

26.3. PERMANENCE MONITORING

Of the 8 indicators proposed for the 3 types of risks (physical, social and economic), the following aspects are identified;

Risk 1 - Fire. It is categorized as medium risk for the project area, taking into account the silvicultural management given in the project area; however, during the monitoring period, there were no fires that affected the natural tree cover present in the project area.

For risk 2 - Flooding. During the monitoring period, there were no severe floods in the eligible areas of the project, nor were homes affected by this climatic event.

For risk 3 - Conservation agreements. The project is categorized as medium risk, taking as a reference the absence of initiatives that establish obligations to conserve natural ecosystems and their biodiversity, avoiding the transformation of land cover; however, during the monitoring period no non-compliance with contractual obligations with landowners was identified.

For risk 4 - Social ownership of the project. During the monitoring site, CATARUBEN promoted the development of the first biodiversity and carbon forum, involving landowners and the community in general, thus strengthening the importance of these initiatives at regional and national level. In addition, it generated a presence in social networks in order to report results of the project's impact.

For risk 5 - Land tenure dispute. Considering that the project links (2) natural ecosystems, of the 141 properties linked to 136 with wetland ecosystems, ownership studies were conducted to establish ownership and carbon rights.

For risk 6 - Non-ownership of stakeholders. It is categorized as medium risk for the project, however, during the monitoring site there were no conflicts between the project proponents (CATARUBEN-PROPERTY OWNERS-NATURAL WEALTH PROGRAM).

For risk 7 - Monitoring of indicators. CATARUBEN guarantees the good development and execution of the projects, incorporating qualified and knowledgeable professionals of the region, in order to guarantee the main objective of the project.

For risk 8 - Governance deficit. The respective follow-up has been carried out in order to guarantee governance in the 136 properties with wetland ecosystems; identifying the constant presence of owners in the properties, the implementation of deep wells, the isolation of ecosystems, the implementation of live fences and the execution of conservation and mitigation activities.

Table 37. Permanency monitoring report

NO	Activity	Type of Risk	Risk	Indicator	Risk Classification		PROCEDURE	INLAND WETLANDS	
					Value	Level		Monitoring results 2016 - 2020	Remarks
1	Fire	PHYSICAL	Loss of forest or wetland ecosystem due to fire	# of fires present in the eligible project area.	2	Medium	Fire monitoring is carried out with the help of the "Global Forest Watch" platform, which allows us to upload data from the project areas and create alerts for fire detection using VIIRS (Visible Infrared Imaging Radiometer Suite) technology. In addition to satellite monitoring, the impact of the fires was corroborated by field visits.	o	During the monitoring period, there were no fires in the natural cover of the wetland ecosystem in the eligible area of the project and the leakage area.
2	Flooding	PHYSICAL	Substrate and plant material washed away, loss of life, infrastructure, and agricultural crops	# of unusual flooding reports	1	Low	Constant communication is maintained with the owners; in the event of flooding with major impacts, a report will be made by filling out a form, in order to proceed with the measures to be taken.	o	During the monitoring period, there were no severe floods in the eligible areas of the project, and no households were affected by this climatic event.
3	Conservation agreement	ECONOMIC	The owner fails to comply with its obligations under the contract.	# of Reports of non-compliance recalls	2	Medium	Conservation activities are monitored in compliance with the stipulations of the contract signed by the owners.	o	During the monitoring period, no non-compliance with contractual obligations with owners was identified.

4	Social ownership of the project	SOCIAL	That the Cataruben Foundation has no credibility in the project.	# of people reached through social networks and events promoted by the Foundation.	1	Low	The following documents are verified: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the CO ₂ Bio project.	493	During the monitoring site, CATARUBEN promoted the development of the first biodiversity and carbon forum, involving landowners and the community in general, thus strengthening the importance of these initiatives at regional and national level. In addition, it generated a presence in social networks to report on the project's impact results.
5	Land tenure dispute	SOCIAL	Loss of the property	# of properties with possession or tenure of the land	1	Low	The following documents are verified: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the CO ₂ Bio project.	135	Considering that the project integrates two natural ecosystems, of the 141 properties linked to 135 that have wetland ecosystems, ownership studies were carried out to establish ownership and carbon rights.
6	Non-ownership of project stakeholders	SOCIAL	If either party fails to fulfill its obligations under the contract.	# of conflicts between the different parties involved	2	Medium	PQRS management procedure	0	There were no conflicts between the project proponents during the monitoring site.
7	Indicator monitoring	ECONOMIC	Lack of adequate monitoring personnel	# of non-compliance reports in monitoring.	1	Low	PQRS management procedure	0	CATARUBEN guarantees the proper development and execution of the projects, incorporating qualified and knowledgeable professionals of the region, in order to guarantee the main objective of the project.

8	Governance deficit	SOCIAL	Abandonment of the properties, noncompliance with governance activities	# of acknowledgements of forest governance structures	1	Low	Follow-up on the indicator of safeguard #4, which establishes the indicators to determine the level of implementation of governance in the properties.	The respective monitoring has been carried out in order to guarantee governance in the 136 properties with wetland ecosystems, based on the constant presence of owners in the properties, the implementation of deep wells, the isolation of ecosystems, the implementation of live fences and the execution of conservation and mitigation activities.
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Source: Cataruben Foundation, 2021

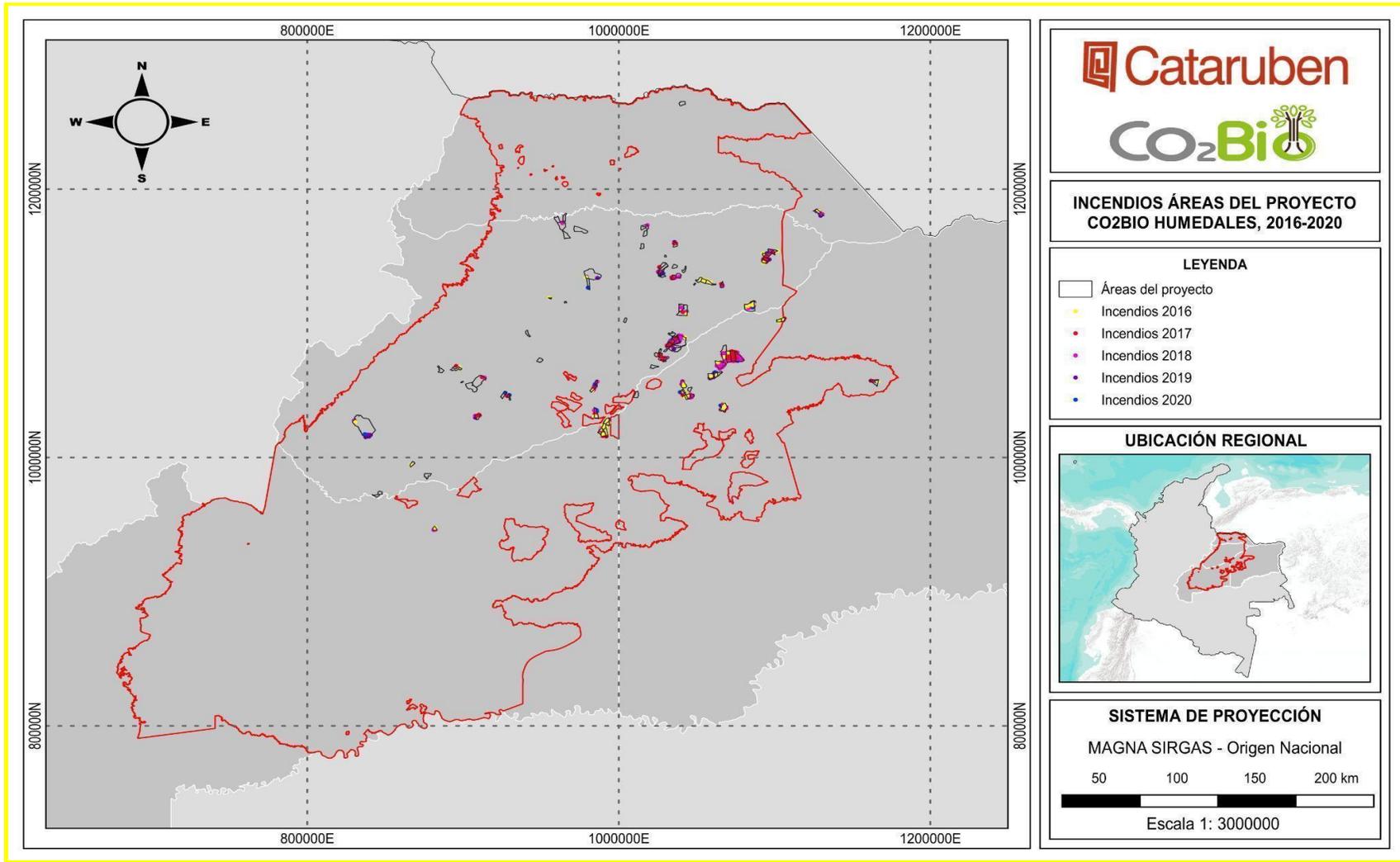


Figure. 28 Fire map of the Continental Wetlands project area.

Source: Cataruben Foundation, 2021

26.4. EMISSIONS MONITORING

Emissions were monitored from the activity data resulting from the project boundary monitoring and according to the formulas established in the methodology in Section 18.5 "Project Emissions Monitoring", Table 38 summarizes the emission reductions in the 2016-2020 monitoring period.

Table 38. Emissions monitoring

Emissions Reduction					
REpmp(tCO _{2e})	t ₁	t ₂	EAIb(tCO _{2e} /year)	EAp (tCO _{2e} /year)	EAf (tCO _{2e} /year)
82.238,2	2.015	2.016	122894,2	9262,1	-9725,2
123.045,7	2.016	2.017	122653,4	9262,1	-9654,4
122.735,3	2.017	2.018	122413,2	9262,1	-9584,2
122.425,9	2.018	2.019	122173,5	9262,1	-9514,5
122.117,6	2.019	2.020	121934,2	9262,1	-9445,4

572.563 TOTAL MONITORING PERIOD

Source: Cataruben Foundation, 2021

Detailed calculations can be found in the spreadsheet Annex 2.5.3.1. Calculations: [3. Monitoring_2020](#)

26.4.1. MONITORING REPORT ON CHANGES IN BIODIVERSITY ASSOCIATED WITH INLAND WETLANDS

During the period 2016 - 2020, the first stage of participatory biodiversity monitoring was executed in which the biodiversity baseline was established, focal groups or species, HCVs and

areas of conservation importance (CSNR and AICAS in Spanish) were identified. In this way, the biodiversity sampling design was established, having the group of birds and aquatic plants as focal groups for the first field sampling. The sampling design, procedures, data collection and sampling results are detailed in the [Annex Monitoring report of birds and aquatic plants](#).

Additionally, project beneficiaries participated in at least 14 activities associated with the characterization and conservation of biodiversity, led by entities such as Calidris, Fundación Cunaguaro, Fundación Orinoquía Biodiversa (FOB), among others. The results of these initiatives were compiled and can be consulted in the [Biodiversity Monitoring Evidence Annex](#).

It is important to mention that these initiatives included a wide variety of activities that mitigate pressures on biodiversity and promote the conservation of endangered species. Among these are the restoration of morichal forests, recognizing the *Mauritia flexuosa* species as a key species for the flooded savannah. In addition, one of the strategies that has been of greatest interest to the community is the community monitoring of felines with camera traps, which helps to reduce the conflict with these species.

26.5. MONITORING OF SOCIOECONOMIC IMPACTS

The reporting of socioeconomic effects in the project area allows us to monitor the expected social and environmental impacts in the project area and mitigate potential risks.

Table 39. Socioeconomic Effects Monitoring Report

Project activities	Positive effect	Indicator	Possible negative effect	Corrective action (negative effect)	Indicator	Frequency of monitoring	Follow-up methodology	Result of implemented actions
Training cycle to strengthen knowledge on wetland conservation and sustainability to prevent the expansion of the agricultural frontier.	Increased educational skills of project beneficiaries in the face of climate change.	Number of people with characterized socioeconomic level	Conflict between traditional and scientific knowledge	To learn about cultural traditions in production and design strategies for dialogue between knowledge that include traditional techniques that are positive for sustainable production.	Number of beneficiaries with new knowledge on climate change mitigation and natural ecosystems conservation	Annual	Training attendance lists	543 people trained in the conservation of strategic ecosystems and sustainable production
Characterization and implementation of sustainable production practices.	Contribute to sustainable rural development	Number of farms with improved sustainable production practices as a result of technical assistance	Difficulty in improving practices due to lack of economic resources of the beneficiaries.	Finding suitable and simple ways to make productive practices sustainable, as well as generating strategic alliances to help their insertion in these models.	Number of sustainable practices implemented	Annual	Photographic record of the implemented sustainable practices	120 farms with sustainable production activities implemented

Participatory monitoring for the conservation of biodiversity and HCVs in the project area.	Conservation of regulating, provisioning and cultural ecosystem services	Number of hectares conserved	Poor management of High Conservation Values	Identification of High Conservation Values in the project area and establishment of a management plan for them together with key stakeholders.	Number of hectares assessed as having High Conservation Values	Annual	Resolutions of declaration of Civil Society Nature Reserves	23,955 ha conserved through the Civil Society Nature Reserve and Identification of High Conservation Values in part of the project area.
Strengthening of governance structures in the territory	Improvement and creation of governance mechanisms	Number of governance mechanisms	Lack of stakeholder participation for natural resource management	Participate in decision making through the mechanisms that manage natural resources.	Number of governance mechanisms strengthened	Every 5 years	SIRAP Technical Committee Meeting Minutes	2 strengthened governance mechanism (Regional System of Protected Areas and COTA CLIMA) with the main stakeholders for decision making regarding natural resources and climate change mitigation.
Recognition of areas and figures of conservation and environmental management for biodiversity conservation.	Improvement of ecosystemic conditions and quality of life indicators	Number of families characterized and users of ecosystem services	None	Not applicable	Not applicable	Every 5 years	Socioeconomic and environmental characterization sheets	116 families and properties characterized at a socioeconomic and environmental level to determine the conditions at the beginning of the project.

CHAPTER 3. REDD+ PROJECT

In this chapter 8 numerals are listed based on the Methodological Document AFOLU Sector / Quantification of GHG Emissions Reductions of REDD+ Projects of ProClima. Version 2.2. 5 February 2021; in order to demonstrate GHG reductions for the issuance of carbon certificates for the forest ecosystem.

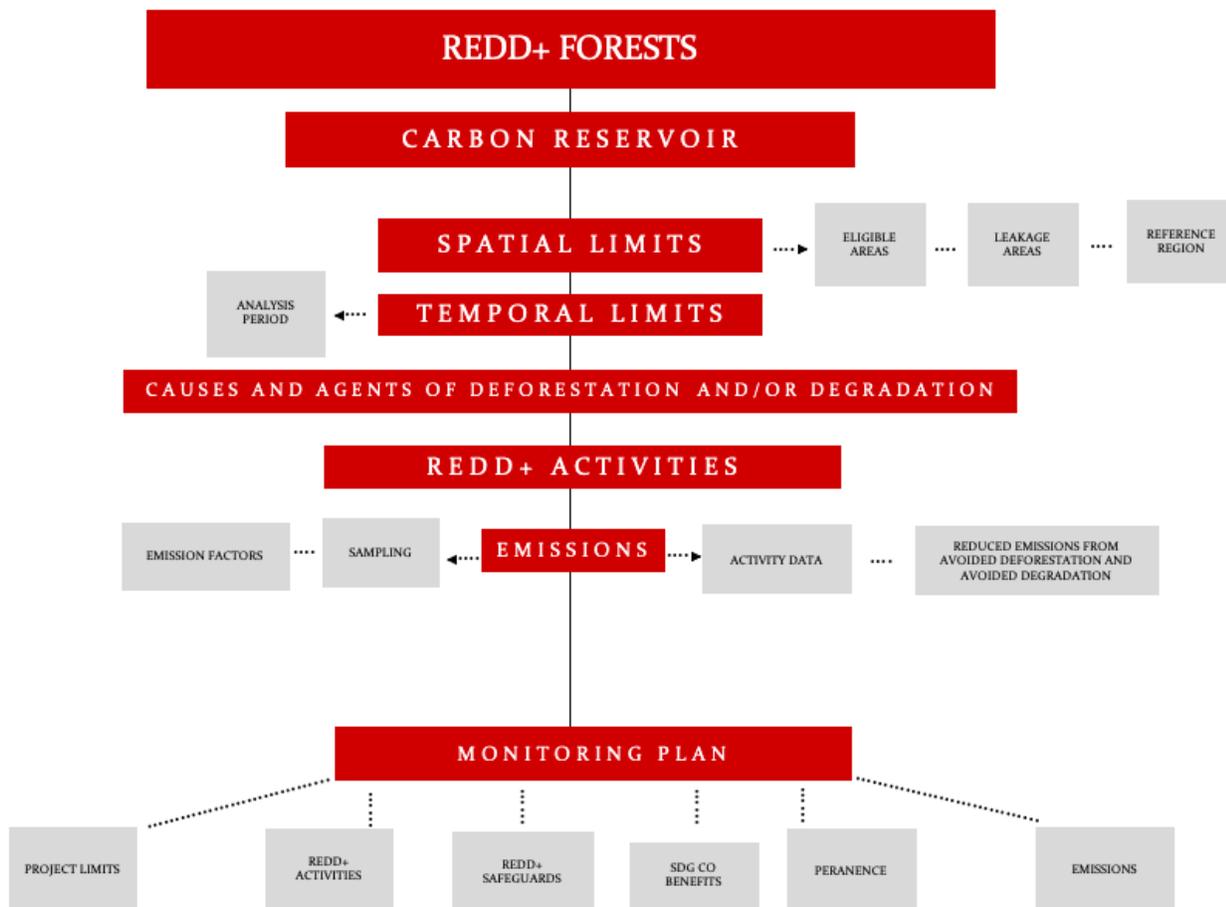


Figure. 29 Basic structure of the REDD+ chapter

Source: Cataruben Foundation

27. CARBON RESERVOIRS AND GHG SOURCES

For forest areas, the GHG reservoirs and sources described in the REDD+ methodology are taken into account.

27.1. CARBON DEPOSITS

The following table shows the carbon pools used to account for the carbon stocks in the project, which were taken from the IPCC good practices (2003, 2006), and taken from IDEAM (2011)

taking into account the 5 carbon pool compartments that can be measured and that have representative quantities for the project:

Table 40. Carbon pools applied to the REDD+ project

COMPARTMENT		DEPOSIT SELECTION	JUSTIFICATION OF CHOICE
Living Biomass	Aerial biomass	including	Considering that it is the deposit that undergoes the greatest change as a consequence of anthropogenic activities
	Subway biomass (Roots)	including	Its total value is representative of carbon stocks, taking into account roots larger than 2 mm in diameter.
Dead Organic Matter	Dead wood detritus	excluded	Its total value is not representative of carbon stocks.
	leaf litter	excluded	Its total value is not representative of carbon stocks.
Soils	Soil organic matter	including	Considering the carbon sequestration in mineral and organic soils in the project area is representative.

Source: Cataruben Foundation

27.2. SOURCES OF GHG

The sources of GHGs associated with the forest ecosystem for REDD+ activities are:

Table 41. REDD+ GHG sources

SOURCE	GGM	SOURCE SELECTION	JUSTIFICATION OF CHOICE
Woody biomass combustion	CH ₄	including	Emissions will be taken into account if fires occur in the project areas during the monitoring period.
	N O ₂	including	Emissions will be taken into account if fires occur in the project areas during the monitoring period.

Source: Cataruben Foundation

28. SPATIAL AND TEMPORAL LIMITS

28.1. SPATIAL LIMITS

Considering that it is a grouped project and the spatial limits are determined, they are established following the guidelines of the Proclima standard and those of the methodology, in the item of applicability conditions.

In this sense, the spatial limits for REDD+ activities are described below:

28.2. REDD+ Eligible Area

Eligible areas for REDD+ activities are those areas that correspond to forest cover according to the national definition established by IDEAM and that meet the condition of being permanent forest at the start date of the project and 10 years before ([ANNEX 3.3 GIS - 2. GEODATABASE](#)).

As land eligibility criteria for the REDD+ project, those project areas were taken into account that were covered by forest at the beginning of the project and that proved to be covered by forest for at least 10 years prior to this date. To verify this, the forest and non-forest maps reported by the Forest and Carbon Monitoring System (SMByC) for the years 2010 and 2017 were used, these maps categorize the national territory into three classes, forest, non-forest and without information, the latter correspond to areas that due to cloud cover or shadows could not be classified.

These maps were processed with the support of geographic information system software, through a comparative analysis between them to find the areas that conserved the forest class during the reference period, these correspond to eligible areas, while the ineligible areas were those that went from forest to non-forest (deforestation) and those that remained under the "non-forest" class.

The following table shows the eligible areas within the project boundaries and Figure 30 shows their spatial distribution.

Table 42. Eligible REDD+ Project Areas

Eligibility	Area (ha)	Percentage (%)
Eligible	20,206	16%
Not Eligible	106,756	84%
Total	126,962	100%

Source: Cataruben Foundation

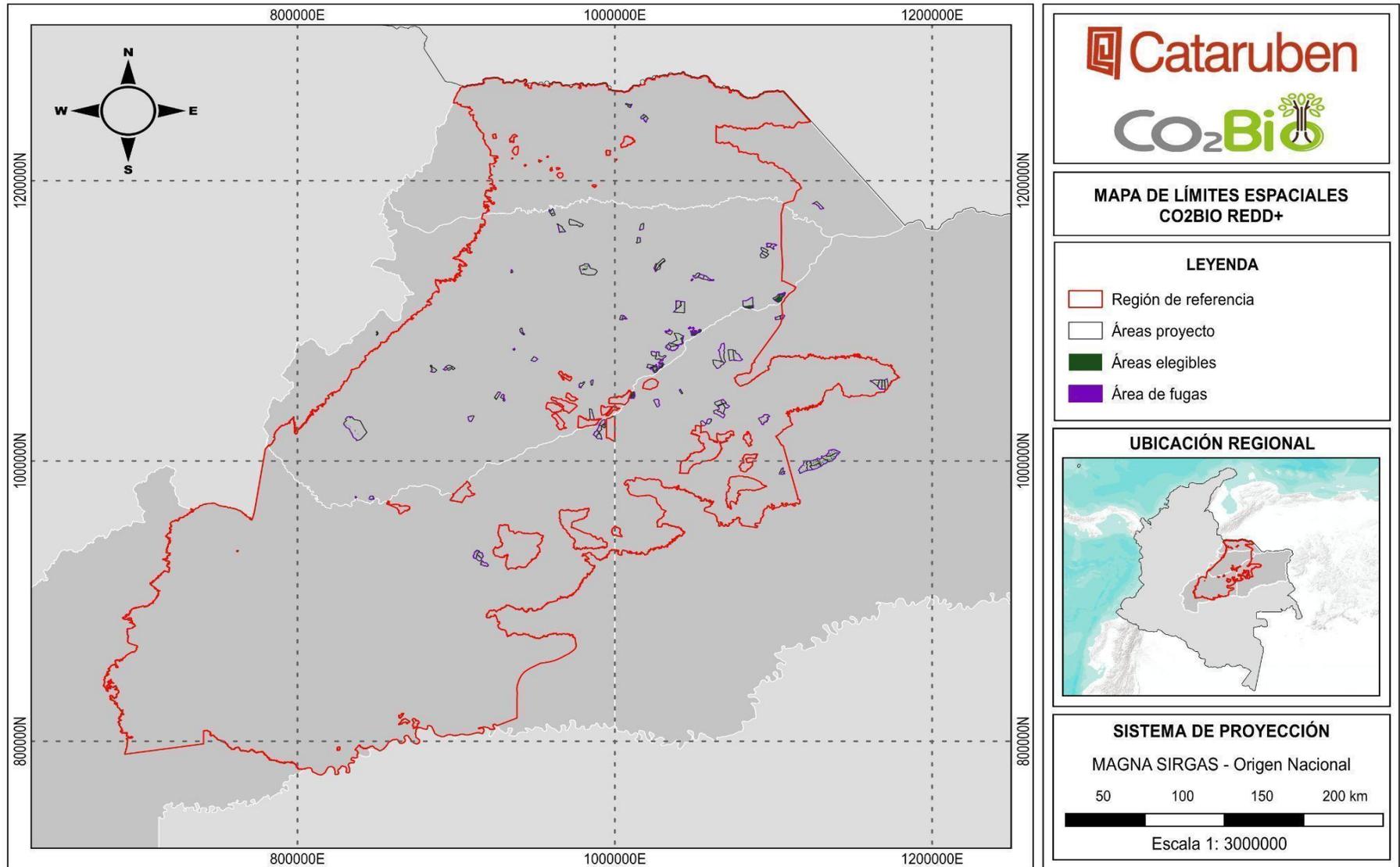


Figure. 30 Map of spatial limits of the CO₂Bio project.

Source: Cataruben Foundation

CO₂Bio Project 2 - 2021

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28.2.1. Addition of areas to the project after validation

The addition of new REDD+ eligible areas for the project will be done in future verifications, and will be defined as new phases of the project, following what is described in the Proclima Standard V3.0 in item 10.17. Grouped projects, complying with the grouping conditions for the AFOLU sector:

- Identify the area of expansion of the initiative or project during the validation process and define the criteria for the addition of new areas;
- Comply with the guidelines of the Certification and Registration Program for GHG Mitigation Initiatives and other Greenhouse Gas Projects, in its most recent version;
- Comply with all applicable PROCLIMA methodological documents, in their most recent version;
- Include emission reductions only for validated project activities;
- Implement the GHG emission reduction or removal activities described in the validated project document;
- Demonstrate that baseline scenario, land tenure and additionality considerations are consistent and valid for new areas;
- Submit evidence of the start date of activities in the new areas, demonstrating that this date is after the start date of GHG removal activities in the areas included in the validation;
- Demonstrate that the causes and agents of deforestation/degradation and the reference scenario are consistent with the characteristics validated for the initial project areas.

28.3. Reference Region

The reference region for REDD+ actions corresponds to the area in which the analysis of deforestation, degradation and study of agents and drivers of deforestation and degradation is conducted ([ANNEX 3.3 GIS - 2. GEODATABASE V2](#)). The geographic limits of this region were delimited taking into account the criteria established in the PROCLIMA methodology for the quantification of GHG emission reductions or removals from REDD+ projects. These criteria are described below:

To be consistent with the national reference level (FREL) submitted by Colombia to the UNFCCC in 2019, the Orinoquia biome was selected, excluding the areas defined in Annex 2 of the FREL "*Adjustment for National Circumstances*", which correspond to :

- Overlap corresponding to other REDD+ forestry projects.
- National park areas.
- Indigenous reserves

Thus, the reference region, whose determined extension is 11,699,109 hectares, is delimited as follows:

- To the north it borders the neighboring country of Venezuela, to the south with the Selva Mataven, Saracure - Cada, Alto Unuma and El Tigre indigenous reserves in the department of Vichada, to the southwest with the department of Guaviare and the

Serranía de la Macarena National Natural Park, and to the west with the eastern mountain range.

As mentioned, in order to determine the reference region, restricted access areas such as national natural parks and indigenous reserves located in the jurisdictions of the departments in question were excluded, see Figure 31 reference region.

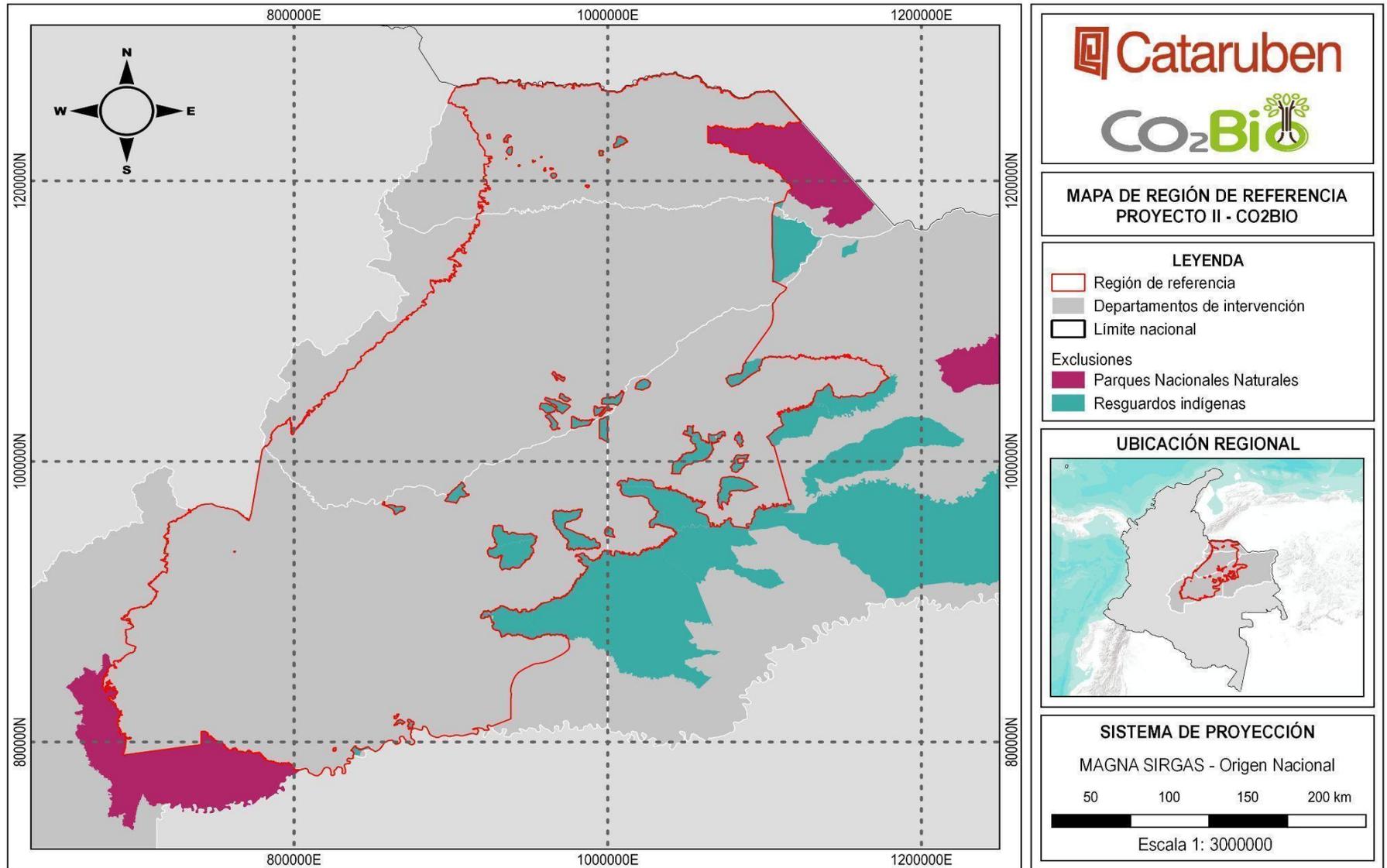


Figure. 31 Reference region Project II - CO₂BIO.

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

28.3.1. Geographic Information

This section describes, at the level of the reference region, characteristics of the terrain such as elevation ranges, slopes and main watersheds that bathe the territory.

- **Terrain Slopes**

The slope map is the result of the slope analysis tool, it is a raster file, which from the DEM calculates the degree or percentage of slope. For the reference area the Slope is represented in percentage according to FAO (2009), being divided into 5 classes (0% -3%, 3% -15%, 15% -30%, 30% -60% and >60%). To obtain the product, the DEM input obtained from the SRTM was used, which showed that the dominant slope is in the 0 - 3% range, with a 74% dominance of the territory (see Figure 11 in the Inland Wetlands chapter).

- **Terrain Elevation**

The Digital Elevation Model (DEM, from now on), determines the height in meters above mean sea level (masl). This product is obtained through the SRTM Downloader Plugin v3.1.15 in the *Quantum GIS* platform (QGIS, from now on). The raster values have a cell resolution of 30 m x 30 m, typical of the Shuttle Radar *Topography Mission* (SRTM *Shuttle Radar Topography Mission*). According to the DEM, the reference region has an elevation range between 88 and 1000 meters above mean sea level (see figure 12, chapter Continental Wetlands).

- **Hydrography**

The region of reference contains part of the great Orinoco river basin, a territory full of diversity of life, landscapes and cultures, extensive plains that change from temporary deserts to large wetlands.

The main hydrographic basins that bathe this portion of the territory are: Cusiana River Basin, Cravo Sur River, Pauto River, Casanare River, Cravo Norte River and Meta River, among others.

28.4. Leakage Area

The leakage area was determined according to: the characteristics of the project grouped in the private properties that are scattered in the Orinoquia area, and finally, it is established taking into account the following criteria:

- a). All areas in forest that are within the range of mobility of the agents identified in section 10.14 should be included.
- b). Exclude areas of restricted access to agents of deforestation and degradation.

These areas have similar characteristics in terms of slope, climate, forest type, elevation, mobility of deforestation and degradation agents (rivers, roads, etc.) ([ANNEX 3.3 GIS - 2. GEODATABASE V2](#)).

Considering the above, it is determined that the eligible area of the project is 20,206 ha and the leakage area is 3,641 ha, therefore, the proportion of the leakage area regarding to the eligible areas is 18%.

Table 43 shows the hectares corresponding to the forest area at the start date of the project.

Table 43. Eligible and Leakage Areas of the REDD+ Project

ELIGIBLE PROJECT AREAS 2010 - 2017	LEAKAGE AREAS 2010 - 2017
20.206	3.641

Source: Cataruben Foundation

28.5. TIME LIMITS PERIOD OF ANALYSIS

Since 2015, the Cataruben Foundation has been constantly approaching private landowners interested in conservation actions for natural ecosystems in the Orinoquia, including forests, wetlands and natural grasslands.

For this reason, the CO₂Bio 2 project began conservation and mitigation activities on private properties in the Orinoco region as of May 6, 2016, ratifying this link with the signing of letters of intent by the owners and their willingness to carry out actions to ensure the conservation of biodiversity and strengthen the governance of the properties.

Under this context, for the Wetland ecosystem, such actions were made effective as of May 6, 2016, avoiding the transformation of natural wetland cover and managing the reduction/removal of GHG; otherwise for the Forest ecosystem, which from 2018 effective actions are demonstrated, in order to avoid deforestation and degradation of Forests in the floodable savannah of the Orinoquia, to demonstrate GHG reductions/removals.

Thus, it is determined that:

- REDD+ Phase 1 verification period: January 1, 2018 - December 31, 2020.
- Accreditation period: May 6, 2016 - December 31, 2045.

Historical period of deforestation and degradation: the estimation of degradation and deforestation by the historical average method in the reference region and the leakage area was carried out for the period 2010 - 2017, taking into account the information on forest cover available in national databases and as established in the methodological document "*Quantification of GHG emission reductions from REDD+ projects*", section 13.2.

29. CAUSES AND AGENTS OF DEFORESTATION AND/OR DEGRADATION

Based on the importance of determining the anthropic dynamics that develop in the territory and their influence on the environment, the causes and agents of deforestation and historical degradation in the reference area of the project are identified, whose main purpose is to describe these actions involved in the loss of forest cover and reduction of carbon stocks within these forest areas, which added to this, allows clarity for the implementation of policies that effectively mitigate damage to ecosystems.

This observation was carried out under the IDEAM methodology "Conceptual and methodological guidelines for the characterization of causes and agents of deforestation in Colombia" using particularly the conceptual guidelines for a Medium Characterization Scenario (ECM).

29.1. SPATIAL AND TEMPORAL DIMENSIONS

The first step is to define the space and time, which is delimited in item 28 and a period of 10 years prior to the start date of the project, collecting with primary and secondary information the possible activities that cause deforestation and forest degradation in the specified area.

29.2. CONTEXT

The following is a description of the territorial, socio-cultural, economic and historical context, which allows us to determine the causes and agents of deforestation.

29.2.1. Territorial Context

The reference region is distributed in the departments of Casanare, Arauca, Meta and Vichada, which belong to the Orinoquia region that represents 33% of the national territory. The population in these four departments is approximately 1'830,208 inhabitants, where 50.71% are men and 49.29% are women. It is important to highlight that 29.57% of the inhabitants of these four departments are located in populated and dispersed rural centers (DANE, 2018).

The project area, which is included in this reference region, is characterized by a great wealth of natural resources, consisting mainly of two subregions, the floodable savannah and the highlands. The floodable savannah (4.5 million hectares) predominantly in the departments of Arauca and Casanare is an area dedicated to livestock (they contribute 7% of the country's livestock production), and in the altillanura (13.5 million hectares) of Meta and Vichada, it is

estimated that less than 3% of its extension has agricultural, livestock or forestry potential (Hernandez, 2018) .

However, these two subregions have in common that they have large hydrocarbon reserves and whose exploitation since 1990 has been increasing, in addition its inhabitants have allocated their land, for the planting of oil palm, rice, rubber, soybeans and corn and other agricultural activities, taking advantage of the large extensions that characterize the Orinoquia region (Hernández, 2018).

As described above, it has become evident that the accelerated and disorganized growth of these activities has affected various ecosystems that function as habitats for wildlife, including 210 species of mammals and 682 species of birds, as well as the numerous environmental goods and services provided by the region's environmental wealth.

29.2.2. Socio-cultural context

In the Colombian Orinoco, before the Spanish Conquest process, the territories were inhabited by various indigenous peoples, among which the Mitua, Bare, Guayape, Guahibos and Maipure stand out (Cf. Vilorio de la Hoz, 2009:4). The first conquistadors arrived from Venezuela, traveling mainly through the territories of the eastern plains.

After Emperor Charles V handed over the exploration and exploitation of the Llanos to the German House of Welser, the first German conquistadors began to arrive, such as Jorge Spira, who arrived in 1537 on the banks of the Guape River and founded the town of Nuestra Señora de la Asunción.

Currently, the Colombian Orinoco region has a heterogeneous population, mainly composed of indigenous communities, Afro-Colombians and llanero farmers (ODDR, 2013).

Regarding peasant communities, in general the region has undergone considerable transformations since the late 1960s that have greatly changed their quality of life. In particular, the distribution of the savanna by the Instituto de la Reforma Agraria - Incora, changed the traditional communal tenure system of the savanna, altering the livestock management patterns and the social organization that supports it (Correa et al., 2006).

Simultaneously, oil exploration and exploitation, intensified since the 1980s, led to the adoption of a developmentalist economic and social model based on the replacement of workers from the lowlands with higher-yield productive technologies. The demographic growth of the settlements near the oil wells, the arrival of new actors related to this type of exploitation and the migration of peasants to enlist in the oil work has generated that the trade of the plain work, transmitted from generation to generation, has lost weight at the present time.

The presence of armed groups has put pressure on land and resource management, contributing to the forced displacement of peasants to the cities.

A special social category are the people known as "vegueros", who are also part of the rural groups of the Orinoco basin. These are peasant farmers located on the banks of the rivers whose subsistence is based on farming methods such as slash and burn agriculture during the summer to plant corn, rice, beans, topocho, among others.

Within the group of Andean peasants, in recent decades extractive activities have determined the emergence of new economic and social dynamics.

29.2.3. Economic Context

According to FEDESARROLLO (2018), the Orinoco region registered during the period 2010-2016 the highest average growth in its GDP among the regions of the country with 5.4%, as a result of the impact of hydrocarbon extraction, especially in the departments of Meta and Casanare. The strong economic expansion presented by this region in recent years contributed to the reduction in the incidence of monetary poverty, which in 2016 was 24.5% , the second lowest among the country's regions, after the Central region .

When considering the contribution by branch of activity to the region's value added, the results reflect the great importance of mining and quarrying, with a contribution of 56.2% in 2016, followed by agriculture, livestock, forestry and fishing with a contribution of 11.2% (FEDESARROLLO, 2018).

Around 30% of the country's agricultural products are produced in the region in question. However, according to research anthropologist Diego Medrano of the Center for Orinoquia Studies at the Universidad de los Andes, land use, land informality, lack of infrastructure and access to financing are some of the possible obstacles faced by the Orinoquia to exploit its potential as the country's star pantry (Polanco, 2019).

The main economic activities in the region are oil exploitation, cattle ranching, agriculture, services and commerce. Livestock represents a large percentage of the Orinoco economy. During 2010, 242,665 head of cattle were slaughtered, representing 6.7% of the national total. Livestock activity is focused on breeding, raising and fattening cattle for commercialization with neighboring departments, and agricultural production is mainly aimed at satisfying local demand (ODDR, 2013).

29.2.4 Historical Context

The historical context that hosts the productive and socio-cultural present of the landowners is described by CORPORINOQUIA (2015) and can be summarized in five stages described below:

- Ancestral occupation of the indigenous peoples: the orinoco originally populated by hunters and gatherers associated with the use of the forest, dedicated to the cultivation of corn, yucca and other agricultural activities complementary to hunting, fishing, gathering fruits and tubers from the forest.
- Livestock colonization process: as a result of pre-Hispanic occupation, colonization, urban expansion, Spaniards and American slaves, a new cultural scenario was formed in the basins. Cattle ranching determined the settlement of the territory, the forms of social organization typical of the region and the growth of the economy. Likewise, the war of independence generated the expansion of the cattle ranch, stripping the land from the peasants, indigenous and mestizos, who were incorporated as labor force, at the service of the colonists who appropriated the savannahs and the cattle ranching, strengthening the Hato.
- Intensive agricultural activity (rice-palm): Rice cultivation transformed ecosystems, being an activity restricted to specific and geographically limited areas, in addition to the implementation of technologies in land adequacy to obtain intensive water consumption and as the only criterion for displacement the depletion of the resource irreversibly. Palm cultivation has been predominant in municipalities such as Villanueva, Maní and Orocué Casanare, and this type of crop has drastically changed the territory, where the trace of the "llaneridad" is blurred by the absence of the typical landscapes of estuaries and wetlands, bushes and extensive gallery forests.

- Incursion of oil exploration and exploitation projects: the famous "oil boom" since 1980 has modified the region's landscape and sociocultural identity, considerably influencing the four departments that belong to the reference area. These changes are reflected in the arrival of people from other regions of the country, who are only interested in the hydrocarbon resource, ignoring the traditions of the plains, subjecting the locals to changes in their modes of production and acceptance of economic activities that are alien to their cultural patterns.
- Agricultural and agro-industrial development presented for the Altillanura: According to national projections, grain, oil palm, forestry, rubber and sugar cane crops have great potential in the seven municipalities that belong to the Altillanura, which are: Cumaribo, Puerto López, Puerto Gaitán, Mapiripán, Puerto Carreño, La Primavera, and Santa Rosalía.

29.3. KEY STAKEHOLDERS, INTERESTS AND MOTIVATIONS

The process of deforestation and degradation involves multiple official actors, non-governmental organizations and civil society, among others. Within the actors, there are both the agents of deforestation and degradation, as well as those actors that promote the processes of forest transformation.

The following is a description of the stakeholders, their interests and motivations that influence decision making:

- Land grabbing for renting or land grabbing: this is related to large landowners who accumulate large areas of land, which have a great potential for medium or long term appreciation, and intend to rent or sell their land for the generation of infrastructure projects, injection of domestic or foreign capital, or areas of wealth in terms of natural resources.
- Another case is indirect agents such as absentee investors, who generate a change in land use and whose main purpose is to keep and maintain a high number of cattle, deforest the areas and after the productive cycle, these areas are put up for sale to expand the agricultural frontier and establish new fronts.
- Industrial or traditional agricultural producer for consumption and/or sale: Installation of common crops in the region, such as palm, rice, soybeans, forestry, and food crops such as cassava and plantain.
- Formal or informal builder of local, regional and national roads, roads are built to facilitate the movement of the population to other territories, in order to reduce mobility time or even achieve or have greater access to points where it is not available, making a change in land use directly and indirectly.
- Agent formally associated with oil pipelines, there are pipeline installations for the transport of oil and its derivatives over long distances, this can cause erosion in the area, and at the time of construction there may be changes in the quality of water sources.

- Agent formally or informally associated to electrical networks; their purpose is to supply electricity from suppliers to consumers, where the owner of the property is obliged to allow the passage, by aerial, subway or surface means, of the transmission and distribution lines of the electrical fluid.
- Population settled in rural and/or urban areas in expansion, for which it is required to make use of space and natural resources, taking into account its geographical position and the availability of connectivity. Being in a possible risk of citizenship deficit in terms of universal access to basic services and social protection.
- Wood extraction for self-consumption: with or without a forestry permit, this section generates the need for the owner to use wood for daily use on the farm, such as fences, firewood for cooking, construction (wind and heavy wood), ornamental use, among others.
- Timber harvester for sale: with or without a logging license, when harvesting high or low volumes of timber for sale, a forestry permit must be requested in order to do so in a sustainable manner, always taking care to do so in a planned manner, without affecting the ecosystem area.
- Agricultural and livestock producers, who carry out "controlled burns" are done intentionally with a specific purpose, in a planned manner and with good management, preparing the land beforehand with guardrails. Otherwise, forest fires can start, which can affect large areas of land.

29.4. ECONOMIC ACTIVITIES AND THEIR IMPORTANCE

The main economic activities in the region are oil exploitation, livestock, agriculture, services and commerce. In Arauca for 2009, the main activities or sectors included in the department's non-traditional exports were: agriculture, hunting, livestock and forestry; timber extraction and mining. For 2010, exports were led by the industrial sector (c.f. DANE, 2011:17). Since the beginning of oil exploitation, royalties have been an important source of resources for the department and its municipalities.

On the other hand, extensive cattle ranching is present throughout the Orinoquia plains; in the department of Casanare it is mainly found in the municipalities of Paz de Ariporo, Hato Corozal and Trinidad. These lands have traditionally been used for extensive cattle ranching, due to the low fertility of the Orinoquia savannas (ODDR,2013). This practice is closely related to traditional llanera culture, as these traditions are based on "llano work", as described by Francisca Reyes (2004):

To be a "llanero" always has to do with working the plains; with knowing the cattle; with riding a horse; with knowing how to chop a "rejo"; with knowing how to compose a cow and knowing the name of each of its parts; with making "cacheras", "sueitas marotas" and knowing how to use them; With dawn seeing savannah, and this in most cases is made possible in the herds, because the llanero far from owning land, cattle and beasts on a large scale that allow him to subsist economically, was formed since the seventeenth century as a peon, resigned to not find the plain deeded to his name and therefore not to find elements held as the basis of their

culture and therefore unable to exercise in their properties by small or nonexistent, all those things that make them feel llaneros (p.44)".

Meta's economy is not as dependent on oil extraction as Arauca and Casanare; this department has diverse economic activities, such as agriculture, livestock, services and oil activity. The agricultural sector and industry are the most important in terms of their participation in Meta's GDP. (ODDR, 2013)

As a result of the fall in oil prices in 2014, currently Meta, Casanare and Arauca have put greater efforts in the agro-industrial production of monocultures, especially the cultivation of oil palm, rice, soybeans and other cereals for domestic supply and some for export. This type of production has become the main bet of the national and departmental government to recover from the economic crisis and provide greater stability to the population, but this dynamic has caused the expansion of the agricultural frontier, becoming one of the main causes of deforestation and degradation of forests and wetlands.

29.5. DIRECT AND INDIRECT IMPACT

For each cause and agent of the project there is a differential impact, which can be qualitative or quantitative. When done quantitatively, it is estimated by means of a spatial analysis that determines the relationship between the cause that is identified and the calculated deforestation or degradation.

Deforestation, on the other hand, generally depends on the combined and synergistic impact of multiple factors, as shown in the following map:

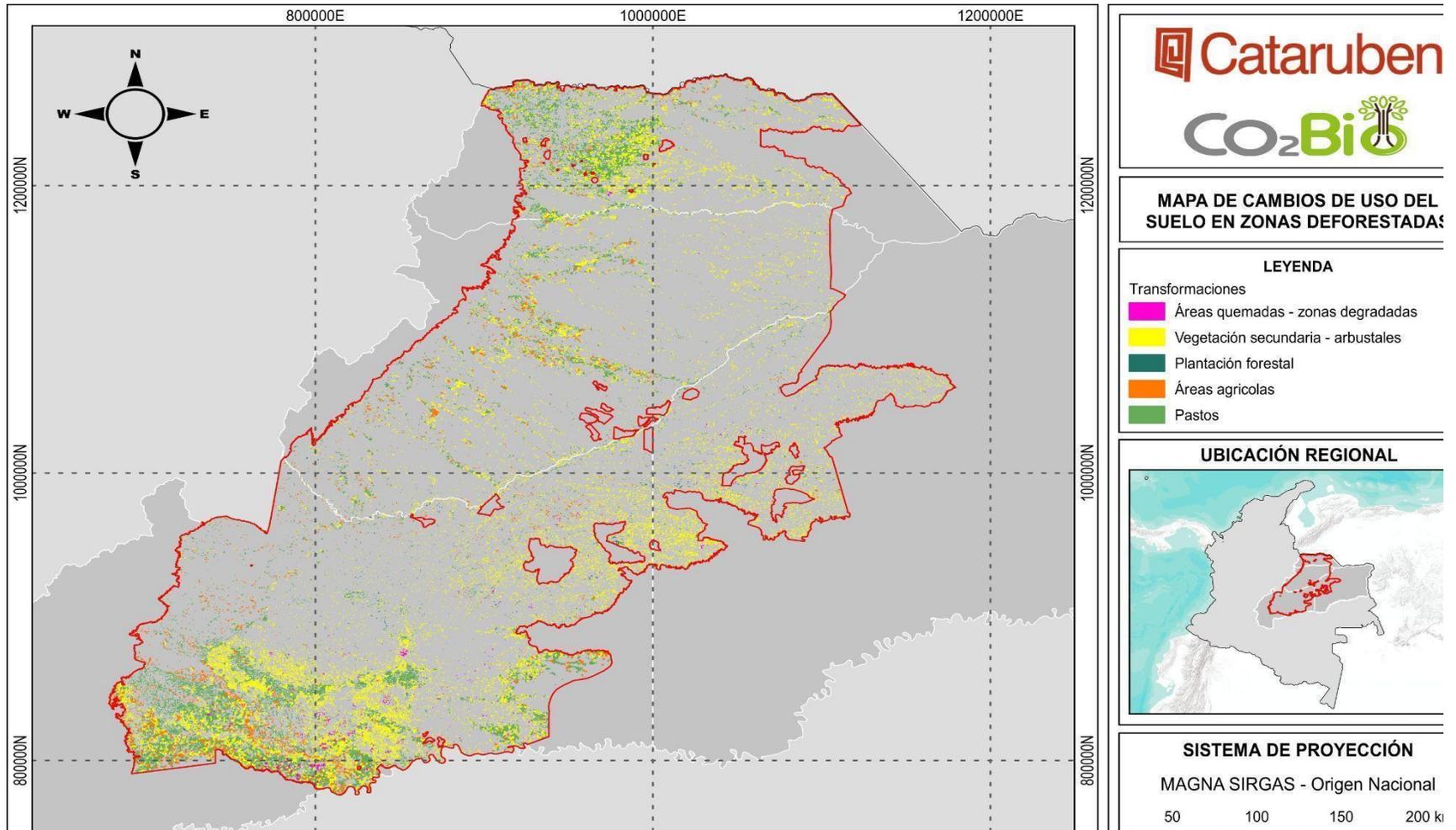


Figure. 32 Map of land use change in deforested areas.

Source: Cataruben Foundation

Between 2010 and 2017 approximately 94,537 ha were deforested in the reference region of which 47% were converted to clean pastures, 11% became grasslands, 10% mosaics of pastures with natural spaces and another 10% to secondary vegetation, (6%) became weeded pastures, another (6%) in mosaic of crops and pastures with natural spaces, a (3%) is evident for cereal crops and finally (1%) refers to permanent tree crops, see figure 33

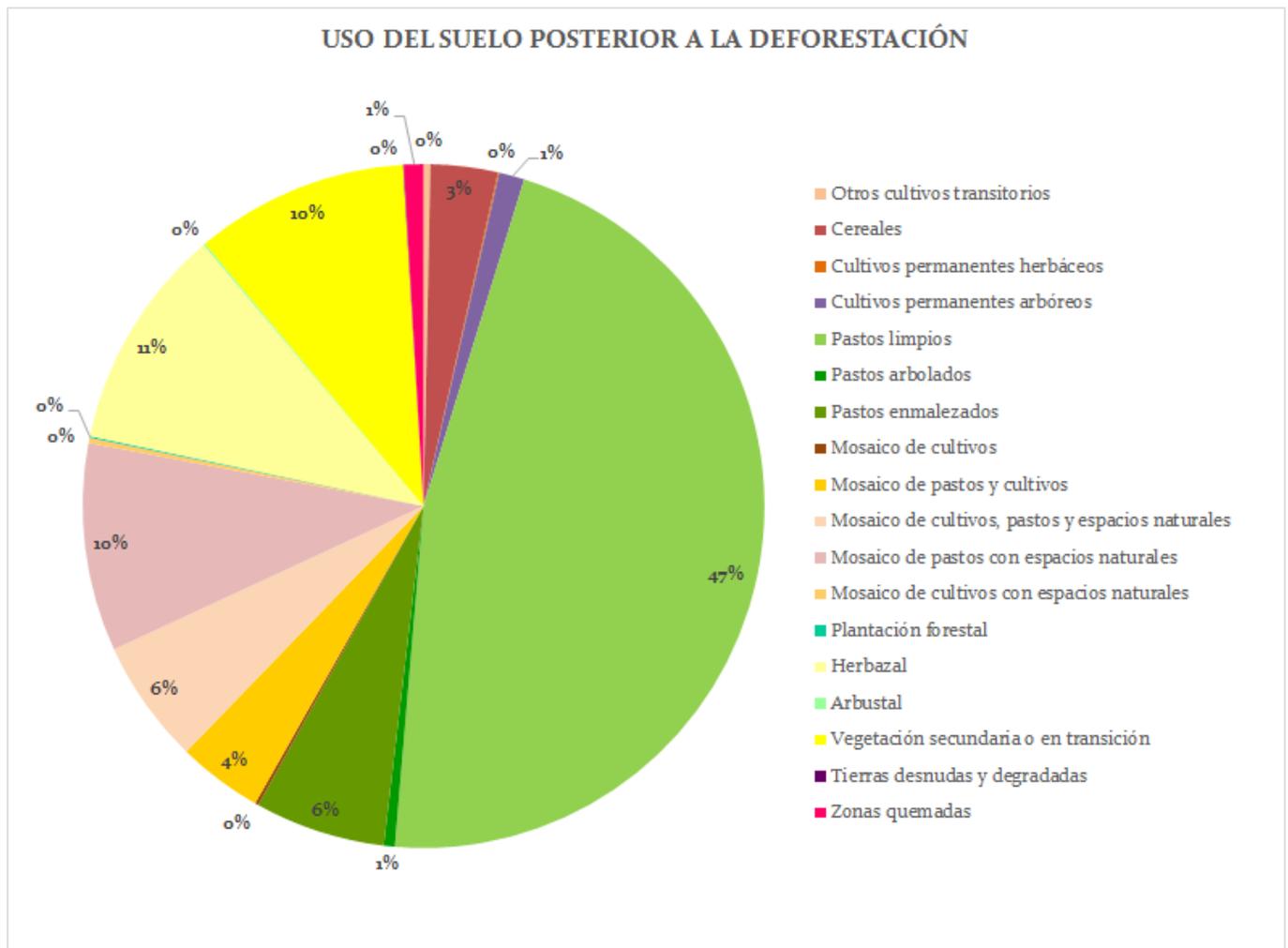


Figure. 33 Land use after deforestation.

Source: Cataruben Foundation.

29.6. RELATIONSHIPS AND SYNERGIES

Interactions and synergies are defined and analyzed among all the elements and actors of the project, to define the REDD+ activities established. It identifies how the actors respond to these activities and the positive interactions that fit each one, allowing to go beyond this

characterization of causes and agents of deforestation, generating proposals for measures and actions.

For the project, the direct causes found for each of the established activities were listed in a range of 1 to 9, which are related to each other and analyzed according to their synergy and interaction, either in a strong or weak way, taking into account the underlying agents and factors involved. ([Annex 3.1. CAUSES AND DRIVERS OF DEFORESTATION](#))

Among the 9 direct causes, we can see that the forest clearing (1) is strongly related to settlements (6), hydrocarbons (5) and natural fires (8). The relationship (1, 6) is generated by the need to deforest for a different land use (renting or land grabbing), for the expansion of infrastructure or population settled in rural and/or urban areas. There is a strong relationship between logging and hydrocarbons (1, 5), as easements for oil pipelines, for example, are identified within the project area, generating logging, and finally, there is a relationship with natural or arson fires (1, 8), as controlled burns are carried out to clear the soil to sell or rent land, with the risk of ending up in uncontrolled arson causing deforestation of the ecosystem.

Additionally, a strong synergy between (2,3, 7) and (4, 5) is analyzed. The first relationship is between livestock production (2) and agricultural production (3) with timber extraction (7), because areas are deforested for crops or extensive cattle ranching, which is driven by the search for higher or faster income from the sale of these products or self-consumption. The second relationship with a strong synergy is between transportation (4) and hydrocarbons (5), since deforestation is used to build roads in order to facilitate mobility and access to hydrocarbon extraction sites.

On the other hand, in terms of weak synergy, we found a relationship between agricultural production (3) and natural or provoked fires (8), since agricultural producers carry out controlled burns in order to prepare the soil for the implementation of crops. When livestock and agricultural production is carried out (2,3), the need to transport (4) these products for sale is identified. There is less synergy between the settlements and the hydrocarbons (5, 6) that exist in the area, which can be identified due to the proximity to this activity, identifying the presence of electrical grids, activities that sometimes require deforestation. Finally, land-use planning is of utmost importance, complying with the areas that are projected for population settlements (6). When these provisions are not complied with, there are cases of flooding that affect those groups that are established very close to water sources, deforesting certain settlements.

29.7. CHAIN OF DEFORESTATION AND DEGRADATION EVENTS.

The chain of events defined for the project area includes the main groups of agents and causes of deforestation and degradation, in order to expose the sequence of events that define this problem. For each activity that generates deforestation, the causes (3 links when required) and responsible agents are identified, as well as the underlying factors that result in the occupation of the territory ([Annex 3.1. CAUSES AND AGENTS OF DEFORESTATION](#)).

The direct causes of deforestation and degradation in this area can be seen in Annex 3.1 and are mainly defined in four activities: the expansion of the agricultural frontier, the expansion of infrastructure, timber extraction and different biophysical factors. This Annex also shows the agents that directly or indirectly influence the transformation of natural forests for the development of other types of activities, thus influencing the deforestation of the territory.

The expansion of the agricultural frontier is defined by three main reasons: Agricultural production (for self-consumption or sale), livestock production (sale or self-consumption) and praderization (for rent or land tenure). Regarding agricultural production, in the reference area, oil palm, rice, cocoa, cotton, banana, sorghum and soybean crops are grown, mostly for sale, however, there is also evidence of traditional crops on a smaller scale, for self-consumption or informal commercialization, activities that have accelerated deforestation in the territory (Corporinoquia, 2014). This is due to the fact that locals change forest cover to crops, causing timber extraction in search of greater expansion or area for the development of this activity; driven by a need for subsistence and/or to obtain economic income.

Livestock production has traditionally been developed in the region under the system of cattle breeding and, to a lesser extent, fattening, an activity that can simultaneously provide security in daily sustenance, conserve ecosystems, promote wildlife conservation and satisfy cultural values and traditions. This, in turn, is associated with the third direct cause, and that is the praderization, either for renting extensions of land where extensive cattle raising is usually carried out, sowing pastures or due to land tenure effects, where under population dynamics, some landowners accumulate large areas of land, having a rational use of inputs, including grains (cereals, soybeans) and fertilizers. Small producers require for their development not only access to better and new technologies, but especially to innovations in production systems, which guarantee their access to markets and/or improve the contribution of self-consumption to food diet requirements (FAO, 2021).

On the other hand, infrastructure expansion is also a direct cause of deforestation in the reference area, due to activities associated with transportation, hydrocarbons or population settlements. In the first place, these transportation activities are related to the construction of roads, in this case regional or rural access roads. The hydrocarbon industry has taken hold in this area, modifying the socioeconomic characteristics and negatively altering biodiversity. And finally, population settlements are linked to the distribution and growth in the number of inhabitants in the region, which implies the construction of housing and other infrastructure necessary for the community, causing land use to change more and more in the rural sector.

Thus, timber extraction is the third direct cause of deforestation in the reference area, both for commercialization (sometimes illegal) and for self-consumption. Forestry activities in the defined area include the harvesting of species such as mosco, cedar, thorny cedar, carob, yopo, and pine, among others. Farmers are forced to clear more land in order to be able to buy inputs that would allow them to produce more on less land.

Finally, biophysical factors are defined as the fourth direct cause, referring to that natural capacity or predisposition for changes in use due to variables such as climate, soils, lithology, topography, relief, hydrology and vegetation; taking into account mass removals and forest fires, which, although they are not the focus or driver of deforestation, they are occasional in the

reference area (Rozo, 2018). It is important to mention that, just as biophysical factors are in this case a direct cause of deforestation, it is also necessary to take into account other underlying causes of this problem, which are mainly: economic (increased production), demographic (population growth) and cultural (indigenous beliefs) factors, which influence the social dynamics and productive activities developed in the reference area.

In short, each of the activities described above generate deforestation; however, they are also the main causes (direct or indirect) of forest ecosystem degradation, with the expansion of the agricultural and livestock frontier, selective logging, timber or firewood extraction, and forest fires being the activities that mainly influence the loss of biomass and prevent the forest from regenerating. This expansion requires a sustainable approach to avoid increasing pressure on the region's natural resources and environment.

30. REDD+ ACTIVITIES

Project activities have been designed taking into account the problems present in the project area and working closely with the local community, owners and workers of the properties that are part of CO₂Bio, who as main agents since 2018, have participated in the identification of the main factors of land use change, deforestation and forest degradation and at the same time providing suggestions on the types of measures to mitigate the identified agents.

Below are the main project activities that are the fundamental basis for emission reductions, as they will help prevent or reduce deforestation and forest degradation, allow for the regeneration of deforested areas and through this the conservation of biodiversity:

1. Implement training and accompaniment processes through training cycles that strengthen the sustainable management of ecosystems and biodiversity conservation.
2. Consolidate and adapt governance principles for sustainable ecosystem management.
3. Promote forest legality.
4. Promote the delimitation and signaling of strategic ecosystems and natural protection areas.
5. Promote and improve agricultural production, livestock (on existing land) and tourism, through the implementation of good sustainable practices.
6. Generate alerts of changes due to deforestation, degradation and/or transformation of ecosystems in the project area and its surroundings.

[REDD+ ACTIVITIES](#) can be seen in Annex [3.2.1. REDD+ activities](#), its relationship with the direct causes of deforestation and degradation, the responsibility and roles of the actors involved, implementation schedule and measurement indicators for the monitoring plan.

31. REDD+ SAFEGUARDS

The project complies with social and environmental protection measures to avoid environmental risks and for landowners in the project area. This also increases the social, economic, and natural resource management benefits for the participants. The safeguards related to the institutional dimension are fully implemented by the project, as they are consistent with the legal, consultation and governance provisions required for REDD+ projects.

Social and cultural safeguards are applied through respect for traditional knowledge, the guarantee of benefit sharing, territorial rights, and the participation of landowners, many of whom are self-identified peasants. The only one that does not apply to the project is Free, Prior and Informed Consent (FPIC), because the project is not being carried out in the territory of ethnic communities or in areas that impact them.

With regard to environmental and territorial safeguards, the project applies measures for the conservation of forests and their biodiversity, the provision of environmental or ecosystem goods and services, environmental and territorial planning, and forest planning, control and monitoring. The following describes how these safeguards will be addressed, presenting the activities that will ensure compliance throughout the project. The follow-up indicators and monitoring information are presented below in Table 57 of section 34.3 (SEE [REDD+ SAFEGUARDS MONITORING PLAN](#)).

31.1. CORRESPONDENCE WITH NATIONAL LEGISLATION, INTERNATIONAL AGREEMENTS AND NATIONAL POLICIES

The project takes as its regulatory framework the national and international legislation that covers REDD+ projects in Colombia. Table 44 describes the regulations governing the initiative.

Given that some of the land included in the project will be declared a CSER and integrated management will be carried out under sustainability criteria that guarantee the conservation of natural ecosystems and environmental goods and services, the project is in direct accordance with Decree 1996 of 1999.

Table 44. Legislation and agreements corresponding to the project

REGULATION	APPLICATION CONTEXT
Decree 2811/1974	Compliance with Article 44, which establishes principles for the management of natural resources to promote a balance between economic development, environmental protection and the efficient use of resources.
Law 164 of 1994	The UNFCCC is ratified and, in accordance with national circumstances, measures are adopted to reduce emissions from deforestation and forest degradation.
Forestry policy (1996)	The overall objective is to achieve a sustainable use of forests to conserve them, consolidate the incorporation of the forestry sector into the national economy and improve the population's

	standard of living.
The Forest Reserves Law (Law 2 of 1959)	It establishes a classification and management regime for lands under its purview, including public lands, indigenous reserves and Afro-Colombian lands.
Green Plan 1998	Its main objective is the inclusion of agroforestry, conservation and ecological restoration in the environmental management of the territory and the recovery of degraded ecosystems.
Law 620 of 2000	Approving the Kyoto Protocol of the UNFCCC, which committed countries to stabilize GHG emissions, based on the principle of common but differentiated responsibilities.
Decree 3570 of 2011	Establishes functions for the Ministry of the Environment and its dependencies and affiliated institutions. Establishes that the Directorate of Forests, Biodiversity and Ecosystem Services is responsible for developing and coordinating the implementation of the National Forestry Development Plan.
Law 1753 of 2015	Guidance for the Implementation of the National Strategy for Reducing Emissions from Deforestation and Forest Degradation
Decree 926 of 2017	Its purpose is to regulate the procedure to make effective the non-payment of the national carbon tax.
Resolution 1447 of 2018	By which the system for monitoring, reporting and verification of mitigation actions at the national level is regulated, in relation to the GHG Emissions Reduction and Removal Accounting System, which includes REDD+ actions.
2030 Agenda for Sustainable Development	The Millennium Development Goals, focused on poverty eradication, and the Rio+20 process on Sustainable Development have resulted in the "2030 Agenda for Sustainable Development". This commitment was adopted by Heads of State and Government on September 25, 2015 during the 2015 United Nations Summit for Sustainable Development.
CONPES 3918	The Sustainable Development Goals (SDGs) are the product of a general global consensus on a measurable framework to achieve minimum levels that guarantee prosperity, the well-being of people and the conservation of the environment.
Decree 1996 of 1999	By which Articles 109 and 110 of Law 99 of 1993 on Civil Society Nature Reserves are regulated. The project complies with this decree to the extent that it supports the declaration of land as Civil Society Nature Reserves.

Source: Cataruben Foundation

In addition to the above, the project's REDD+ activities are articulated with the goals of the 2018-2022 Development Plan, as shown in the following tables.

Table 45. Lines of action in common with the National Development Plan 2018-2022.

GOVERNMENT COVENANTS	OBJECTIVES	PROJECT RELATIONSHIP
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Sustainability pact: producing by conserving and conserving by producing	Sectors committed to sustainability and climate change mitigation	The project seeks to contribute to mitigating climate change by reducing greenhouse gases generated by deforestation and forest degradation for other activities, through the conservation of this ecosystem, which is susceptible to other anthropogenic activities.
	Biodiversity and natural wealth: strategic assets of the Nation	The direct relationship between forests and biodiversity in general allows the project to generate actions for the conservation of the ecosystem in general.
	Resilient Colombia: knowledge and prevention for disaster risk management and climate change adaptation	Among the project's activities is training the people who are part of the project on climate change issues and the importance of forest conservation in the face of this adaptation and mitigation challenge.
	Modern environmental institutions, social appropriation of biodiversity and effective management of socio-environmental conflicts.	By promoting the care of the forest ecosystem in private properties, and strengthening the intervention in participation mechanisms that bring together different landowners and the local community in general, it allows the appropriation of biodiversity to be important for these communities, and also strengthens community and state institutions related to the management of these conflicts.
Pact for the protection and promotion of our culture and development of the orange economy	We are all culture: the essence of a country that transforms itself from its territories	The conservation activities proposed in the project fully take into account the cultural and traditional knowledge of the communities belonging to the project region, constantly involving them in the actions that strengthen the project.
Women's equity pact	Equity for women in peace building	Nearly half of the owners of the properties that belong to the project are women, which in the first place reveals that land tenure is no longer only a matter of male gender, however, it also reveals that many of the activities that are developed in each property will be led by women, which favors gender equality. It is also expected to train not only women owners, but also those in charge of the properties and girls, in conservation issues. and preservation of forests, climate change, biodiversity conservation and other issues related to the project.
Plains-Orinoquia Region Pact: Connecting and enhancing the region's sustainable food pantry with the country and the world	To boost productivity and improve the efficiency of agricultural, agroindustrial and tourism clusters and value chains.	Directly, the project seeks to promote new economic activities such as eco-tourism in favor of the conservation of the forest ecosystem.

Source: Cataruben Foundation

Likewise, with regard to the chapters and objectives of the National Development Plan 2018-2022, the activities of the CO₂Bio 2 project to which it relates are mentioned below:

Table 46. Lines of action in common with the National Development Plan 2018-2022.

CHAPTER	OBJECTIVE	PROJECT ACTIVITIES
Equitable Colombia without extreme poverty	Objective 2: Reduce population gaps in terms of income	In general, the project carries out biodiversity conservation initiatives, especially in the forest ecosystem, which, in the market, functions as an economic income mechanism for the environmental services offered by these ecosystems, so that the owners of the land where these natural resources are located can receive economic values for their conservation.
Transformation of the field	Accelerate the emergence from poverty and the expansion of the rural middle class through a commitment to productive inclusion of rural dwellers.	Farmers who have an economic deficit even though they have land that they can take advantage of, find in the project, first of all, the possibility of acquiring economic resources for the conservation of the natural forest, however, they also find technical and scientific support to promote agriculture in existing areas, strengthening productivity from the respect for the zoning of the land.
Green growth	Objective 2: To protect and ensure the sustainable use of natural capital and improve environmental quality and governance.	The project is related to this objective because it protects natural capital by conserving, restoring and reducing forest degradation, which directly leads to the reduction of deforestation, strengthening the capacity of forests to be carbon sinks and providers of other ecosystem services.
	Objective 3: Achieve resilient growth and reduce vulnerability to disaster risks and climate change.	The project strengthens knowledge through training and workshops on issues related to climate change and its management in adaptation and mitigation measures.
Environment, agribusiness and human development: growth and wellbeing for the Plains	Objective 2: Manage the territory prospectively according to its environmental, agricultural, mining-energy and cultural vocation, by increasing institutional capacities throughout the region.	In accordance with the strategies of this objective, the project is related to the integral management of the forests, implementing strategies such as the declaration of Natural Reserves of the Civil Society, and other conservation initiatives.

Source: Cataruben Foundation

31.2. TRANSPARENCY AND ACCESS TO INFORMATION

To ensure access to information related to the project, Cataruben Foundation will use its website and social networks (Whatsapp Business, Twitter, Instagram, LinkedIn and Facebook) to publicize the positive environmental and social impact, as well as success stories about the implementation of conservation activities of natural ecosystems in the project area. Additionally, interested parties may submit Petitions, Complaints, Claims, Suggestions or Complaints (PQRSD) through our virtual portal or in person.

Regarding national reporting, Cataruben Foundation will register the project in the RENARE platform, in order to report the removals and/or reductions achieved by the project, and thus provide the public with access to the information.

31.3. ACCOUNTABILITY

The project will periodically hold an event called "Biodiversity and Carbon Forum", with broad participation of public and private entities, landowners and the general public, in order to report on the results and impact generated by the project in environmental, climate change mitigation, social and economic terms within the framework of its operation.

In this space, all concerns related to the operation of the project are received, in terms of time, economic resources, CO₂ removals achieved and areas impacted.

31.4. RECOGNITION OF FOREST GOVERNANCE STRUCTURES

For CO₂Bio project 2, it is essential to strengthen the principles of forest governance to the landowners, who are the first-line decision-makers about the forests and the biodiversity that inhabits the project area. This strengthening will be done through the recognition of key actors and the generation of a governance mechanism that will help strengthen the actions and articulate the actors that are part of the project.

This mechanism will consist of participatory sessions with representatives of the owners, the project owner and other key stakeholders, following the methodology of "structural analysis". This is a tool for structuring a collective reflection, which offers the possibility of describing the project and systematically planning its development, with the help of a matrix that relates all the constituent elements of the CO₂Bio 2 project, among these elements are both relevant stakeholders for the project and variables that make up the project or come from its environment.

31.5. CAPACITY BUILDING

The owners of the properties that belong to the project will be trained on the following topics and will be followed up on the implementation of the knowledge and skills in the execution of activities on their properties:

Table 47. Capacity building for project owners.

SUBJECT	DESCRIPTION	OBJECTIVES
Training in sustainable ecosystem management	Sustainable ecosystem management is defined as the practices that must be carried out in a responsible manner that contribute to the conservation of all existing ecosystems in order to guarantee their permanence over time.	<ul style="list-style-type: none"> - Encourage sustainable management practices of the resources present on the property that promote conservation. - Raise awareness among landowners that good management of the resources present on their properties can guarantee greater availability of these resources for future generations. - Emphasize the importance of adopting good practices for the development of activities on the property.
Biodiversity conservation training	Biodiversity conservation encompasses the protection of endangered species of fauna and flora, and the recovery of degraded ecosystems due to the pressures we exert on our territory	<ul style="list-style-type: none"> - Promote conservation practices of fauna species found in forests. - Raise awareness among landowners that forests play a fundamental role in the maintenance of biodiversity. - Promote practices aimed at resolving human-animal

	with actions such as the elimination of habitats for wildlife through deforestation, contamination of soils and aquifers due to the expansion of the agricultural frontier in an unsustainable manner, highlighting the forest unit as fundamental in the processes of conservation of fauna species and maintenance of biodiversity.	conflicts.
Training in land planning	Farm planning is a strategy based on knowing the status and relationship of all the components of a farm, its strengths and weaknesses, in order to guide its development possibilities, define the actions to be undertaken and the order of implementation for each family.	Train owners, families, managers and workers in land planning, which allows them to have a clear idea of the past, present and future of the property, aiming to achieve the main objective of the project, which is based on the conservation of the forest ecosystem and its associated biodiversity. It is a tool to identify the different zones of the property and the natural resources associated with the land, as well as the shortcomings and aspects to be improved in terms of such zoning. On average, it defines: the location of houses, crops on each of the farms, rivers and bodies of water, access roads to the farms, water sources, deep wells, river catchment points; pastures for livestock and crops, forest areas, water tanks and reservoirs; corrals and stables; identify burning areas and septic tanks; storage areas.
Climate change trainings	Training whose main objective is to inform about the role and importance of citizen participation mechanisms, specifically those mechanisms that are exercised in the project's area of reference and that can contribute to the fulfillment of mitigation activities.	Train landowners on climate change and Greenhouse Gases (GHG), and the relationship with the project. Promote and strengthen knowledge on laws, organization, leadership, monitoring and inter-institutionalism, so that forest governance is exercised in the forest lands. Train owners and collaborators in sustainable livestock practices.

Source: Cataruben Foundation

31.6. FREE, PRIOR AND INFORMED CONSENT

Within the CO₂Bio 2 project area, there are no ethnic communities, nor are there any activities that impact the collective territories of these communities, as these are only carried out in the area of the properties participating in the project. In this sense, the population involved in the project are only the owners of the land, their families, and the managers or day laborers who contribute to the execution of the activities on the land.

31.7. RECOGNITION OF TRADITIONAL KNOWLEDGE

In CO₂Bio, the ancestral knowledge of peasant communities and of the plains tradition is indispensable for the development of mitigation activities. Therefore, each of the activities will

be subject to the respect and recognition of the owners' and their families' own visions of the territory.

Within our activities to reduce emissions due to deforestation, in component 2 is "Implement training and support processes to strengthen sustainable forest management and biodiversity conservation", education is a key tool to give value and proper management to the environment, particularly forests and their biodiversity. Specifically, it seeks to embrace the ancestral and traditional knowledge of the peasant communities, to relate it to technical and scientific knowledge, resulting in better guidance in decision making around land use planning and sustainable forest management.

31.8. PROFIT SHARING

The implementation of the project's REDD+ activities will generate benefits for the communities and the environment in the project area, allowing the main objectives of the project in terms of community and biodiversity to be met. These benefits are related to the improvement of the social conditions of the landowners and their families, through the generation of complementary income from the sale of the first carbon credits, also ensuring an environmental benefit from the conservation of the forest, the associated biodiversity and the improvement of governance. The distribution of the economic benefits from the sale of the carbon credits will be distributed 70% to the beneficiaries and 30% to the project owner and the person in charge of ensuring compliance with the project activities.

In addition, REDD+ activities contribute to the development of economic activities and sustainable livelihoods by training the community in climate, forestry, agriculture and livestock issues to generate an increase in income from their productive activities. It will also contribute to improving the administrative capacity of the landowners, preserving the customs and cultural roots and environmental awareness, contributing to the increase of employment in the community to sustain the activities.

31.9. TERRITORIAL RIGHTS

Although the project does not develop its activities with ethnic communities, the local communities that participate are the peasants of the Orinoquia region, as well as the entire Colombian peasantry, this population has a series of rights that must be guaranteed, one of which is their right to land and territory, which is protected by the Political Constitution and the laws of the Colombian State.

With its activities, the project strengthens the fulfillment of these rights, especially the right to the adequacy of their lands thanks to the generation of income from the conservation of forests and their biodiversity, as well as helping to strengthen the right to the sustainability of land and territory, which contribute significantly to the protection of the environment, being sustainable, which contributes directly to ensure access to other rights such as education, food, work, a healthy environment, among others.

To this end, participatory land use plans will be developed, which will establish a plan for the sustainable use of land, production systems and the design of strategies that will help to promote the sustainable use of natural resources.

31.10. PARTICIPATION

The fundamental objective of the project is to guarantee the full participation of the landowners in the implementation of the activities, specifically to support the transmission of new knowledge and participatory dialogue in the decision-making process. To this end, meetings, workshops and forums will be held with the participation of all interested parties, guaranteeing the full participation of landowners and beneficiaries in project decision making, as well as promoting the participation of public and private entities working in biodiversity conservation, rural development and territorial planning.

In addition, communication strategies will be strengthened with landowners to encourage their participation in bodies such as the Regional System of Protected Areas (SIRAP in Spanish) of the Orinoquia region or the Municipal System of Protected Areas (SIMAP in Spanish) of San Luis de Palenque and Trinidad, municipalities where some of the project properties are located. In addition, they will integrate the 97 properties with their owners and families in a participatory monitoring of biodiversity through 5 study nuclei, according to the geographic distribution of the properties in the project area. The landowners will actively participate in each of the phases of this monitoring.

31.11. CONSERVATION OF FORESTS AND THEIR BIODIVERSITY

The CO₂Bio 2 project will contribute to biodiversity conservation in the region through a phased participatory monitoring strategy. This strategy will be structured according to three main objectives: i. Characterization of biodiversity in the project area, ii. Identification of HCVs (High Conservation Values) and iii. Mitigation of pressures on biodiversity.

The stages of the strategy correspond to the periods in which the activities that will help meet these objectives will be implemented, as shown below:

1st Stage (2018 - 2020)

- State of the art of biodiversity in the project area: Search and compilation of biodiversity information from official sources such as the Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH), SiB Colombia, GBIF, UICN, among others; and information from biological characterization activities, restoration and sustainable use of natural resources in the project area.
- Identification of potential HCVs in the project area.
- Characterization of environmental conditions of the property associated with biodiversity.

2nd Stage (2021 - 2023)

- Socialization of the objectives of the strategy and transfer of experiences and traditional knowledge about biodiversity elements.
- Identification of HCVs with the participation of the owners.
- Sampling design where the variables, methods and area to be sampled will be selected prioritizing the monitoring of the HCVs identified.
- Identification of pressures on biodiversity, especially those that threaten the permanence of HCVs.

3rd Stage (2023 - 2045)

- Implementation of participatory monitoring according to the sampling design established with the community.
- Design of mitigation measures for pressures on biodiversity and HCVs.
- Implementation of measures to mitigate pressures on biodiversity.
- Report on results and progress of the strategy.

31.12. PROVISION OF ENVIRONMENTAL OR ECOSYSTEM GOODS AND SERVICES

Forests contribute to the well-being of project beneficiaries because these ecosystems provide a wide range of goods and services that can be valued in economic, cultural, scientific and even spiritual terms. However, the provision of these ecosystem services is determined by the ecosystem integrity (EI) of the forest, which is directly related to biodiversity. This means that forests with higher EI have a greater capacity to support biodiversity at the level of communities and populations of organisms, as well as provide ecosystem services, regarding to degraded or intervened forests (Hansen, Noble, Veneros, *et al.*, 2021; Brockerhoff, *et al.*, 2017).

Considering that the provision of ecosystem services is based on complex ecological processes, the CO₂Bio 2 project can help beneficiaries to continue receiving these goods and services from forests. To this end, the EI of the forests must be assessed and the ecosystem services they are providing must be identified. To this end, remote sensing methodologies will be used to identify and map forest EI in the project area. This information will serve as the main input for participatory identification and monitoring of essential ecosystem services for project beneficiaries.

● Evaluation of IE with remote sensing

To assess forest EI, there are a large number of indices that can be estimated by remote sensing and *in situ* observations, which provide quantitative information on forest structure, function and composition. These indices have also been included in the Essential Biodiversity Variables (EBVs) system as they provide information on the ecological quality of the forest area evaluated (Hansen, Noble, Veneros, *et al.*, 2021). Accordingly, the following indices will be estimated:

- Forest Landscape Integrity Index (FLII).
- Biodiversity Intactness Index (BII).

Firstly, FLII functions as an indicator of the degree of forest intervention due to anthropic activity (Grantham, H.S., Duncan, A., Evanst, T. D., *et al.*, 2020). As for BII, it evaluates the composition of the forest by means of the average abundance of taxonomic groups determined in a specific geographic area, in relation to their reference populations (Scholes & Biggs, 2005).

- **Valuation and recognition of ecosystem services**

Based on the EI assessment, a socialization will be conducted with the beneficiaries of the properties in order to identify those ecosystem services that have greater importance and relevance. To this end, some type of value will be assigned to the ecosystem services identified, which may be economic, social, spiritual or other.

Knowing the importance or value of ecosystem services for the well-being of the beneficiaries, participatory recognition and valuation activities will be designed to determine the status and capacity of the forest to provide these services in the long term. The design of these activities will be in line with the development of the participatory monitoring strategy presented in safeguard 11. Conservation of Forests and their Biodiversity, especially regarding the mitigation of biodiversity pressures that may indirectly threaten the provision of ecosystem services.

31.13. ENVIRONMENTAL AND TERRITORIAL PLANNING

The activities and objectives of the project are consistent with the land use and biodiversity conservation vocation of the Land Management Plans. It is especially related to the Regional Environmental Plan 2013-2025 and the Regional Comprehensive Climate Change Plan for the Orinoquia. The project activities related to these objectives are presented below.

In addition, the Cataruben Foundation will participate in the Regional System of Protected Areas (SIRAP in Spanish) of the Orinoquia, the Departmental System of Protected Areas (SIDAP in Spanish) of Casanare, the Municipal System of Protected Areas (SIMAP in Spanish) of San Luis de Palenque, which integrate the Natural Reserves of the Civil Society of the region and have an impact on the actions to improve the conservation of forests and ecosystems of the properties that are also part of the project in this municipality.

Table 48. Lines of action in common with the Regional Environmental Plan 2013-2025.

Lines	Strategic component	Goals	CO ₂ Bio Activities
Strategic line 2	Formation of the regional system of protected areas.	Form the network of natural reserves of the Orinoco civil society	Promote the delimitation and signaling of strategic ecosystems and natural protection areas.
		Ecological restoration of degraded ecosystems strategic for biodiversity conservation.	Promote the delimitation and signaling of strategic ecosystems and natural protection areas.

Strategic line 5	Preparedness for environmental risk management	Raise awareness and train communities in climate change mitigation and adaptation practices in Corporinoquia's jurisdiction.	Implement training and accompaniment processes through training cycles that strengthen the sustainable management of ecosystems and biodiversity conservation.
Strategic line 6	Community stakeholders involved in the environmental processes of the territory	Consolidate a network of environmental allies in the jurisdiction's territory.	Consolidate and adapt governance principles for sustainable ecosystem management.
		Consolidate a citizen participation strategy focused on socio-environmental monitoring.	

Source: Cataruben Foundation

Table 49. Lines of action in common with PRICCO

Adaptation measures	CO ₂ BIO Activities
Recovery and rehabilitation of protective areas of water catchment areas	Promote the delimitation and signaling of strategic ecosystems and natural protection areas.
Recovery of riparian forest	Promote the delimitation and signaling of strategic ecosystems and natural protection areas.
Site-specific agriculture	Promote sustainable agricultural and livestock production and tourism, through the implementation of best practices.
Landscape connectivity	Implement training and accompaniment processes through training cycles that strengthen the sustainable management of ecosystems and biodiversity conservation.
Promotion of civil society reserve areas	Promote the delimitation and signaling of strategic ecosystems and natural protection areas.
Mitigation measures	CO ₂ BIO Activities
Programs and campaigns aimed at reducing deforestation	Monitor changes due to deforestation and ecosystem degradation in and around the project area
Landscape connectivity through biological corridors	Implement training and accompaniment processes through training cycles that strengthen the sustainable management of ecosystems and biodiversity conservation.
Natural regeneration in paddocks	Consolidate and adapt governance principles for sustainable ecosystem management.

Source: Cataruben Foundation

31.14. **SECTORAL PLANNING**

For the project, it is important to highlight the validity of the land tenure of each of the owners, as they have a public deed, a resolution verifying tenure for several decades, and additional documents such as certificates of title, property tax, and a title study. However, in most of the properties the current use of the land is not clear and there is limited awareness of the distribution and different uses that can be given to the property, in many cases affecting the natural resources present.

31.15. FOREST CONTROL AND SURVEILLANCE

The project will implement a series of activities to control and monitor the detection of changes in forest composition and structure in the project area. This is achieved through the establishment of an early warning system that will obtain reports on the status of forest cover. In addition to allowing timely decision making to minimize/mitigate risks associated with the degradation and subsequent deterioration of ecosystem services perceived by the forest.

The use of geospatial information (active and passive satellites) is ideal for monitoring the project's Essential Biodiversity Variables (EBV), especially in leakage areas; the use of geospatial tools for landscape-scale monitoring allows the calculation of deforestation and degradation rates, multi-temporal analysis, time series and determination of pressures from hierarchical analysis processes, among other indices for biodiversity, soil, fire and water.

In addition to this monitoring measure, informative meetings will be held on the objectives of the project and the negative impacts of deforestation or forest degradation caused by the displacement of its agents and causes. Measures will also be designed to monitor the forest and its associated biodiversity, which are expected to involve landowners and their families. In addition, a community communication strategy is being designed to provide early warning of fires or other factors in the project area and in leakage areas.

32. REDUCTION OF GHG EMISSIONS

The project will reduce emissions by:

- Avoided Deforestation and Degradation (REDD+)

For phase 1, only reductions from avoided deforestation and degradation are included, using the guidelines of the Proclima International methodology in its version 2.2. Subsequent phases will include new areas in this ecosystem of the Orinoquia.

32.1. REDUCTION OF GHG EMISSIONS FROM REDD+ ACTIVITIES

Emission reductions from **deforestation** and **degradation** were estimated for the Phase 1 areas. For the areas of subsequent phases, the same methods will be used and will be integrated with the data from the accumulated phases, as well as the updates required by the most recent version of the Proclima standard and methodology, as well as national and international legislation.

In this regard, Resolution 1447 of 2018 mentions in Article 41 **Establishment of baselines for REDD+ projects.** *"The REDD+ Project holder shall establish its baseline from the most updated NREF that has been formally submitted by Colombia and evaluated by the UNFCCC, and that includes the geographic area of the project, as well as REDD+ activities, periods and carbon pools in which the initiative is intended to be implemented.*

The establishment of the REDD+ project baseline from the FREL consists of the methodological reconstruction of the NREF over the project area demonstrating consistency with the FREL. The methodological reconstruction is the calculation of the expected GHG emissions in the REDD+ Project area with the consistent use of the variables used in the FREL, based on the information provided by the SMByC: the definition of forest, global warming potentials, emission factors by forest type, historical deforestation data for the Project area and its method of estimating emissions and their projection over time".

The project is consistent with the FREL because it uses official data from SMByC in terms of activity data and data from historical periods of deforestation in the region where the project is being developed, as well as the projection over time of forest area change (BAC). In addition, to ensure greater accuracy in the project's own emission factor data and not to generate an underestimation or overestimation, the project decided to establish permanent sampling plots in the project area following the guidelines of the document "*Protocol for the national and subnational estimation of biomass-carbon in Colombia*"¹⁶.

32.1.1. Uncertainty Management

Uncertainty is a classification attribute that reflects the degree of accuracy of the maps containing the activity data used for emissions calculations.

Under the PROCLIMA Program, uncertainty management is determined by the accuracy of the maps used to estimate activity data values and the application of discounts in emission factors. For activity data, the accuracy should be greater than 90%. The accuracy assessment should be made from the use of field observations or analysis of high resolution imagery. For emission factors, an uncertainty of 10% is acceptable for the use of average carbon values (assessment should be done per repository). If the uncertainty is greater than 10%, the lower value of the 95% confidence interval should be applied.

In this project we used the Forest - Non-forest maps for the years 2010, 2017 and 2020, developed by the IDEAM and its SMByC, which constitute official data of the forest cover in the national territory, which is why it **is not necessary to calculate the uncertainty for the activity data, i.e. for the quantification of the areas and the change in forest cover (CSB).**

On the other hand, for the calculation of the uncertainty of the emission factors, formula 15 of the tool "**Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities**" was used.¹⁷

¹⁶ 2011, Institute of Hydrology, Meteorology and Environmental Studies-IDEAM. All rights reserved. The texts may be used partially or totally quoting the source. Their total reproduction must be authorized by the Instituto de Hidrología, Meteorología y Estudios Ambientales-IDEAM.
<http://www.ideam.gov.co/documents/13257/13548/Protocolo+para+la+estimaci%C3%B3n+nacional+y+subnacional.pdf/11c9d26b-5a03-4d13-957e-obcciaf8f108>

¹⁷ <https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v4.2.pdf>

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

Where:

b_{TREE}	= Mean tree biomass per hectare in the tree biomass estimation strata; t d.m. ha ⁻¹
w_i	= Ratio of the area of stratum i to the sum of areas of tree biomass estimation strata (i.e. $w_i = A_i/A$); dimensionless
$b_{TREE,i}$	= Mean tree biomass per hectare in stratum i ; t d.m. ha ⁻¹
u_C	= Uncertainty in C_{TREE}
t_{VAL}	= Two-sided Student's t -value for a confidence level of 90 per cent and degrees of freedom equal to $n - M$, where n is total number of sample plots within the tree biomass estimation strata and M is the total number of tree biomass estimation strata
s_i^2	= Variance of tree biomass per hectare across all sample plots in stratum i ; (t d.m. ha ⁻¹) ²
n_i	= Number of sample plots in stratum i .

The uncertainty analysis yielded a value of **9.76%**, therefore the average biomass value is accepted under the uncertainty management guidelines of the REDD+ methodology as it is below 10%.

UNCERTAINTY					
Uncertainty	B_{Tree}	t_{VAL}	W	S_2	n
9,76%	332,79	1,725	1	7451,727231	21

32.1.2. Reducing Emissions from Deforestation

The avoided deforestation reduction projection was made in the following steps:

Activity Data:

- Determination of the reference region (ha);

- Calculate the annual **CSB** (forest area change) in the reference region from the analysis between the periods 2010 and 2017 (ha);
- Projection of the trend of the reference region in the project area (ha) and the adjustment for national conditions (%CN¹⁸) The adjustment for national conditions was made by taking the national value submitted by Colombia to the UNFCCC, which is the most conservative;
- Determine the area of Leakage and Calculate the annual **CSB** from the analysis between the periods 2010 and 2017 (ha);
- Calculate the **BSC** in the project area in the scenario with project (ha), projecting a 95% reduction in deforestation, taking into account that the project activities are aimed at conserving the entire eligible forest area.
- Calculate the **CSB** in the Leakage area in the with-project scenario. (ha) a 10% increase in leakage area is projected due to project activities.

32.1.2.1. Emission Factors

- Aboveground and belowground biomass

To estimate the aerial biomass of the CO₂Bio 2 project, the procedure for the selection and survey of plots was followed and after this, through office work and with the data collected in the field, the allometric equations were used, in this case the one corresponding to the Tropical Rainforest developed by Alvarez et al. (2012), taking into account the Holdridge classification characteristics, all the plots are located in this life zone, characterized according to their temperature and life zones (Allometric equations used for the estimation of aboveground biomass in natural forests in Colombia).

It should be noted that in the procedure for the selection and survey of plots, additional data were taken in addition to those required for the calculation of biomass according to the allometric equation selected, taking into account possible changes or situations that may arise during the development of the project and that will represent cost overruns in the collection of field data; Thus, the height data of the individuals sampled were disregarded, since in the allometric equation, the aerial biomass (BA) models are only expressed as a function of the normal diameter (D) of the individuals and the basic density of the wood (ρ); The same happened with the estimates of dead organic matter, specifically for litter, which had been contemplated for sampling, but when the cost-benefit study was carried out with respect to obtaining biomass, its contribution was not significant; therefore, it was decided to exclude this compartment from the calculation of carbon stock.

¹⁸The proposed reference level of forest emissions from deforestation in Colombia for payment for REDD+ results under the UNFCCC considers a national circumstances adjustment calculation. The project holder may adjust the value of CSB_{lb} following the guidelines in the annex for estimating the national circumstances adjustment (https://REDD+.unfccc.int/files/31122019_annexo_circumstances_nref_nal_v7.pdf).

Finally, the data obtained for the basic wood density (ρ), ([see annex BIOMASS DATA](#)), due to the complexity of its determination in the field, followed the guidelines of the protocol for the national and subnational estimation of potential carbon stocks stored in aboveground biomass in natural forests in Colombia, which proposes to use the databases reported by the IPCC (2003, 2006), Chave et al. among others for tropical species (all of them are available on the websites of the respective institutions). When wood density values are not available for a given species, the average of the higher taxonomic level (Genus or Family) should be used. For individuals without taxonomic information (e.g. indeterminate) the average of the density of the species found in the whole plot should be used, therefore, for the individuals, for which the specific wood density was not found, the guidelines described above were met.

$$BA = \text{Exp}^{((-2,406 + (1,289 \ln(D)) + (1,169 (\ln(D))^2) - (0,122 (\ln(D))^3) + (0,445 \ln(\rho)))}$$

Once the suitable allometric equation was selected, the aboveground biomass (AB) was calculated for each tree and the total aboveground biomass (TAB) for each plot. The latter is calculated as the sum of the biomass of all living trees. However, the aboveground biomass value is reported in units of tons per hectare (t ha⁻¹). For this, the value obtained per plot must be multiplied by the conversion factor according to the plot size used. Table 9 of the protocol for the national and subnational estimation of potential carbon stocks stored in aboveground biomass in natural forests in Colombia presents the conversion factors for each of the suggested plot sizes, in this case for the CO₂Bio 2 Project the correction factor of 4 was taken taking into account that the plot is 0.25 ha; after this, the resulting value is divided by 1000 to take it to tons (Equation 14) of the protocol.

$$BA = (\sum BA) * ((1 \text{ t}) / (1000 \text{ kg}))$$

Where, BA is the aerial biomass; kg is the unit of kilograms; t is the unit of tons, and FC is the conversion factor to be used according to the plot size used ([ANNEX 3.3 GIS - 2. GEODATABASE V2](#)).

Table 50 Location of plots

SUMMARY OF PLOTS			
Department	Municipality	N°	PROPERTY
CASANARE	TRINIDAD	1	LA PALMITA
CASANARE	TAURAMENA	2	BARLEY 1
ARAUCA	ARAUCA	3	PASTORA VIEJA
ARAUCA	ARAUCA	4	PATEVACO
CASANARE	PAZ DE ARIPORO	5	VILLA ESPERANZA
VICHADA	LA PRIMAVERA	6	EL SILENCIO
CASANARE	TAURAMENA	7	SAN FELIX
CASANARE	SAN LUIS DE PALENQUE	8	VILLA HERMOSA
CASANARE	OROCUE	9	LOT 5(HATO LA PALMITA)

CASANARE	TAURAMENA	10	Villanueva
CASANARE	TAURAMENA	11	BARLEY 2
CASANARE	OROCUE	12	THE ARABIA
VICHADA	PRIMAVERA	13	VAIVEN
CASANARE	TRINIDAD	14	PELIGRO
VICHADA	SANTA ROSALIA	15	LA BENDICIÓN
META	PUERTO GAITAN	16	EL TOLIMA
VICHADA	SANTA ROSALIA	17	EL CONDOR
VICHADA	LA PRIMAVERA	18	LOS ALCARAVANES
VICHADA	LA PRIMAVERA	19	LAS COROCORAS
VICHADA	CUMARIBO	20	YARITAGUA
VICHADA	CUMARIBO	21	BERLIN

Source: Cataruben Foundation

From the data analysis and application of the equations mentioned above, the emission factor for the forest in the project area was determined as shown in Table 51 column TEF (Total Emission Factor), The soil organic carbon value was taken from the NREF of the Orinoquia Biome presented by Colombia in 2019.

Table 51. Emission Factors

EMISSION FACTORS						
BA t/ha	BS t/ha	BT t/ha	C t/ha	Co2e t/ha	COSe t/ha	FET
332,79	79,87	412,66	193,95	711,16	11,90	723

Source: Cataruben Foundation

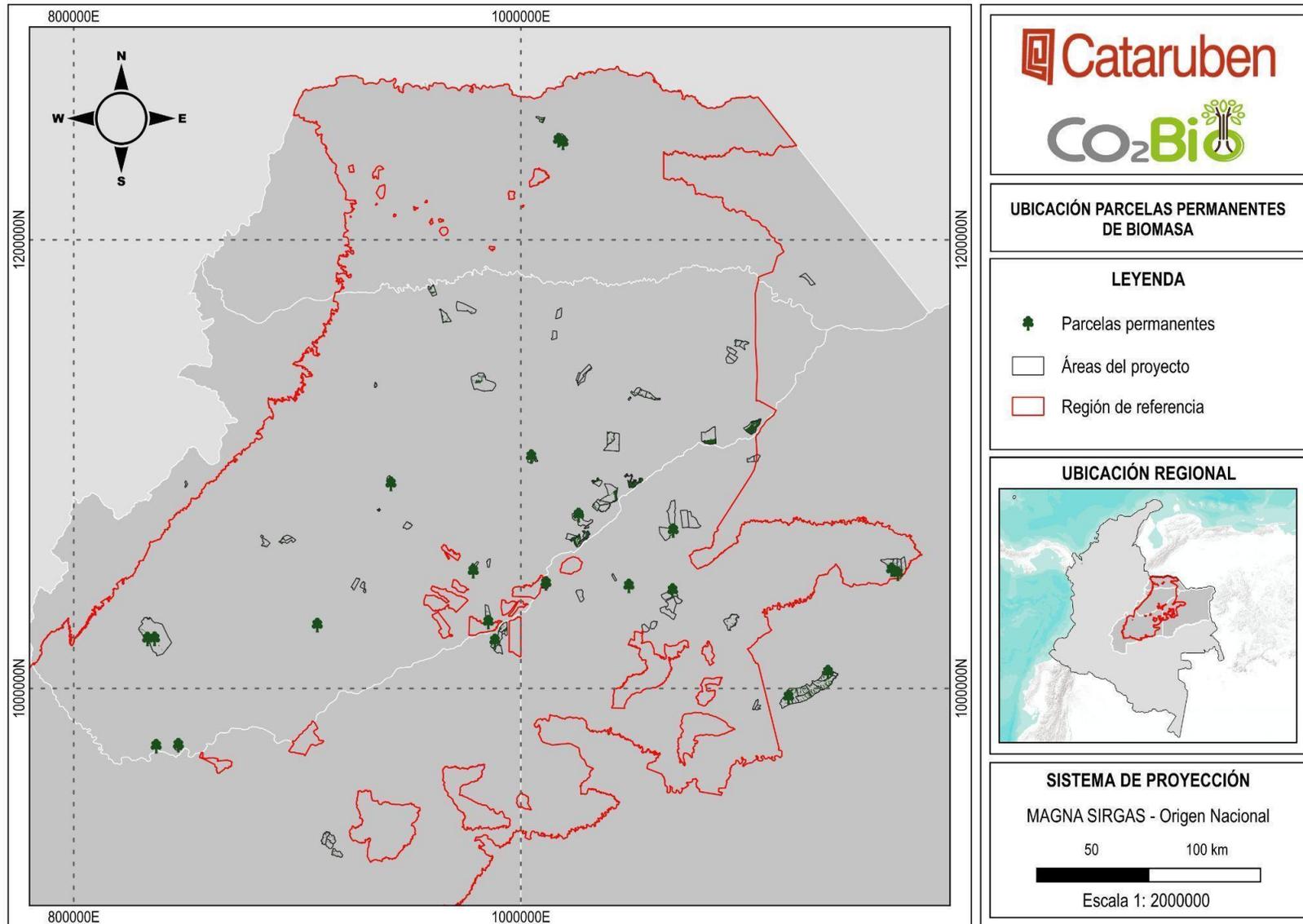


Figure. 34 Map of the location of REDD+ biomass plots.

Source: Cataruben Foundation

For the permanent monitoring plots, the protocol for the national and subnational estimation of biomass - carbon in Colombia (IDEAM 2011) was followed as established in section 3.1. Type, size and number of plots; Taking into account the above, the type of plot established corresponds to a permanent measurement, which is statistically more efficient and allows monitoring the changes registered in the carbon compartments of interest over time, as for the size of the plots according to the protocol, it is recommended to use plots of 0,25 ha (50 m x 50 m) because it is the most appropriate size to reach the required error in carbon estimates ($\pm 10\%$ with 95% confidence) in forestry projects and finally the number of plots which complies with the summary in Table 4 of the protocol (Plot size and number of sampling units to reach the required error (with 95% confidence) in carbon estimates.), finding that for a margin of error of ± 10 a minimum of 27 plots of 0.25 ha should be implemented, however, this information was verified with the decision tables in Annex 2, since, with this procedure any project developer dispenses with investing resources in pre-sampling, and omits the step of calculating the number of plots (n) described in section 4.3 of Chapter I of the protocol, therefore, in Annex 2 (Decision matrices for the selection of the number of plots according to the required size and error.) of Table 4 corresponding to the local analysis of seasonal tropical rainforest, with 21 monitoring plots of 50 X 50 The percentage error of 9.168 is identified, which is within the required range of $\pm 10\%$ with 95% confidence.

- COS defined in the most recent NRef for the Orinoquia Biome (tCO_{2e}/ha).

Table 52. Soil organic carbon (COS), COS_{20años} and COSeq for the five biomes of Colombia.

Bioma	COS (tC ha ⁻¹)	COS _{20años} (tC ha ⁻¹)	COSeq (tCO _{2e} ha ⁻¹)
Amazonía	74,0	3,7	13,6
Andes	125,0	6,25	22,9
Caribe	101,0	5,05	18,5
Orinoquia	65,0	3,25	11,9
Pacífico	92,0	4,6	16,9

Source:

Methodological document AFOLU sector (2021)

32.1.2.2. GHG Emissions in the Project analysis period

Emissions in the project area and in the leakage area in the analysis period (tCO_{2e}/ha/year) can be seen in Annex [ANNEX 10. MONITORING > 4. EMISSIONS > PROJECT2>1.REED+> 1.Emissions_CO2BIO2_REDD+_v1.xlsx > 1.](#)

32.1.2.3. Reduction of GHG Emissions in the scenario with the project

The conservative projection of emission reductions from the difference between project emissions in the with-project scenario and project emissions in the without-project scenario, as follows:

$$RE = EADEF, lb, year - EADEF, REDD + proj, year - EADEF, f, año$$

Table 53 shows the results of the calculations, column 1 shows the projected reductions year by year for a period of 30 years, in total 3,482,267 tCO_{2e} reduced. The projections are monitored and verified in the 2018-2020 monitoring report.

Table 53. Projected emissions reductions from deforestation in the analysis period 2018-2045 (30 years).

Reduced Emissions from Deforestation						
Project						
REDEF,REDD+proy (tCO2e)	t1	t2	EADEF _{,lb,year}	EADEF _{,REDD+proj,year}	EADEF _{,f,year}	
109.747	2.017	2.018	223.059	87.974	25.339	
116.728	2.018	2.019	234.587	92.521	25.339	
121.997	2.019	2.020	243.287	95.952	25.339	
126.151	2.020	2.021	250.147	98.657	25.339	
129.096	2.021	2.022	255.010	100.576	25.339	
128.033	2.022	2.023	253.255	99.883	25.339	
126.950	2.023	2.024	251.466	99.178	25.339	
125.874	2.024	2.025	249.689	98.477	25.339	
124.805	2.025	2.026	247.924	97.781	25.339	
123.744	2.026	2.027	246.172	97.090	25.339	
122.690	2.027	2.028	244.433	96.404	25.339	
121.644	2.028	2.029	242.706	95.723	25.339	
120.606	2.029	2.030	240.991	95.046	25.339	
119.574	2.030	2.031	239.288	94.374	25.339	
118.550	2.031	2.032	237.597	93.708	25.339	
117.534	2.032	2.033	235.918	93.045	25.339	
116.524	2.033	2.034	234.251	92.388	25.339	
115.522	2.034	2.035	232.595	91.735	25.339	
114.526	2.035	2.036	230.952	91.087	25.339	
113.538	2.036	2.037	229.320	90.443	25.339	
112.556	2.037	2.038	227.699	89.804	25.339	
111.582	2.038	2.039	226.090	89.169	25.339	
110.614	2.039	2.040	224.492	88.539	25.339	
109.654	2.040	2.041	222.906	87.914	25.339	
108.700	2.041	2.042	221.331	87.292	25.339	
107.753	2.042	2.043	219.767	86.676	25.339	
106.812	2.043	2.044	218.214	86.063	25.339	
105.878	2.044	2.045	216.672	85.455	25.339	

3.287.383 TOTAL PROJECTED EMISSIONS REDUCED BY PHASE 1

Source: Cataruben Foundation

The step-by-step calculations can be reviewed in [Annex 3.2.3 EMISSIONS >2. Emissions REDD+ P2 v2.xlsx](#)

32.1.3. Reduction of Emissions from Degradation

For the projection of emissions reductions due to avoided degradation, we followed the guidelines of the methodology based on the IDEAM and SMByC document "Estimation of forest degradation in Colombia based on a fragmentation analysis"¹⁹.

Activity Data:

- Determination of the reference region (ha);
- The annual **PFD AND SFD**²⁰ (primary and secondary forest degradation) in the reference region were calculated from the analysis between the periods 2010 and 2017 (ha);
- Trend projection of the reference region in the project area.
- The area of Leakage was determined and the annual **PFD AND SFD** were calculated from the analysis between the periods 2010 and 2017 (ha);
- The **PFD and SFD** were calculated in the project area in the scenario with project (ha).
- The **PFD and SFD** were calculated in the Leakage area in the scenario with project (ha).

32.1.3.1. Emission Factors

The average difference of CO₂e in the biomass of the transition classes (core, perforated and patch) was calculated in **tCO₂e/ha**, based on the aerial biomass map by forest type; in our case **BHT** (Tropical Humid Forest).

32.1.3.2. GHG Emissions in the Project analysis period

Emissions in the project area and in the leakage area in the analysis period (tCO₂e/ha-year) were calculated by multiplying the activity data by the emission factors.

32.1.3.3. GHG Emission Reduction in the scenario with the project

The conservative projection of emission reductions from the difference between project emissions in the with-project scenario and project emissions in the without-project scenario is shown in the table below.

¹⁹ Ramírez-Delgado J.P., Galindo G.A., Yepes A.P., Cabrera E. Estimation of forest degradation in Colombia through fragmentation analysis. Institute of Hydrology, Meteorology and Environmental Studies - IDEAM, Ministry of Environment and Sustainable Development - MADS, UN-REDD+ Colombia Program. Bogotá, 2018

²⁰ The area reported as degraded is that with a degradation trend in the two periods of analysis. That is, areas that move from a primary to a secondary class in one period and then return to a primary class will not be considered degraded.

Table 54. Projected Emission Reductions from Avoided Degradation

13.5 GHG EMISSION REDUCTIONS IN THE PROJECT SCENARIO					
13.5.1. DEGRADATION					
Emission reductions from avoided degradation					
REDEG, REDD+proy	t1	t2	EADEG, lb, year (tCO ₂ eq)	EADEG, REED+proy, year (tCO ₂ eq)	EADeg, f, year (tCO ₂ eq)
33.991	2017	2018	40.806	5566	1250
29.660	2018	2019	35.619	4709	1250
25.799	2019	2020	30.910	3861	1250
22.500	2020	2021	27.049	3299	1250
19.631	2021	2022	23.749	2869	1250
17.119	2022	2023	20.881	2512	1250
14.913	2023	2024	18.369	2207	1250
12.972	2024	2025	16.162	1940	1250
11.265	2025	2026	14.222	1707	1250
9.764	2026	2027	12.515	1502	1250
8.442	2027	2028	11.013	1322	1250
7.279	2028	2029	9.691	1163	1250
6.256	2029	2030	8.528	1023	1250
5.355	2030	2031	7.505	901	1250
4.562	2031	2032	6.604	793	1250

3.865	2032	2033	5.812	697	1250
3.251	2033	2034	5.114	614	1250
2.711	2034	2035	4.501	540	1250
2.236	2035	2036	3.961	475	1250
1.818	2036	2037	3.485	418	1250
1.450	2037	2038	3.067	368	1250
1.126	2038	2039	2.699	324	1250
841	2039	2040	2.375	285	1250
590	2040	2041	2.090	251	1250
369	2041	2042	1.839	221	1250
175	2042	2043	1.619	194	1250
4	2043	2044	1.424	171	1250
- 146	2044	2045	1.253	150	1250

Source: Cataruben Foundation

The step-by-step calculations can be reviewed in [Annex 3.2.3 EMISSIONS >2. Emissions REDD+ P2 v2.xlsx](#)

32.1.4. Summary of REDD+ Emission Reductions

Table 55 shows the projected reductions from deforestation and degradation for the period 2018- 2045.

Table 55 Summary of REDD+ Emissions Reduction Phase 1 CO₂Bio 2 Project.

PROJECTED EMISSIONS REDUCTION PERIOD 2018-2045				
PERIOD	YEAR	REDEF,REDD+proj (tCO ₂ e	REDEG,REDD+proj	REDD+ total year
1	2018	109.747	33.991	143.738
2	2019	116.728	29.660	146.388
3	2020	121.997	25.799	147.796

4	2021	126.151	22.500	148.651
5	2022	129.096	19.631	148.728
6	2023	128.033	17.119	145.152
7	2024	126.950	14.913	141.862
8	2025	125.874	12.972	138.846
9	2026	124.805	11.265	136.070
10	2027	123.744	9.764	133.508
11	2028	122.690	8.442	131.132
12	2029	121.644	7.279	128.923
13	2030	120.606	6.256	126.861
14	2031	119.574	5.355	124.929
15	2032	118.550	4.562	123.113
16	2033	117.534	3.865	121.399
17	2034	116.524	3.251	119.775
18	2035	115.522	2.711	118.233
19	2036	114.526	2.236	116.762
20	2037	113.538	1.818	115.355
21	2038	112.556	1.450	114.006
22	2039	111.582	1.126	112.708
23	2040	110.614	841	111.455
24	2041	109.654	590	110.244
25	2042	108.700	369	109.069
26	2043	107.753	175	107.928
27	2044	106.812	4	106.816
28	2045	105.878	- 146	105.732
TOTAL		3.287.382,5	247.796,6	3.535.179,1

Source: Cataruben Foundation

As more hectares are included in each of the phases the projections will be adjusted.

33. DOUBLE COUNTING

The project will trade carbon reduction units in a single certification program and will be traded in the Colombian voluntary market and through PROCLIMA's platform and is expected to make use of the RENARE platform established in resolution 1447 of 2018 for the management of climate change project information. In the case of quantification calculations in carbon accounting, double counting or the use of overlapping areas is reduced to zero.

34. MONITORING PLAN

The following is the monitoring plan designed to evaluate changes in project boundaries, REDD+ activities, REDD+ safeguards, co-benefits and SDGs, project permanence and project emissions, based on the established methodological guidelines, in order to generate accurate and quality information in the verification process.

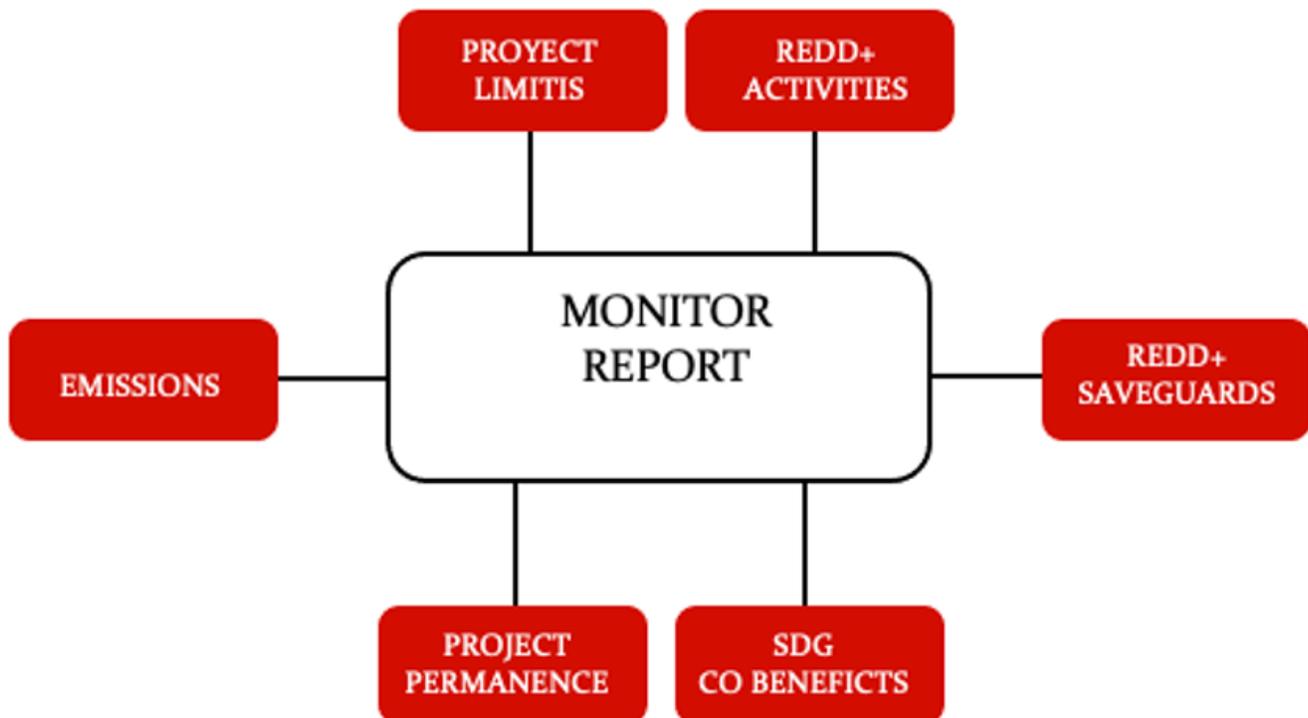


Figure. 35 Forest ecosystem monitoring plan, period 2018-2020.

Source: Cataruben Foundation

34.1. PROJECT BOUNDARY MONITORING

The methodology establishes the monitoring of the geographical limits of the project, this activity is developed in each verification, following a Geographic Information System (GIS) for the reference region, the total areas of the project, the eligible areas and the leakage belt ([ANNEX 3.3 GIS - 2. GEODATABASE V2](#)); the above according to the stipulated in numeral 28 (Spatial and Temporal Limits) of this document.

34.2. MONITORING PLAN FOR THE IMPLEMENTATION OF REDD+ ACTIVITIES

The REDD+ activities have a proposed implementation period from 2018 to 2045, which includes environmental, social and economic baseline surveys, as well as the implementation of action plans with deadlines agreed with the landowners. Table 56 shows the REDD+ activities with the proposed indicators, type, target and time for compliance, as well as the unit of measurement.

Table 56. REDD+ activities and their indicators for reporting measurement progress

ID	REDD+ ACTIVITIES	Indicator ID	Indicator name	Type	Goal	Unit of measure	Monitoring methodology	Frequency of monitoring	Responsible for measurement
1	Implement training and accompaniment processes through training cycles that strengthen the sustainable management of ecosystems and biodiversity conservation.	1.1	Number of people trained in the conservation and sustainable management of ecosystems and their biodiversity.	Strengthening of capacities in environmental management of farms	80	Unit	Application of training or workshops	Annual	Cataruben Foundation
2	Consolidate and adapt governance principles for sustainable ecosystem management.	2.1	Number of properties characterized	Socio-environmental survey of the properties	97	Properties	Characterization of properties by means of property characterization sheets, management plan, beneficiary households, among others.	Annual	Cataruben Foundation
		2.2	Number of follow-up reports on the implementation of activities to strengthen governance structures	Strengthening of forest governance structures	1	Document	Under the monitoring of the governance action plan, a report will be generated every 5 years, once the first verification has been carried out.	Every 5 years	Cataruben Foundation

3	Promoting forest legality	3.1	Number of forest harvesting permits	Accompaniment in the process of legal forest harvesting on the properties.	1	Document	Monitoring of eligible ecosystem areas for evidence of changes in coverage or at the request of a landowner.	Annual	Cataruben Foundation
4	Promote the delimitation and signaling of strategic ecosystems and natural protection areas.	4.1	Number of reports on the process of delimitation and marking of forest areas according to established guidelines.	Forest conservation	1	Unit	Visit to properties and photographic record	Annual	Cataruben Foundation
		4.2	Number of properties with implemented delimitation and signaling activities		97	Properties	Follow-up in the field and through evidence provided by the owners of the execution of activities once the first verification has been carried out.	Every 5 years	Cataruben Foundation
5	Promote and improve agricultural production, livestock (on existing lands) and tourism, through the implementation of good sustainable practices.	5.1	Number of properties with characterized productive activities	Implementation of sustainable production practices	97	Properties	Socio-productive recognition of the properties by means of a psychosocial and socioeconomic sheet and a survey of beneficiary households.	Annual	Cataruben Foundation
		5.2	Number of properties with implemented sustainable productive		97	Properties	Follow-up of evidence generated in the field or provided by the landowners	Annual	Cataruben Foundation

			activities						
6	Generate alerts of changes due to deforestation, degradation and/or transformation of ecosystems in the project area and its surroundings.	6.1	Number of properties with satellite analysis to identify changes due to deforestation, degradation and/or transformation of eligible areas.	Preventing deforestation, degradation and/or transformation of ecosystems	97	Properties	Coverage monitoring report	Annual	Cataruben Foundation

Source: Cataruben Foundation.

Annex 3.2.1. Monitoring of REDD+ Activities shows the monitoring methodology, monitoring frequency and the person responsible for measurement.

34.3. REDD+ SAFEGUARDS MONITORING PLAN

The CO₂Bio 2 project has designed a series of activities with their respective indicators to monitor compliance with the REDD+ social and environmental safeguards defined for Colombia. This has sought to prevent the environmental and social risks of the project, thus avoiding the impact on the social, economic and cultural rights of the landowners and their families. Table 57 establishes the monitoring plan with the projection of the indicators to be measured for each safeguard, followed by a description and evaluation of each of the 15 safeguards in the context of the project. The monitoring report section evaluates the progress of the goals for the period 2018 to 2020.

Table 57. REDD+ safeguards

Indicator ID	Indicator name	Type	Goal	Unit of Measurement	Monitoring methodology	Frequency of monitoring	Responsible
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1.1	Percentage of land declared as Civil Society Nature Reserves (CSNR)	Contribute to and be consistent with national objectives	20%	Properties	Obtaining resolutions approving the declaration	Annual	Cataruben Foundation
2.1	Number of updates and registration in the RENARE platform	Contribute to guaranteeing the right to information.	1	Unit	Recording and updating in the RENARE platform of the activities carried out once the platform is operational.	Annual	Cataruben Foundation
3.1	Number of Biodiversity and Carbon Fora held	Strengthen transparency in the development of the project.	1	Forums	Forums held where a record of attendees and a report will be taken.	Annual	Cataruben Foundation
4.1	Percentage of properties whose governance activities have been characterized.	Identify the degree of implementation of activities that ensure governance	100%	Predios	Photos, logbooks, personnel contracts, housing on the properties, etc.	Annual	Cataruben Foundation
5.1	Number of people trained	Strengthen technical and legal skills in project-related issues.	59	Unit	Site visits and data collection	Annual	Cataruben Foundation
NOT APPLICABLE							
7.1	Number of properties with diagnosis of households, tradition of beneficiaries and follow-up on indicators	Integrating traditional knowledge into the implementation of REDD+ activities	59	Properties	Surveys and processing of results	Every 2 years	Cataruben Foundation
8.1	Percentage of properties with higher economic benefits	Contribute to making the project sustainable for the	100%	Properties	Carbon certificates traded per property	Every 5 years	Cataruben Foundation

	resulting from conservation	owners and their families.					
9.1	Number of properties characterized and with strengthened land planning	Contribute to guaranteeing the land rights of landowners.	97	Properties	Elaboration and updating of property plans	Every 5 years	Cataruben Foundation
10.1	Number of beneficiaries fully and effectively informed about the project	Ensuring full and informed participation of owners	97	Unit	Signing of the binding and updating contracts by both parties	Every 12 years	Cataruben Foundation
11.1	Percentage of implementation of the stages of the participatory biodiversity monitoring strategy (%).	Biodiversity conservation	100%	Stages	Follow-up of the execution of the strategy stages, reporting documents	every 2 years	Cataruben Foundation
12.1	Number of analyses of ecosystem integrity, structure and composition of the forest	Monitoring the provision of ecosystem services	6	Analyses performed	Remote sensing, attendance lists, photographic registration	Every 5 years	Cataruben Foundation

13.1	Number of instruments or mechanisms for protected area management strengthened	Contribute to regional environmental management	4	Unit	Relationship between the Regional Environmental Plan, PRICCO, the Regional System of Protected Areas (SIRAP) of the Orinoco and the REDD+ activities of the project.	Annual	Cataruben Foundation
14.1	Number of properties in land legalization process	Contribute to the formalization of land ownership.	97	Properties	Follow-up process	Every 5 years	Cataruben Foundation
15.1	Number of spatial analyses to assess deforestation as a control of emissions leakage	Decrease potential displacement of emissions by displacement of land use change causes and agents.	30	Analyses performed	Spatial analysis and deforestation calculations	Annual	Cataruben Foundation

Source: Cataruben Foundation

34.4. SUSTAINABLE DEVELOPMENT GOALS MONITORING PLAN

The project seeks to contribute to three Sustainable Development Goals, these are: Climate Action (13), Life of Terrestrial Ecosystems (15) and Gender Equality (5). The specific target to which it contributes to the thirteenth goal on Climate Action is: (13.3) Improve education, awareness and human and institutional capacity for climate change mitigation, adaptation, mitigation and early warning.

To this end, the project will carry out training and support processes with landowners to strengthen sustainable forest management, as well as training on climate change, declaration of Civil Society Nature Reserves, strengthening the principles of forest governance and implementation of the management plan that will allow the preservation of this ecosystem. The procedure for the evaluation of this goal will be the follow-up of the attendance record to the training, the evaluation of the knowledge acquired and its subsequent implementation in the activities developed in each property.

The target to which the project contributes to the fifteenth objective on Life of Terrestrial Ecosystems is: (15.1) To ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and the services they provide, in particular forests, wetlands, mountains and drylands, consistent with obligations under international agreements.

To this end, the project will contribute to the declaration of Civil Society Nature Reserves (CSNR) in more than half of the participating properties, thus contributing to the protection and sustainable use of ecosystems and the ecosystem services they provide. The procedure for the evaluation of this goal will be to follow up on the issuance of CSER resolutions, the preparation or updating of management plans or property plans with the identification of ecosystem, biodiversity, socioeconomic and productive conditions, and the monitoring of compliance with conservation activities.

The project will contribute to the fifth objective on Gender Equality, especially to the target: (5.5) Ensure women's full and effective participation and equal leadership opportunities at all decision-making levels in political, economic and public life. This will be done through meetings with women owners and women members of the families, as well as their participation in workshops on strengthening project governance and training spaces for the appropriation of knowledge and skills on climate change mitigation, biodiversity conservation and sustainable production practices. The procedure for the evaluation of this goal will be the monitoring of the participation of the owners and other women beneficiaries, and the fulfillment of the objectives or activities of the project that are led by them.

The criteria and indicators defined for the contribution of the three Sustainable Development Goals (SDGs) are presented below:

Table 58. Monitoring plan for the Sustainable Development Goals.

Target	Objective goal	Indicator name	Goal	Unit of Measuret	Monitoring methodology	Frequency of monitoring	Responsible
(13) Climate action	(13.3) Improve education, awareness, and human and institutional capacity for climate change mitigation, adaptation, mitigation, and early warning.	Climate change mitigation trainings	20	Number of trainings conducted	Visits to the properties for training and information gathering	Every 5 years	Social Unit
(15) Life of terrestrial ecosystems	(15.1) Ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems and the services they provide, in particular forests, wetlands, mountains, and drylands, consistent with obligations under international agreements.	Civil Society Nature Reserves	42	Number of properties declared as Natural Reserves of the Civil Society	Obtaining resolutions that approves the declaration	Annual	Social Unit and Biodiversity Unit
(5) Gender equality	(5.5) Ensure women's full and effective participation and equal opportunities for leadership at all decision-making levels in political, economic, and public life.	Women's participation in decision making	500	Number of women beneficiaries of the project participating in decision making spaces.	Creation of spaces and participation activities about the project with women beneficiaries.	Every 2 years	Social Unit

Source: Cataruben Foundation

34.5. CO-BENEFITS MONITORING PLAN

The procedures related to the monitoring of co-benefits and the special Orchid category are presented below, as well as the criteria and indicators defined to demonstrate the additional benefits and the measurement of the co-benefits of the Orchid category.

34.5.1. Biodiversity conservation

34.5.1.1 Biodiversity conservation and ecosystem services.

- **Declaration of Civil Society Nature Reserves (CSNR).**

The Cataruben Foundation, within the framework of the project, promotes the declaration of private properties as CSNR, as part of the strategy for the conservation of natural ecosystems and biodiversity. For this, we will provide technical and legal advice and support to landowners requesting the registration of their properties as CSNR before the National Natural Parks of Colombia (PNNC), as well as participating in each of the steps of the declaration process, which consist of:

- Identification, characterization and analysis of the biotic and abiotic components.
- Preparation of the environmental management plan.
- Follow-up of the registration process, accompaniment, or visit by PNN.

This process will be monitored on an annual basis, with follow-up and management of each of the previous steps, resulting in the final resolution of the declaration as a CSER.

- **Identify, recognize and evaluate Key Areas for Conservation (KBAs).**

In addition to the CSNR declaration, a KBA identification exercise will be carried out to determine if there are already identified KBAs in the project area or if there are potential areas to be designated as KBAs. To this end, each of the criteria established in The Global Standard for the identification of Key Biodiversity Areas, which aim to locate and highlight areas that contribute significantly to the global persistence of biodiversity (IUCN, 2016), will be evaluated. This identification process will be carried out only once, however the biological conditions of the identified KBAs will be monitored every 5 years.

34.5.1.2. Encourage the use of native species

As mentioned above, the project activities do not involve the use of invasive species. However, landowners may introduce this type of species into productive systems in search of greater efficiency or profit. In this regard, there will be a cycle of socializations about the impact of invasive species on biodiversity, as well as the use of native species in agroforestry systems, sustainable cattle ranching and restoration through revegetation or enrichment of forests, morichales and other palm groves, recognizing the benefits they generate.

34.5.2. Community Benefits

34.5.2.1. Identifies and strengthens mechanisms for social and community participation.

The indicator to be measured is the number of actions of the SIMAP (in Spanish) and SIRAP (in Spanish) Action Plan supported by the project and implemented through the strengthening of the participation of the different stakeholders. The procedure for annual monitoring of the strengthening of social and community participation mechanisms at the local and regional level will be carried out through meetings of the parties involved in the SIMAP and SIRAP and reports on the activities implemented to support the sustainability of the project mechanisms.

34.5.2.2. Benefits to small-scale production systems

Short-term benefits to small-scale productive projects with members of the communities in the project area will be measured through the percentage of income invested in optimizing the productive projects of the owners and their families. And the long-term benefits will be focused on measuring the increase in the sustainability of the productive projects, the indicator to measure it is: No. of hectares with sustainable productive management and conservation of ecosystem services provision. The procedure for annual monitoring of the indicators is through the activities carried out by the owners to make livestock farming sustainable, to establish green businesses, ecotourism or to declare the properties as Natural Reserves of the Civil Society that unite production with conservation.

34.5.2.3. Average net increase in income of local producers

The average net increase in the income of local producers from REDD+ activities will be measured through the difference between the average annual net income without the project and the amount of income taking into account the income received from the sale of carbon certificates and the profits from the investment in productive projects. The procedure for monitoring the indicator **is through** the reporting of income from landowners and investments in their productive systems that are derived from the increase in their income from the sale of carbon certificates resulting from REDD+ activities.

34.5.3. Gender Equity

34.5.3.1. Consider determinants set forth in the regulatory framework related to gender: (a) Law 731/02 on Rural Women

To measure the contribution and strengthening of the improvement of the quality of life of rural women through competencies for social entrepreneurship with a focus on gender, the number of women who participate and implement the competencies in this type of entrepreneurship in their productive activities will be quantified. The procedure to follow up on this is through attendance to training and workshops, as well as the accompaniment of the entrepreneurial activities of rural women who are part of the project.

34.5.3.2. Demonstrates that it considers determinants set forth in the normative framework related to gender: (b) Policy Guidelines for Women's Equity 2012.

The strengthening of processes that contribute to cultural transformation in favor of non-discrimination, raising awareness through training to eradicate stereotypes about the role of women in rural areas will be measured through the percentage of participation of women owners and women beneficiaries of the project, as well as through the number of men who recognize the importance of the work they perform in rural areas. The procedure for monitoring this is the control of attendance at workshops and the evaluation of knowledge in this regard, in addition to monitoring the empowerment of women through achievements in the educational and labor dimensions.

34.5.3.3. Ensures women's full and effective participation and equal leadership opportunities at all levels of decision-making at the project level.

The project's contribution to women's full participation and equal leadership opportunities in all areas of the project will be measured by the number of women owners and beneficiaries participating in the project's decision-making spaces, as well as the number of women leaders in the different units that make it possible to monitor project activities. The procedure to follow up on this is the attendance record of women participating in the project's decision-making spaces, as well as human resources management, through the monitoring of gender equity in recruitment and selection, professional development, training, remuneration, family-work life, environment, occupational health and risk, sexual and labor harassment. And through the external projection of the company, in the company's image and language in its institutional communication.

34.5.4. Adaptation to Climate Change

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

The activity proposed in the National Climate Change Policy that is considered in the project is "evaluation of the conservation status of ecosystems associated with areas of water supply, flooding and drought, and sea level rise, such as water sources and watersheds within priority watersheds, and mangroves in coastal areas". In the project area, the biological conditions of the ecosystems associated with water sources and water courses will be identified and characterized, describing their conservation status, diagnosing the tangible and intangible value of the ecosystem services they provide, and managing actions to maintain or improve their conservation.

This activity will be carried out periodically (every 5 years) in order to demonstrate changes or trends in biodiversity conditions and the provision of ecosystem services. For this purpose, remote sensing methodologies, official cartographic information of the project area (as updated as possible) and field visits will be used.

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

A cycle of trainings will be held where knowledge and experiences will be shared among beneficiaries, professionals and technicians of the project, about activities that generate sustainable productive landscapes and low carbon suitable for the project area. In this space, the protocol for the implementation of these activities will be designed in a participatory manner, which will include the methodology, implementation times, as well as a general evaluation of the benefits generated by these activities. In addition to this, whenever required, technical support and advice will be provided to the beneficiaries in the implementation.

It is important to mention that once the protocol for the implementation of sustainable and low-carbon productive activities (selected by the beneficiaries) is designed, new specific indicators will be established to monitor the implementation of these activities throughout the project.

34.5.4.3. Designs and implements adaptation strategies based on an ecosystem approach.

The beneficiaries of the properties will implement climate change mitigation activities based on an ecosystem approach related to mitigating the effects of the dry season. These activities correspond to fire control by means of fire breaks and shrub and bush management, which reduce the degradation of vegetation cover and soils caused by fire. On the other hand, the implementation of water harvesting ensures greater availability of water resources during the dry season through reserve systems that allow water to be stored during the rainy season.

The implementation of these activities will be carried out under the technical assistance of the group of professionals of the project, through training and continuous monitoring. Finally, the implementation of these activities will be monitored annually by following up on the establishment of the activities, as well as a report describing how they helped reduce the effects of fires and water shortages during the drought season.

34.5.4.4. Designs and implements adaptation strategies based on an ecosystem approach.

The implementation of activities to adapt to the dry season will be monitored, corresponding to guardrails, bush and shrub management and water harvesting. These activities must be implemented by the beneficiaries on an annual basis (only one or both activities can be implemented on the farms) according to the seasonality of the region. The monitoring of these activities includes a description of the implementation of the activity, and how it helped to reduce the effects of the dry season.

Finally, the monitoring plan of the co-benefits generated by the project corresponding to the Orchid category is summarized in the following table.

Table 59. Co-benefits monitoring plan

Category Orchid							
Components	Cobenefit	Indicator name	Goal	Unit of measure	Monitoring methodology	Frequency of monitoring	Responsible
Biodiversity conservation	Develops effective actions and measures to halt the loss of biological diversity, favoring that ecosystems continue to provide essential services.	CSNR Statement	50%	Percentage of properties declared as CSERs	Obtaining resolutions that approves the declaration	Annual	Biodiversity Unit
		Evaluation of KBA status	7	Report	Report describing the status of the KBAs in the project area.	Every 5 years	Biodiversity Unit
	Due to project activities, no invasive species have been introduced.	Assistance in the identification and management of invasive species	100%	Percentage of implementation of training and accompaniment programs carried out	Attendance lists, photographic record, progress report, etc.	Every 2 years	Biodiversity Unit
Benefits on communities	Identifies and strengthens mechanisms for social and community participation at the local and regional levels.	Protected area systems	4	Number of environmental management mechanisms strengthened	Minutes and progress in the action plans resulting from the project	Annual	Social Unit
	The initiative generates short- and long-term benefits to small-scale productive projects with members of the communities in the project area.	Sustainability in productive projects	70%	Percentage of farms with sustainable production practices	Changes recorded through field logs, evidence of sustainable production practices and their profitability.	Annual	Social Unit
	Activities under the GHG mitigation initiative produce an average net increase in income for local producers.	Increased in producer income	100%	Percentage of homeowners with increased income	Changes in owners' equity in income from business activities	Every 2 years	Social Unit

Gender equity	It considers determinants set forth in the normative framework related to gender: (a) Law 731/02 on Rural Women (b) Women's equity policy guidelines	Women entrepreneurs	50%	Percentage of women participating and implementing entrepreneurship competencies with a gender perspective.	Attendance at trainings and workshops, as well as accompaniment of activities	Every 5 years	Social Unit
	Ensures women's full and effective participation and equal leadership opportunities at all levels of decision-making at the project level.	Valuation of rural women's work	100%	Percentage of women and men trained in avoiding gender discrimination and valuing women's work.	Attendance at workshops and evaluation of knowledge, and accompaniment of achievements in the educational and labor dimensions of women.	Every 2 years	Social Unit
Adaptation to climate change	Consider any of the activities proposed in the National Climate Change Policy.	Conservation of water sources	7	Number of evaluations performed.	Assessments of the status of ecosystems associated with water sources.	Every 5 years	Biodiversity Unit
	Implements activities that generate sustainable and low-carbon productive landscapes.	Follow-up on the implementation of the protocol for the establishment of activities that generate sustainable and low-carbon productive landscapes.	100%	Percentage of implementation of sustainable low-carbon productive activities, according to the designed protocol.	Record of evidence: photographs of the training, attendance lists, implementation protocol, visit logs.	Every 2 years	Biodiversity unit
	Design and implement adaptation strategies based on an ecosystem approach.	Implementation of fire breaks, brush and shrub management activities for fire control	80%	Percentage of properties that implement the strategy	Reporting	Annual	Biodiversity unit
		Implementation of water harvesting	50%	Percentage of properties implementing the	Reporting	Annual	Biodiversity unit

				strategy.			
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Source: Cataruben Foundation

34.6. PERMANENCE MONITORING

In accordance with the PROCLIMA methodology (Version 2.2-2021), a reserve of 15% of the total GHG reductions or removals quantified for each verified period is deducted and maintained. This reserve is made in order to guarantee that if events occur that require the replacement of credits placed in the market, this 15% will be used to cover those affected.

Project permanence monitoring will be carried out at each periodic verification previously stipulated by the Project Owner, under the following indicators and following the established procedures:

34.6.1. Biophysical risks

Fires: account the geographical location - and climatic characteristics - of the project area, and the anthropic activities that take place there, such as the use of fire for burning biomass and expanding the borders for agricultural or livestock purposes, where these uncontrolled fires destroy vegetation cover, especially grasslands, pastures and natural forests and their respective degradation, forest fires are an issue of considerable relevance in the implementation of the CO₂Bio project.

Therefore, in the event that a forest fire is generated on a property and affects the project's REDD+ conservation areas, a written record must be generated, as well as photographs and testimonies to establish the procedure to follow, the affected areas must be included and the CO₂ and CH₄ emissions must be estimated and included in the quantification of emissions.

In this way, different activities were implemented on the properties that are in line with the conservation activities established in the contractual contract signed with the landowners, so from the REDD+ activities, the following prevention measures are shared to avoid a forest fire disaster:

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

Floods: Floods are an issue of environmental concern in the forest ecosystem, since, they can affect ecological communities (both flora and fauna), either because they cover them or because they wash them away. The force of the water carries away part of the substrate and vegetation, as well as shallow seeds, which can affect the species' ability to resprout and therefore colonize. Another of the effects that floods can have on the environment is the dispersion of pollutants when they occur in areas where such substances are present.

However, it is important to mention that in the project area floods are periodic and very characteristic, so the negative impact on carbon stocks is reduced or null, however, such floods that may occur in areas where this risk was not foreseen, may affect the beneficiaries or those who live on the land, making access difficult or giving rise to large economic losses.

34.6.2 Socioeconomic Risks.

-Land tenure disputes : Land tenure and the exercise of forest governance is a priority issue in project implementation, since land tenure allows social, cultural and environmental practices to be centralized, sustainable and equitable, thus regulating the way in which communities relate to each other and to their environment in general. Weak governance has adverse effects on social stability, sustainable use of the environment, investment and economic growth.

As a prevention and mitigation plan in the first place, one of the requirements to be part of the project is compliance with legal requirements; whose main objective is to establish the legality of the properties, demonstrating the land tenure according to the provisions of CONPES 3859 of 2016, as owner (who holds the real right of the domain that appears in a real estate registration folio), possessor (who on a real estate of private nature acts with the spirit of owner with the conviction of being it, but without being able to demonstrate compliance with the requirements of the real estate tradition that legally validly accredits him as owner) or holder (who uses and enjoys a real estate property for which the existence of an owner is recognized), at least during the period of quantification of GHG reductions or removals.

The following documents demonstrate the veracity and legality of each of the project participants, as well as their properties, so that the following information can be corroborated in the documents attached to the validation process: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the project.

REDD+ activities also address the issue of forest governance, where knowledge about this exercise is strengthened through training, workshops and lectures.

-Project stakeholder conflicts : The main prevention measure to avoid conflict between the project stakeholders which are the Owners or beneficiaries, USAID, Cataruben Foundation and subsequent buyers of carbon certificates, is to manage the agreements, linkage contracts or alliances adhering to Colombian regulations, where they are properly socialized, understood and signed by the parties involved, so that there is full knowledge of the different stages and processes of the implementation of the CO₂Bio 2 project; what is generated outside the regulatory context, will be strictly dealt with by the legal area of each of the parties.

Non-ownership of project stakeholders: The main indicator of project implementation is compliance with REDD+ activities, which are described in the linkage contracts, clarifying annexes and other legal and technical documents; therefore, any failure to comply with the commitments described therein will be dealt with as specified in the contracts. However, another preventive measure is the monitoring of safeguards (social and environmental axis), where it is possible to have an overview of the possible leaks that may occur in the project, which allows exercising greater control in this type of project.

Governance Deficit: We diagnosed all the properties where we will determine the presence of personnel, if they have housing, and if it is in good conditions of habitability and sanitation, we will visit the properties and fill out various forms to see the progress in terms of the different levels of governance that are carried out in each property.

Table 6o. Permanency monitoring plan

NO	Activity	Type of Risk	Risk	INDICATOR	Impact	Probability	Rating (Probability Impact)	Risk Classification		MITIGATION ACTIONS	PROCEDURE
								Value	Level		
1	Fire	PHYSICAL	Loss of forest cover due to fire	# of fires present in the eligible project area.	2	2	4	2	Medium	1. Disposal of biomass that can function as fuel in a fire. 2. Establishment of firewalls 3. Implementation of guardrails 4. Avoid burning in critical summer seasons.	Fire monitoring is carried out with the help of the "Global Forest Watch" platform, which allows us to upload data from the project areas and create alerts for fire detection using VIIRS (Visible Infrared Imaging Radiometer Suite) technology. In addition to satellite monitoring, the impact of the fires was corroborated by field visits.
2	Flooding	PHYSICAL	Substrate and plant material washed away, loss of life, loss of infrastructure, loss of agricultural crops, loss of crops.	# of unusual flooding reports	2	1	2	1	Low	Do not locate houses near water sources, keep control of the maximum flood levels that occur year after year in the properties.	Constant communication is maintained with the owners; in the event of flooding with major impacts, a report will be made by filling out a form, in order to proceed with the measures to be taken.
3	Preservation agreement	ECONOMIC	The owner fails to comply with its obligations under the contract.	# of Reports of non-compliance recalls	2	2	4	2	Medium	Socialize and agree with the owner on the contract, its scope in time and commitments, sign it and carry out constant follow-up	Monitoring of safeguards (social and environmental) and REDD+ activities is carried out in compliance with the contract signed by the landowners.

4	Social ownership of the project	SOCIAL	That the Cataruben Foundation has no credibility in the project.	# of Complaints about credibility issues	1	2	2	1	Low	Make economic alliances for the development of the project with prestigious organizations with a high level of compliance guarantee.	PCC management procedure
5	Land tenure dispute	SOCIAL	Loss of the property	# of properties with possession or tenure of the land	1	1	1	1	Low	Perform title analysis prior to signing the contract, maintain constant communication with the owner regarding the legal status of the property, update the Certificate of Title and Freedom every 5 years.	The following documents are verified: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the CO2Bio project.
6	Non-ownership of project stakeholders	SOCIAL	If either party fails to fulfill its obligations under the contract.	# of conflicts between the different parties involved	2	2	4	2	Medium	Sign the contract jointly, knowing the limitations, commitments and benefits.	PCC management procedure
7	Indicator monitoring	ECONOMIC	Lack of adequate monitoring personnel	# of non-compliance reports in monitoring.	2	1	2	1	Low	The Cataruben Foundation is staffed by experts in monitoring issues.	PCC management procedure
8	Governance deficit	SOCIAL	Abandonment of the properties, noncompliance	# of acknowledgements of forest governance	1	1	1	1	Low	Governance actions were implemented on the	Follow-up on the indicator of safeguard #4, which establishes the indicators to determine the level of

			with governance activities	structures					properties and their constant monitoring.	implementation of governance in the properties.
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Source: **Cataruben** Foundation

34.7. PROJECT EMISSIONS MONITORING

Project emissions are performed periodically according to the monitoring report analysis periods, updating the activity data and emission factors, based on the monitoring of the project limits.

The calculations follow the guidelines of Proclima's REDD+ methodology numeral 14.15.

35. REDD+ MONITORING REPORT (2018-2020)

The following is the monitoring plan designed to evaluate changes in project boundaries, REDD+ activities, REDD+ safeguards, Co-benefits, project permanence and project emissions and SDGs, this last activity is evaluated from the year (2016), the project start date; based on the established methodological guidelines, in order to generate accurate and quality information in the verification process.

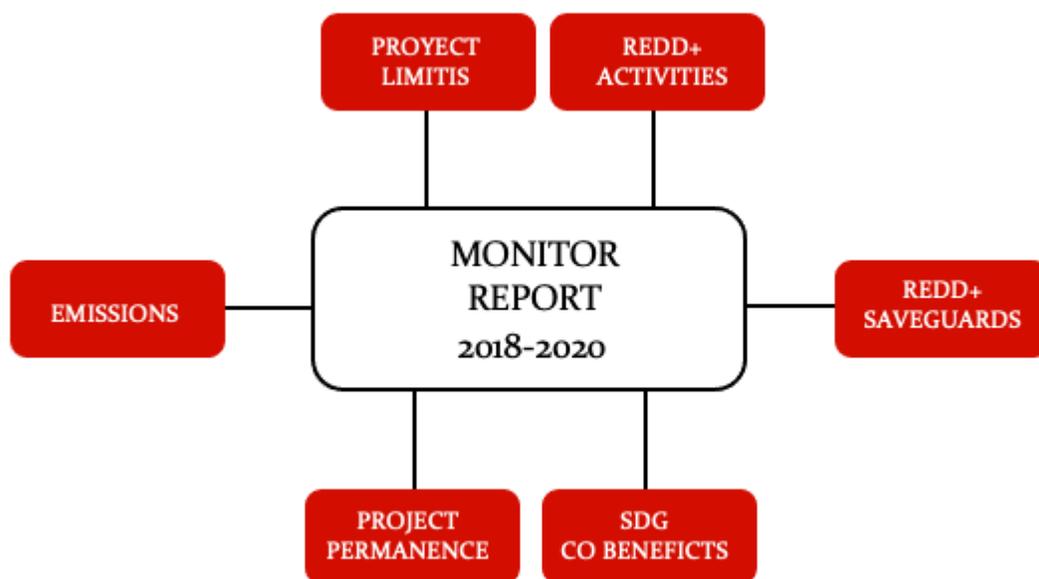


Figure.36 Forest ecosystem monitoring plan, period 2018-2020.

Source: Cataruben Foundation

35.1. PROJECT BOUNDARY MONITORING

35.1.1. Reference region

The boundaries of the reference region remained stable during the monitoring period, thus maintaining its extension of 11,699,109 ha.

35.1.2. Project area

During the monitoring period, no new properties were included in the project, so the project areas remained stable.

35.1.3. Eligible Areas

Eligible areas were updated, taking into account those that remained stable during the monitoring period.

Table 61. Eligible REDD+ areas

Eligibility	Area (ha)	Percentage (%)
Eligible	19,841	15.6%
Not Eligible	107,121	84.4%
Total	126,962	100%

Source: Cataruben Foundation

35.1.4. Leakage area

Leakage area monitoring was conducted under the same eligibility criteria, i.e., forest areas present in a 100 m buffer around the project areas.

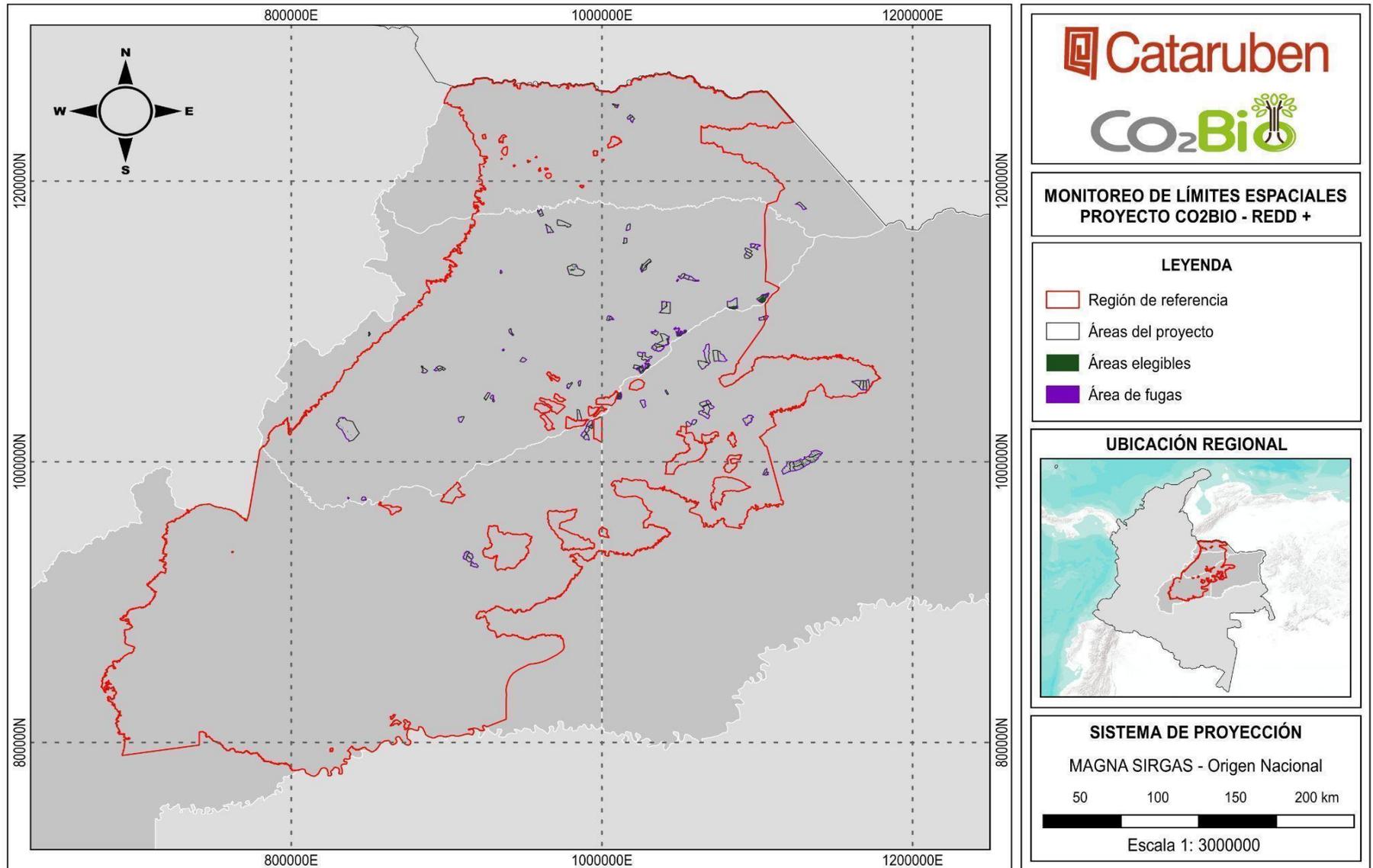


Figure. 37. Project boundary monitoring.

Source: Cataruben Foundation

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35.2. MONITORING OF THE EXECUTION OF REDD+ ACTIVITIES

The progress of activities executed from 2018 to 2020, it can be evidenced that:

For Activity 1. Apply training and support processes through training cycles that strengthen the sustainable management of ecosystems and biodiversity conservation, 547 people were trained in topics related to the objectives and scope of the CO₂BIO project, sustainable management of ecosystems and biodiversity conservation, land planning, among others.

For Activity 2. Consolidate and adapt the principles of governance for the sustainable management of ecosystems, strategic documents were obtained to recognize how governance exercises are being applied so far, and thus be able to generate an action plan to facilitate the strengthening of governance in the properties, having as a product the field logs and socio-environmental surveys.

In Activity 3. Promote forest legality. To date, most deforestation events have been caused by illegal loggers, so strategies have been implemented to increase vigilance in specific areas and prevent logging of forest resources. Thus, the indicator for forest harvesting permits has not yet been implemented because it is not yet required.

Activity 4. Promote delimitation and signaling in strategic ecosystems and natural protection areas: To generate a baseline for delimitation and signaling, two (2) documents specifically function as support. The first are the properties that have already been declared as RNSC and have a management plan or, failing that, other properties that have property planning because they have already carried out a zoning exercise on their properties. Finally, the Ecosystem Signage and Delimitation Manual provides a starting point for signage specifications.

Activity 5. Promote and improve agricultural production, livestock (on existing lands) and tourism, through the implementation of good sustainable practices: The economic characterization of the properties is carried out, including their productive activities, which allows understanding the context of the properties and thus the lines of action that will allow improving production and generally implementing good practices in their activities. The good agricultural, livestock, tourism and other practices developed with great effort by the landowners can be observed through the evidence they provide and describe in [Annex 4.1](#).

Activity 6. Generate alerts of changes due to deforestation, degradation and/or transformation of ecosystems in the project area and its surroundings: It has been essential to monitor forest cover in the properties in order to determine change alerts and to be able to follow up and analyze interactions.

Table 62. REDD+ activities monitoring report

ID	REDD+ ACTIVITIES	ID	Indicator name	Type	Goal	Unit of measure	Monitoring methodology	Frequenc y of monitoring	Responsibl e for measurement	Result reporting period (2018-2020)	Documents to support the information
1	Implement training and accompaniment processes through training cycles that strengthen the sustainable management of ecosystems and biodiversity conservation.	1.1	Number of people trained in the conservation and sustainable management of ecosystems and their biodiversity.	Capacity building in the environmental management of the farms	80	Unit	Application of training or workshops	Annual	Cataruben Foundation	547	List of 2020 trainings (54 people), Attendance at the Biodiversity & Carbon Forum (493 people).
2	Consolidate and adapt governance principles for sustainable ecosystem management.	2.1	Number of properties characterized	Socio-environmental survey of the properties	97	Properties	Characterization of properties by means of property characterization sheets, management plan, beneficiary households, among others.	Annual	Cataruben Foundation	97	Field logs and/or socio-environmental surveys.
		2.2	Number of follow-up reports on the implementation of activities to strengthen governance structures	Strengthening of forest governance structures	1	Document	Under the monitoring of the governance action plan, a report will be generated every 5 years, once the first verification has been carried out.	Every 5 years	Cataruben Foundation	0	Not applicable

3	Promoting forest legality	3.1	Number of forest harvesting permits	Accompaniment in the process of legal forest harvesting on the properties.	1	Document	Monitoring of eligible ecosystem areas for evidence of changes in coverage or at the request of a landowner.	Annual	Cataruben Foundation	0	Not applicable
4	Promote the delimitation and signaling of strategic ecosystems and natural protection areas.	4.1	Number of reports on the process of delimitation and marking of forest areas according to established guidelines.	Forest conservation	1	Unit	Visit to properties and photographic record	Annual	Cataruben Foundation	2	Properties declared RNSC - Property planning form and/or property plans
		4.2	Number of properties with implemented delimitation and signaling activities		97	Properties	Follow-up in the field and through evidence provided by the owners of the execution of activities once the first verification has been carried out.	Every 5 years	Cataruben Foundation	97	Photographs of the activities carried out on the properties and activity report.
5	Promote and improve agricultural production, livestock (on existing land) and tourism, through the implementation of good sustainable practices.	5.1	Number of properties with characterized productive activities	Implementation of sustainable production practices	97	Properties	Socio-productive recognition of the properties by means of a psychosocial and socioeconomic sheet and a survey of beneficiary households.	Annual	Cataruben Foundation	59	Psychosocial-Socioeconomic survey and beneficiary household survey

		5.2	Number of properties with implemented sustainable productive activities		97	Properties	Follow-up of evidence generated in the field or provided by the landowners	Annual	Cataruben Foundation	97	Photographic and other evidence. Monitoring Report 2018-2020/Monitoring of REDD+ Activities/5. Sustainable production and practices/5.2 SUSTAINABLE PRACTICES 2018-2020 (SECONDARY SOURCE).
6	Generate alerts of changes due to deforestation, degradation and/or transformation of ecosystems in the project area and its surroundings.	6.1	Number of properties with satellite analysis to identify changes due to deforestation, degradation and/or transformation of eligible areas.	Preventing deforestation, degradation and/or transformation of ecosystems	97	Properties	Coverage monitoring report	Annual	Cataruben Foundation	97	Calculation document. Annex. Calculations 2018-2020

Source: Cataruben Foundation

Taking into account that REDD+ activities have been with the main objective of reducing the causes of deforestation and forest degradation, below are some actions to highlight that the owners have carried out since 2016:

- To prevent the expansion of the frontier for cattle ranching use

Bearing in mind that the project is developed in a region where livestock activity is representative, the livestock producers initiate a common exercise where they perceive a direct relationship between the natural environment and the productivity and profitability of this economic activity.

Considering the above, strategies are implemented individually on each farm, or some owners form alliances with entities such as the Departmental Cattlemen's Committee or other non-governmental organizations that provide social and technical support to initiate sustainable production activities. Among these strategies, the following can be highlighted:

Table 63. Good practices recommended by the Departmental Livestock Committee.

STRATEGIES	ACTIVITY	SUBACTIVITY
Conserve and protect water resources, forests, fauna and flora, through sustainable use and an implementation plan to improve the environmental management of the properties.	Protect and expand areas of forests and strategic aquifers.	Establishment of nurseries.
		Transplanting and monitoring of seedlings planted.
		Adaptations for water harvesting.
		Establishment of shade in paddocks.
	Ecosystem conservation and protection training	Personalized and group training.
Apply sustainable production practices that generate better farm organization and livestock productivity in a biodiverse environment through an implementation plan that strengthens the productive management of the farms.	Organization of sustainable livestock activity applying GMP.	Elaborate information registers of the properties
		Establish a management plan.
		Establish a rational savanna burning plan to minimize impacts on flora and fauna.
		Training in the preparation of records and management plans.
To value the ancestral knowledge and cultural traditions of the llaneridad as a complementary support to GMP - GAP and food security, through the recognition and use of medicinal plants and technification of the conuco.	Participate in workshops, diploma courses or any other complementary training to improve the techniques adopted by the families.	Participate in the training programmed in the productive and environmental components.
	Technification of conuco	Adequacy of the conuco.

Source: Cataruben Foundation

Detailing this, we can highlight the implementation of sustainable livestock farming in farms such as El Madroño, a great example of activities implemented from 2010-2020, which can be summarized as follows:

- Installation of new electric fences, subdivision of paddocks and isolation of conservation areas.
 - Maintenance and reinforcement of old fences by replacing posts and forest wood with immunized post, metal post and or concrete post.
 - Installation of new drinking troughs and refurbishment of old drinking troughs, and installation of float closures. Rationalization of water resources.
 - Drilling of new water wells only in superficial aquifers.
 - Installation of tower with high water storage tank and conduction to water troughs with float closure.
 - Installation of solar water pumps and two second-hand windmills purchased from a neighbor.
 - Planting of native trees and watering of seeds collected at various sites of interest.
 - Installation of salt shakers in 50 cm high half-basins.
 - Transformation of the corral into a metallic tube with the installation of an electronic scale.
 - Construction of a steel tower to support water in a tank for barnyard collempaques.
 - Construction of warehouse and roof to work area in the corral.
 - Purchase of 5 bulls of Velasquez Colombian synthetic criollo breed.
 - Buy in company 50% Velasquez bull (partner victory).
 - Formation of an access alleyway in reinforced gravel and planting of trees in the same.
 - Construction of a corraleja and a jetty in the "el triángulo" paddock with access to the property.
 - Installation of natural gas and industrial stove. Eliminate the use of firewood.
 - Planting of forests of native species to evaluate their adaptability in an activity carried out with the STA TERESA DE PUNTO NUEVO school of agricultural and livestock baccalaureate students.
 - Elimination of chemical herbicides and ivermectins and incorporation of natural organic products.
 - Orderly collection, sorting and disposal of waste and garbage.
 - Planting of bread and fruit products.
- Sacha inchi pilot and information gathering for pre-feasibility study.
- Installation of two solar plants for electric energy with inverters of 2 kw each and change of lighting to 24 volt LED system, independent of the plant for operation of electric fences.

-Strengthening of boundary fences of direct responsibility with a greater number of electrified electric ropes to encourage cattle rustling, poaching and the movement of cattle to neighboring properties.

-Genetic improvement program in search of more and better adapted cattle to the untamed savannah, more efficient and productive through the inclusion of genes from "tauros" breeds, either native or subjected to natural selection in tropical conditions equivalent and applicable to ours. Note: it has been a total success.

-IATF programs with the initial support of ABS and the participation of professionals such as Antonio Chaparro, Oscar Ivan Correa, Alexander Camargo.

-Expansion and improvement of the loading pen with the possibility of installing a mobile electronic scale.

It is important to mention that not all owners implement the activities at the same pace, they do it according to their economic capacities and the time they can invest in their development, however, farms such as the Puerto Gaitán nucleus (Deva, Aipe, Mirador and Galicia), the Barley 1 farm in Casanare, and farms in the department of Vichada such as the Borinquen nucleus (Villa Lorena), also develop exemplary sustainable cattle raising activities.

2. Expansion of the agricultural frontier: Due to the flat terrain in the project area, it is common to see changes in land use for monoculture of large tracts of land, where landowners lease their land for the implementation of these activities. Another scenario is the low land use planning that in some cases is present in the properties, which influences decision making with low sustainability in forest management.

Consequently, it is important to establish actions that in the first place allow the organization and zoning of the property, which facilitates having a clear picture of the establishment of minor crops, as well as practices that increase their productivity. For this point, training and accompaniment are indispensable in order to potentiate knowledge and perceive results.

An example of these activities are the farms located in the municipality of Arauca, Arauca, such as Patevaco, Pastora la Vieja, Las Mercedes and Altamira, which with the support of the Neotropical Cuencas Foundation, have developed FAMILY ORGANIC FARMS AND COMPOSTING, where environmental education activities have been carried out on the topics of proper solid waste management, composting of organic waste and the importance of applying good agricultural practices, with a view to sustainable production.

In addition to the above, conservation, identification and biodiversity monitoring activities have also gained momentum over the years in most of the farms, where some of them started monitoring felines with Panthera Colombia, others with La Palmita, Centro de Investigación, and others on their own.

A clear example in the monitoring of fauna is the Buenaventura farm, which is carrying out a Predial, Participative Planning and Work Plan, with the Panthera Colombia Organization, whose main objective is to identify and prioritize conservation areas and areas of high vulnerability for cattle and horses, to reduce predation by big cats, in order to contribute to land

use planning. This allows reducing retaliatory hunting and creating regional examples of how big cats can coexist with productive systems.

Other activities include beekeeping, including the BARLEY farm, which is currently developing a study with a particular species of bee, creating a habitat for its special development on the farm.

Likewise, the activity of the TOMO GRANDE property located in the department of Vichada, which is a scientific and research station of riparian forests, and scientific publications have been made on species diversity, forest structure of the region compared to the country and South America, terra firme forest, flooded land forest. Research on the earwig species, primate behavior, and studies of reforestation processes in the savannah have shown that they are not very successful due to soil conditions, soil conditions and susceptibility to fire. Work has been carried out with the communities, environmental education on the Chigüiro, participation in territorial planning and prospecting of Vichada and Tomo Grande as a tourist attraction.

In this last point, ecotourism is also strong in the CO₂Bio 2 project properties, where the Hato Barley property can be highlighted as an attraction that allows observing the llanera tradition, conservation and productivity in the same place. Other properties that stand out in this item are the Buenaventura, Rascador, Santa Cruz and Campo Alegre properties.

Attached to this document is a folder with the evidence, where you can see an excel of forest cover change year 2018 vs 2020, where the main conclusion is the increase of forest areas in the project area.

It is important to mention that the above was the description of specific activities, and everything is supported under the letters of intent to belong to the CO₂Bio 2 project since 2016, and the declaration of the different Civil Society Nature Reserves throughout the process, which are exposed in the descriptive document of the project and the documents attached in C1. support of activities.

35.3. REDD+ SAFEGUARDS MONITORING

The monitoring report was conducted for the years 2018 to 2020 For compliance with safeguards, indicators and progress in their monitoring were determined, as evidenced in the following reporting table.

Table 64. REDD+ Safeguards Monitoring Report

ID Safeguard	ID Indicator	Indicator name	Type	Goal	Unit of Measurement	Monitoring methodology	Frequency of monitoring	Responsible	Indicator result in the reporting period	Documents to support the information
Correspondence with national legislation.	1.1	Percentage of land declared as Civil Society Nature Reserves (CSNR)	Contribute to and be consistent with national objectives	20%	Properties	Obtaining resolutions approving the declaration	Annual	Cataruben Foundation	15%	Resolutions or orders of initiation of RNSC or RESNATUR declaration
Transparency and access to information	2.1	Number of updates and registration in the RENARE platform	Contribute to guaranteeing the right to information.	1	Unit	Recording and updating in the RENARE platform of the activities carried out once the platform is operational.	Annual	Cataruben Foundation	1	Not applicable
Accountability	3.1	Number of Biodiversity and Carbon Forums held	Strengthen transparency in the development of the project.	1	Forums	Forums held where a record of attendees and a report will be taken.	Annual	Cataruben Foundation	1	Photographic evidence and attendance
Recognition of forest governance structures	4.1	Percentage of properties whose governance activities have been characterized.	Identify the degree of implementation of activities that guarantee governance	100%	Properties	Photos, logbooks, personnel contracts, housing on the properties, etc.	Annual	Cataruben Foundation	100%	Photographic record and logs
Capacity building	5.1	Number of people trained	Strengthen technical and legal skills in project-related issues.	59	Unit	Site visits and data collection	Annual	Cataruben Foundation	59	Registration of trained persons

Free, Prior and Informed Consent	NOT APPLICABLE									
Respect for traditional knowledge	7.1	Number of properties with diagnosis of households, tradition of beneficiaries and follow-up on indicators	Integrating traditional knowledge into the implementation of REDD+ activities	59	Properties	Surveys and processing of results	Every 2 years	Cataruben Foundation	59	battery indicators
Profit sharing	8.1	Percentage of properties with higher economic benefits resulting from conservation	Contribute to making the project sustainable for the owners and their families.	100%	Properties	Carbon certificates traded per property	Every 5 years	Cataruben Foundation	0	Not applicable
Territorial rights	9.1	Number of properties characterized and with strengthened land planning	Contribute to guaranteeing the land rights of landowners.	97	Properties	Elaboration and updating of property plans	Every 5 years	Cataruben Foundation	74	Management sheets for each property
Participation	10.1	Number of beneficiaries fully and effectively informed about the project	Ensuring the full and informed participation of owners	97	Unit	Signing of the binding and update contracts by both parties	Every 12 years	Cataruben Foundation	97	Contracts signed by the interested parties

Forest conservation and biodiversity	11.1	Percentage of implementation of the stages of the participatory biodiversity monitoring strategy (%).	Biodiversity conservation	100%	Stages	Follow-up of the execution of the strategy stages, reporting documents	every 2 years	Cataruben Foundation	100%	Safeguards reporting document 11 and 12
Provision of environmental or ecosystemic goods and services	12.1	Number of analyses of ecosystem integrity, structure and composition of the forest	Monitoring the provision of ecosystem services	6	Analyses performed	Remote sensing, attendance lists, photographic registration	Every 5 years	Cataruben Foundation	0,5	
Environmental and territorial planning	13.1	Number of instruments or mechanisms for protected area management strengthened	Contribute to regional environmental management	4	Unit	Relationship between the Regional Environmental Plan, PRICCO, the Regional System of Protected Areas (SIRAP) of the Orinoco and the REDD+ activities of the project.	Annual	Cataruben Foundation	2	RESPA, COTA CLIMA
Sector planning	14.1	Number of properties in land legalization process	Contribute to the formalization of land ownership.	97	Properties	Follow-up process	Every 5 years	Cataruben Foundation	97	Analysis of property ownership

Forestry control and monitoring to prevent emissions displacement	15.1	Number of spatial analyses to assess deforestation as a control of emissions leakage	Decrease potential displacement of emissions by displacement of land use change causes and agents.	30	Analyses performed	Spatial analysis and deforestation calculations	Annual	Cataruben Foundation	5	Geodatabase and project calculations
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Source: Cataruben Foundation

35.4. MONITORING OF SUSTAINABLE DEVELOPMENT GOALS - REPORTING

This report corresponds to the period 2016 - 2020, in which the contribution to the Sustainable Development Goals (SDGs) targets was monitored through the implementation of activities and collection of evidence presented in table 65 and the respective annexes.

Table 65. Monitoring Sustainable Development Goals

Target	Objectives goal	Indicators name	Goal	Unit of Measure	Monitoring methodology	Monitoring Frecuency	Indicator result (2016 - 2020)	Documents to support the information	Remarks
(13) Climate action	(13.3) Improve education, awareness, and human and institutional capacity for climate change mitigation, adaptation, mitigation, and early warning.	Climate change mitigation trainings	20	Number of trainings conducted	Visits to the farms for training and information gathering	Every 5 years	4	Photographic register and attendance list	Training for beneficiaries, their families, and farm workers, as well as training for the general public on climate change.
(15) Life of terrestrial ecosystems	(15.1) Ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems and the services they provide, in particular forests, wetlands, mountains, and drylands, consistent with obligations under international agreements.	Civil Society Nature Reserves	42	Number of properties declared as Natural Reserves of the Civil Society	Obtaining resolutions approving the declaration	Annual	21	Annex: MONITORING OF SAFEGUARDS - 1.1 Safeguarding: Nature Reserves	The declaration and strengthening of Civil Society Natural Reserves is carried out by the different NGOs present in the Orinoquia region, these activities will be carried out during the time of project development, these properties once declared RNSC must carry out a process of creation and implementation of land or management plans, through which the CO ₂ Bio 2 project will strengthen the objectives of the RNSC.

(5) Gender equality	(5.5) Ensure women's full and effective participation and equal opportunities for leadership at all decision-making levels in political, economic, and public life.	Women's participation	500	Number of women beneficiaries of the project participating in decision making spaces.	Creation of spaces and participation activities about the project with women beneficiaries.	Every 2 years	269	Photographic register and list of attendance and list of beneficiaries	Training for beneficiaries, their families, and farm workers, as well as training for the general public on climate change.
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Source: Cataruben Foundation

To contribute to a goal of the thirteenth objective: **Climate action**, the project carried out training and monitoring processes with landowners to strengthen sustainable forest management, as well as training on climate change. The procedure for the evaluation of this goal was the monitoring of attendance records for training and conservation activities.

For the contribution to the goal of the fifteenth objective: **Life of terrestrial ecosystems**, project participants contributed to the declaration of Natural Reserves of Civil Society (RNSC), so far 21 properties have been declared, thus contributing to the protection and sustainable use of ecosystems and the ecosystem services they provide. This is monitored through the issuance of CSER resolutions and the preparation or updating of management plans or property plans.

The project contributes to a target of the fifth SDG: **Gender equity, through** the creation of meeting spaces with the landowners and women members of the families, as well as the participation of other women interested in this project in the Biodiversity and Carbon forum. This goal was evaluated by monitoring the participation of landowners and other women beneficiaries and external project participants in training sessions generated by the project and the baseline evaluation of social conditions.

35.5. PERMANENCE MONITORING

For the monitoring period from 2018 to 2020, the possible activities that generate a risk of permanence for the project were followed up, evidencing the following results:

Table 66. REDD+ Risk Identification and Management Matrix

N O.	Activity	Type of Risk	Risk	Indicator	Risk Classification		PROCEDURE	FOREST	
					Value	Level		Monitoring results 2018 - 2020	Remarks
1	Fire	PHYSICAL	Loss of forest or wetland ecosystem due to fire	# of fires present in the eligible project area.	2	Medium	Fire monitoring is carried out with the help of the "Global Forest Watch" platform, which allows us to upload data from the project areas and create alerts for fire detection using VIIRS (Visible Infrared Imaging Radiometer Suite) technology. In addition to satellite monitoring, the impact of the fires was corroborated by field visits.	0	During the analysis period, there were no fires in the eligible project areas or in the leakage areas.
2	Flooding	PHYSICAL	Substrate and plant material washed away, loss of life, infrastructure, and agricultural crops	# of unusual flooding reports	1	Low	Constant communication is maintained with the owners; in the event of flooding with major impacts, a report will be made by filling out a form, in order to proceed with the measures to be taken.	0	During the analysis period, no unusual flooding occurred in the eligible project areas or in the leakage areas.
3	Conservation agreement	ECONOMIC	The owner fails to comply with its obligations under the contract.	# of Reports of non-compliance recalls	2	Medium	Conservation activities are monitored in compliance with the stipulations of the contract signed by the landowners.	0	During the period under analysis, there were no calls for attention or reports of non-compliance with conservation activities.

4	Social ownership of the project	SOCIAL	That the Cataruben Foundation has no credibility in the project.	# of people reached through social networks and events promoted by the Foundation.	1	Low	The following documents are verified: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the CO ₂ Bio 2 project.	493	During the monitoring site, CATARUBEN promoted the development of the first biodiversity and carbon forum, involving landowners and the community in general, thus strengthening the importance of these initiatives at regional and national level. In addition, it generated a presence in social networks to report on the project's impact results.
5	Land tenure dispute	SOCIAL	Loss of the property	# of properties with possession or tenure of the land	1	Low	The following documents are verified: citizenship card, public deed document, INCODER resolution, the certificate of tradition and freedom, the cadastral certificate and the title study of each property with its contract of connection with the CO ₂ Bio 2 project.	97	A title analysis was carried out for the 97 properties that are part of the CO ₂ Bio 2 project using the REDD+ methodology.
6	Non-ownership of project stakeholders	SOCIAL	If either party fails to fulfill its obligations under the contract.	# of conflicts between the different parties involved	2	Medium	PCC management procedure	0	During the analysis period, there were no conflicts between the project proponents.

7	Indicator monitoring	ECONOMIC	Lack of adequate monitoring personnel	# of non-compliance reports in monitoring.	1	Low	PCC management procedure	o	The cataruben foundation guarantees the professionalism, quality and good management of the data and the professionals involved in the project.
8	Governance deficit	SOCIAL	Abandonment of the properties, noncompliance with governance activities	# of acknowledgements of forest governance structures	1	Low	Follow-up on the indicator of safeguard #4, which establishes the indicators to determine the level of implementation of governance in the properties.	o	The respective monitoring of the safeguards has been carried out, without identifying a possible risk of noncompliance by any of the parties.

Source: Cataruben Foundation

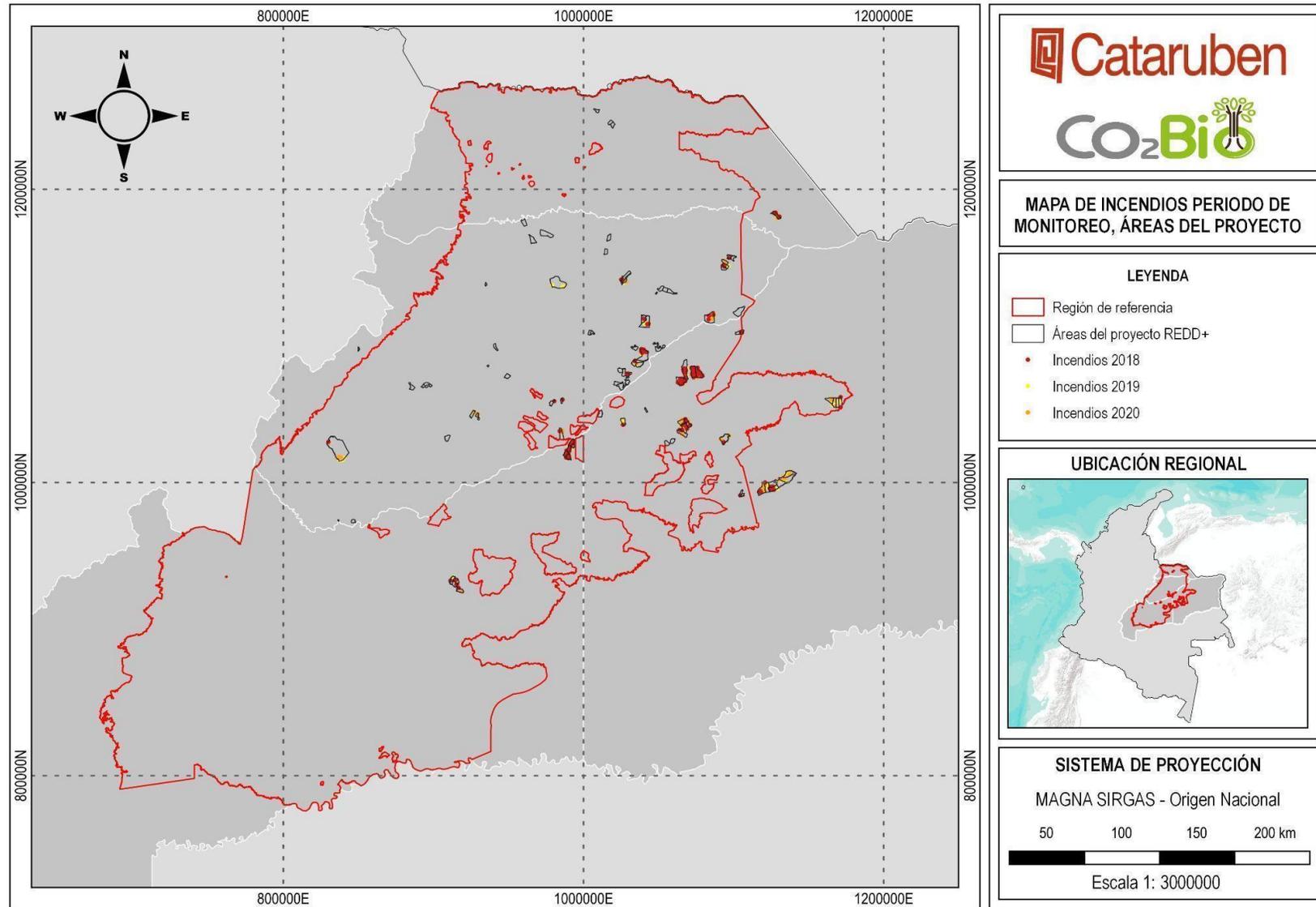


Figure.38 Fire map
Source: Cataruben Foundation

35.6. PROJECT EMISSIONS MONITORING

Phase 1 of the project presents results of monitoring emissions from deforestation and degradation in the analysis period 2018-2020. Calculations were performed following the REDD+ methodology guidelines,

Table 67 summarizes the project's emissions for the current analysis period, a total of 521,619.2/CO₂e of avoided emissions from deforestation and degradation.

Table 67. REDD+ Project Emissions Monitoring

EMISSIONS REDUCTION MONITORING PERIOD 2018- 2020			
YEAR	REDEF,REDD+proj (tCO₂e)	REDEG,REDD+proj (tCO₂e)	RE Total year
2.018	134.982,0	33.333,5	168.315,5
2.019	146.509,9	28.146,5	174.656,4
2.020	155.209,8	23.437,5	178.647,3
Totals	436.701,7	84.917,5	521.619,2

Source: Cataruben Foundation

Step-by-step calculations can be reviewed in Annex 3.2.3 Emissions: [2. Emissions REDD+ P2 v2> 4. R_Monitoring_2020](#)

CHAPTER 4. PROJECT GHG REDUCTION AND/OR REMOVALS

In the fourth section, the results obtained from the first monitoring (2018-2020) for the eligible areas for the Forest ecosystem, in terms of CO₂ emission reductions and compliance with REDD+ activities are related. As well as the results of the first monitoring (2016-2020) for the wetland ecosystem, in terms of CO₂ emission reductions and removals and compliance with conservation and mitigation activities.

Table 68. Summary of project reductions and removals for Wetland and REDD+ areas.

EMISSIONS REDUCTION MONITORING PERIOD 2016- 2020				
YEAR	Wetlands	REDEF,REDD+proj (tCO₂e)	REDEG,REDD+proj (tCO₂e)	RE Total year
2.016	82.238,2			82.238,2
2.017	123.045,7			123.045,7
2.018	122.735,3	134.982,0	33.333,5	291.050,8
2.019	122.425,9	146.509,9	28.146,5	297.082,3
2.020	122.117,6	155.209,8	23.437,5	300.764,8
Totals	572.562,6	436.701,7	84.917,5	1.094.181,8

Source: Cataruben Foundation

CHAPTER 5. QUALITY CONTROL AND QUALITY ASSURANCE PROCEDURES



Figure. 39 Basic structure of chapter 5

Source: Cataruben Foundation

36. QUALITY CONTROL AND QUALITY ASSURANCE PROCEDURES

The Cataruben Foundation has foreseen the measures described below, to ensure and control the quality during the implementation of the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions of ProClima REDD+ Projects. Version 2.2. 5 February 2021 and the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands, for each of the phases of the CO₂Bio 2 project (Figure 40 Project Phases), taking into account the applicable legal and technical requirements and thus comply with the following aspects:

- Ensure the correct development and management of the project;

- Identify and control the resources (economic, support, human, etc.) to carry out the activities during all the stages of the project;
- Through the implementation of the necessary manuals, procedures, instructions and formats, it must be ensured that the requirements and expectations indicated in the methodologies of Quantification of GHG Emission Reductions of REDD+ Projects and methodology of Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands, the requirements of ISO 9001/2015, ISO 14001/2015, as well as legal and regulatory requirements and those of the Cataruben Foundation's own Integrated Management System are met;
- Identify and control the interrelationships among the participants during the execution of the project phases, indicating for each of them their scope, roles and responsibilities.

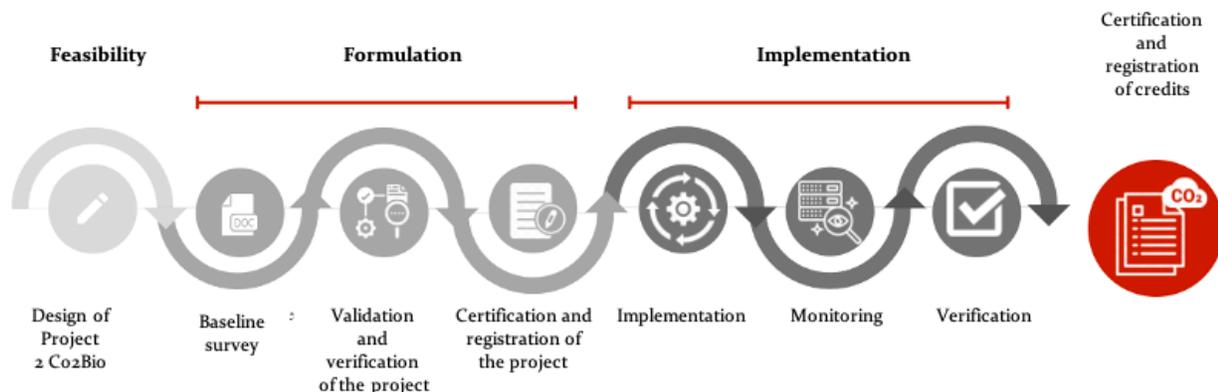


Figure. SEQ Figure. ARABIC 40. Project phase Source: Cataruben Foundation

Figure 40. Project phase Source: Cataruben Foundation
Source: Cataruben Foundation

Taking into account that the implementation of the methodologies has as its fundamental basis the geographic, social, economic and environmental information that characterizes the CO₂Bio 2 Project, the quality assurance and control actions of this aspect are relevant, which is why the following attributes are established throughout the data collection and processing process:

- **Accuracy:** Accuracy means that the data are free of errors (arithmetic and grammatical), are clear, unbiased and reflect the meaning of the data on which they are based.

- **Completeness:** Data must be complete and meet all your needs. Incomplete or partial information may result in erroneous decisions and financial and social cost overruns.
- **Timeliness:** Timeliness means that the data must reach its intended recipients within a pre-established time frame, allowing them to decide on appropriate actions based on the information received.
- **Relevance:** Data is said to be relevant if it answers stakeholders' questions and enables them to make decisions. At this point it is important that the information is communicated to the right people.
- **Ease of use:** The data must be understandable. Thus, reports should be constructed in such a way that no additional time is spent in processing them and the required information can be extracted directly.
- **Reliability of Source:** Information must come from reliable sources. The reliability of the source must be evaluated in each delivery of information, taking into account the metrics of collection, validation, debugging and consolidation of information.

To comply with these principles, information management activities must implement the continuous improvement cycle, in order to prevent non-conforming outputs during the process, as described below:

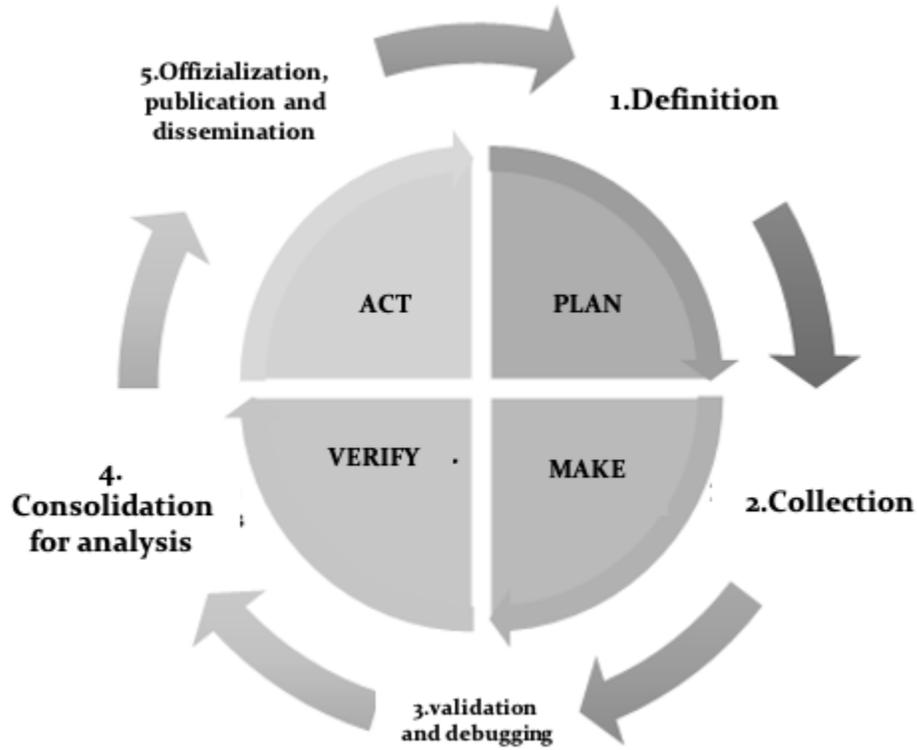


Figure. 41 Information management cycle

Source: Cataruben Foundation

36.1. REVIEW OF INFORMATION PROCESSING

Table 69. INFORMATION PROCESSING

Stages of information management	Responsible	Controls
<p>Definition of information Review of the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions from ProClima REDD+ Projects and the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands, to identify the type of data required, as well as the appropriate tools, means and strategies for their collection, in order to prevent duplication of efforts and ensure compliance with applicable technical and legal requirements. In this first step, the structure of the information, the relationships and its integrity are identified, in addition to identifying and ensuring that the sources are reliable and official, such as IDEAM and IGAC.</p>	<ul style="list-style-type: none"> ● Project Manager ● Documentary Unit ● Biodiversity Unit ● Social Unit ● Property Unit ● GIS Unit 	<p>This stage of the process must be recorded in the minutes of the meeting, in which at least the following aspects are described and approved:</p> <ul style="list-style-type: none"> ● Technical Requirements ● Legal Requirements ● Formats and their content (geographic, social, biodiversity, legality of land) ● Data collection tools and means (official and appropriate) ● Responsible for each activity
<p>Harvesting: In accordance with the means and tools established in the previous stage, the information identified as necessary for the implementation of the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions of ProClima REDD+ Projects and the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands is collected. Competent personnel and the appropriate tools are available for this process.</p>	<ul style="list-style-type: none"> ● Project Manager ● Documentary Unit ● Biodiversity Unit ● Social Unit ● Property Unit ● GIS Unit 	<p>Prior to the start of data collection activities, the operability of the equipment to be used and the competence of the personnel performing this activity must be verified, both for the use of the tools (procedures and forms) and for the use of the technological equipment. Any non-compliance should be reported to the corresponding area in order to prevent delays in programming and/or inadequate processing of the information collected. Procedures and instructions have been established for the collection of information at this stage, which have been validated in the previous stage by the leaders or persons responsible for the project and each of the units involved in the process.</p>

<p>Validation and debugging</p> <p>Once compliance with the principles of the information in the previous stage has been reviewed, the data are validated and cleaned using the technological tools and equipment initially established.</p> <p>In order to comply with numeral 15.5.2 of the methodological document AFOLU sector - Quantification of GHG emission reductions or removals from sectoral mitigation projects, related to the review of the processing of information, 10% of the records of the information collected will be reviewed in order to prevent errors from occurring during the consolidation of the information for the analysis.</p>	<ul style="list-style-type: none"> ● Project Manager ● Documentary Unit ● Biodiversity Unit ● Social Unit ● Property Unit ● GIS Unit 	<p>The data collected must be verified by the Documentary Unit, for which the approval of the person in charge of the Documentary Unit is established in the records (both physical and digital).</p> <p>If inconsistencies are found in the data collected, they must be recorded in the corresponding form and managed through the non-conforming output procedure.</p>
<p>Consolidation of information for analysis</p> <p>The information collected is stored in digital and physical databases in compliance with the Documented Information Control Procedure and the Information Security Manual (FC-GAM-03).</p> <p>This information is processed and analyzed according to what is established in the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions of REDD++ Projects of ProClima and the Methodological Document AFOLU Sector / Quantification of GHG Emission Reductions and Removals - Activities that avoid land use change in inland wetlands applicable through the ODK Collect application.</p>	<ul style="list-style-type: none"> ● Project Manager ● Documentary Unit ● Biodiversity Unit ● Social Unit ● Property Unit ● GIS Unit 	<p>At this stage, the Management Development Program (PDD in Spanish) is prepared, reviewed and validated by the project manager according to the requirements identified in the initial stage and the applicable methodology.</p> <p>To validate compliance with the requirements, the information is audited by the corresponding entity and corrective actions are established if significant findings are found.</p>
<p>Officialization, publication and dissemination</p> <p>Once the Management Development Program (PDD in Spanish) has been generated and validated, the results are published and disseminated to the relevant stakeholders.</p>	<ul style="list-style-type: none"> ● Project Manager ● Documentary Unit 	<p>The information generated throughout the process is stored in physical and digital media in accordance with the provisions of the Information Security Manual (F-GAM-03) and the Archive Manual (FC-GAM-04), in order to ensure the security and proper maintenance of such information for as long as required.</p>

Source: Cataruben Foundation

All documented information generated during the process must comply with the following characteristics:

- They must be written in the present tense of the verb
- They must have uniformity in terminology and wording.
- They must have uniformity in terminology and wording.
- They must comply with the Cataruben Foundation's image in terms of icons, logos, fonts, color palette, among other aspects.
- The process leader and/or project manager is responsible for ensuring compliance with the project's document management requirements.

36.2. REGISTRATION AND FILING SYSTEM OF THE DATA

During all the phases of the CO₂Bio 2 Project, different documents are obtained, among which are the following:

Table 70. Data Recording and Filing System

Legal Documents	Operational Documents	Economic Documents
<p>Copies of documents supporting the tenure of the properties.</p> <ul style="list-style-type: none"> • Public deed of the property. • Certificate of tradition and freedom. • Real estate registration. • Certificate of sound possession. • Cadastral certificate • Property tax. • Power of Attorney <p>Copies of identification documents of project beneficiaries.</p> <ul style="list-style-type: none"> • Citizenship card. • Conservation agreements • Letter of engagement • Tie-in contracts • Confidentiality agreements 	<p>Before, during and after the execution of the field trips are taken into account:</p> <ul style="list-style-type: none"> • Instructions, programs, procedures and manuals that provide guidelines for the collection and analysis of the information obtained. • Field records • Maps of the properties • Photographic evidence 	<p>The economic documents include:</p> <ul style="list-style-type: none"> • Financial simulators. • Accounts receivable. • Accounts receivable payments

Source: Cataruben Foundation

These are classified and treated according to the guidelines established by procedures, manuals and policies, where required:

- Organize physical and electronic documents through document classification.
- Establish retention and disposal deadlines for information and electronic records in document retention schedules (TRD).

- Execute partial or complete elimination processes in accordance with the times established in the TRD.
- Ensure the authenticity of records and information throughout the document life cycle.
- Maintain the integrity of the documents, by means of document groupings, in series and subseries.
- Preserve the documents and their documentary groupings, in series and subseries, in the long term, regardless of the technological procedures used for their creation.

36.3. PROTECTION OF RECORDS

The Cataruben Foundation has established the following methodologies for the protection of records associated with the implementation of the methodology as described below:

- **Physical Records:** records are protected and stored in filing cabinets located in the archive area of the Cataruben Foundation's facilities, free from humidity, direct sunlight and any other characteristic that may accelerate their deterioration. The Documentary Management Coordinator must guarantee their protection in this way, as well as control their access and consultation.
- **Digital Records:** To ensure the protection of the digital records of the Cataruben Foundation, these are stored in the "Google Drive" application assigned to the project. Ensuring the protection of their integrity through access credentials assigned to the Project Manager.

In addition, the following policies and manuals are in place to ensure compliance with legal requirements for the treatment of information during the execution of the project:

- **FC-GDN-07. Intellectual Property Policy.** Establishes a process of management and internal and external regulation, active, transparent and responsible through principles and guidelines to strengthen and encourage scientific research and the creation of works of this nature in the Foundation. Likewise, to have the necessary mechanisms to mitigate the risk of the use, exploitation and appropriation of its intangible assets.
- **FC-GDN-08. Personal Data Protection Policy.** The Cataruben Foundation, and in compliance with the constitutional right to Habeas Data, only collects Personal Data, when previously authorized by the Holder, implementing for this purpose, clear measures on confidentiality and privacy of Personal Data.
- **FC-GAM-03. Information Security Manual.** Establish security measures and control mechanisms for the information assets of the **CATARUBEN FOUNDATION**, within the framework of the Information Security Management Manual.
- **FC-GAM-04.** The purpose of this manual is to set out the guidelines for the application of document transfers, consultation and loan of documents, bibliographic collections,

updating and application of the Document Retention Tables (TRD), opening of new files, establishing information security and document management policies together with the handling of electronic documents. On the other hand, it is intended that the management of the Cataruben Foundation's archives is functional and complies with the service required by the entity and the applicable regulations, taking into account the importance of document management as the knowledge management of the institutions and the improvement of the quality of services to the user.

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