Caribbean Region Climate change mitigation project

Caribbean Region CCMP

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Acronyms and abbreviations

AFOLU	Agriculture, Forestry, and Other Land Use
DBH	Diameter at breast height
GHG	Greenhouse Gases
IDEAM	Institute of Hydrology, Meteorology and Environmental Studies (*Instituto de Hidrología, Meteorología y Estudios Ambientales*)
MADS	Ministry of Environment and Sustainable Development (*Ministerio de Ambiente y Desarrollo Sostenible*)
SDG	Sustainable Development Goals
RENARE	National Registry of Greenhouse Gas Emissions Reduction (*Registro Nacional de Reducción de Emisiones de Gases de Efecto Invernadero*)
UPRA	Rural Agricultural Planning Unit (*Unidad de Planificación Rural Agropecuaria*)
REDD+	Reducing Emissions from Deforestation and Forest Degradation
PDD	Project Design Document
PZ	Project zone
PA	Project area
RR	Reference region

1 General

1.1 Project overview

The Caribbean Region Climate Change Mitigation Project (CCMP) has the purpose to reduce and remove greenhouse gases (GHG) through forest plantations and the conservation of dry and very dry tropical forests. The project holder is Forestal Monterrey Colombia S.A.S. (FMC), which with the support of Greenwood Resources Colombia S.A.S (GRC) has been carrying out actions and implementing afforestation, reforestation and conservation activities that have removed emissions and avoided the deforestation of natural forests within their properties.

The project's Reference Region (RR)[1] is part of the departments of Bolívar and Magdalena, in the Colombian Caribbean, between the Montes de María subregion and the Momposina depression. In the RR, historical, socioeconomic and cultural contexts are associated with the ecosystem richness and productivity, facilitating the establishment and development of agricultural activities by different human populations[2]. The historical development of agricultural and mining activities and the mismanagement of water resources in the region have led to deforestation and forest degradation, making this one of the country's areas with the greatest loss of natural cover over the years[3], which has led to forest fragmentation and loss. The Caribbean Region CCMP began its activities on lands that had previously housed fattening cattle, which had the potential to continue growing in number of units, but reforestation and forest conservation activities have prevented the loss of carbon reserves in this privately-owned territory. The Caribbean Region CCMP intends to increase the areas reforested and continue with the activities aimed at preserving existing forest remnants.

In March 2012, Forestal Monterrey started the reforestation activities associated to the Caribbean Region CCMP using *Gmelina arborea* and *Pachira quinata*, the latter being a native species of tropical dry forest. Considering an area of 2,416.8 hectares (ha), in a period of 30 years the removal of more than 1,413,700 tons of equivalent carbon (tCO_2e)[4] are expected. For this, the establishment of certified forest plantations for the production of certified solid wood (to be used for plywood and lumber) is proposed.

Forest conservation activities started in April 2016, after the first training workshop on basic concepts for project design and planning, which was aimed at community stakeholders that gave rise to the generation of new strategies that have guaranteed protection 5,864 ha of dry and very dry tropical forest, the most threatened ecosystem in Colombia and the Neotropics due to the uncontrolled expansion of the agricultural frontier [5,6]. This has also promoted environmental knowledge transfer, community-based activities and the appropriation of environmental conservation. During the 30-year crediting period, this initiative expects to reduce 762,527 tCO_2e.

During the first monitoring period (from June 1, 2012 to December 31, 2021), the GHG removal activity is expected to remove a total of 259,975 tCO_2e, while the REDD+ initiative (from April 2, 2016 to December 31, 2020) would reduce 375,978 tCO_2e.

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[1] The areas were selected taking into account their similar conditions to those of the project area in terms of access, drivers and determinants of deforestation, types of forest, post-deforestation land use, land tenure, political context, and enforceable regulations.

[2] Herrera, L.F. (2006). *"Paleoecología en la depresión momposina. 21.000 años de cambios ambientales." Agricultura ancestral camellones y albarradas. Contexto social, usos y retos del pasado y del presente. Institut de Recherche pour le développement*: 227-240.

[3] IDEAM. (2015). *Monitoreo y seguimiento al fenómeno de la deforestación en Colombia*. http://www.ideam.gov.co/web/bosques/deforestacion-colombia.

[4] 48,184 tCO_2e per year.

[5] Camargo, M. & Albenis, F. (2017). *La transformación del bosque seco desde la mirada Geográfico-ambiental, en la cuenca hidrográfica del Río Cesar*. https://repository.udca.edu.co/bitstream/handle/11158/813/Bosque%20seco.pdf?sequence=1&isAllowed=y.

[6] Rodríguez., Banda-R., Reyes B., Sandra P., Estupiñán. & Ana Cristina. (2012). *Lista comentada de las plantas vasculares de bosques socos prioritarios para la conservación en los departamentos de Atlántico y Bolívar (Caribe Colombiano).* http://www.humboldt.org.co/images/Atlas%20de%20paramos/Biota13(2)-Bosque_Seco.pdf.

The Caribbean Region CCMP seeks to become a pioneer project with certified GHG removals and reductions in the Colombian Caribbean since the protection of tropical dry forests and the establishment of native species are aimed at integrating community and environment in a sustainable way.

1.1.1 Project objective

The main objective of the project is to develop activities that promote the positive impacts of sustainable forest production and management on communities and the environment, mitigating the potential negative impacts that forest production can generate both socially and environmentally. In addition, it has the objective of conserving the tropical dry forest in order to guarantee the protection of species of high conservation value such as *Belencita nemorosa*.

1.2 Project name

Climate change mitigation project in the Caribbean Region (hereinafter "Caribbean Region CCMP").

1.3 Project location

The project zone[7] is located in the Caribbean coast region of Colombia and has a direct influence on the municipalities of Córdoba, El Carmen de Bolívar and Zambrano (in the department of Bolívar), which are part of the Los Montes de María subregion and border the lowlands of the Magdalena River, other tributaries and the Momposina Depression. It also includes an area located in the municipality of Ariguaní (in the department of Magdalena), specifically in the corregimiento of El Carmen de Ariguaní, whose social and economic context is adapted to a steeper and more mountainous land in the transition zone between the Momposina Depression and the Snow-Covered Mountain Range of Santa Marta.

The two centers of the project are known as Monterrey in the department of Bolívar and Punto Nuevo in in the department of Magdalena. Table 1 details the area of each municipality that has been set aside for the project and their corresponding percentage based on the total project area.

Table 1: Location of the Caribbean Region CCMP

Area of Influence[8]	Project Center[9]	Area (ha) – Project Zone[10]	Proportion (%)
Zambrano	Monterrey	4,907.32	29.9
El Carmen de Bolívar		979.26	6.0
Córdoba		6,642.96	40.4
Ariguaní (El Difícil)	Punto Nuevo	3,895.20	23.7

[7] The Project Zone is the area made up of both the eligible and non-eligible areas of each type of initiative (REDD+ and GHG removal activities). These are properties of the project holder where the project activities (reforestation and conservation) are carried out. See section 4.1.1 for REDD+ and 5.1.1 for GHG removal activities.
[8] The area of influence of the project is made up of the municipalities of Zambrano, El Carmen de Bolívar, Córdoba and Ariguaní. This area was delimitated in order to characterize environmental and socioeconomic aspects at the regional level given the lack of information available at the local level.
[9] Group of properties according to their location by department. The project holder groups the project area in two centers: Monterrey, which includes the properties located in the department of Bolívar; and Punto Nuevo, which includes the properties located in the department of Magdalena.
[10] The Project Zone is the area made up of both the eligible and non-eligible areas of each type of initiative (REDD+ and GHG removal activities). These are properties of the project holder where the project activities (reforestation and conservation) are carried out. See section 4.1.1 for REDD+ and 5.1.1 for GHG removal activities.

Area of Influence[8]	Project Center[9]	Area (ha) – Project Zone[10]	Proportion (%)
TOTAL		**16,424.75**	**100%**

(Source: South Pole, based on information provided by FMC, 2022)

In addition, Figure 1 shows the RR of the Reducing Emissions from Deforestation and Forest Degradation (REDD+) activities, the area of influence, the project zone and the project area[11] of the Caribbean Region CCMP.

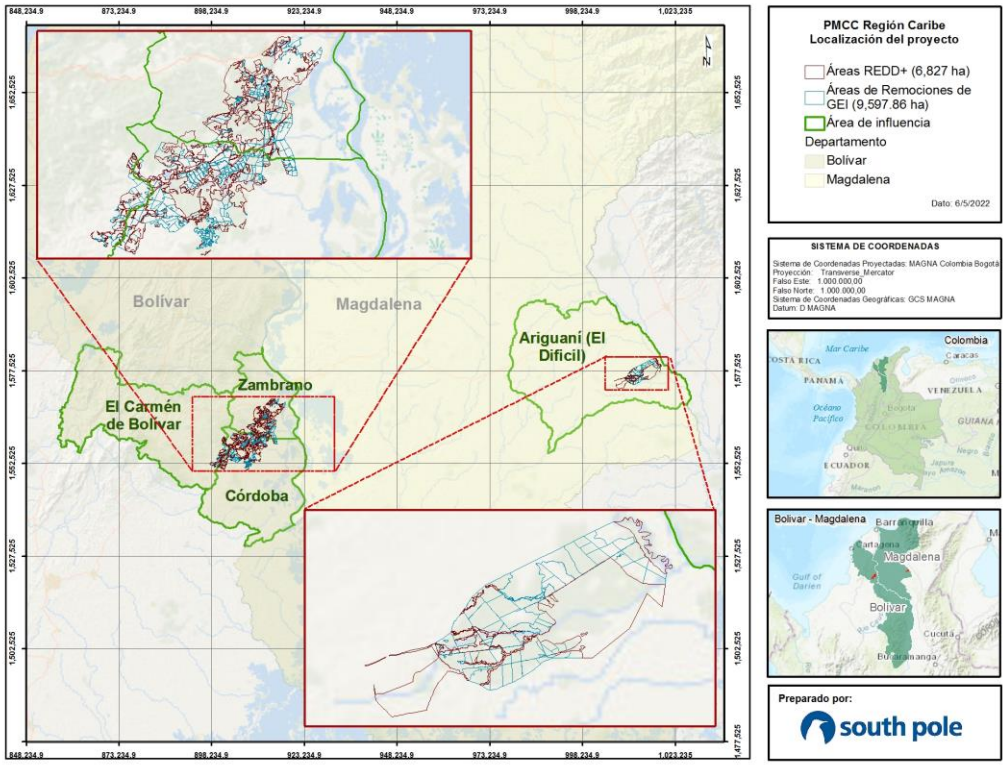

Figure 1: Location of the Caribbean Region CCMP
(Fuente: South Pole, based on information provided by FMC, 2022)

1.4 Entities involved in the project

Forestal Monterrey Colombia S.A.S. is the holder of the Caribbean Region CCMP, being responsible for coordinating and implementing the activities in the territory while owning the land. Another participating entity is Greenwood Resources, which acts as the FMC's asset manager. Likewise, South Pole Carbon Asset Management S.A.S. supports the design and certification of the forest carbon project as well as the sale of the resulting carbon credits.

[11] The Project Area corresponds to the eligible and non-eligible areas of each type of initiative (REDD+ and GHG removal activities). See section 4.1.1 for REDD+ and 5.1.1 for GHG removal activities.

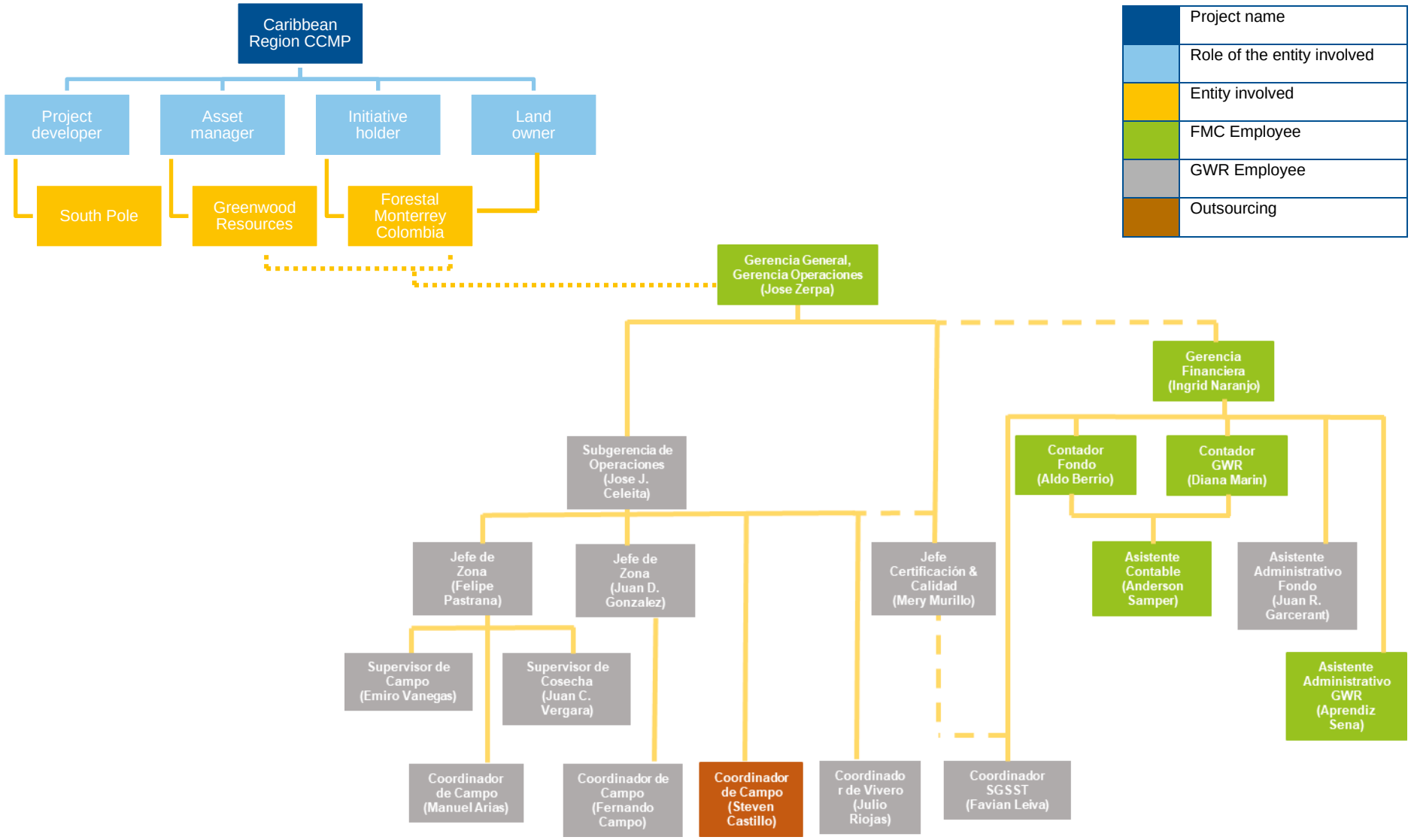

Figure 2: Roles of project participants

The description of each of the positions in the organizational chart of the project holder and the asset manager is presented in “Gestión de la información\General\Organigrama\Descr_cargos”.

1.4.1 Project holder

Organization name	Forestal Monterrey Colombia S.A.S.
Contact person	José Zerpa
Title	Legal Representative, Greenwood Resources Colombia S.A.S.
Address	Calle 77b #57-55, Oficina 1902, GreenTowers Barranquilla, Colombia
Telephone	57 60 322 429 6118
Email	Jose.Zerpa@nuveennc.com

1.4.2 Other entities involved in the project

Organization name	Greenwood Resources Colombia S.A.S.
Contact person	Gwenlyn Busby
Title	Managing Director, Head of Research and Strategy
Address	GreenWood Resources, Inc. 101 SW Main Street, Suite 1500 Portland, OR 97204
Telephone	503 970 7129
Email	Gwen.Busby@nuveennc.com

Organization name	South Pole Carbon Asset Management S.A.S.
Contact person	Dayhana Osorio
Title	Senior Project Manager
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Email	l.osorio@southpole.com

1.4.3 Management model for project development

In accordance with the responsibilities of each of the entities involved in the project, the management model for the development of the Caribbean Region CCMP is as follows:[12]:

[12] The project management model in PDF format is available at: Gestión de la información_V2\General\Organigrama/Gestion_Proyecto

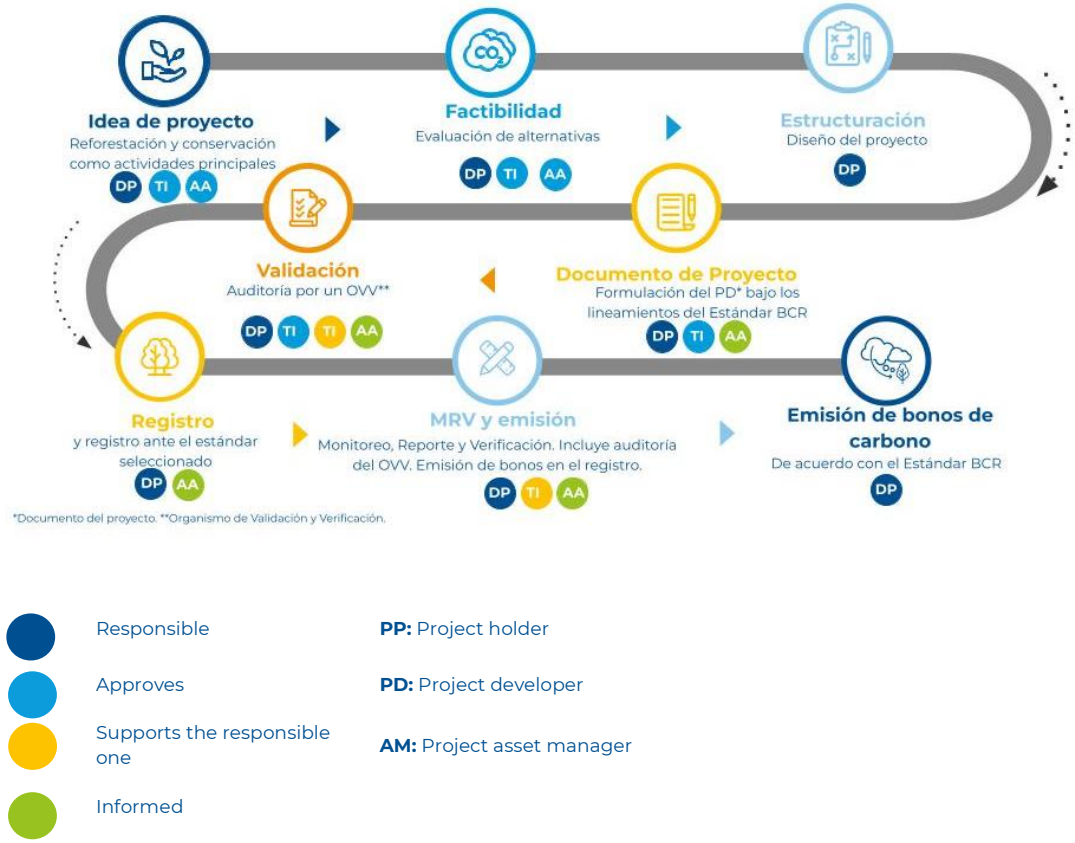

Figure 3: Management model of the Caribbean Region CCMP

(Source: South Pole, 2022)

1.5 Carbon ownership and rights

The company Forestal Monterrey Colombia S.A.S. has legal ownership of the Verified Carbon Credits (VCC). In this project, carbon rights are derived from land tenure rights.

1.5.1 Land tenure

The owner of the properties where the Caribbean Region CCMP is developed is FMC. The real right of ownership of all the properties is demonstrated by means of the Certificates of Tradition and Freedom (CTyL)[13], which are legal documents that guarantee that FMC has the right of use, enjoyment and disposition of these real estate.[14]

The Caribbean Region CCMP has two centers: Monterrey and Punto Nuevo. The Monterrey center consists of 41 properties spread in three municipalities: four properties in El Carmen de Bolívar, 30 in Córdoba and 13 in Zambrano. For its part, the Punto Nuevo center consists of a single property located in the municipality of Ariguaní (Table 2).

[13] Information available at: Gestión de la información\Tenencia Tierra\CTyL2021.
[14] In accordance with article 656 of Law 82 of 1873, real estate or farms are goods that cannot be transported from one place to another, such as land and mines, and those that permanently adhere to them, such as buildings and trees. In addition, plants are immovable property since they adhere to the ground by their roots (Article 657 of the same law).

Table 2: Details of the properties of the Caribbean Region CCMP

Municipality	Property	Real estate registration	Type of activity	Area (ha)
Ariguaní	Punto Nuevo	226-21974	GHG RA	2,192.18
			REDD	1,703.68
Carmen de Bolívar	El Modelo	062-5458	GHG RA	395.48
			REDD	250.11
	Lote	062-14923	GHG RA	44.48
			REDD	6.83
	Miraflores	062-1099	GHG RA	87.85
			REDD	45.44
	Santo Domingo	062-13831	GHG RA	279.09
			REDD	90.97
Córdoba	Altamira	062-375	GHG RA	62.73
			REDD	53.64
	Carreto	062-5248	GHG RA	213.01
			REDD	97.56
	Casa Nueva	062-4645	GHG RA	212.55
			REDD	8.49
	Cienagueta	062-494	GHG RA	74.60
			REDD	3.48
	Cienaguita	062-2472	GHG RA	32.92
			REDD	143.15
	El Centro	062-24628	GHG RA	80.48
			REDD	12.37
			GHG RA	5.03
			GHG RA	1.40
			GHG RA	10.79
	El Porvenir	062-2863	GHG RA	74.98
			REDD	2.55
		062-2864	GHG RA	87.12
			REDD	0.66
	La Esperanza	062-373	GHG RA	94.39
			REDD	44.03
	La Estrella	062-5249	GHG RA	277.11
			REDD	9.00
	La Totumera	13212000100010097000	GHG RA	7.17
	Loma de los Hachados	062-11109	GHG RA	36.71
			REDD	59.28
	Los Deseos	062-2471	GHG RA	259.89
			REDD	189.85
	Rural lot	062-6016	GHG RA	24.17
			REDD	13.65
		062-6017	GHG RA	56.82
			REDD	61.11
	Terrón Seco	062-2630	GHG RA	1.11
			REDD	3.28
	Papayo 2	062-4644	GHG RA	310.58
			REDD	11.29
	Paraco 1	062-11111	GHG RA	542.17
			REDD	338.07
	Paraco 2	062-11112	GHG RA	414.88

Municipality	Property	Real estate registration	Type of activity	Area (ha)
			REDD	107.31
	Paraco 3	062-11113	GHG RA	289.60
			REDD	459.77
	Paraco 4	062-11114	GHG RA	454.05
			REDD	255.29
	Playas Marinas	062-21001	REDD	2.55
	San Gil	062-2631	GHG RA	51.48
			REDD	30.22
	San Ignacio	062-19564	GHG RA	265.65
			REDD	76.68
	Santa Rosa	062-1705	GHG RA	61.36
			REDD	23.31
	Terron Seco	062-4471	GHG RA	9.19
			REDD	24.98
	Toloda or La Pradera	062-5683	GHG RA	62.16
			REDD	5.71
	Totumito	062-2588	GHG RA	553.40
			REDD	105.74
	Verdun	062-5250	GHG RA	42.32
			REDD	441.87
Zambrano	Barcelona	13894000000020054000	REDD	0.95
	Bongal	062-982	GHG RA	113.44
			REDD	367.10
	Ciénaga Manglar	13894000000020007000	REDD	1.80
	El Socorro	062-1750	GHG RA	232.50
			REDD	258.24
	El Último Esfuerzo	062-2697	GHG RA	169.06
			REDD	285.34
	Esmeralda	062-13787	GHG RA	0.01
	La Magdalena	062-6296	REDD	97.93
	Los Deseos	062-11260	GHG RA	42.06
			REDD	28.14
	Los Juncales K7	13894000000020057000	GHG RA	0.03
			REDD	0.98
	Lote in the land	062-7094	GHG RA	35.60
			REDD	53.01
	Monterrey	062-4858	GHG RA	1,281.12
			REDD	884.73
	Zorra 2	062-38127	REDD	0.00
	Zorra	062-6675	GHG RA	1.24
			REDD	6.52
Total				**16,210.64**

(Source: South Pole based on information provided by the project holder)

The property area was calculated taking into account the public information posted by the IGAC and the certificates of tradition and freedom of the Caribbean Region CCMP. There is a difference between the area reported for the Project Zone and the property since the official IGAC information on property boundaries has not been updated in more than 15 years. However, the CTyLs evidence that the entire project area is owned by FMC. During the year 2021, the United Nations Development Program (UNDP) was contracted by the National Land Agency (ANT) to prepare the property information that will be delivered to the IGAC for its official update. As a

supporting document, the email exchange between the UNDP/ANT and FMC to define the verification visit to the properties is attached[15]..

During the assessment of the land tenure status, an overlap was found between the area of the project zone[16] and the Montes de María Peasant Reserve Zone[17], which covers six properties of the Monterrey center (7.4% of the project area). However, FMC requested clarification on property rights and its exclusion from this scheme before the National Land Agency (ANT) in 2021.

In consequence, on December 10, 2021, the ANT responded to the request made by FMC, clarifying in paragraph 2 that the Montes de María PRZ is the "*product of an agreement and participatory exercise led by the Rural Communities of this country's region. This condition does not represent any limitation to private ownership for those properties included within this scheme, nor can it be considered a threat to properties whose legal status was defined before the creation of this schema; the foregoing in the terms considered by the Law for such purposes*"[18]. In conclusion, despite the delimitation of this PRZ, there is no risk of loss of real right of ownership over the FMC properties.

1.5.2 Validity of the prior consultation

In its capacity as a legal entity, FMC submitted to the Ministry of the Interior the "*request for determining the validity and appropriateness of prior consultation for the execution of works and projects*" for the Monterrey and Punto Nuevo centers on September 9, 2021. In accordance with Resolution ST-1418 of October 14, 2021, prior consultation is not applicable in Punto Nuevo, but to date the Ministry of the Interior has not responded to the request for Monterrey. Additionally, cartography was reviewed to verify that the project area is not located on collective lands (Figure 4).

[15] ANT's response is available at: Gestión de la información\Tenencia Tierra \PNUD
[16] The Project Zone is the area made up of both the eligible and non-eligible areas of each type of initiative (REDD+ and GHG removal activities). These are properties of the project holder where the project activities (reforestation and conservation) are carried out. See section 4.1.1 for REDD+ and 5.1 for GHG removal activities.
[17] PRZ visualization portal. Available at: https://mig.etnoterritorios.org/index.php/view/map/?repository=sig&project=Visor_etnoterritorios
[18] ANT's response is available at: Gestión de la información\Tenencia Tierra\CTyL2021

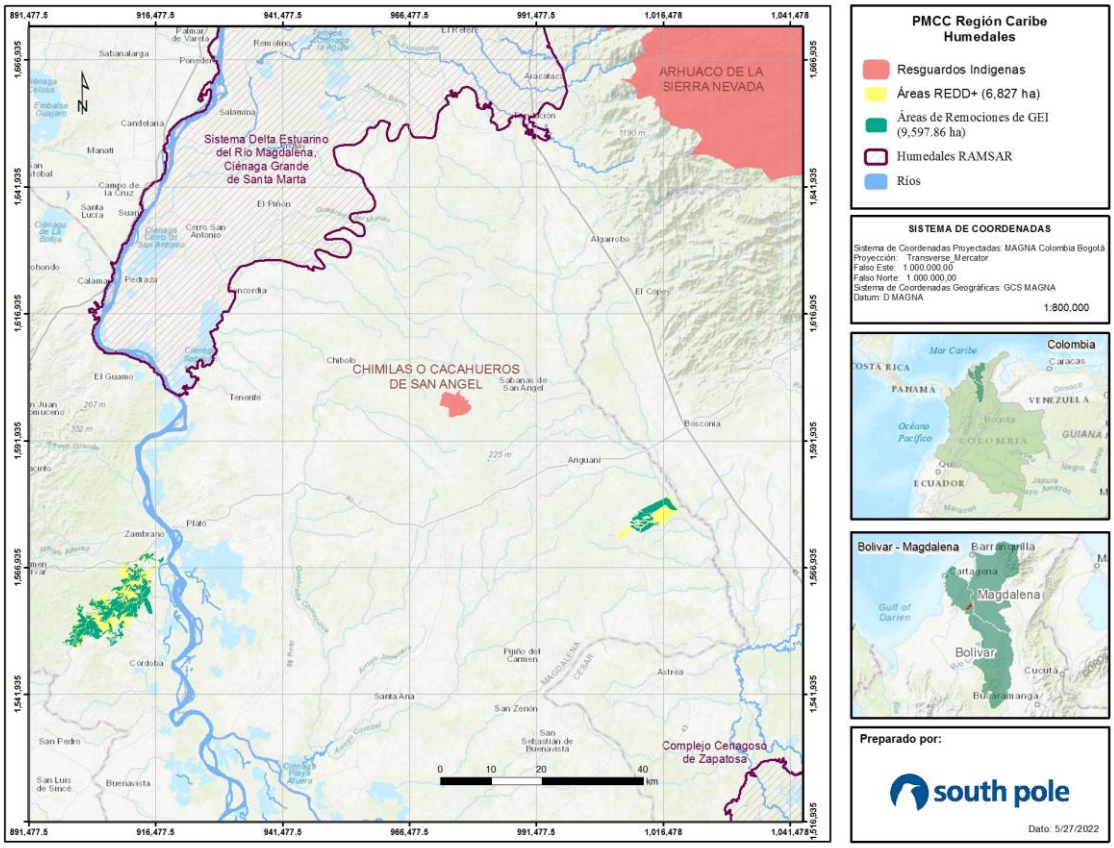

Figure 4: Location of indigenous reservations near the project area

(Source: South Pole, 2022[19])

1.6 Sectoral scope and project type

The Caribbean Region CCMP[20] is developed under the requirements of the Agriculture, Forestry and Other Land Use (AFOLU) sector and includes two types of projects:

- The REDD+ project, which seeks to reduce Greenhouse Gas (GHG) emissions resulting from deforestation (hereinafter "REDD+ project or component").
- The Greenhouse Gas (GHG) mitigation sector project whose main activity is the removal of GHG through the establishment of forest plantations (hereinafter "GHG removal project or activities").

Table 3: Project type of the Caribbean Region CCMP

Project Type	Standard	Methodological Document
REDD+	The REDD+ component is in the category of "Avoiding Unplanned Deforestation and/or Degradation" (AUDD) and intends to reduce GHG emissions through the implementation of deforestation and degradation reduction activities, including the conservation of carbon	The REDD+ component of the Caribbean Region CCMP complies with the conditions of the BCR0002 AFOLU Sector Methodological Document for the *Quantification of GHG Emission*

[19] The SIGOT (IGAC) shapefile document containing indigenous communities.
[20] Taking into account that the two projects (GHG removal activities and REDD+) are included in the Caribbean Region Climate Change Mitigation Project, each of the projects will be referred to as an initiative or component.

Project Type	Standard	Methodological Document
	stocks associated with aboveground biomass in arboreal vegetation, belowground biomass and soil organic carbon. These activities are in accordance with the REDD+ actions defined by the United Nations Framework Convention on Climate Change (UNFCCC) in paragraph 70 of Decision 1/CP.16 (UN, 2010)[21]. In addition, the initiative is designed in line with the mitigation actions in the Land Use, Land Use Change, and Forestry (LULUCF) sector, which are carried out at the regional and national levels within the framework of the National Development Plan 2018-2022, the Colombian Low Carbon Development Strategy (ECDBC), the National REDD+ Strategy (ENREDD+), and the principles and objectives of the National Climate Change Policy and the National Forest Policy. This initiative seeks the approval of the *Voluntary Carbon Market BCR Standard, from differentiated responsibility to common responsibility. Version 2.0* (hereinafter "BCR Standard").	*Reductions from REDD+ Projects,* Version 3.0 of February 16, 2022 (hereinafter "REDD+ Methodological Document").
GHG Removal Activities	The GHG Removal Activities component is based on forestry activities and, therefore, is part the AFOLU sector. For this component, it is expected to quantify carbon stocks associated with aboveground biomass in arboreal vegetation, belowground biomass and soil organic carbon. Registration before the BCR Standard will be requested.	For the GHG Removal Activities component of the Caribbean Region CCMP, the conditions of the BCR0001 AFOLU Sector Methodological Document for the *Quantification of GHG Emission Reductions from GHG Removal Activities,* Version 3.0 of April 13, 2022 (hereinafter "GHG Removal Activities Methodological Document") are applicable.

(Source: South Pole, based on Biocarbon Registry, 2020)

The Caribbean Region PMCC includes GHG mitigation initiatives classified into REDD+ projects and GHG Removal Activities, in adherence to the *Voluntary Carbon Market BCR Standard, from differentiated responsibility to common responsibility. Version 2.0* (hereinafter "BCR Standard").

1.7 Applicability conditions

The Caribbean Region CCMP complies with the BCR Standard applicability conditions and with the corresponding methodologies. This is demonstrated as follows:

[21] UN. (2010). The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention. [Conference] *Framework Convention on Climate Change*. Cancun, Mexico. https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf

Table 4: BCR Standard applicability conditions

Applicability Conditions	Applicability of REDD+	Applicability of GHG Removal
The methodological documents contain the applicability criteria and the detailed steps for the quantification and monitoring of the results based on the design and implementation of GHG mitigation initiatives and other GHG projects, by project type.	The initiative is developed in accordance with the guidelines of the *REDD+ Methodological Document*.	The initiative is developed in accordance with the guidelines of the *GHG Removal Activities Methodological Document*.
The holders of the AFOLU sector GHG mitigation initiatives can only certify and register in this program those initiatives whose start date is defined within the five (5) years prior to the validation date.	Start date within 5 years prior to project validation[22]. Start date: April 2, 2016 (See Section **¡Error! No se encuentra el origen de la referencia.**).	Start date within 10 years prior to project validation [23]. Start date: March 29, 2012 (See Section **¡Error! No se encuentra el origen de la referencia.**).

(Source: South Pole, based on Biocarbon Registry and FMC, 2022)

Table 5: Applicability conditions of the REDD+ component

Applicability Conditions	REDD+ Methodological Document
a) **The areas in the project boundaries correspond to the forest category (as outlined by the national definition for the Clean Development Mechanism), at the start of the project activities and ten years before the project start date.**	The areas within the project geographical boundaries were under the forest category (they comply with the forest definition of the Clean Development Mechanism) between 2006 and 2016, that is, during a 10-year period before the project start date 4.1.1 Spatial boundaries).
b) **The identified causes of deforestation may include, among others, expansion of the agricultural frontier, mining, timber extraction, and infrastructural expansion.**	The causes of deforestation identified include: expansion of the agricultural frontier, mining, logging, and expansion of infrastructure (see Section 4.2)[24].
c) **The causes of forest degradation identified may include selective logging, fuelwood extraction, forest fires, forest grazing, an expansion of the agricultural frontier – illicit crops.**	The REDD+ component does not include the degradation activity in the emissions quantification for the monitoring period.
d) **No reduction in deforestation or degradation is expected to occur in the absence of the project.**	According to the barrier analysis in Section 2 Identification of the baseline scenario and additionality[25], it was concluded that deforestation or forest degradation are expected to be reduced in

[22] Three project start date extensions were requested, taking into account that the project activities started prior to the launch of the BCR Standard (February 14, 2022). At that moment, the project was registered to apply to the *Program for Certification and Registration of GHG Mitigation Initiatives and Other Greenhouse Gas Projects* (Proclima Program), and the *Standard for the Certification and Registration of Voluntary GHG Mitigation Initiatives* (Proclima Voluntary Standard). However, the project is registered in the Biocarbon registry platform: https://biocarbonregistry.com/en/project/?id=23. The response from Biocarbon Registry is available at: Information management\General\Extension.

[23] Three project start date extensions were requested, taking into account that the project activities started prior to the launch of the BCR Standard (February 14, 2022). At that moment, the project was registered to apply to the *Program for Certification and Registration of GHG Mitigation Initiatives and Other Greenhouse Gas Projects* (Proclima Program), and the *Standard for the Certification and Registration of Voluntary GHG Mitigation Initiatives* (Proclima Voluntary Standard). However, the project is registered in the Biocarbon registry platform: https://biocarbonregistry.com/en/project/?id=23. The response from Biocarbon Registry is available at: Information management\General\Extension.

[24] The entire document on agents and drivers of deforestation is presented in Annex 3. Agents and drivers of deforestation. Availabe at: Gestión de la información\Secciones Anexas\Anexo 3_CausasyAgentesDeforestación.

[25] Annex 2: Baseline scenario and additionality. Available at: Gestión de la información\Secciones Anexas\Anexo 2_LB & Adicionalidad.

Applicability Conditions	REDD+ Methodological Document
	the absence of the project due to the dynamics of the region.
e) **The carbon stock in the organic matter soil, litter and dead wood in project boundary may decrease or remain stable.**	Deforested areas are subject to litter and dead wood loss due to the lack of availability of plant material. In deforested areas, carbon stocks in soil organic matter, litter, and dead wood may decrease or remain stable.
f) **The quantification of GHG other than CO_2 must be included in the quantification of emissions caused by forest fires (if applicable) during the monitoring period.**	The areas within FMC properties where wildfires occurred are outside of the project eligible areas. When a fire occurs in the project area, non-CO_2 GHGs will be quantified in accordance with the guidelines of the *REDD+ Methodological Document*.

(Source: South Pole, 2022)

Table 6: Applicability conditions of the GHG Removal Activities component

Applicability Conditions	GHG Removal Activities Methodological Document
a) **The areas in the project boundary shall not correspond to the forest category (according to the definition of the Forest and Carbon Monitoring System, SMByC), nor natural vegetation different to a forest, at the beginning of project activities and not five years before the project start date.**	The GHG Removal project areas were selected based on an eligibility analysis, which allowed for selecting only the areas that did not have forest or natural vegetation cover in a 5-year before the start of the project activities (see Section 5.1.1.1 Eligible areas for GHG removal activities).
b) **The areas in the project boundary do not fall in the wetland category.**	According to the information on RAMSAR wetland areas, IGAC's base cartography of double drainages (2018) and maps of the aquatic ecosystems from the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), the project areas are not under the wetland category (see Figure 5).
c) **The areas in the project boundary do not contain organic soils.**	Organic soils were defined by the IPCC (2006) as those that have at least 12% organic carbon by weight (around 20% organic matter) and are subject to episodes of water saturation. They are defined as histosols and other soils with histic horizon.[26] The project area does not have organic soils according to the information found in the SoilGrid soil organic carbon map database[27]. In the Project Zone the Acrisols, Cambisols and Fluvisols were found to be the predominant types of soil.[28,29] According to the Colombian soil classification[30], the Project Zone has the soil categories of Vertisols,

[26] IPCC. (2006) *IPCC Guidelines for National Greenhouse Gas Inventories*. Prepared by the National Greenhouse Gas Inventories Programme, Eggleston, In: H. S., Buendia L., Miwa K., Ngara T., and Tanabe K. (Eds.), IGES, Japan.
[27] https://soilgrids.org/
[28] The result of the analysis of soil organic carbon by using SoilGrid can be found in: Gestión de la información\General\Condiciones_ambientales\Soil_GriD_SOC_report.
[29] This classification is made with the World Reference Base (WRB). In correlation with the USDA (soil taxonomy), Acrisols are: Ultisols, Cambisols are Inceptisols, and Fluvisols are Entisols. See: https://warnercnr.colostate.edu/wpcontent/uploads/sites/2/2017/09/2012MOR2_AM_MSRM_Classification_Soils_Sergelen_Eng.pdf
[30] Classification with the USDA (soil taxonomy).

Applicability Conditions	GHG Removal Activities Methodological Document
	Entisols, Alfisols and Inceptisols (Section 1.9.1.4: Soils).[31] These characteristics hinder the accumulation of organic matter and the presence of organic soils in the project area. The land uses prior to project implementation did not include activities described in appendices 1 and 2 of the AR-ACM0003 methodology. In turn, they corresponded to pastures for livestock (Section **¡Error! No se encuentra el origen de la referencia.**), which is based on practices such as burning for land preparation, decreasing the organic carbon accumulation capacity in the soil. In the absence of project activities, the baseline is expected to remain as pasture for livestock, which is lower in carbon compared to plantations and forest cover.
d) **Natural regeneration is not expected to occur in the project area due to the absence of seed sources and the presence of weeds, as well as the performance of land use practices that do not allow for the establishment of tree vegetation.**	Land use practices associated with livestock activities that took place before the project start date do not promote natural regeneration as they result in a high degree of soil compaction and deterioration. In addition, burning is common to prepare soil for planting[32] or to renew pastures with regeneration potential. Soil preparation practices were necessary for the establishment of the plantations while species regeneration or colonization required silvicultural management practices.
e) **Carbon stocks in soil organic matter, litter, and dead wood are decrease or remain stable in the absence of project activities, that is, relative to the baseline scenario.**	The accumulation of carbon stocks in soil, litter and dead wood is not possible in the baseline of the project area (where livestock is the main land use), also considering that the environmental conditions (hot and dry weather) accelerate the mineralization of organic matter. Traditional land use in the region has resulted in overused soils, which are more susceptible to erosion and salinization processes that hinder the accumulation of organic matter[33,34]. Low carbon levels predominate in the soils of project's area of influence (the soils are mostly Vertisols) given its hot and dry climate, which accelerates the mineralization of organic matter. On the other hand, the region has sparse vegetation, making it difficult for organic matter to accumulate. In general, overused soils are observed, promoting erosion and salinization

[31] According to this, SOCref is 38 for Monterrey and 38 for Punto Nuevo.
[32] IDEAM. (s.f). *Incendios de la cobertura vegeta*l. http://www.ideam.gov.co/web/ecosistemas/incendios-cobertura-vegetal.
[33] Vallejo., Ramón., Díaz, F., & De la Rosa. (2005*). Impactos sobre los recursos edáficos*.
[34] Bolívar, A., Camacho, C., Ordoñez, N., Gutiérrez, J., Álvarez, G., Guevara, M., Olivera, C., Olmedo, G.F., Bunning, S. & Vargas, R. (2021). Estimación de carbono orgánico del suelo en Colombia, una herramienta de gestión del territorio. *Ecosistemas 30*(1) . https://doi.org/10.7818/ECOS.2019.

Applicability Conditions	GHG Removal Activities Methodological Document
	processes that hinder the accumulation of organic matter in areas with these types of conditions[35]. In the absence of project activities, the baseline is expected to remain as pastures for livestock, which do not lead to carbon accumulation in litter or dead wood compared to plantations and forest covers. The organic matter of the soil, litter and dead wood can decrease as erosion is an effect of cattle trampling[36].
f) **Flood irrigation is not used.**	Flood irrigation is not used for project activities as described in the Forest Management Plan (PMEF).[37]
g) **The effects of drainage are negligible, so non-CO_2 GHG emissions can be omitted.**	No drainage has been made for the establishment of the plantation. Therefore, non-CO_2 GHG emissions are omitted in this case.
h) **Soil disturbances due to project activities, if any, are carried out following appropriate soil conservation practices and have not been repeated for less than 20 years.**	The forest plantation is established manually or by using machinery while generating minor impacts on the soil and following the PMEF. To ensure this, the Land Preparation SOP-PRE-001 and Land Adaptation SOP-PRE-002 protocols are in place[38]. In the case of *Pachira quinata,* a species with a final rotation of 25 years, no additional practices are carried out during site preparation. In addition, in order to achieve the forest management certification, the site must be regenerated after the harvest, in such a way that it remains in similar or better conditions than before.
i) **The amount of nitrogen-fixing species used in project activities is negligible, so GHG emissions from denitrification can be considered insignificant.**	Nitrogen is fixed in the soil by microorganisms, such as bacteria, cyanobacteria, actinomycetes, and blue-green algae[39]. In addition, these microorganisms sometimes generate symbiotic associations with plants, which offer nutrients to the microorganisms through exudates and benefit from the nitrogen fixed[40]. A common symbiotic association is that between bacteria and legumes, where nitrogen-fixing nodules are generated[41]. Neither nitrogen-fixing microorganism species nor leguminous species (Fabales order) were used in the project activities[42], considering that *Gmelina arborea* species belongs to the Lamiales order and the *Pachira quinata* species to the Malvales order.

[35] Bolívar, A., Camacho, C., Ordoñez, N., Gutiérrez, J., Álvarez, G., Guevara, M., Olivera, C., Olmedo, G.F., Bunning, S & Vargas, R. (2021). Estimación de carbono orgánico del suelo en Colombia, una herramienta de gestión del territorio. *Ecosistemas 30*(1). https://doi.org/10.7818/ECOS.2019.
[36] Bolívar, A., Camacho, C., Ordoñez, N., Gutiérrez, J., Álvarez, G., Guevara, M., Olivera, C., Olmedo, G.F., Bunning, S & Vargas, R. (2021). Estimación de carbono orgánico del suelo en Colombia, una herramienta de gestión del territorio. *Ecosistemas 30*(1). https://doi.org/10.7818/ECOS.2019.
[37] Gestión de la información\Actividad_Remocion_GEI\PEMF.
[38] Gestión de la información\SOP\Titular_iniciativa.
[39] Mayz-Figueroa, J. (2004). Fijación biológica de nitrógeno. *Revista Científica UDO Agrícola 4*.1: 1-20.
[40] Mayz-Figueroa, J. (2004). Fijación biológica de nitrógeno. *Revista Científica UDO Agrícola 4*.1: 1-20.
[41] Acosta, C. (2005). Los árboles fijadores de nitrógeno y sus mecanismos biológicos. *Inventio, la genesis de la cultura universitaria en Morelos*. 23-28.
[42] Available at: Gestión de la información/SOP/SOP-EST-001_Establecimiento Plantaciones_V4

Applicability Conditions	GHG Removal Activities Methodological Document
j) **The activities under the GHG mitigation sector project will not give rise to the breach of any applicable law.**	The activities of the project comply with the environmental legislation, so they will not result in the breach of any law. The compliance with national legislation is presented in Section 1.10[43].

(Source: South Pole, 2022)

Table 7: Tool applicability conditions for GHG removal activities

Applicability Conditions		Methodological Document
Soil organic carbon (SOC). **The GHG Removal Activities Methodological Document, in Section 15.2.3 Soil organic carbon (COS), requires compliance with the following:**	a) Litter remains on-site and is not removed from the project area.	In accordance with the Forest Management Plan[44], no litter is removed from the site during soil preparation.
	b) Soil disturbance attributable to the project activity, if any, is: ○ By appropriate soil conservation practices. ○ Limited to site preparation before planting and is not repeated in less than twenty years.	The soil is prepared manually or by using machinery while generating minor impacts on the soil and following the PMEF. To ensure this, the Land Preparation SOP-PRE-001 and Land Adaptation SOP-PRE-002[45] protocols are in place. The areas eligible for organic carbon quantification are those planted with *Pachira quinata,* a species with a final rotation of 25 years.

(Source: South Pole, 2022)

[43] The full enviromental legilation document can be found at the Anexo 1: Cumplimiento de la legislación nacional.
[44] Gestión de la información\General\Planes.
[45] Gestión de la información\SOP\Titular_iniciativa.

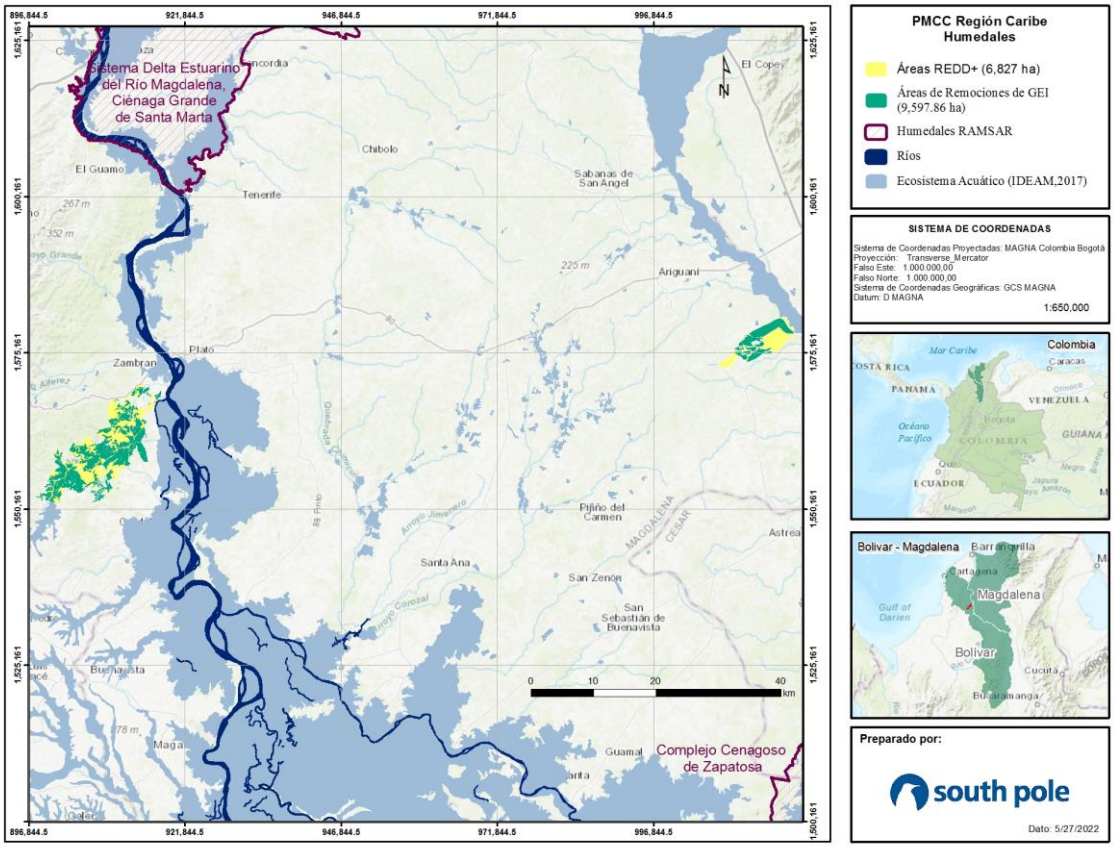

Figure 5: Wetland categories in the Caribbean Region CCMP

(Source: South Pole, 2022)

1.8 Project limits

1.8.1 Spatial limits

The Caribbean Region CCMP comprises 16,424.75 ha, of which 6,826.89 ha are part of the REDD+ component and 9,597.86 ha are dedicated to GHG removal activities. Table 8 shows the eligible[46] and non-eligible areas of the project. The details of each of the project components can be found in Section 4.1.1 for REDD+ and 5.1.1 for GHG removal activities.

[46] Eligible areas are equivalent to the project area.

Table 8: Spatial boundary of the Caribbean Region CCMP project area

Classification	REDD+	GHG removal	
Eligible	5,864.15	8,861.64	14,725.8
Non-eligible	962.74	736.22	1,699.0
Total	**6,826.89**	**9,597.86**	**16,424.75**

(Source: South Pole, 2022)

1.8.2 Project temporal limits

1.8.2.1 Start date and quantification period

Component	Start Date
REDD+	The start date of the REDD+ component is April 2, 2016, when the first training workshop on basic concepts for project structuring and planning was held with community stakeholders[47]. This activity was carried out as part of the "Community engagement and management of local environmental education" strategic line and the "Community engagement to strengthen education in the project's area of influence" program[48]. This workshop involves the community sector by training neighbors to raise environmental awareness and, in this sense, contribute to knowledge transfer of the commercial and environmental value of the territories, as well as of the risks associated with the occupation and alteration of dynamic and unstable lands. The quantification period began on April 2, 2016, and will end on April 2, 2046, for a total duration of 30 years.
GHG Removal Activities	The start date is based on the site preparation activities, specifically on the Petate lot cleaning (March 29, 2012)[49]. Taking into account the distribution of the project by centers, the following are the dates of plantations establishment: **Table 9: Date of forest plantations establishment by center** **Center** / **Establishment date** **Monterrey** — June 1, 2012 **Punto Nuevo** — June 1, 2015 (Source: Forestal Monterrey Colombia, 2021) The quantification period began on March 29, 2012, and will end on March 29, 2042, for a total duration of 30 years.

(Source: South Pole, 2022)

[47] The supporting document of the training workshop for community stakeholders in basic concepts for project structuring and planning is available at: Gestión de la información\Fecha de inicio\REDD+ and at: Gestión de la información\EPCAC\Compromiso_comunidades\LineaEstrategica2\PlaneacionProyectos.
[48] Strategic Line 2: Community engagement and management of local environmental education. Information available at: Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto\LineaEstrategica2.
[49] The supporting document can be found at: Gestión de la información\Fecha de inicio\ARGEI

1.8.2.2 Quantification periods for GHG emission reductions or removals

Table 10: Quantification and monitoring periods of the Caribbean Region CCMP

Component	Start date	End date	Quantification period	Monitoring period
REDD+	April 2, 2016	April 2, 2046	30 years	The GHG emissions reduction for the REDD+ component are quantified during the first monitoring period, between April 2, 2016 and December 31, 2020.
GHG Removal Activities	March 29, 2012	March 29, 2042	30 years	The first monitoring period will be between June 1, 2012 and December 31, 2021.

(Source: South Pole, 2022)

1.9 Socio-ecosystem characterization

The description of the project's environmental conditions will be based on the area of influence, specifically, the municipalities of Zambrano, El Carmen de Bolívar and Córdoba (in the department of Bolívar) and Ariguaní (in the department of Magdalena). The most relevant climatic, physical, biotic and socioeconomic aspects are described below:

1.9.1 Physical-biotic conditions

1.9.1.1 Climate

1.9.1.1.1 Rainfall and temperature

Based on the Climatological Atlas of Colombia prepared by IDEAM in 2015, the project's area of influence has a mean annual rainfall that ranges between 1,000 mm and 1,500 mm, which is distributed along 50 to 100 days per year. Regarding the mean temperature, two predominant temperature ranges are observed: 26°C-28°C and higher than 28°C in the municipalities of Zambrano, Córdoba and Ariguaní. According to the Caldas Lang classification, the area of influence has two types of weather: hot arid and hot semi-arid (Table 11).

Table 11: Rainfall, temperature and weather of the project's area of influence[50]

Area of influence	Total annual rainfall (mm)	No. of rainy days	Average temperature (°C)	Weather (Caldas Lang classification)
Zambrano	1,000 – 1,500	50 - 100	26 – 28 > 28	Hot arid

[50] IDEAM. (2015). *Atlas climatológico de Colombia (1981-2010).* http://atlas.ideam.gov.co/visorAtlasClimatologico.html

Area of influence	Total annual rainfall (mm)	No. of rainy days	Average temperature (°C)	Weather (Caldas Lang classification)
El Carmen de Bolívar*	1,000 – 1,500	50 - 100	26 - 28	Hot semi-arid
Córdoba	1,000 - 1,500	50 - 100	26 – 28 > 28	Hot arid
Ariguaní (El Difícil)	1,000 – 1,500	50 - 100	26 – 28 > 28	Hot semi-arid

* These rainfall values correspond to the project area and nearby areas. In this municipality, there is evidence of another site further away from the project area where rainfall reaches values between 1,500 mm and 2,000 mm.

(Source: South Pole, based on information by IDEAM, 2022[51])

The rainfall regime in these municipalities is bimodal, with maximum values in the months from September to November and from May to June (Promontes, 2003)[52].

1.9.1.1.2 Life zones

According to the Holdridge's classification, the Monterrey and Punto Nuevo centers present the characteristics of the Very Dry Tropical Forest (bms-T) and Dry Tropical Forest (bs-T) life zones, respectively[53,54], as described and displayed below (Figure 6):

Tropical dry forest

It exists at heights ranging from 0 to 1,100 masl, with temperatures above 24ºC. It is located in the agricultural zone of the department, that is, the banana region and the Ariguaní river valley. Its expanse used to be almost 70% but with the conversion of the areas into intensive agriculture, livestock and artificial pasture systems, the original forests have disappeared.

Tropical very dry forest

It is found in areas with temperatures higher than 24ºC and heights ranging between 0 to 500 masl. Most of the vegetation in this life zone is drought deciduous, with a few species (such as the orange tree) retaining their foliage. In this formation it is also worth mentioning the presence of mangroves, which are a vegetation adapted to living in regularly flooded and brackish soils, located in areas close to river mouths and freshwater channels.

[51] IDEAM. (2015). *Atlas climatológico de Colombia (1981-2010).* http://atlas.ideam.gov.co/visorAtlasClimatologico.html
[52] Promontes. (2003). *Programa de Desarrollo y Paz de los Montes de María -Promontes*. University of Cartagena.
[53] https://www.unep-wcmc.org/resources-and-data/holdridges-life-zones
[54] Holdridge, L. R. (1967). *Life Zone Ecology*. Tropical Science Center.

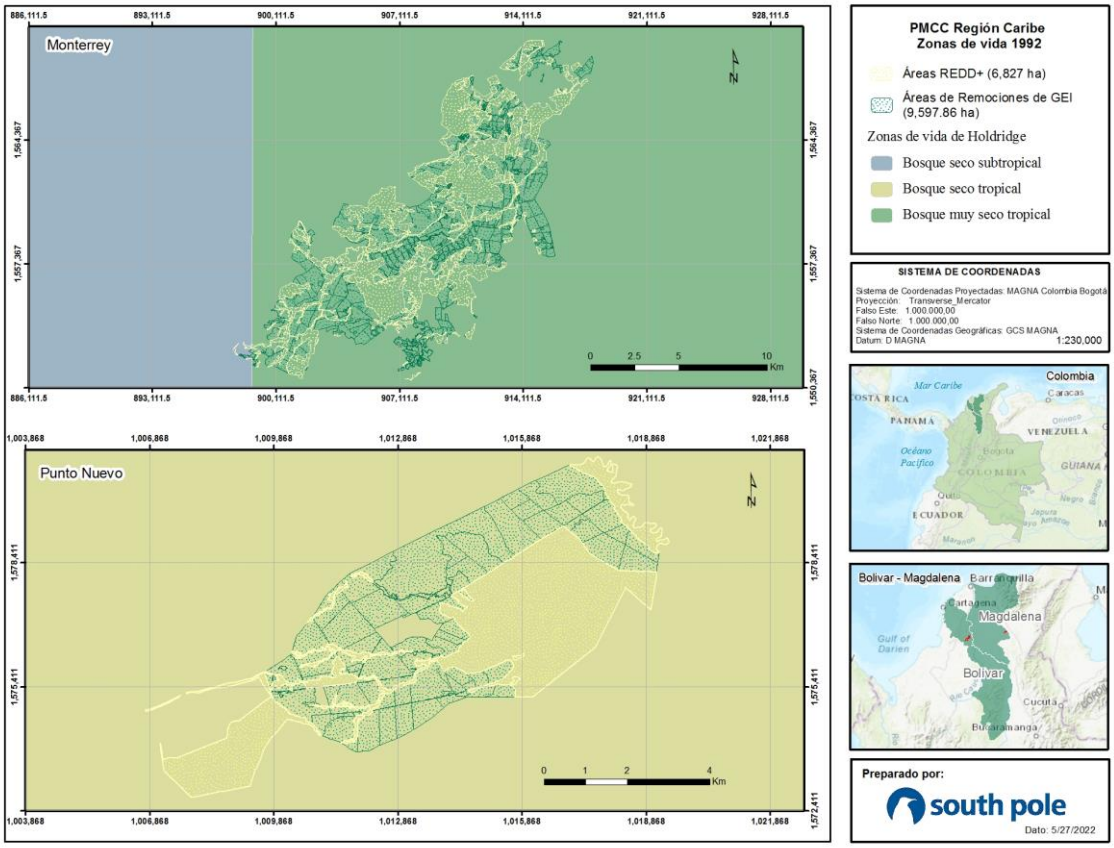

Figure 6: Life zones in the Caribbean Region CCMP

(Source: South Pole, based on Holdridge's life zones, 2022)

1.9.1.2 Hydrology

In the municipalities of Zambrano and Córdoba, in the department of Bolívar, the most important fluvial axis is the Magdalena River. There is also the region of the Momposina Depression, the most floodable area in the country due to the fluvial dynamics that occur in the area where it is located[55]. Specifically, the municipality of Zambrano has important tributaries besides the Magdalena River, such as the Raicero, Alférez, Mancomoján and Los Cabezones streams[56]. The most important tributaries of the municipality of Córdoba are the Mancomoján and the Poncio streams[57]., while among the main ones of El Carmen de Bolívar are the Alférez stream and its main tributaries: the Sin Cabeza and the Mancomoján streams. The Alférez stream is the main water current of the municipality, running through it in a west-east direction, crossing the municipality of Zambrano and flowing to the Zambrano swamp and the Magdalena River at the end of its length[58].

In general, the municipalities of Zambrano, Córdoba and El Carmen de Bolívar are made up of oceanic, runoff, infiltration and lentic waters. However, most of the extensive water network of these municipalities is seasonal[59]. This condition implies a deficit of surface water during the dry

[55] CARDIQUE. (1999*). Evaluación Potencial Ambiental de los Recursos Suelo, Agua, Mineral y Bosques*.
[56] CARDIQUE. (1999*). Evaluación Potencial Ambiental de los Recursos Suelo, Agua, Mineral y Bosques*.
[57] Alcaldía del municipio de Córdoba. (2008). *Plan de Desarrollo municipio de Córdoba departamento de Bolívar 2008 - 2011*.
[58] Mayor's Office of El Carmen de Bolívar. (2002). *Plan Básico de Ordenamiento Territorial del municipio del Carmen de Bolívar 2002-2011*.
[59] Aguilera-Díaz, M. (2013). *Montes de María: una subregión de economía campesina y empresarial.* Documentos de Trabajo Sobre Economía Regional y Urbana; No. 195.

period, which, and even though marshy areas store considerable water volumes that are used locally, the supply is insufficient to cover the demands for agricultural consumption[60]. In this sense, forest fragments, and even forest plantations, could help regulate water flows[61,62,63].

Regarding the Magdalena River, which is the largest tributary in the project's area of influence, it reaches its lowest levels and flows between February and April, which is the driest season in most of the country's central area, making the river lose its flow. For its part, the highest levels occur from October to December, occasionally until January, staying up until April and slightly decreasing from the end of June onwards, with an average flow of 4,086 m³/sec. However, as the average level goes from 6.17 masl in March to 13.00 masl in November, the average flow at the end of the year is 9,960 m³/sec[64].

In particular, the project area that encompasses the Monterrey center is located within the Magdalena-Cauca Hydrographic Area (HA), Bajo Magdalena-Cauca-San Jorge Hydrographic Zone (HZ), and the Bajo San Jorge-La Mojana and Direct to Bajo Magdalena Hydrographic Subzones (HSZ), between El Plato and Calamar (IDEAM, 2013)[65]. The municipality of Ariguaní, in the department of Magdalena, has an extensive water network that runs through the territory, most of it belonging to the Ariguaní River basin and the Magdalena River basin. The main rivers of the municipality are Fundación, Aracataca, Frío, Sevilla, Ariguaní and Tucurinca[66].

For its part, the project area covering the Punto Nuevo center is located within the Magdalena-Cauca Hydrographic Area (HA), the Cesar Hydrographic Zone (HZ), and the Ariguaní River Hydrographic Subzone (HSZ) [67].

[60] CARDIQUE. (1999*). Evaluación Potencial Ambiental de los Recursos Suelo, Agua, Mineral y Bosques.*
[61] Vásquez-Velásquez, L. (2016). *Influencia del uso de la tierra en la respuesta hidrológica de cuencas de cabecera en los Andes centrales de Colombia* [PhD Thesis]. National university of Colombia.
[62] Taniwaki, R, Cassiano, Fransozi, Vásquez, Posada, R, Velásquez, & Ferraz, S. (2019). Effects of land-use changes on structural characteristics of tropical high-altitude Andean headwater streams*. Limnologica, 74*, 1-7.
[63] Meyfroidt, P, & Lambin, F. (2011). Global forest transition: prospects for an end to deforestation. *Annual review of environment and resources, 36*, 343-371.
[64] CARDIQUE. (1999). *Evaluación Potencial Ambiental de los Recursos Suelo, Agua, Mineral y Bosques.*
[65] IDEAM (2013). *Zonificación y codificación de unidades hidrográficas e hidrogeológicas de Colombia*. Publication approved by the IDEAM Communications and Publications Committee, Bogotá, D. C., Colombia.
[66] Municipality of Ariguaní. (2020). *Plan de educación ambiental del municipio de Ariguaní, departamento del Magdalena 2017-2019.*
[67] IDEAM (2013). *Zonificación y codificación de unidades hidrográficas e hidrogeológicas de Colombia*. Publication approved by the IDEAM Communications and Publications Committee, Bogotá, D. C., Colombia.

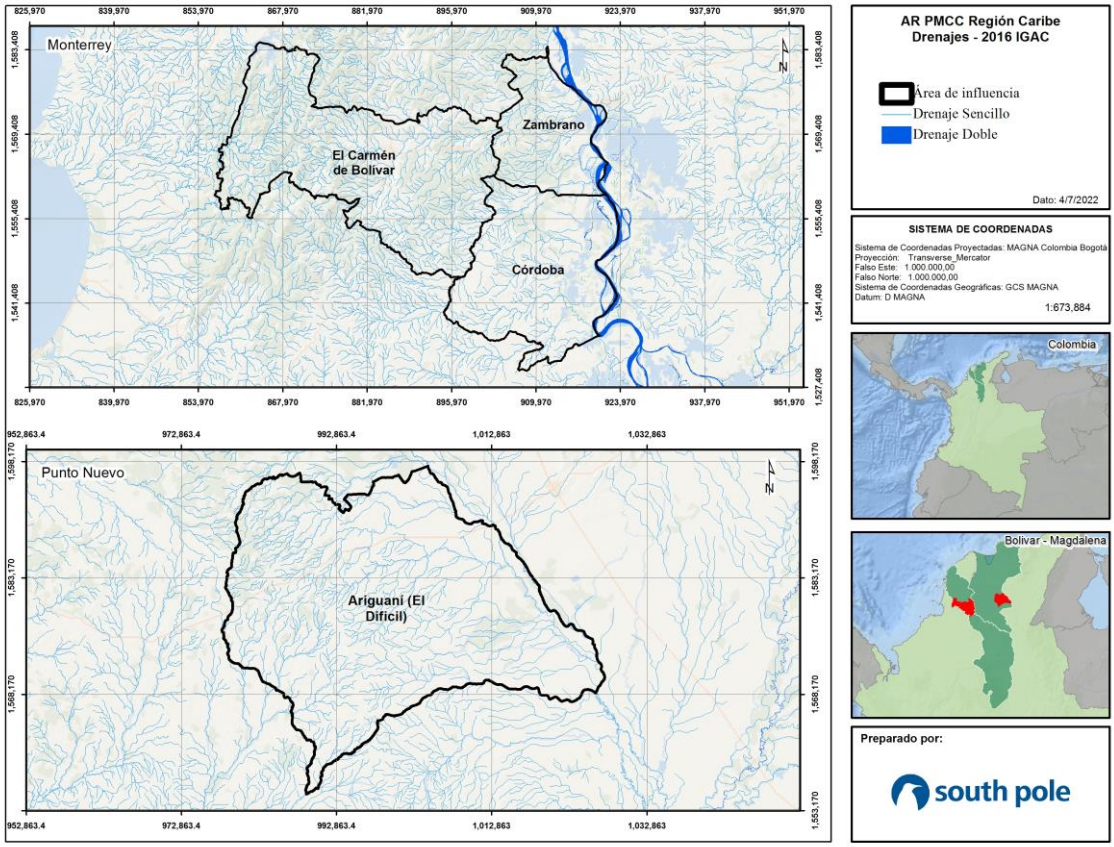

Figure 7: Drainage network in the area of influence of the Caribbean Region CCMP

(Source: South Pole, based on the IGAC drainage network, 2022)

1.9.1.3 Geology and geomorphology

The geomorphology was approached according to the landscapes found in the area of influence[68], which, in general, are identified as low hills[69,70,71]. This type of landscape corresponds to reliefs such as low hills and hills, little valleys and low hills and undulations, being characterized by having recurring round or elongated hills, with summits at variable heights that are split by a moderately dense hydrographic network and small colluvial-alluvial valleys[72]. In this type of landscapes, in general terms, the soils are superficial to moderately deep with moderately fine to fine textures, neutral to slightly alkaline, well drained, with a high base saturation and a high to moderate fertility[73].

[68] Made up of the municipalities of Zambrano, El Carmen de Bolívar, Córdoba and Ariguaní.
[69] IGAC. (2009). *Mapa Digital de Suelos del Departamento de Magdalena, República de Colombia. Escala 1:100.000.*
[70] IGAC. (1997). *Mapa Digital de Suelos del Departamento de Bolívar, República de Colombia. Escala 1:100.000.*
[71] Numpaque, Rincón, Garzón, &Jorge Stember. Suelos por tipo de paisaje asociados al cultivo de la palma de aceite en la Zona Suroccidental de Colombia. *Revista Palmas 37*.1 (2016): 25-43.
[72] Zinck, A. (2012). *"Geopedología." Elementos de geomorfología para estudios de suelos y de riesgos naturales.* ITC Faculty of Geo-Information Science and Earth Observation. Enschede, The Netherlands.
[73] Zinck, A. (2012). *"Geopedología." Elementos de geomorfología para estudios de suelos y de riesgos naturales.* ITC Faculty of Geo-Information Science and Earth Observation. Enschede, The Netherlands.

Table 12: Geomorphology in the area of influence of the Caribbean Region CCMP

Area of influence	Landscape
Zambrano	Low hills: 57,5% Piedmont: 29,9% Water body: 6,58% Plain: 5.5% Urban area: 0.5
El Carmen de Bolívar	Low hills: 65.8% Mountain: 31.5% Piedmont: 1.1% Urban area: 1%
Córdoba	Low hills: 61.5% Plain: 17.8% Piedmont: 14.4% Water body: 6.0% Urban area: 0.3%
Ariguaní (El Difícil)	Low hills: 68,5% Valley: 31,3% Urban area: 0.2% Water body: 0.03%

(Source: South Pole, based on information from the IGAC, 2022)

1.9.1.4 Soils

According to the soil classification in the project's area of influence, Vertisols are the main type found there. These soils are moderately acid to neutral, with a high base saturation and fertility, moderately deep, fine to moderately fine textured, and moderately well drained[74] (Table 13).

Table 13: Soil order with greater representativeness in the project's area of influence[75]

Area of influence	Soil Order
Zambrano	Vertisols Entisols Alfisols
El Carmen de Bolívar	Entisols Mollisols Vertisols
Córdoba	Entisols Vertisols
Ariguaní (El Difícil)	Vertisols Inceptisols Entisols

(Source: South Pole, based on information from the IGAC, 2022)

The predominant soil type in the Punto Nuevo center is the association Chromic Haplusterts, Typic Haplusterts and Fluventic Haplustepts, which covers 76% of the area (Table 13). This association contains deep and moderately deep Vertisols and Inceptisols, which are well to moderately drained, with fine textures, slightly acidic to moderately acidic, and with high to very high natural fertility[76]. Based on this classification, default values are determined in order to quantify the soil organic carbon for GHG removal activities as presented in Section **¡Error! No se encuentra el origen de la referencia.**.

[74] IGAC. (2009). *Mapa Digital de Suelos del Departamento de Magdalena, República de Colombia. Escala 1:100.000*.
[75] *IGAC. (2009). Mapa Digital de Suelos del Departamento de Magdalena, República de Colombia. Escala 1:100.000.*
[76] IGAC. (2009). *Mapa Digital de Suelos del Departamento de Magdalena, República de Colombia. Escala 1:100.000.*

Table 14: Predominant soil orders and types in the project area [77].

Zone	UCS	Soil Order	Soil	Area (ha)	Percentage
Monterrey	PWD	Vertisols	Consociation: Sodic Haplusterts	5,427.27	50.24
	LWD	Entisols and Alfisols	Association: Typic Ustipsamments, Typic Haplustalfs	2,314.99	21.43
Punto Nuevo	VWA	Vertisols; Vertisols; Inceptisols	Association: Chromic Haplusterts, Typic Haplusterts, Fluventic Haplustepts	2,951.92	76.34

(Source: South Pole, based on information from the IGAC, 2022)

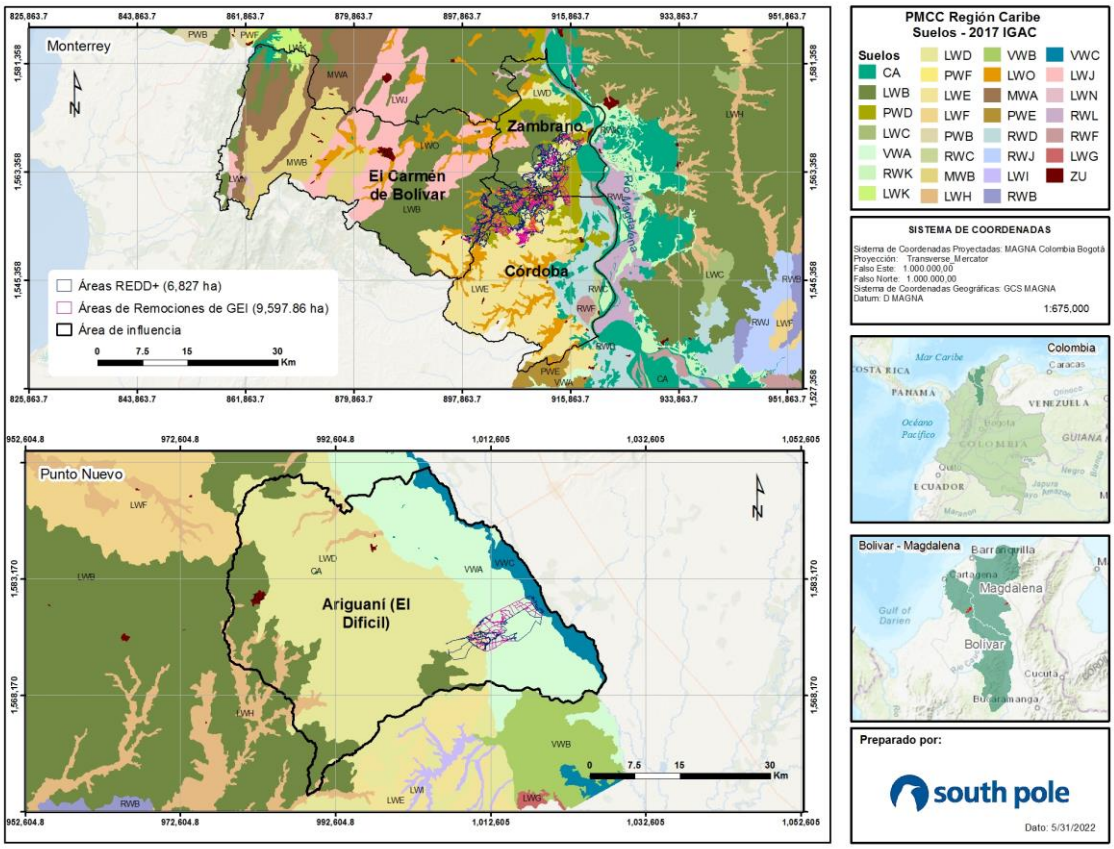

Figure 8: Soil types in the area of influence of the Caribbean Region CCMP

(Source: South Pole, based on information from the IGAC, 2022)

[77] The complete list of soil types in the project area is available at: Gestión de la información\General\ Condiciones_ambientales.

1.9.1.5 Land covers and land uses

1.9.1.5.1 Land covers and land uses

According to the IDEAM's cover classification map (2018)[78], the land cover with the greatest predominance (41.55%) in the project's area of influence is associated to pastures for livestock use (Table 15). The second most predominant cover is herbaceous and/or shrubby vegetation (23.88%), while other important covers are transitory crops, permanent crops, heterogeneous agricultural areas, and forests (together covering 27.07%). Forest plantations are included within these areas (Figure 9).

Specifically, both the Monterrey and the Punto Nuevo centers have the following land covers with their respective land uses: commercial forest plantations for productive use, gallery and/or riparian forests, secondary and/or transition vegetation with protection use[79].

[78] IDEAM. (2018). *Mapa Nacional de Coberturas de tierras.*
[79] Forestal Monterrey Colombia (2019). Plan de Manejo Ambiental. Available at: Gestión de la información\Actividad_Remocion_GEI\PEMF.

Table 15: Land cover and land uses inthe area of influence of the Caribbean Region CCMP[80]

Land Cover	Land Use	Córdoba (ha)	El Carmen de Bolívar	Zambrano (ha)	Ariguaní (ha)	Total Area (ha)	Percentage (%)
			Monterrey		Punto Nuevo		
1.1. Urban areas	Infrastructure	201.15	508.12	170.47	328.76	1,208.51	0.40
1.2. Industrial or commercial areas and communication networks	Infrastructure		37.77	9.40		47.17	0.02
2.1. Transitory crops	Agriculture	1,190.16		361.38		1,551.54	0.52
2.2. Permanent crops	Agriculture		124.54	319.66	653.05	1,097.25	0.37
23. Pastures	Livestock	20,222.04	22,271.29	9,085.56	72,581.74	124,160.63	41.55
2.4. Heterogeneous agricultural areas	Agriculture	8,949.83	34,038.97	4,277.68	9,198.45	56,464.92	18.90
3.1. Forests	Conservation/production	5,138.42	7,989.51	2,805.77	5,819.13	21,752.83	7.28
3.2. Areas with herbaceous and/or shrubby vegetation	Conservation	13,403.48	28,880.39	10,986.36	18,081.99	71,352.21	23.88
3.3. Open areas, with little or no vegetation	No use	1,899.37	41.29	61.71	3,120.66	5,123.03	1.71
4.1. Inland humid areas	Water natural bodies	6,320.82	150.60	1,066.40	3,344.86	10,882.68	3.64
5.1. Inland waters	Water natural bodies	2,324.18	750.48	1,941.76	150.31	5,166.73	1.73
Total		**59,649.44**	**94,792.97**	**31,086.15**	**113,278.94**	**298,807.50**	**100%**

(Source: South Pole, 2022, based on information from IDEAM, 2018[81])

[80] The entire list of the cover types in the project's area of influence is available at: Gestión de la información\General\Condiciones_ambientales.
[81] IDEAM (2018). Mapa Nacional de Coberturas de tierras.

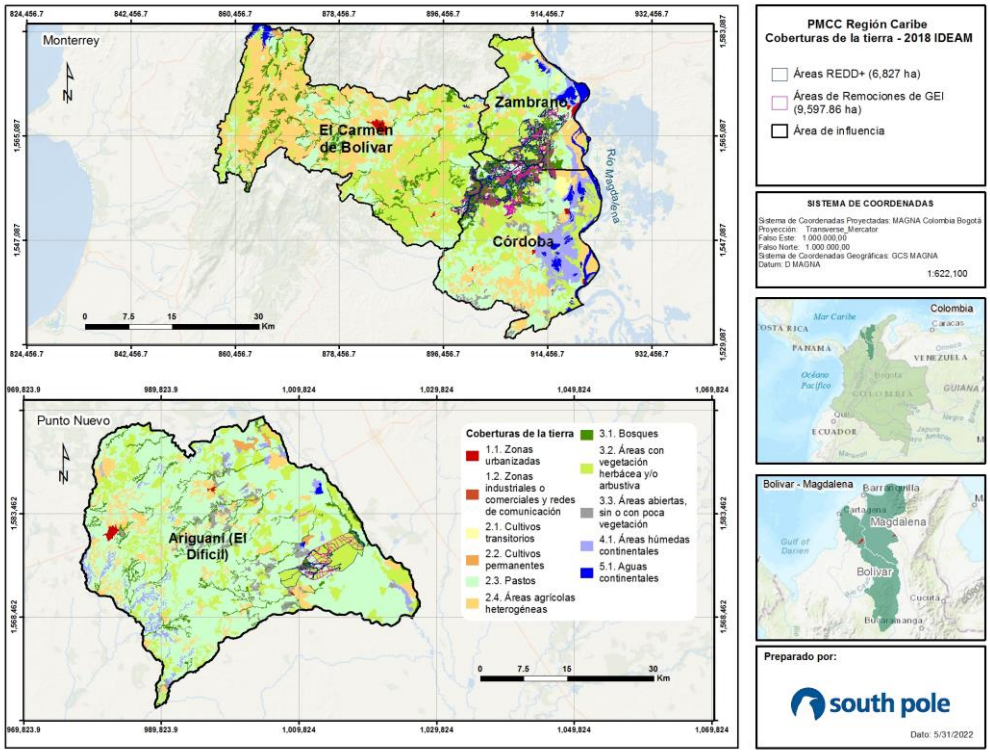

Figure 9: Land covers in the area of influence of the Caribbean Region CCMP

(Source: South Pole, 2022, based on information from IDEAM, 2018[82])

1.9.1.5.2 Potential use

The Basic Land Management Plans of the municipalities of El Carmen de Bolívar and Córdoba and the Land Management Schemes of the municipalities of Zambrano and Ariguaní propose forestry activities for rural land use management, which are aligned with the project activities[83].

The above is confirmed by the information included in the Land Classification Map by Land Use Vocation at a scale of 1:100,000. By cross-checking this map with the project's area of influence, and particularly with the project zone, it can be seen that almost 40% of it has a forest vocation (including use for production and protection) and 60% has a productive use vocation (Table 16 and Figure 10).

Table 16: Land use vocation of the project zone of the Caribbean Region CCMP[84,85]

Zone	Vocation	Main Use	Area (ha)	Percentage (%)
Monterrey	Forestry	Warm climate, forestry production	703.97	6.52
	Agricultural	Warm climate, semi-intensive permanent crops	1,395.29	12.92
	Forest	Protection and production	2,472.27	22.89
	Livestock	Warm climate, semi-intensive grazing	5,427.31	50.24

[82] IDEAM (2018). *Mapa Nacional de Coberturas de tierras*. http://www.ideam.gov.co/web/ecosistemas/coberturas-nacionales
[83] The land use certificate is available at: Gestión de la información\General\Certificado Uso del Suelo.
[84] IGAC (2017). Mapas de Clasificación de las Tierras por su Vocación de Uso a escala 1:100.000.
[85] The entire list with the land use vocation types present in the project area are available at: Gestión de la información\General\Condiciones_ambientales.

Zone	Vocation	Main Use	Area (ha)	Percentage (%)
Punto Nuevo	Agroforestry	Agrosilvopastoral with permanent crops	280.08	7.24
	Agricultural	Warm climate, transitional semi-intensive crops	2,951.92	76.34
	Livestock	Warm climate, extensive grazing	84.34	2.18

(Source: South Pole, 2022, based on information from IGAC, 2017)

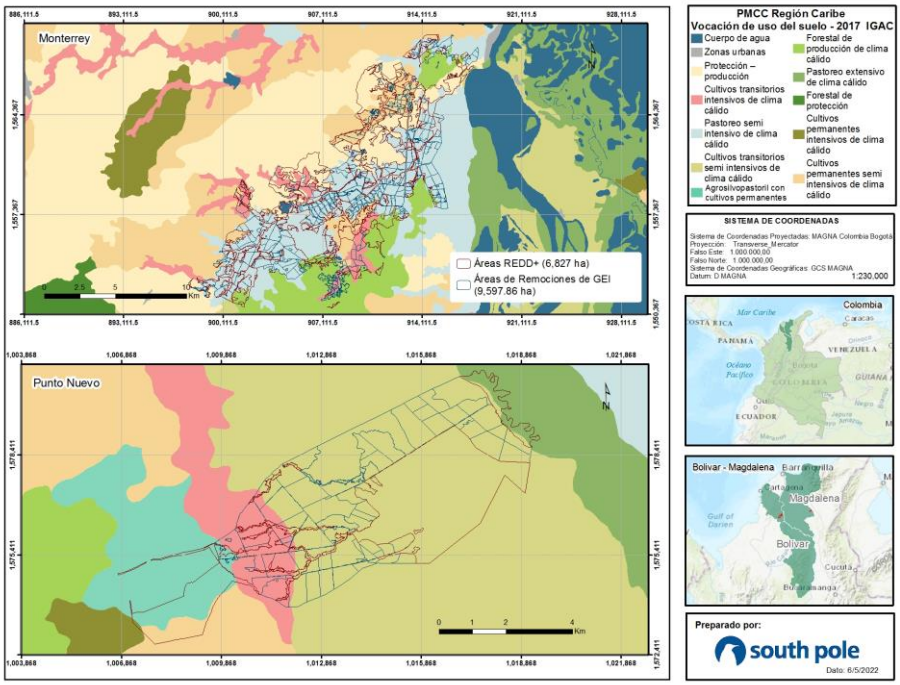

Figure 10: Land use vocation in the project's area of influence and the project zone

(Source: South Pole, based on information from IGAC, 2017)

1.9.1.6 Biodiversity

In the area of influence of the project, reported flora species include *Sarcostemma glaucum, Lagascea mollis, Ruellia ciliatiflora, Solanum adhaerens, Passiflora foetida, Bastardia viscosa, Bignonia aequinoctialis, Sesamum indicum, Luffa cylindrica, Capparidastrum pachaca, Cissus javana, Tabebuia rosea, Adenocalymma inundatum, Aristolochia anguicida, Bastardia viscosa, Fridericia dichotoma, Gyrocarpus americanus, Hibiscus phoeniceus, Opuntia caracassana, Ziziphus thyrsiflora, Enterolobium cyclocarpum, Ipomoea carnea fistulosa, Pithecellobium roseum, Plumeria rubra, Roseodendron chryseum* and *Gyrocarpus americanus*[86]*.*

In the project zone, flora monitoring has reported the existence of 16 species in areas of tropical dry forest[87] (Table 17). Among these species is *Belencita nemorosa* (Figure 11), a species of high conservation value, with a reduced habitat, typical of dry areas, and endemic to the Colombian Caribbean[88].

[86] Biodiversity Information System of Colombia (*Sistema de Información sobre Biodiversidad de Colombia*, SIB).
[87] FMC. (2016). *Informe de actividades - Resumen público año 2016*. Available at: Gestión de la información\General\Informes_actividades.
[88] FMC. (2019). *Plan de Manejo de Atributos de Alto Valor de Conservación-AAVC*. Available at: Gestión de la información\General\Informes de actividades.

Table 17: Species reported in the flora monitoring carried out in the project zone

Family	Scientific name	Threat level[89]
Boraginaceae	*Cordia alba*	-
Zygophyllaceae	*Bulnesia arborea*	-
Capparaceae	*Quadrella odoratissima*	-
Capparaceae	*Belencita nemorosa*	-
Anacardiaceae	*Astronium graveolens*	-
Fabaceae	*Albizia niopoides*	-
Lecythidaceae	*Lecythis minor*	-
Malvaceae	*Guazuma ulmifolia*	-
Fabaceae	*Piptadenia viridiflora*	-
Fabaceae	*Acacia farnesiana*	-
Fabaceae	*Caesalpinia coriaria*	-
Polygonaceae	*Ruprechtia ramiflora*	-
Malpighiaceae	*Malpighia punicifolia*	-
Primulaceae	*Jacquinia aristata*	-
Arecaceae	*Bactris guineensis*	-
Sapindaceae	*Melicoccus bijugatus*	-

(Source: Forestal Monterrey Colombia, 2019)[90]

Blossom | Green fruit | Ripe fruit

Figure 11: Characteristics of the blossom and fruits of *Belencita nemorosa*

(Source: Forestal Monterrey Colombia, 2019) [91]

[89] IUCN. (2022). *The IUCN Red List of Threatened Species*. *Version 2021-3*. <https://www.iucnredlist.org>
[90] FMC. (2016). *Informe de actividades - Resumen público año 2016*. Available at: Gestión de la información\General\Informes_actividades.
[91] Monitoring plan of the *Belencita nemorosa* HCV. Available at: Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto\LineaEstrategica1\Monitoreo AVC2 Diversidad de especies\Belencita_nemorosa.

In the Monterrey center, 832 fauna sightings have been recorded. The species with the highest recurrence were the roadside hawk, yellow-olive flycatcher, violetear, yellow-headed caracara, smooth-billed ani, rufous-vented chachalaca, pale-eyed pygmy tyrant, tufted antshrike, yellow-backed oriole, chauchau, and tura pigeon, with more than 20 reports each[92]. Regarding the Punto Nuevo center, 67 sightings have been recorded, with the species with the highest recurrence being the yellow-headed caracara, brown hawk, smooth-billed ani and squirrel, with 4 to 5 reports each on average[93]. Some of the most common species recorded are listed below (Table 18).

Table 18: Species reported in the fauna monitoring carried out in the project zone

Family	Common Name	Scientific Name	Threat level [94,95]
Callitrichidae	Cotton-top tamarin	*Saguinus oedipus*	Endemic, Appendix I CR (Critically Endangered)
Psittacidae	Scarlet macaw	*Ara macao*	Appendix I
Canidae	Bush dog	*Speothos venaticus*	-
Felidae	Margay	*Leopardus wiedii*	NT (Near Threatened)
Mustelidae	Otter	*Lontra longicaudis*	Appendix I, NT (Near Threatened)
Myrmecophagidae	Giant anteater	*Myrmecophaga tridactyla*	-
Anhimidae	Northern screamer	*Chauna chavaria*	-
Falconidae	Peregrine falcon	*Falco peregrinus*	Appendix I
Procyonidae	Honey bear	*Potos flavus*	-
Cervidae	White-tailed deer	*Odocoileus virginianus*	-
Accipitridae	Roadside hawk	*Rupornis magnirostris*	-
Scarabaeidae	-	*Malagoniella astyanax*	-

(Source: Forestal Monterrey Colombia, 2019)[96]

1.9.2 Socioeconomic aspects[97]

The project's area of influence is located in the departments of Bolívar and Magdalena, specifically in the municipalities of Córdoba, Zambrano and Ariguaní, in the Colombian Caribbean, withing the Momposina Depression. There, historical, socioeconomic and cultural contexts are associated with the ecosystem richness and productivity, facilitating the

[92] Fauna sighting and registration. Available at: Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto\LineaEstrategica1\Avistamientos y Registros de fauna.
[93] Fauna sighting and registration. Available at: Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto\LineaEstrategica1\Avistamientos y Registros de fauna.
[94] IUCN. (2022). *The IUCN Red List of Threatened Species. Version 2021-3.* https://www.iucnredlist.org
[95] CITES. (2022). *Convention on International Trade in Endangered Species of Wild Fauna and Flora.* https://cites.org/eng/disc/text.php.
[96] FMC. (2016). *Informe de actividades - Resumen público año 2016*. Available at: Gestión de la información\General\Informes_actividades
[97] The full description of the socioeconomic aspects of the Caribbean Region CCMP is included in the document ECPAC Participatory Baseline (LPB_PMCC), available at: Gestión de la información\EPCAC. And the agents and drivers of deforestation are described in Annex 3: Causes and agents of deforestation, available at: Gestión de la información\Secciones Anexas\Anexo 3_CausasyAgentesDeforestación

establishment and development of agricultural activities by different human populations (Herrera, 2006[98]).

The area of influence of the project has more than 60,000 inhabitants, of which 89.8% is connected to the electrical grid and only 4.73% have access to sewerage service. The population mainly accesses the government-subsidized health system and the main problems in the education area are related to the lack of school infrastructure added to the poor condition of the existing ones, as well as insufficient availability of teachers that can supply the population educational needs.

Due to the population characteristics, the way in which the territory has been inhabited and the socioeconomic and political dynamics associated with the use of natural resources, agriculture and livestock activities have changed over centuries and millennia, which has generated an increase in traditional, subsistence agriculture. In fact, soil fertility has facilitated the establishment of intensive and permanent agricultural crops, and drainage and land recovery systems nourish the lands when the floodwaters lower their levels, strengthening agricultural production and improving home gardens and pastures for livestock.

The result of these dynamics has been the loss of large hectares of forests in areas used to expand the agricultural frontier (see Section 4.2: Causes and agents of deforestation)[99], preventing the implementation of other land use activities, such as reforestation, due to lack of resources and incentives aimed at promoting new practices (see Section 2: Identification of the baseline scenario and additionality)[100].

1.10 Compliance with national legislation

The assessment of compliance with national legislation can be found in Annex 1: Compliance with national legislation [101].

1.10.1 Registration in RENARE

The project is in the process of being registered in the National Registry for the Reduction of Greenhouse Gas Emissions (RENARE). The current registration status is “feasibility” and the code is 3841[102].

1.11 Carbon pools and stocks and GHG sources

1.11.1 Carbon pools and stocks

In compliance with the BCR0002 AFOLU Sector Methodological Document for the *Quantification of GHG Emission Reductions from REDD+ Projects,* Version 3.0 of February 16, 2022 (REDD+ Methodological Document) and the BCR0001 AFOLU Sector Methodological Document for the *Quantification of GHG Emission Reductions from GHG Removal Activities,* Version 3.0 of April 13, 2022 (GHG Removal Activities Methodological Document), the carbon stocks of aboveground arboreal biomass, belowground biomass and soil organic carbon are selected, both for the baseline and the project scenario.

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[98] Herrera, F. (2006). Paleoecología en la depresión momposina. 21.000 años de cambios ambientales. *Agricultura ancestral camellones y albarradas. Contexto social, usos y retos del pasado y del presente. Institut de Recherche pour le développement*: 227-240.

[99] Annex 3: Causes and agents of deforestation. Available at: Gestión de la información\Secciones Anexas\Anexo 3_CausasyAgentesDeforestación

[100] Annex 2: Baseline scenario and additionality. Available at: Gestión de la información\Secciones Anexas\Anexo 2_LB & Adicionalidad

[101] Gestión de la información\Secciones Anexas.

[102] Taking into account that the Caribbean Region CCMP involves REDD+ and GHG Removal Activities, RENARE was consulted to determine which modality should be used for project registration: an individual registration by initiative or a joint one. To date, the information entered corresponds to GHG removal activities. To see the information contained in the registration go to: Gestión de la información\General\Renare.

For the REDD+ component, the stocks associated with non-arboreal biomass, dead wood, and litter were not included according to the REDD+ Methodological Document. In addition, the Forest Reference Emission Levels in the Caribbean biome (FREL[103]) does not consider these values because of the lack of official information available.

The selection of the carbon pools to quantify the changes and the carbon pools in the boundaries of the Caribbean Region CCMP are presented in Table 19.

Table 19: Carbon pools and stocks included in the project area boundary

Carbon Pool	REDD+	GHG Emissions Removal Activities
Aboveground arboreal biomass	The change in the carbon content in this pool is significant according to the IPCC and the national FREL.	Carbon stocks increase in this pool due to the establishment of tree species.
	Yes	Yes
Aboveground non-arboreal biomass	The National FREL does not consider the carbon content in the aboveground non-arboreal biomass due to the lack of available official information. In addition, the final land use does not consist in the establishment of permanent crops.	It is not considered because non-arboreal plant species were not established. Moreover, the carbon removal by sinks in the baseline scenario is considered zero (see sections 5.1.1 and **¡Error! No se encuentra el origen de la referencia.**5.3.4).
	No	No
Belowground biomass	The change in the carbon content in this pool is significant according to the IPCC and the national FREL.	Carbon stocks increase in this pool considering the established species as well as the fact that, in the absence of project activities, the baseline land use is expected to remain as pasture for livestock, which stores less belowground biomass than trees.
	Yes	Yes
Dead wood	The National FREL does not consider carbon content in litter, dead wood or in the soil due to the lack of available official information. The exclusion of the corresponding sinks will not result in a significant overestimation of the net mitigation results of the project. Furthermore, the carbon content in this pool is expected to decrease in the baseline scenario.	As a result of the species being established, the carbon stocks in this pool increase. This is evidenced with the results of studies on necromass and fine litter carried out in the project area[104].
Litter		

[103] Nivel de referencia de las emisiones forestales. Propuesta de nivel de referencia de las emisiones forestales por deforestación en Colombia para pago por resultados de REDD+ bajo la CMNUCC. Available at: https://redd.unfccc.int/files/02012019_nref_colombia_v8.pdf

[104] Obando, D. (2004). *Interceptación de la radiación, acumulción y distribución de biomasa y contenido de carbono en Gmelina arobrea Roxb. y Pochota quinata (Jacq) Dugand.* Available at: Gestión de la información\Estimaciones\RemociónGEI\Fuente.

Carbon Pool	REDD+	GHG Emissions Removal Activities
	No	Yes
Soil organic carbon	The change in the carbon content in this pool is significant according to the IPCC and the national FREL.	This deposit is applicable to those species that have a rotation greater than 20 years. Carbon stocks increase and are not removed during this period.
	Yes	Yes

(Source: South Pole, based on the REDD+ Methodological Document and the GHG Removal Activities Methodological Document of Biocarbon Registry, 2022)

1.11.2 GHG sources

The GHGs selected for the Caribbean Region CCMP are listed in Table 20.

Table 20: GHG sources by component of the Caribbean Region CCMP

Source	Gas	REDD+	GHG Removal Activities
Combustion of woody biomass	CO_2	CO_2 emissions resulting from the combustion of woody biomass are quantified as changes in carbon stocks.	
		No	No
	CH_4	CH_4 emissions were not included because there were no fires in the PA during the monitoring period.	Because FMC uses fire to clear land of crop residues during soil preparation, non-CO_2 GHG emissions are accounted for.
		No	Yes
	N_2O	N_2O emissions were not included because there were no fires in the PA during the monitoring period. In the event of a fire, the affected area will be identified and the CO_2 and CH_4 emissions will be quantified in the project emissions for the corresponding monitoring period[105].	Because FMC uses fire to clear land of crop residues during soil preparation, non-CO_2 GHG emissions are accounted for.
		No	Yes

(Source: South Pole, based on the REDD+ Methodological Document and the GHG Removal Activities Methodological Document of Biocarbon Registry, 2022)

[105] According to the BCR methodological document, CH_4 and N_2O emissions caused by the combustion of woody biomass are estimated based on the guidelines presented in the *2006 IPCC Guidelines for National Greenhouse Gase Inventories. Volume 4: Agriculture, Forestry and Other Land use. Non-CO2 greenhouse gas emissions from biomass burning.*

2 Identification of the baseline scenario and additionality

2.1 REDD+ component

The summary presented below is based on the comprehensive analysis of the baseline scenario and the additionality of the REDD+ initiative, which is submitted as an attached document (Annex 2)[106].

The identification of the baseline scenario and the additionality of the REDD+ initiative adhered to the rules of the REDD+ Methodological Document, specifically following criterion C (which is related to changes in carbon stocks within the project boundaries) and identifying the most probable land use at the beginning of the project. To determine the baseline scenario and the additionality of the Caribbean Region CCMP, steps 0 to 4 are taken[107]:

Step 0. Project start date
Step 1. Identification of alternative land-use scenarios
Step 2. Barrier analysis
Step 3. Impact of REDD+ project registration
Step 4. Investment analysis

The spatial limits for the identification of alternative land-use scenarios correspond to the reference region (RR) selected for the Caribbean Region CCMP, which includes the Momposina Depression and its surrounding areas (municipalities of Zambrano, Córdoba, El Carmen de Bolívar and Ariguaní) and the Serranía de San Jacinto or the Montes de María. The RR reflects similar land tenure conditions and land use practices to those of the project area, with common deforestation agents and causes due to their spatial and temporal migratory nature. On the other hand, the RR has also been narrowed down to preserve only the characteristics of the low-lying areas of the Colombian inland Caribbean, such as the relatively high atmospheric temperatures, marked seasonality, and flood pulses associated with swamps and rivers.

The project area, the reference region and the area of influence are separated into two centers[108]: Monterrey and Punto Nuevo. The delimited reference region has an extension of 84,287 ha in the Monterrey center and covers other areas in the Montes de María subregion, bordering the lowlands of the Magdalena River, other of its tributaries and the Momposina Depression. For its part, the reference region in the Punto Nuevo center has 105,623 ha and is located at the transition of the Momposina Depression and the foothills of the Snow-Covered Mountain Range of Santa Marta, where terrain is steeper. For statistical purposes, the departments of Bolívar and Magdalena will be considered.

2.1.1 Step 0. REDD+ Project start date

Initiative type	Start date[109]	Description	Compliance
REDD+	April 2, 2016	Date of the first training workshop on basic concepts for project structuring and planning, which was aimed at community stakeholders.	It complies with the rule related to the five-year period prior to the validation start date.

(Source: South Pole, based on information provided by the project holder)

[106] Annex 2: Baseline scenario and additionality. Available at: Gestión de la información\Secciones Anexas\Anexo 2: LB & Adicionalidad.
[107] Adaptation of the *BCR0002 AFOLU Sector Methodological Document for the Quantification of GHG Emission Reductions from REDD+ Projects* and the *BCR0001 AFOLU Sector Methodological Document for the Quantification of GHG Emission Reductions from GHG Removal Activities* of the Biocarbon Registry standard.
[108] Group of properties according to their location by department. The project holder groups the project area in two centers: Monterrey, which includes the properties located in the department of Bolívar; and Punto Nuevo, which includes the properties located in the department of Magdalena.
[109] For more details on the start date go to Section 4.1: Project boundaries.

2.1.2 Step 1. Identification of alternative land-use scenarios

According to the results of the analysis of the deforestation agents and drivers in the Caribbean Region CCMP, the deleterious cycle of the territory occupancy, soil deterioration and subsequent abandonment, as well as the colonization of new lands are the result of a process of acculturation between the Spanish Crown (who brought livestock to America and occupied the alluvial valleys for this purpose) and the Malibú indigenous people (who used the slash-and-burn technique to clear new territories). These Malibu-Spanish mixed techniques have lost functionality and environmental sustainability due to the fast-paced growth of the cattle herd, climate change, the aggravated process of denudation and erosion of the Magdalena River basin and other tributaries, its associated loss of navigability, conflicts of interest in relation to the lands, and the pressures of the national and international markets[110].

The reason why this territorial occupancy and land use system from the colonial era still exists in the Colombian inland Caribbean is the multiple conflicts of interest over land throughout history: the Spanish Crown vs. indigenous people, free traders vs. protectionists, federalists vs. centralists, landowners vs. peasants, liberals vs. conservatives and, more recently, land restitution beneficiaries vs. armed criminal gangs or splinter groups of the parties to the armed conflict.

The prevalence of the agricultural system is mainly related to investment, institutional, social and land use barriers[111]. In municipalities such as Zambrano, Córdoba, El Carmen de Bolívar and Ariguaní the average Gini coefficient is 0.67[112], that is, there is an unequal land distribution. In addition, livestock practices and palm crops are considered safer activities than the agriculture of transitory crops[113], although they require greater expanses of land for production. This means that in an area such as the Caribbean region, which has a high agricultural potential, current land uses are in conflict due to overuse or underuse[114].

[110] Aguilera-Díaz, M.M. (2004). La Mojana: Riqueza Natural y Potencial Económico. Bank of the Republic.

Herrera, L., Sarmiento, G., Romero, F., Botero, P., Berrío, J. (2001). Evolución Ambiental de la Depresión Momposina (Colombia) desde el Pleistoceno Tardío a los Paisajes Actuales. Geol. Colomb. - An Int. J. Geosci. 26, 95–121.

Pinzón, L. (2015). Amérique Latine Histoire et Mémoire. Les Cahiers Emigración y éxodo en la historia de Colombia 1–11.

Plazas, C., Falchetti, A., Sáenz, J., Archiva, S. (1993). La Sociedad Hidráulica Zenú. Estudio arqueológico de 2.000 años de historia en las llanuras del Caribe colombiano. Bol. Gold Museum.

Sánchez, H.R. (2012). Composición, mercedes de tierras realengas y expansión ganadera en una zona de frontera de la gobernación de Santa Marta: Valledupar (1700-1810). University of Valle.

Restrepo, J.D. (2015). Causas naturales y humanas de la erosión del río Magdalena.

Van der Hammen, T. (1986). Fluctuaciones holocénicas del nivel de inundaciones en la cuenca del bajo Magdalena Cauca San Jorge (Colombia). Geol. Andin. 10, 11–18.

[111] For more information on the assessment of the historical context, go to Annex 2: Baseline scenario and additionality

[112] The total concentration of the territory in a single property or owner corresponds to a value of 1.

[113] Information taken from https://www.hchr.org.co/index.php/compilacion-de-noticias/56-desc/8139-problemas-y-realidades-del-campo-en-el-caribe-colombiano

[114] The complete analysis of the cover in the project's area of influence can be found in Annex 2: Baseline scenario and additionality.

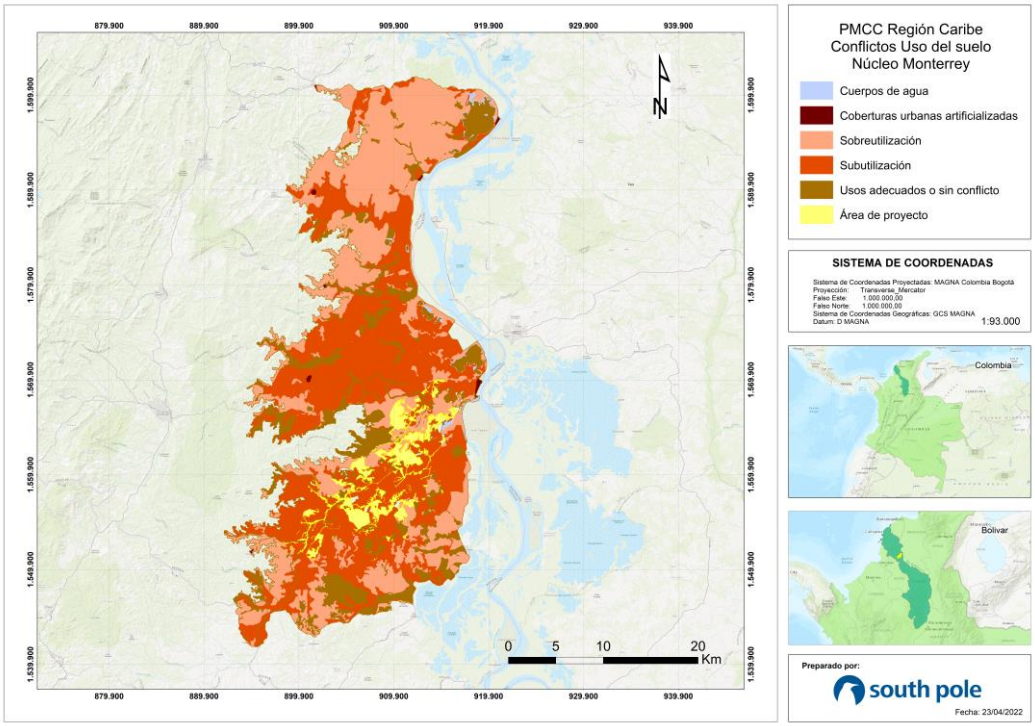


Figure 12: Land use conflicts in the RR of the Monterrey center

(Source: IGAC, 2012[115])

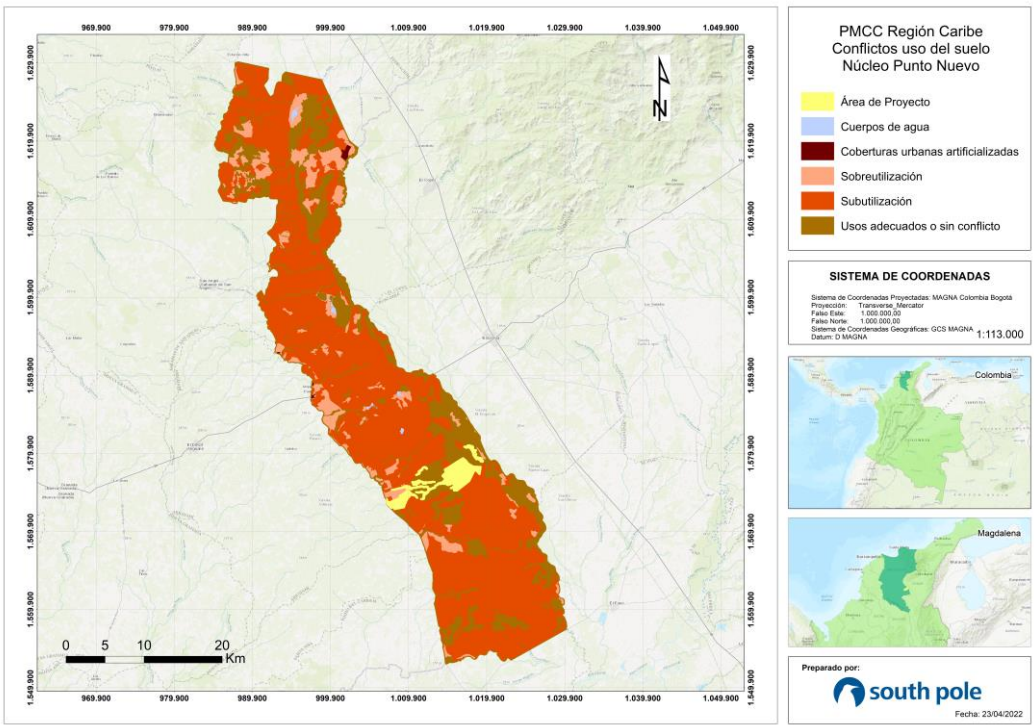


Figure 13: Land use conflicts in the RR of the Punto Nuevo center

(Source: IGAC, 2012)

[115] Agustín Codazzi Geographic Institute (IGAC). (2012). Mapa de clasificación de tierras por su clasificación de uso a escala 1:100.000. Available at: https://geoportal.igac.gov.co/contenido/datos-abiertos-agrologia.

2.1.2.1 Identification of probable land use alternatives in the project areas

- Extensive livestock farming

In terms of landscape, the lands of the region have been traditionally dedicated to agricultural crops in the slopes and extensive cattle raising in the valleys[116]. In the reference region of the project, especially in Montes de María, a great contrast has been identified between land use and land vocation. For example, the area considered suitable for livestock activities has exceeded 10 times its capacity, that is, there is an overuse conflict[117]. Livestock farming in the area is extensive, requiring large areas and, therefore, demanding from both small and large producers the expansion of their areas to increase productivity[118,119.]

- Oil palm crops

The most important oil palm productive nuclei are found in low and warm lands such as the Colombian Caribbean and the middle to lower area of the Magdalena River. Between the 1990s and 2000s, the oil palm supply chain was set in a top-down, high-yield fashion, requiring little or no involvement from smallholder communities[120,121]. This resulted in a progressive increase in planted areas in the departments of Bolívar and Magdalena. At the same time, in Zambrano, El Carmen de Bolívar and Ariguaní (municipalities in the project's area of influence), the presence of crops has been reported between 2007 and 2020, and by 2021 the municipality of Zambrano already had 1,430 ha, El Carmen de Bolívar had 25 ha[122,123], and Ariguaní had 790 ha planted[124,125].

In the reference region there are 5,931 ha of oil palm crops, of which 1,151 ha are located in the Monterrey sector and 4,780 ha in the Punto Nuevo surroundings (Figure 14).

[116] Platform of European Development Organizations in Colombia (PODEC). (2011). Análisis del plan de consolidación de Montes de María.
[117] Puello, A. D. J. D. (2016). La transformación de la estructura productiva de los Montes de María: de despensa agrícola a distrito minero-energético. *Memorias. Revista Digital de Historia y Arqueología desde el Caribe*, (29), 52-83.
[118] Aguilera Díaz, M. (2014). La economía de los Montes de María.
[119] The complete analysis of land cover in the area of influence of the project can be found in Annex 2: Baseline scenario and additionality.
[120] Mujica, C. (2010). Evolución del Sector Palmicutor. UDI, Bucaramanga.
[121] Nepstad, D.C., Bezerra, T., Stickler, C., Mcgrath, D.G. (2013). Deforestación en Colombia: Aumentar la producción terrestre.
[122] Minagricultura. (2021). Reporte: Evaluaciones Agropecuarias (EVA) y Anuario Estadístico del Sector Agropecuario. Agronet: Red de Información y Comunicación del Sector Agropecuario Colombiano. Available at: https://www.agronet.gov.co/estadistica/Paginas/home.aspx?cod=59
[123] National Federation of Oil Palm Growers (Fedepalma). (2021a). La palma de aceite en el departamento de Bolívar. Available at: http://repositorio.fedepalma.org/handle/123456789/141258
[124] National Federation of Oil Palm Growers. (Fedepalma). (2021b). La palma de aceite en el departamento de Magdalena. Available at: https://repositorio.fedepalma.org/handle/123456789/141267
[125] The complete analysis of the land cover in the project's area of influence can be found in Annex 2: Baseline scenario and additionality.

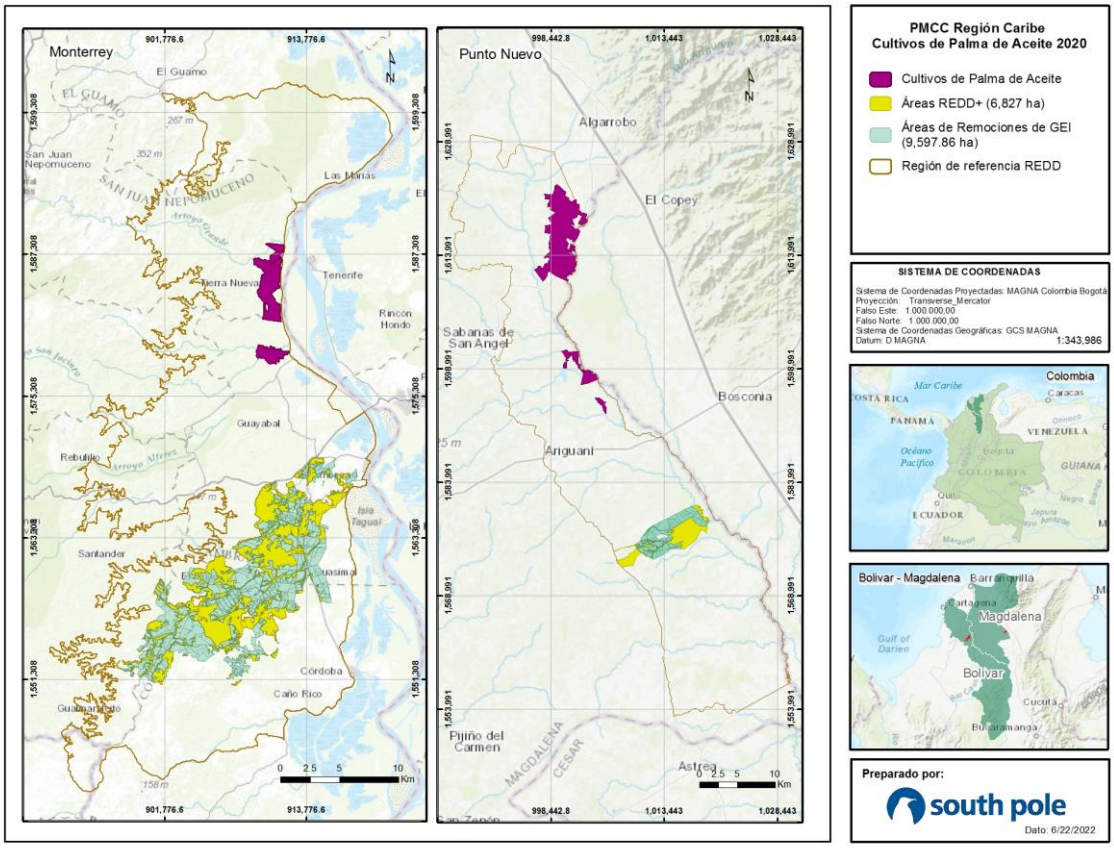


Figure 14: Oil palm crops in the RR

(Source: South Pole, 2022, based on information from UPRA[126])

A side effect of the large extensions of oil palm is the biological imbalance they create. For instance, pest outbreaks have damaged between 35,000 ha and 40,000 ha of oil palm crops in the country and are currently affecting surrounding traditional crops such as the peach palm, the plantain and the banana[127]. At the same time, these dynamics derive in the need for new lands for growing food and, therefore, in the transformation of natural ecosystems. Another effect that has been generated in the project's area of influence by the expansion of palm oil plantations is the replacement of tradition crops that used to have a high representativeness, such as corn, yam, and cassava[128].

- REDD+ project without the emissions reduction certification

Forest conservation in the area of the Caribbean Region CCMP is conditioned on the project permanence over time, which in turn depends on the profitability of the wood trading and the climate change mitigation initiatives for their investors. In the analysis of agents and drivers of deforestation, the pressure for land use change is evidenced, and the financial barriers describe the opportunity cost of the forestry project in comparison with the common practice of the reference region. In addition, the failure of other conservation efforts made by the company Monterrey Forestal (MF)[129] in the 1980s and 1990s due to the escalation of the armed conflict between the already dissolved FARC guerrillas and the Colombian State is reported (Figure 15).

[126] Rural Agricultural Planning Unit.
[127] Lizcano, M.F. (2018). Colombia: la palma de aceite pone en jaque la flora y la fauna del Pacífico. Available at https://es.mongabay.com/2018/11/colombia-palma-de-aceite-pacifico/
[128] Platform of European Development Organizations in Colombia (PODEC). (2011). Análisis del plan de consolidación de Montes de María.
[129] Monterrey Forestal Ltda. was the previous name of the company, which was replaced by Forestal Monterrey Colombia S.A.S. This is the project holder of the Caribbean Region CCMP.

Fig. 125 Vista general de la Unidad de Investigación.

Biological Research Unit in the Monterrey center in 1981

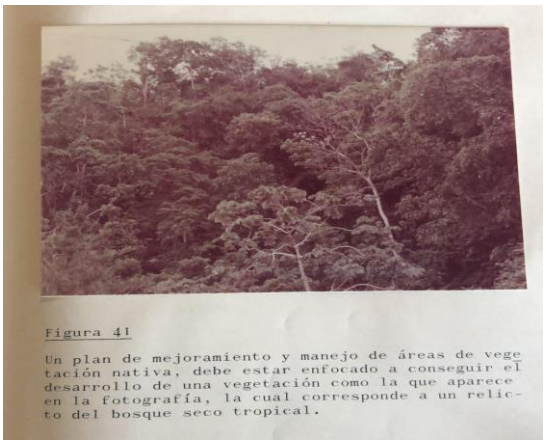
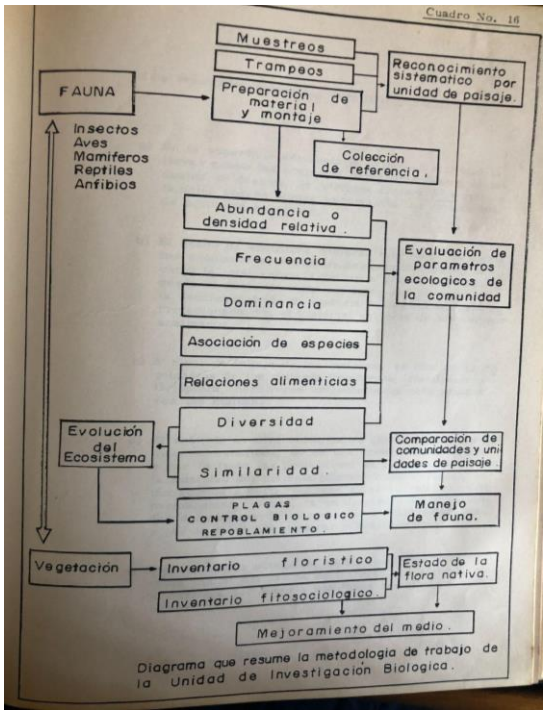


Figura 41

Un plan de mejoramiento y manejo de áreas de vegetación nativa, debe estar enfocado a conseguir el desarrollo de una vegetación como la que aparece en la fotografía, la cual corresponde a un relicto del bosque seco tropical.

Relict of tropical dry forest in the Monterrey center in 1981



Work diagram of the Biological Research Unit in 1982

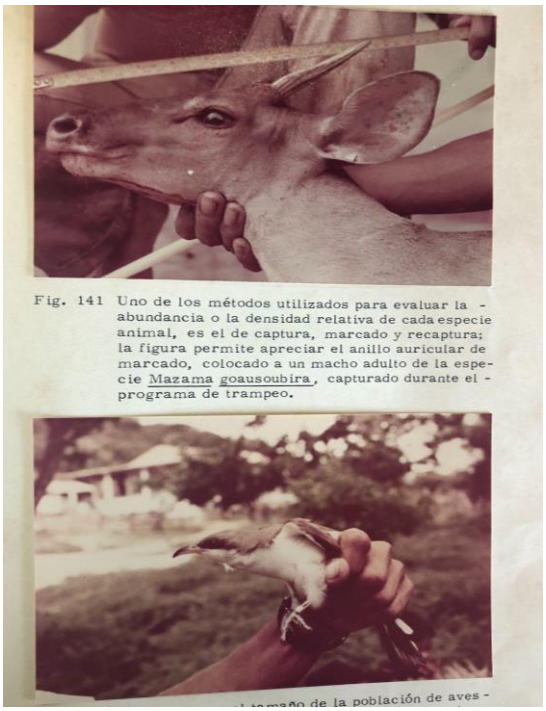


Fig. 141 Uno de los métodos utilizados para evaluar la abundancia o la densidad relativa de cada especie animal, es el de captura, marcado y recaptura; la figura permite apreciar el anillo auricular de marcado, colocado a un macho adulto de la especie Mazama goausoubira, capturado durante el programa de trampeo.

Fauna capture and marking for research in 1982

Figure 15: Initiatives for the conservation of plant and animal biological resources supported by FMC in the 1980s and 1990s

(Source: FMC S.A.S. archives)

With the objective of exploring the possibility of receiving conservation incentives other than the certification of emission reductions, some Payments for Environmental Services (PES) initiatives in the country were identified, but none of them was found to be applicable to the project area, as described below:

- In the development plans of the municipalities of Ariguaní and El Carmen de Bolívar, PES are considered alternative financing sources, but none have yet been implemented in rural areas. In addition, there is only one case of PES implemented in the urban area, which is related to live fences in the Villa Palmera Reserve, in the municipality of Ariguaní.
- There are two large PES initiatives in the country that, despite having the potential to be expanded to the Caribbean Region CCMP, are currently developed at medium or high elevations or have different spatial and socioeconomic scopes.

The first initiative is the PrepaRedd Magdalena macro-project, led by Cormagdalena with the support of ONF Andina and the French Facility for Global Environment (FFEM), whose purpose is to reduce deforestation or degradation in Andean and inter-Andean forests and to strengthen dynamics of sustainable local development in the upper basin of the Magdalena River. To date, this large-scale initiative has validated and registered the Huila-Guacharos-Puracé biological corridor REDD subproject, generating direct benefits for small farmers.

The second initiative is the BanCO_2 scheme that is subdivided into the Plus GHG Offsetting, Biodiversity and Water lines, with the purpose to financially compensate the environmental services provided by peasant families that have strategic ecosystems within their own properties. The Plus line (for GHG offsetting) brings together projects in the inter-Andean valley, between the Eastern and Central mountain ranges, while the Water line is also located in this inter-Andean valley, in addition to some Amazon foothills and rivers. The Biodiversity line, for its part, does have influence in the Caribbean region of Colombia, but only in the municipalities of San Juan de Nepomuceno and San Jacinto, in the department of Bolívar.

Result of sub-step 1a. List of possible land-use alternatives that can occur in the project area in the absence of project activities:

- Extensive livestock farming
- Oil palm crops
- REDD+ project without the emissions reduction certification.

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

Table 21: Consistency of land use alternatives with applicable laws and regulations

Regulatory framework		Land use (relation with sub-step 1b)
See Table 26 of Section 2.2.2: Step 1. Identification of alternative land-use scenarios for the GHG Removal Activities and Table 2 of Annex 2: Baseline scenario and additionality.		Extensive livestock and oil palm crops.
Law 99 of 1993	The general principles to be followed by environmental policies such as precaution, prevention and sustainable development are stated. In addition, the Ministry of the Environment is created as the governing body for the management of the environment and renewable natural resources, and the National Environmental System (SINA) as the set of guidelines, regulations, activities, resources, programs and institutions that enable the implementation of the environmental law. The legal nature of the Regional Autonomous Corporations (CAR) is defined, and the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) is created. Article 108 declares that the State, through the CARs, must acquire strategic areas or ecosystems for the conservation, preservation and recovery of natural resources.	REDD+ project without the emissions reduction certification
National Policy for Comprehensive Management of Biodiversity and Ecosystem Services (PNGBSE) of 2011	Emphasis is placed on the need to include other ecosystem services, in addition to those related to water resources, in existing biodiversity management instruments, including PES.	
Decree 953 of 2013	Payment for environmental services schemes, mainly associated with water resources, are considered for the first time as an economic alternative.	
Law 1753 of 2015, Article 174	Article 108 of Law 99 of 1993 is modified in relation to the channeling of national or regional resources for the implementation of PSA or other economic incentives aimed at preserving ecosystems of strategic interest. These resources are allocated based on the fees received for water use, transfers from the electricity sector and the mandatory investment of 1% made by projects that require water resources and have to compensate for biodiversity loss to receive their environmental licenses. The Ministry of Environment and Sustainable Development must design the terms, conditions, procedures and sources of financing for the implementation of the PES and other conservation-based incentives.	
CONPES 3886 of 2017	Public policy guidelines are provided to public institutions, the private sector and civil society	

Regulatory framework		Land use (relation with sub-step 1b)
	regarding the implementation of payment for environmental services. Strategies focused on overcoming technical and operational gaps, the few institutional coordination mechanisms, financial weaknesses and regulatory limitations are also established.	
Decree 870 of 2017	It is stated that the owners, possessors or tenants of properties located in strategic areas and ecosystems may be beneficiaries of the payment for environmental services incentive, including those who are subject to land restitution or compensation according to Law 1448 of 2011 and who are located in protected or special environmental management areas, or who are part of the National System of Protected Areas (SINAP).	
Decree 1007 of 2018	The general components of the payment for environmental services incentive and the acquisition and maintenance of properties in strategic areas and ecosystems are regulated. This instrument is applicable to environmental authorities, territorial entities and other public or private entities that promote, design and implement payment for environmental services projects that are financed or co-financed with public and private resources, or that carry out land acquisition and maintenance processes according with the rules indicated in the previous article.	

(Source: South Pole, 2022)

Result of the sub-step 1b. List of possible land use alternatives that comply with the legislation and mandatory norms and regulations, considering their compliance in the region or country, for national or sectoral policies

- Extensive livestock farming
- Oil palm crops
- REDD+ project without the emissions reduction certification.

2.1.3 Step 2. Barrier analysis

2.1.3.1 Sub-step 2a. Identification of the barriers that would prevent the project implementation

Table 22: Identification of barriers to the implementation of the alternative scenarios identified in sub-step 1a

Barrier	Impact of the barrier on the alternative scenario	Alternative scenario
Investment barriers	Colombia has several high-level (large scale) financial support mechanisms for the agricultural and livestock sectors, such as the Fund for the Agricultural Sector (Finagro), other public-private and union funds, royalties from the mining and extractive sector and Official Development Assistances (ODA) (Nepstad et al., 2013).	Extensive livestock farming
	The palm sector enjoys tax holidays according to law 788 of 2002 and law 939 of 2004, tax-free zones according to decree 383 of 2007 and tax reductions for asset investments according to law 111 of 2006. In 2010, the Ministry of Agriculture declared that the national area planted with oil palm crops was approximately 420,000 ha, but today Colombia has more than 500,000 ha, which evidences the fast-paced growth of this product and represents good news for the country from a macroeconomic perspective.	Oil palm crops
	Forest conservation is exposed to two types of risk: 1. Land use changes due to the competitiveness of the most probable alternative scenario (activity with fewer barriers). An analysis was carried out to assess the need for additional investment through carbon credits. 2. The availability of resources for conservation activities in the project area that involve the stakeholders with influence on deforestation control, even in the forestry activity continuation scenario. To counteract the two barriers found, the Caribbean Region CCMP requires additional resources, e.g., from the sale of carbon credits. According to the results of the opportunity cost analysis, the scenario with less barriers, which is also presented as a common practice in the reference region of both project centers, is extensive livestock.	REDD+ project without the emissions reduction certification.
Institutional barriers	The lack of political will, the corruption or the ineffectiveness of the methods to support small and medium-sized farmers are reflected in the disappearance of most of the livestock-supporting funds, which consist of mixed corporations to channel public and private money with the purpose of offering cattle units as a direct work force to the farmers who manage to demonstrate more or less adequate conditions for their possession.	Extensive livestock farming
	El fortalecimiento de este sector se vio frenado por la apropiación de tierras por parte de grupos armados al margen de la ley y por la configuración de empresas palmeras de dudoso origen	Oil palm crops
	The strengthening of this sector was slowed down as a consequence of land misappropriation by illegal armed groups and the establishment of palm oil companies with an unknown track record.	

Barrier	Impact of the barrier on the alternative scenario	Alternative scenario
	There are diverse circumstances around land tenure, including social and administrative instability. Additionally, one of the highest historical rates of productivity loss was reached due to bud rot [130].	
	Inability of the municipal government or other private institutions to generate efficient mechanisms that guarantee key benefits for communities being pressured by land use change. **Food security:** In 1985, Monterrey Forestal Ltda[131]; which owned the plantations and land of FMC S.A.S., met part of the nutritional needs of the local population with a self-consumption beekeeping project that involved 60 families. The cooperative closed due to lack of cash flow and the lack of willingness of the beneficiaries to get registered in the health and social benefits system on their own. Later, beekeeping was resumed as a joint effort by FMC and the community, but for commercial purposes. **Water security:** Between the 1970s and 1980s, Monterrey Forestal financed the establishment or modernization of some water collection systems, but these efforts were not strengthened or replicated by the Government to achieve sufficient local coverage. In El Carmen de Ariguaní (corregimiento of the Ariguaní municipality) and Zambrano, the communities have mentioned that the water is not suitable for human consumption due to its low levels of sanitation and also that they are affected by the intermittency of the provision of the aqueduct service. **Lack or poor condition of infrastructure** (roads, collection places, processing centers, solid and liquid waste collection system) that supports local, subregional, regional or national economies. In the period from 1970 to 1980, FMC even assumed State's role by fixing some tertiary roads. However, when the plantation business activity decreased, the economic support was stopped and the government did not continue with the FMC's infrastructure efforts.	Extensive livestock farming
Barriers due to social conditions	• Disturbance of the peace, common crime and forced migration of the peasants to other areas, either for reasons of habitability or to carry out certain economic activities. • Lack of human resources to establish best practices in the agricultural sector.	Oil palm crops
	Barriers associated with the implementation of REDD+ activities: • Lack of human resources and enabling conditions for the establishment of new economic sectors such as ecological tourism, aquaculture, beekeeping and activities being part of the "orange sector". • Little business organization and absence of commercial agreements that contribute to reducing the number of intermediaries. • Lack of interest or general apathy of local residents towards governmental or private organization proposals. • Unsustainable practices for the use the biological resources of forests and water bodies, and reluctance to change them.	REDD+ project without the emissions reduction certification.

[130] Lizcano, M.F. (2018). Colombia: la palma de aceite pone en jaque la flora y la fauna del Pacífico. Available at: https://es.mongabay.com/2018/11/colombia-palma-de-aceite-pacifico/

[131] By this year, the company was called Monterrey Forestal. In 2014 it became Forestal Monterrey Colombia S.A.S.

Barrier	Impact of the barrier on the alternative scenario	Alternative scenario
Barriers related to land tenure	The agricultural and livestock economy in Colombia is considered bimodal: on the small scale are the landless peasants or the small and medium producers, and on the larger scale are the large productive structures of dairy products, oil palm, etc.[132] Agricultural products traded under informal schemes (there is 86% informality in the agricultural sector and 35% in the livestock sector) or by a long chain of intermediaries do not reflect a sufficient economic benefit for small producers[133,134,135].	Extensive livestock farming Oil palm crops
	• Formal and informal tenure systems that result in territorial fragmentation. • Unfinished land restitution processes.	Extensive livestock farming Oil palm crops REDD+ project without the emissions reduction certification.
	Conflict of interests between landless or displaced peasants, private land owners, the Government and illegal armed groups on the use of vacant lands, water resources and forests.	REDD+ project without the emissions reduction certification.

(Source: South Pole, 2022)

[132] Nepstad, D.C., Bezerra, T., Stickler, C., Mcgrath, D.G. (2013). Deforestación en Colombia: Aumentar la producción terrestre.
[133] Cubillos, O. (2019). ¿Qué hacer con la informalidad? Available at https://www.contextoganadero.com/columna/que-hacer-con-la-informalidad
Gonzales, J., 2019. La formalidad laboral en el sector agropecuario, una tarea que está pendiente en Colombia. Available at https://www.agronegocios.co/agricultura/la-formalidad-laboral-en-el-agro-una-tarea-que-esta-pendiente-en-colombia-2920191;
[134] Gonzales, J. (2019). La formalidad laboral en el sector agropecuario, una tarea que está pendiente en Colombia. Available at https://www.agronegocios.co/agricultura/la-formalidad-laboral-en-el-agro-una-tarea-que-esta-pendiente-en-colombia-2920191
[135] Nepstad, D.C., Bezerra, T., Stickler, C., Mcgrath, D.G. (2013). Deforestación en Colombia: Aumentar la producción terrestre.

2.1.3.2 Sub-step 2b. Selection of the baseline scenario

The barriers identified for each alternative scenario demonstrate that extensive cattle farming is the scenario least affected by the barriers and prevails as a common practice[136].

2.1.4 Step 3. Impact of project registration

Activity implementation, validation and verification in the Caribbean Region CCMP will make it possible to continue protecting some natural forest remnants and their ecological functions while forging ahead with reforestation activities in the municipalities of El Carmen de Bolívar, Zambrano, Córdoba and Ariguaní. The additional cash flow derived from the issuance and sale of carbon credits will financially compensate the project holder (FMC) not only for maintaining the natural forests standing within its lands dedicated to logging, but also for addressing the underlying causes of deforestation and degradation both within its property and in the area of influence of the project.

The impacts identified for the Caribbean Region Climate Change Mitigation Project are comprehensively addressed in the PDD's impact assessment, both for the GHG removal activities and for the REDD+ component. In addition, Tables 5, 6 and 7 of Annex 2: Baseline scenario and additionality detail the connection between the strategic lines of the REDD+ project, the barriers of each line and the measures to overcome them through the sale of the resulting carbon credits. In Table 22, a summary is presented.

Table 23: Strategic lines of the Caribbean Region CCMP and barriers faced according to their type

Strategic lines	Institutional	Social	Tenure	Investment	Natural	Total
Climate change mitigation and biodiversity conservation and monitoring	6	4	2	2	3	20
Community engagement and local environmental education	1	4	0	2	0	7
Support for local job creation and economic diversification	3	7	0	4	1	15
Prevention and control of forest fires	5	3	0	1	3	12

(Source: South Pole, 2022)

2.1.5 Step 4. Investment analysis

This step serves to determine which of the probable land use alternatives identified in sub-step 1b is the most attractive in economic or financial terms. For this purpose, an investment analysis is carried out following the following sub-steps.

[136] For further detail go to Anexo 2: Escenario de líne base y adicionalidad

2.1.5.1 Sub-step 4a. Determination of the appropriate analysis method

Determine whether to apply simple cost analysis, investment comparison analysis, or benchmark analysis (sub-step 4b).

If the project generates no financial or economic benefits other than carbon credits sale-related income, apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III). Please note that options I, II and III are mutually exclusive. Therefore, only one of them shall apply.

Option I does not apply to the proposed project as other financial benefits will be generated from the sale of timber. Therefore, the investment comparison analysis (Option II) is applied to demonstrate the financial barrier of the Caribbean Region CCMP.

2.1.5.2 Sub-step 4b. Option II. Investment comparison analysis

Identify the financial indicator most suitable for the project type and decision context, such as the Internal Rate of Return (IRR), the Net Present Value (NPV) or the Cost-Benefit Ratio (RBC).

The valuation methodology applied in this analysis was the free cash flow, which consists of bringing to present value each of the projected cash flows for the project crediting period. Taking this into account, the Net Present Value (NPV), the Internal Rate of Return (IRR), the Cost-Benefit Ratio (CBR) and the Investment Recovery Period (IRP) were calculated in two scenarios:

- **Scenario 1:** Without the income from the sale of Verified Carbon Credits (VCC), the project activity is economically or financially less attractive than livestock farming.
- **Scenario 2:** Without the income from the sale of Verified Carbon Credits (VCC), the livestock farming is economically or financially more attractive than the project activity.

2.1.5.3 Sub-step 4c. Calculation and comparison of financial indicators

The suitable financial indicator for the project activity was calculated, without the financial benefits from the sale of VCC and, in the case of Option II above, for the other alternatives (livestock). All relevant costs (including the related to investment, operation and maintenance, among others) and all revenues (excluding VCC-related ones) were included. For the analysis, the assumptions used are based on secondary, country-level information. In addition, for each scenario the income, costs and cash flows are determined[137].

Results

According to the investment comparison analysis, it is concluded that the alternative livestock activity has the best indicators (NPV, IRR, CBR, IRP), while the carbon project cannot be considered financially attractive. Therefore, the assumptions of scenarios 1 and 2 were confirmed.

Since it is concluded that the project is not financially attractive without the benefits derived from the sale of the Verified Carbon Credits, sub-step 4d (sensitivity analysis) is followed.

2.1.5.4 Sub-step 4d. Sensitivity analysis

The sensitivity analysis shows whether the initial conclusion regarding the baseline scenario's financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis only provides a valid argument in identifying the baseline scenario and demonstrating additionality if it consistently supports (for a realistic range of assumptions) the initial conclusion that the project, without the financial benefits from the sale of VCC, is financially attractive.

For the analysis, three scenarios were considered: an optimistic one, a pessimistic one, and a conservative one. Table 24 shows the variations (%) in each parameter, according to the

[137] The complete analysis can be found in Annex 2: Baseline scenario and additionality.

corresponding scenario. For scenario 1, percentage variations were established based on three parameters: wood price, wood sold (volume in m^3), and wood cost.

Table 24: Sensitivity analysis scenarios

Parameters	Optimistic Scenario	Pessimistic Scenario	Conservative Scenario
Wood price (COP)	105%	95%	103%
Volume of harvested wood (m^3)	105%	95%	103%
Wood cost	95%	105%	97%

(Source: South Pole, based on project cash flow, 2021)

In general, it is observed that the NPV of the project (without VCC sales) is negative in all the scenarios (Table 2) for which changes in a realistic range of assumptions were considered. However, the project remains unlikely to be attractive.

Table 25: Sensitivity analysis results

Parameters	Reference value	Optimistic Scenario	Pessimistic Scenario	Conservative Scenario
NPV	-$ 18,478,288	-$ 59,315	-$ 36,897,262	-$ 7,426,904
IRR	11%	12%	9%	11%
CBR	1	1	1	1
IRP	10	9	11	9

(Source: South Pole, based on project cash flow, 2021)

After carrying out the sensitivity analysis, it is concluded that the project, without the financial benefits of carbon, is unlikely to be financially attractive.

As a general conclusion, the REDD+ initiative is **additional** taking into account the results of Steps 2, 3 and 4 proposed by the BCR Standard.

2.2 GHG Removal Activities component

2.2.1 Step 0. Project start date

Initiative type	Start date [138]	Description	Compliance
GHG Removal Activities	March 29, 2012	This is supported by the activities report made by the company Monterrey Forestal during 2012. The start date is based on the land preparation activities, when the Portobelo lot was cleared.	It complies with the rule related to the ten-year period prior to the validation start date.[139]

[138] For more details on the project start date, go to section 5.1: Project limits.

[139] Three project start date extensions were requested, taking into account that the project activities started prior to the launch of the BCR Standard (February 14, 2022). At that moment, the project was registered to apply to the *Program for Certification and Registration of GHG Mitigation Initiatives and Other Greenhouse Gas Projects* (Proclima Program), and the *Standard for the Certification and Registration of Voluntary GHG Mitigation Initiatives* (Proclima Voluntary Standard). However, the project is registered in the Biocarbon registry platform: https://biocarbonregistry.com/en/project/?id=23. The response from Biocarbon Registry is available at: Information management\General\Extension.

2.2.2 Step 1. Identification of alternative land-use scenarios

The review of the Colombian National Land Cover Map for the year 2018[140] showed that more than 40% of the project's area of influence were pastures.

2.2.2.1 Sub-step 1a. Identification of probable land use alternatives in the project areas

- Extensive livestock farming (land use prior to the initiative)

During the last 500 years, Colombia has undergone the transformation of its lands for livestock, agricultural and mining land uses as these are significant sources of income and means for the assurance of land tenure. In 2011, close to 1.7 million properties in Colombia were set aside for agricultural activities and 49% of these had some relationship with livestock[141].

Livestock is one of the main productive activities carried out in Bolívar and Magdalena due to the topographic conditions and environmental offer of these departments. Between 2011 and 2021, they have reached an average of 9.9% of the country's total bovine and buffalo production[142], Magdalena being one of the departments with the largest total population[143]. In the project's area of influence, 41.55% of the lands are pastures dedicated to livestock farming, having 188,154 cattle units in average (9.9% of the production of Bolívar and Magdalena between 2016 and 2019).

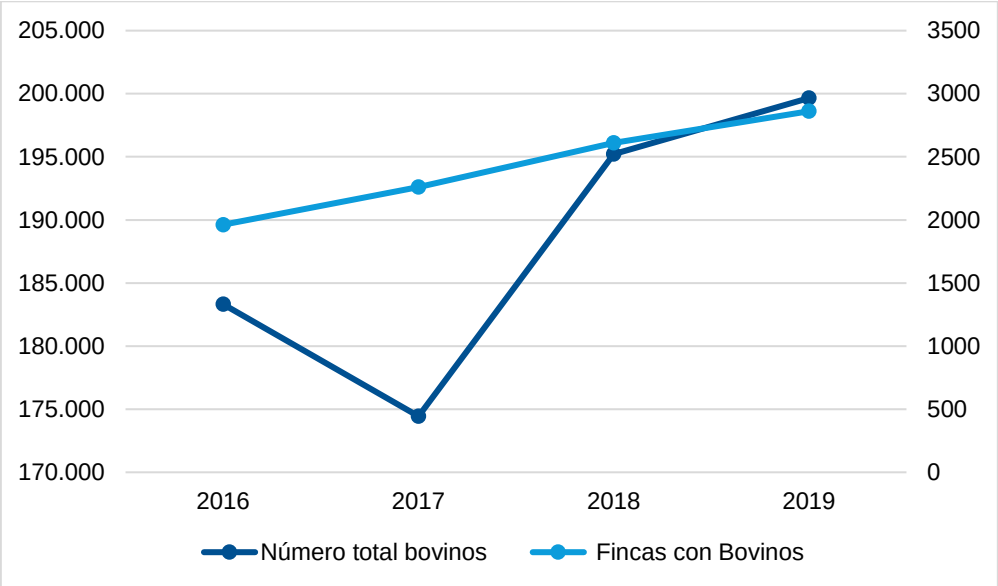


Figure 16: Total number of cattle units and cattle farms in the area of influence of the Caribbean Region CCMP

(Source: South Pole, based on information provided by ICA, 2022[144])

[140] Mapa Nacional de Coberturas de la Tierra. Adaptación Corine Land Cover. República de Colombia. Escala 1:100.000. Periodo 2005 – 2009. Available at: http://geoservicios.ideam.gov.co/geonetwork/srv/spa/catalog.search;jsessionid=57D326AC7EBEFD7F65248092C57661C4?uuid=a0cd1183-237d-4c98-9011-7dd769febfb2#/metadata/a0cd1183-237d-4c98-9011-7dd769febfb2.

[141] Gonzales A, et al, (2011*). Análisis de tendencias y patrones espaciales de deforestación en Colombia.* Institute of Hydrology and Meteorology and Environmental Studies - IDEAM.

[142] Fedegán. (2022). *Inventario Bovino y Bufanilo*. Available at: https://www.fedegan.org.co/estadisticas/inventario-ganadero.

[143] Censo Pecuario Nacional. (2016). https://www.ica.gov.co/getdoc/8232c0e5-be97-42bd-b07b-9cdbfb07fcac/censos-2012.aspx

[144] ICA. (2022). Instituto Colombiano Agropecuario. *Inventario nacional de bovinos*. https://www.ica.gov.co/areas/pecuaria/servicios/epidemiologia-veterinaria/censos-2016. Accessed April 30, 2022.

The increase in the pasture areas for livestock farming is mainly due to the decrease of areas with other land uses such as forests and other forest covers[145]. This is intensified considering that the livestock practice in the RR is extensive, which requires large areas and, therefore, demands from both small and large producers to increase their areas in order to boost productivity[146]. In consequence, livestock farming is an economic activity that covers 54.2% of the Montes de María lands[147,148] and has a significant representativeness in the project area, where the properties used to be livestock farms prior to the start of project activities (see Section **¡Error! No se encuentra el origen de la referencia.**).

The complete description of this activity is included in Annex 2: Baseline scenario and additionality[149].

- Oil palm crops (other alternative uses)

With the aim of promoting legal activities and strengthening management capacities, the Colombian Government has supported the establishment of new crops such as oil palm and sugarcane, especially for the production of biofuel. The most important oil palm productive nuclei are found in low and warm lands such as the Colombian Caribbean and the middle to lower area of the Magdalena River. Between the 1990s and 2000s, the oil palm supply chain was set in a top-down, high-yield fashion, requiring little or no involvement from smallholder communities (Mujica, 2010[150]; Nepstad et al., 2013[151]). This resulted in a progressive increase in planted areas in the departments of Bolívar and Magdalena (see Figure 17), where the planted areas went from 8,750 ha in 1987 to 81,233 ha in 2017, that is, an increase of more than 900% in just 30 years.

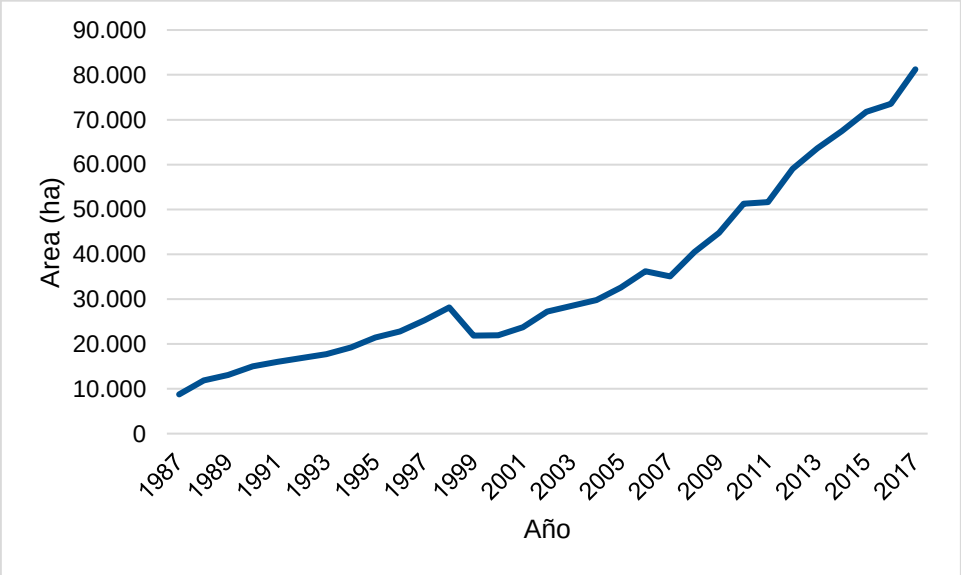


Figure 17: Area planted with oil palm in Bolívar and Magdalena

(Source: South Pole, based on Minagricultura, 2017[152])

[145] Platform of European Development Organizations in Colombia (PODEC). (2011). Análisis del plan de consolidación de Montes de María.
[146] Aguilera, M. (2014). *La economía de los Montes de María.*
[147] Baribbi, A. & Spijkers, P. (2011). Campesinos, tierra y desarrollo rural. Reflexiones desde la experiencia del tercer laboratorio de paz. Bogotá, 28 pp.
[148] Aguilera, M. (2014). *La economía de los Montes de María.*
[149] Annex 2: Baseline scenario and additionality. Available at: Gestión de la información\Secciones Anexas\Anexo 2_LB & Adicionalidad.
[150] Mujica, C. (2010). *Evolución del Sector Palmicutor*. UDI.
[151] Nepstad, D.C., Bezerra, T., Stickler, C. & Mcgrath, D.G. (2013). *Deforestación en Colombia: Aumentar la producción terrestre.*
[152] Ministry of Agriculture. (2017). *Tablas del anuario estadístico del sector agropecuario.*

At the same time, in Zambrano, El Carmen de Bolívar and Ariguaní (municipalities in the project's area of influence), the presence of oil palm crops has been reported between 2007 and 2020, and by 2021 the municipality of Zambrano already had 1,430 ha, El Carmen de Bolívar had 25 ha (MinAgricultura, 2021[153], Fedepalma, 2021a[154]), and Ariguaní had 790 ha planted(Fedepalma, 2021b[155]; Rural Agricultural Planning Unit, UPRA, 2021). This shows that the cultivation of oil palm is an alternative land use in the region (Figure 18).

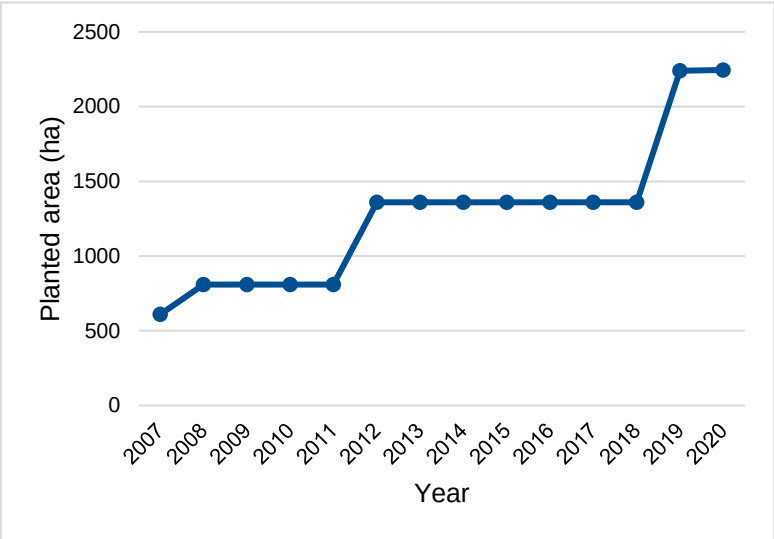


Figure 18: Area planted with oil palm in the area of influence of the Caribbean Region CCMP

(Source: South Pole, based on MinAgricultura, 2021[156])

The complete description of this activity is included in Annex 2: Baseline scenario and additionality[157].

- Forest plantations (project activity)

Forest plantations are a type of economic activity with high potential for implementation at the country level. In fact, 21.8% of the Colombia's inland territory has high suitability for this type of land cover (7,258,442 ha), but only approximately 540,430 ha are estimated to have commercial forest plantations throughout the country (UPRA, 2014[158]). In the departments of the project's area of influence, 776,119 ha are suitable (551,559.6 ha in Magdalena and 224,559.4 ha in Bolívar), according to the UPRA (2014), although there are only 16,869 ha planted in Magdalena and 15,413 ha Bolívar. Even though forest suitability represents an attractive scenario, the expanse of planted areas is well below expectations.

[153] MinAgricultura. (2021). *Reporte: Evaluaciones Agropecuarias – EVA y Anuario Estadístico del Sector Agropecuario. Agronet: Red de información y comunicación del sector Agropecuario Colombiano* https://www.agronet.gov.co/estadistica/Paginas/home.aspx?cod=59

[154] Fedepalma. (2021a). *La palma de aceite en el departamento de Bolívar.* http://repositorio.fedepalma.org/handle/123456789/141258

[155] Fedepalma. (2021b). *La palma de aceite en el departamento de Magdalena.* https://repositorio.fedepalma.org/handle/123456789/141267

[156] MinAgricultura. (2021). *Reporte: Evaluaciones Agropecuarias – EVA y Anuario Estadístico del Sector Agropecuario. Agronet: Red de información y comunicación del sector Agropecuario Colombiano* https://www.agronet.gov.co/estadistica/Paginas/home.aspx?cod=59

[157] Annex 2: Baseline scenario and additionality. Available at: Gestión de la información\Secciones Anexas\Anexo 2_LB & Adicionalidad.

[158] Rural Agricultural Planning Unit, UPRA. (2014). Zonificación para plantaciones forestales con fines comerciales, escala 1: 100.000. Memoria Técnica. Bogotá D.C., Colombia. [cited 2019] Available at: https://upra.gov.co/web/guest/publicaciones. Imprenta Nacional.

Despite the low implementation of forest plantations as an economic activity in the country (only 1% of GDP: UPRA, 2014), its promotion by international markets is expected, making it more attractive and bringing new opportunities and challenges at the national level. Added to this opportunity are the political initiatives by the Colombian State to expand this land cover with the purpose to increase productivity and offer better social and economic conditions to the communities that can benefit from it (UPRA, 2014). Nevertheless, due to the challenges, the lack of existing incentives and the long periods required for return on investment, the activity has been underdeveloped.

FMC[159] was part of these forestry initiatives previously developed in the country with the aim to promote reforestation. Since 1980, the company started *Pinus caribaea* plantations in places where natural forests had been removed[160]. However, despite this species having been in the territory for more than 35 years, the planted areas reach just over 6,000 ha.

Result of sub-step 1a. List of possible land-use alternatives that can occur in the project area in the absence of project activities:

- Extensive livestock farming
- Oil palm crops
- Forest plantations

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

[159] By 1980 it was recognized as Monterrey Forestal.
[160] Activity report for the year 1980. Gestión de la información\Actividad_Remocion_GEI\LineaBase.

Table 26: Consistency of land use alternatives with applicable laws and regulations

Regulatory framework		Land use (relation with sub-step 1b)
Law 363 of 1997	Livestock facilities are recognized as mixed-economy entities whose purpose is to encourage, improve and promote sustainability in the agricultural and livestock sector. These facilities are created or will be created with funds from the nation, territorial entities of any order and private capital, and will access credits or rediscounts for specific support to small and medium-sized farmers.	Extensive livestock farming
Decree 1615 of 1998	It partially regulates Law 363 of 1997 and establishes the provisions regarding the incentives and loans to small and medium-sized farmers through the Fund for the Agricultural Sector (Finagro).	
Law 676 of 2001	Laws 363 of 1997 and 510 of 1999 are amended and additional provisions are issued on the rediscount of credit operations before the Fund for the Agricultural Sector (Finagro) and on the granting of the livestock capitalization incentives to independent livestock funds of the Colombian Federation of Cattle Farmers (Fedegan) and the National Livestock Fund.	
Law 89 of 1993, Law 101 of 1993, Decree 696 of 1994, Decree 2025 of 1996, Law 395 of 1997, Decree 1187 of 1999, Decree 2255 of 2007	The conditions for the collection of a Livestock and Dairy Promotion Fee (or *parafiscal* fees) are enabled and the destination of the corresponding money is allocated, e.g., for epidemiological control and technological innovation. In the same way, the "livestock" term is specifically assigned to bovine and buffalo species, and a price stabilization system is designed for the export of meat and its by-products.	
Decree 2278 of 1982, Decree 1500 of 2007, Resolution 072 of 2007, Resolution 2905 of 2007, Resolution 18119 of 2007	All safety requirements for meat and its by-products are regulated.	
Decree 0616 of 2006, Resolution 0012 of 2007	It sets out the technical regulation on the requirements of milk intended for human consumption that is obtained, processed, packaged, transported, marketed, sold, imported or exported in the country.	
Law 914 of 2004, Decree 3149 of 2006, Modifying Decree 414 of 2007, Resolution 0070 of 2007, Resolution 00071 of 2007, Modifying Resolution 00185 of 2007, Resolution 005131 of 2007, Resolution 003278 of 2008	The provisions on the commercialization, transport and slaughter of bovine and buffalo cattle, as well as the sale of meat in the national territory, are stated.	
Decree 672 of 1991, Decree 2524 of	Aimed at stabilizing the prices of products at the national level since ceiling and floor prices affect the	

Regulatory framework		Land use (relation with sub-step 1b)
1994	final value of the tariff.	
CONPES 2723 of 1994	It establishes the mechanism to guarantee the absorption of national harvests, i.e., a specific tariff for each ton of imported product.	
Decree 440 of 2004	The Tariff Contingency Mechanism for the Agricultural Sector is established and the number of tons of a specific product that can enter the country is limited.	
CONPES documents (3477 of 2007 for the palm sector in general, and 3811 of 2015 for the palm sector of Tumaco)	Guidelines are provided to ensure the social and economic development of the palm sector.	Oil palm crops
Law 138 of 1994	The Parafiscal Fee for the Promotion of the Palm Agroindustry is established, and the Palm Promotion Fund is created with the money collected, aiming at supporting the growth of the palm sector. Any natural or legal person who benefits from the palm fruit on their own account is subject to the fee payment.	
Pesticide Use and Management Policy Guidelines of 2005	These are guides for institutions involved in territorial environmental management. They facilitate decision-making regarding pesticides and sustainable development of the productive sector.	
Kyoto Protocol, Paris Agreement, Nationally Appropriate Mitigation Actions submitted to UNFCC in 2011	At least 77% of the total energy generated in 2020 is expected to come from the use of own resources (sugar cane and African palm oil).	
Law 939 of 2004	Incentives for the production and commercialization of biofuels are defined.	
Resolution 4170 of 2014	It officially declares the pests to be controlled in the oil palm crops of the national territory and establishes the phytosanitary measures for their management and control.	
Decree 2811 of 1974 (Natural Resources Code)	The project forestry activity is defined according to the categories established in this decree, e.g., industrial forest plantation.	Forest plantations
Law 37 of 1989 and National Forestry Development Plan	The bases to structure the National Forest Development Plan are established and the Forest Service is created in order to improve the management of forest resources and, in turn, improve the quality of life of the communities inhabiting natural forests areas. In addition, the Forest Service seeks to offer more sustainable, productive alternatives.	
Law 139 of 1994	The Forest Incentive Certificate is created as a State recognition of the positive benefits generated by reforestation activities.	

Regulatory framework		Land use (relation with sub-step 1b)
Decree 2300 of 2006	By means of which Law 1021 of 2006 related to the Forest Incentive Certificate is regulated.	
Policy for the stimulation of commercial reforestation in Colombia (CONPES Document 3237)	Policy issued within the framework of the National Development Plan 2003-2006 aimed at contributing to the achievement of the goals of the National Forest Development Plan.	
Law 1377 of 2010, regulated by Decree 2803 of 2010	The purpose of this law is to define and regulate commercial reforestation activities, specifically forest plantations and agroforestry systems. This guarantees that the commercial reforestation activity is regulated and approved by the Colombian Government, registering forest crops and agroforestry systems for the purposes of mobilizing primary forest products.	
Decree 1071 of 2015	Registration of forest crops or agroforestry systems for commercial purposes: All agroforestry systems or forest cultivations with commercial purposes will be registered before the Ministry of Agriculture and Rural Development or the delegated entity. Technical Control: The Colombian Agricultural Institute (ICA) is responsible for the technical control of agricultural supplies, animal genetic material and sowing seeds. For this purpose, it will have powers to regulate, supervise and control production, certification, propagation, commercialization, import and export of the sowing seeds and the animal genetic material used for the national agricultural production. Project participants make sure to purchase seeds from suppliers that comply with the regulations. Species suitable for reforestation projects: Reforestation projects will plant native or introduced tree species that produce mainly, although not exclusively, timber material.	
National Development Plan 2018-2022 “A pact for Colombia, a pact for equity”	It contains a section with the name “Pact for Sustainability: Producing by conserving and conserving by producing”, whose central axis consists of implementing actions that lead to the balance between conservation and production, in such a way that the natural wealth of the country is preserved as a strategic asset.	
Land Management Scheme (EOT) of the Municipality of Zambrano, Bolívar (2002-2011)	The EOT is proposed as a land occupancy and land use policy for rural areas of the municipality of Zambrano. Its objective is to promote agroforestry development to facilitate the creation of competitive production chains in the regional context.	
Basic Land Management Plan (PBOT) of the Municipality of El Carmen de Bolívar, Bolívar (2002-2011)	In the land use units included in the PBOT, agrosilvopastoral production areas are considered as a possible use for the rural area of the municipality.	

Regulatory framework		Land use (relation with sub-step 1b)
Land Management Scheme (EOT) of the Municipality of Córdoba, Bolívar (2012-2015)	The municipal Mayor's Office proposed setting aside areas for timber production within its rural land environmental zoning, even considering the company Forestal Monterrey due to its participation in this type of productive activity.	
Basic Land Management Plan (PBOT) of the Municipality of Ariguaní, Magdalena (2000)	The municipal administration entity shall promote forestry production and use, using dual-purpose timber tree planting, recovering soils degraded by unsustainable production activities, and hence, seizing the opportunities of forest use in the long term.	

(Source: South Pole, 2022)

Result of sub-step 1b. List of possible land use alternatives that comply with the legislation and mandatory norms and regulations, considering their compliance in the region or country, for national or sectoral policies:

- Extensive livestock farming
- Oil palm crops
- Forest plantations

2.2.3 Step 2. Investment analysis

Taking into account Section 11.2 of the GHG Removal Activities Methodological Document, for determining additionality of GHG removal activities an investment analysis (Step 2) or a barrier analysis (Step 3) must be carried out. The additionality of the GHG removal component of the Caribbean Region CCMP was determined by following Step 2. Investment analysis.

This analysis was incorporated into Step 4 of the REDD initiative (see section 2.1.5) and the entire document can be found in Annex 2: Baseline and additionality[161].

As a general conclusion, the GHG Removal Activities initiative is **additional** based on the investment analysis (Step 2) required by the GHG Removal Activities Methodological Document of the BCR Standard.

2.2.4 Step 3. Impact of project registration

The implementation of GHG removal activities under project certification and registration generate the following impacts:

- Net anthropogenic GHG removals evidenced.
- Increase in the removal of GHG emissions from the atmosphere due to the continuity of activities that are made possible thanks to the benefits received from registration and certification.
- Permanence of plantation management activities and increase in planted forest areas.
- Based on the free cash flow method and the four financial indicators applied in the investment comparison analysis (the Net Present Value (NPV), the Cost-Benefit ratio (CBR), the Internal Rate of Return (IRR) and the Investment Recovery Period (IRP)) to determine the project scenario with the sale of VCC, it was evidenced that without the financial benefits of carbon, the project is unlikely to be financially attractive. With the benefits obtained from the sale of VVC, the economic and financial barrier that would prevent the return of agricultural activities is expected to decrease.
- The project holder reduces the economic and financial risks of the project through the benefits derived from the sale of VVC, which will make it possible to implement the proposed forestry activities.

[161] To access the investment analysis document, go to: Gestión de la información\Secciones Anexas\Anexo 2_LB & Adicionalidad\Remocion_GEI

3 Monitoring plan

3.1 REDD+ monitoring plan

The monitoring plan of the REDD+ initiative[162] will comply with the requirements of the Biocarbon Registry's REDD+ Methodological Document, which includes the monitoring of the project limits, the REDD+ initiative emissions, the REDD+ activities implementation, the compliance with safeguards and the project permanence. To ensure this, the following elements will be also included:

a) Verification that the applicability conditions listed in Section 4 of the Biocarbon Registry's REDD+ Methodological Document were met.
b) Verification of changes in carbon stocks in selected pools, according to Table 5.
c) Verification of project emissions and leakages.

This procedure is detailed in Section 4.7 Monitoring of the REDD+.

3.1.1 Monitoring of the project boundaries of the REDD+ component

Project boundaries, which include both the Project Area (PA) and the Leakage Area (LA) of the Monterrey and Punto Nuevo centers, as defined in Section 4.1.1: Spatial boundaries, will be monitored in order to determine the reduction of the emissions caused by deforestation, in accordance with section 13.4: GHG emissions of the REDD+ Methodological document. For this, the period analyzed will be as required in the REDD+ Methodological Document and detailed in sections 4.8.2: GHG Emissions and 4.8.3: Quantification of project emissions reduction.

3.1.2 Monitoring of project emissions

For each monitoring period, the activity data and emission factors will be monitored in accordance with IPCC and the most recent FREL that had been formally submitted by Colombia and evaluated by the UNFCCC. The data and parameters described in section 3.1 will be verified in each monitoring period. The monitoring of project emissions will follow the procedure described in section 4.8: Monitoring of project emissions in the 2016-2020 period.

3.1.3 Monitoring of the implementation of REDD+ activities

REDD+ activities will be monitored taking into account the activities described in Annex 5: Project activities[163] and including the following information:

Table 27: Monitoring plan for the implementation of REDD+ activities

Title	Description
Program	The programs are related to the strategic lines described in section 4.4: REDD+ project activities. Each strategic line has different associated programs.
Activity	The activities developed under the program associated to a certain strategic line are listed.
Indicator ID	Code of reference for the activity.

[162] The collected data will be archived for at least two years after the end of the last monitoring period of the project, including the data and parameters monitored, the methods used to generate the data and to ensure their proper collection and file, as well as the processes related to sampling models and their quality control.
[163] Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto.

Title	Description
Type	According to the activity implemented, it is described as Impact, Result, and Product.
Goal	Objectives to be met.
Unit of measurement	Parameter used to measure the indicator.
Monitoring methodology	Description of how the activity will be developed.
Monitoring frequency	Time lapse in years.
Responsible for the measurement	FMC or project stakeholders.
Result of the indicator in the reporting period	According to the current monitoring period.
Documents supporting the information	Location of the information used or the values obtained in the monitoring period.

(Source: South Pole, based on information from FMC, 2022)

The results of the project activity monitoring plan are presented in section 0.

3.1.4 Monitoring of the permanence of the REDD+ component

The project risks of permanence will be assessed based on the project risks analyzed in Section 8: Risk management. A description of each risk, together with their scoring and mitigation measures will be provided based on a known methodology. Biophysical and socioeconomic risks such as fires[164], floods, land tenure disputes, conflicts between project stakeholders, lack of ownership of project activities, and poor governance will be analyzed for each monitoring period. The possible existence of natural and human-based disturbances that may affect carbon stocks will also be evaluated in order to determine if the discount of 15% is applicable.

The results of the monitoring of the REDD+ initiative permanence can be found in Section 8: Risk management.

3.2 Monitoring plan for GHG removal activities

During each monitoring period, the monitoring plan for GHG Removal Activities will focus on: (a) monitoring the project boundaries; (b) monitoring the implementation of forest activities; (c) monitoring of crop management and biomass growth in forestry crops; and (d) monitoring the quantification of GHG net removals by the project. During each verification period, the following elements will also be included[165]:

a) Verification that the applicability conditions listed in Section 5 of the Biocarbon Registry's GHG Removal Activities Methodological Document were met.
b) Verification of changes in carbon stocks in selected pools.
c) Verification of project emissions and leakages.

3.2.1 Monitoring of the implementation of project activities

The monitoring of the implementation of reforestation activities will include the following:

[164] In case of fire occurrence, it is expected to identify the affected area and estimate CO_2 and CH_4 emissions for their inclusion in the quantification of the project's emissions in the corresponding monitoring period.
[165] The collected data will be archived for at least two years after the end of the last monitoring period of the project, including the data and parameters monitored, the methods used to generate the data and to ensure their proper collection and file, as well as the processes related to sampling models and their quality control.

a) Confirmation that soil preparation, site selection and other silvicultural activities carried out as described in the forest establishment and management plans and the project document.
b) Monitoring of the planted areas in each verification event.
c) Monitoring of the plantations survival and changes in the validated areas in each verification event.

3.2.1.1 Forestry activities

3.2.1.1.1 Pachira quinata[166]

Species description

Pachira quinata grows in the tropical areas of Central America and northern South America, mainly in tropical dry forests, although it also exists in some premontane humid forests or dry forests in Venezuela and humid forests in Panama and Costa Rica. It extends naturally along the Pacific coast of Costa Rica, Honduras and Nicaragua, in regions with marked seasonality. In Panama, it spreads out over both coasts and in Colombia, over the dry area of the Caribbean coast. In Venezuela, it is restricted to the plains of the country's central area and around Lake Maracaibo.

Pachira quinata, commonly known as red ceiba, is a deciduous species during the dry period, between the months of December and April in northern Colombia. In its natural distribution area throughout the country, it reaches a height of up to 32 m and a DBH of 2.4 m. It has a straight trunk, a thorny bark and protruding roots. It has been found growing naturally on the Atlantic coast of Choco and Antioquia and in the departments of Córdoba, Sucre, Bolívar, Magdalena, Atlántico and Cesar in the Colombian Caribbean, and in the departments of Casanare, Arauca and Caquetá. The altitudinal range of these departments is between 0 masl and 400 masl, with average rainfalls ranging from 900 mm to 2,500 mm per year[167].

Production of plant material

The red ceiba seedlings are obtained from seeds produced in the orchard for genetic improvement installed in FMC properties. These seeds are germinated and developed into seedlings in the FMC nursery, which operates in Zambrano (Bolívar). The production of the seedling is carried out using the single-tube method, which allows the seedling to reach the size required for planting (25 cm - 30 cm in height) in a period of three months.

Plantation establishment

The establishment of the plantations first requires *land adaptation* activities, which consist of removing the grass present in the area to be planted in a way that facilitates and guarantees the growth and survival of the species. Next, *weed removal*, and plant waste collection, stacking and handling (cutting with a chainsaw, burning, etc.[168]) are carried out.

After adapting the area, *plowing and raking* works begin in order to facilitate seedling development and root penetration during the initial period of take-up and to allow adequate aeration. The next activity is *subsoiling*, which requires an average depth from 50 cm to 60 cm and a distance between lines of 3.5 m, diagonally oriented in direction to the slope and the drainages, in order to minimize surface runoff, increase infiltration and soil moisture retention, facilitating root development in the subsoiled area. *Bedding* activities are also carried out approximately between 25 cm and 30 cm high, on the subsoiling lines, to protect the seedlings from possible temporary flooding. Additionally, the land is improved with activities such as fire barriers, roads and fences construction.

[166] Detailed information on silvicultural activities can be found in the Forest Management Plan 2020-2024 at: Gestión de la información\Actividad_Remocion_GEI\PEMF.
[167] FMC. (2020) *Plan de manejo forestal 2020-2024*. Available at: Gestión de la información\Actividad_Remocion_GEI\PEMF.
[168] Only waste from forest use for site preparation.

Subsequently, a distance between lines of 3.5 m and a distance between trees on the subsoiling line of 2.6 m in length is demarcated, for a total of 1,100 trees per ha. Before sowing, a water retention product is applied in the hole to ensure rooting, especially in the event of a prolonged dry period.

After the previously mentioned activities, the plant material is *sown*. Finally, the *replacement of material or replanting* is carried out when the percentage of mortality is greater than 10% in the first month, which occurs due to environmental or phytosanitary conditions, characteristics of the plant material and/or inadequate handling. Efforts are made so that this activity is carried out between 30 and 40 days after planting so that it occurs in the rainy season corresponding to the first semester.

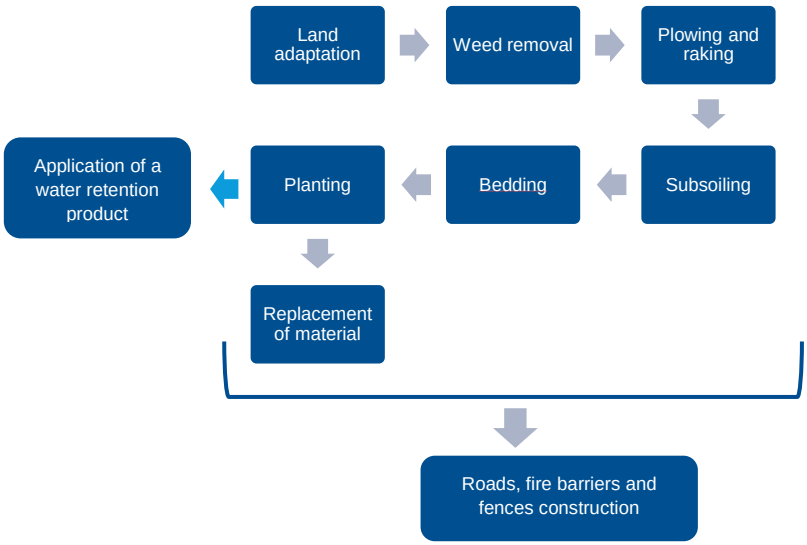


Figure 19: Plantation establishment process

(Source: South Pole, based on information from FMC, 2022)

Plantation maintenance

In the sixth month after the seedling establishment, it is recommended to carry out leader pruning in those red ceiba stands where the basal forking rate exceeds 10% of the planted trees. This **pruning** consists of leaving the straightest sprout as the main stem. After the third year of establishment, pruning is carried out by removing all the branches and sprouts from the ground level up to 3 m high. After the sixth year, pruning is carried out by removing all the branches and sprouts from the ground level up to 6 m high. This activity is recommended only on the trees that will remain standing, preferably before thinning.

Thinning and final harvest

Two thinnings are performed during the species' rotation. Depending on the survival and development of the stand, approximately 40% of the existing flight is removed at the ninth (9^{th}) year, and 35% to 40% of the existing flight at the fifteenth (15^{th}) year.

Based on the analysis of the growth, yield and productivity of the red ceiba plantations, an average rotation period of 25 years has been defined. At the end of the rotation, between 350 and 400 trees per ha will be harvested using chainsaws.

Replacement system

Once the harvesting program is completed, forest species are expected to be established again, in an equal number of hectares, in order to maintain a cycle of plantations on the properties and guarantee the sustainability of the project.

Phytosanitary control

Specialized literature reports risks for young plantations (3 years or younger) to be attacked by the big-assed ant (*Atta laevigata*) and damaged by termites that bore into the stem and branches, by earthworms (*Spodoptera frugiperda*) in buds and new leaves, and by insects of the Acrididae (Orthoptera) family that can cause severe defoliation if the insect populations are big (Pinzón, 1997[169]).

It is also reported that the disease with the greatest potential danger is "machete disease" (*Ceratocystis fimbriata*), which can be severe in humid climates, near cacao plantations. When trees are attacked by the disease, leaves turn a yellowish color and get dry quickly (remaining on the tree even after death), the trunk is blotched bluish-gray and oozes a red wine-like fluid through the bark that can be transmitted to other plants by tools. From the start of the forestry project on the Colombian northern coast, a very low pressure of pests and diseases on the red ceiba crops was evidenced. However, in order to prevent pest attacks or disease outbreaks, permanent surveillance activities are carried out, and any anomaly observed in the trees yield is reported.

3.2.1.1.2 Gmelina arborea[170]

Species description

The *Gmelina arborea* species (commonly known as melina) is native to India, Myanmar and Sri Lanka, although it has been introduced into the tropics and planted in many countries for commercial purposes, mainly in areas with a marked dry season and rainfall greater than 800 mm.

This tree that reaches 20 m to 30 m in height; with a diameter ranging between 60 cm and 100 cm; a grayish-brown bark; a broad crown; thick branches; a conical trunk; and light green, opposite-positioned and heart-shaped leaves up to 15 cm x 25 cm. Its inflorescence occurs in showy clusters of purple and yellow flowers, and its abundant fruits have a yellow to reddish color. In dense plantations, the trunk is less conical and has fewer branches[171]. The production rotation of melina for roundwood uses is 12 years.

The reforestation program on the property seeks to establish, maintain and benefit the forests hosting *Gmelina arborea* (melina), where timber extraction is expected for the manufacture of boards and solid wood.

Production of plant material

Gmelina arborea (melina) seedlings are obtained by vegetative propagation of the ramets that come from the clonal garden located in the FMC nursery or from seeds produced in the Seed Orchard that has been established for this species on FMC properties in Zambrano (Bolívar).

The production of the seedlings required to establish and replant the *Gmelina arborea* species is carried out in the FMC nursery that operates in Zambrano (Bolívar) using the single-tube method, which allows the seedlings to reach the size and quality required to be planted after three months of growth in the nursery.

Plantation establishment

In weedy areas, the establishment is done by using an "Argentinian roll" that is pulled by a pneumatic-tired tractor or a bulldozer when the weeds have taller heights[172]. In pastures, depending on their height, a weed cutter is operated to facilitate soil preparation.

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[169] Pinzón O. (Ed). (1997). *Guía de insectos dañinos en plantaciones forestales*. CONIF. https://www.guao.org/sites/default/files/biblioteca/Gu%C3%ADa%20de%20Insectos%20Da%C3%B1inos%20en%20Plantaciones%20Forestales.pdf

[170] Detailed information on the silvicultural activities can be found in the Forest Management Plan 2020-2024 at: Gestión de la información\Actividad_Remocion_GEI\PEMF.

[171] FMC (2020). *Plan de manejo forestal 2020-2024*. Available at: Gestión de la información\Actividad_Remocion_GEI\PEMF.

[172] Para preparación de sitios de replante.

Plowing, subsoiling and *bedding* practices are implemented in the areas, depending on their topography and vulnerability to flooding. The activities to prepare the land for melina planting are carried out preferably during the dry months, that is, between January and April.

Subsequently, a distance between tree lines of 3.5 m and a distance between trees on the same line of 3.1 m is demarcated, for a total density of 922 trees per ha.

Plantation maintenance

The implementation of several weed control systems, such as the mechanized cleaning using a weed cutter or cultivator and the application of herbicides, is considered. It is important to clarify that, for chemical weed control, only herbicides authorized by official Colombian Government agencies are used, making sure that they are not prohibited or highly restricted in the *FSC Lists of Highly Hazardous Pesticides*[173].

After the first year of establishment, pruning is carried out by removing all the branches and sprouts from the ground level up to 3 m high. After the third year, pruning is carried out by removing all the branches and sprouts from the ground level up to 6 m high. This activity is recommended only on the trees that will remain standing, preferably before thinning.

Thinning and final harvest

The first thinning is carried out in the first 3 to 5 years of the plantation, and the second one, when it is 6 to 8 years old. This practice is carried out according to the degree of development of the plantation, and the selections are determined based on the stand density index (SDI). The wood obtained from thinning can be used for the small-sized sawmill industry and for the manufacture of pallets.

Each selection will have an intensity between 30% and 40% of the remaining population, so it is expected to obtain 400 trees per ha at the end of the rotation. The harvest will be carried out using chainsaws, splitting the branches and cutting the trunk into logs for loading and transport to the timber transformation sites. Given the predominance of manual labor, these techniques reduce the effects of soil compaction and promote the generation of local jobs.

Replacement system

Once the harvesting program is completed, the species are expected to be established again in order to guarantee the sustainability of the project.

3.2.1.1.3 Fire control

In order to protect forest plantations and forests in the project area, FMC together with GRC has put in place the Forest Fire Control and Prevention procedure (SOP-PRO-002) to control possible fires in plantations and forests in the shortest time, ensuring the bodily integrity of the participants.

For the proper functioning of the procedure, FMC has brigades to deal with events that may occur. This system includes the description of each of the phases that must be followed during an event, such as: identification, reporting, activation of the brigade on duty, strategy, fire control according to the type of factor to be controlled (heat, oxygen, fuel, etc.) and evaluation of tools at the end of the event. The detailed description can be found in the Forest Fire Control and Prevention procedure (SOP-PRO-002)[174], which additionally contains the description to attend third-party affectations, and in 4.4.2.4: Strategic Line 4: Forest fire prevention and control, the descriptions of the activities are expanded.

[173] Source: https://connect.fsc.org/document-center/documents/72c54321-cc63-4f37-8289-41b092674319

[174] See available information at: Gestión de la información\SOP\Titular iniciativa\SOP-PRO-002_CONTROL INCENDIOS_V4.

3.2.1.2 Variables to be validated and monitored

In Annex 12: Parameters available for the validation and verification of the GHG Removal Activities initiative[175], there is a detailed description and application of all parameters.

Table 28: Variables to be validated and monitored in GHG removal activities

Variable	Unit of measurement	Measured (m), calculated (c), estimated (e) or default (d)	Recording frequency	Coverage / Other measurements or number data collected	Observations
Stratum name (Ai)	Alphanumeric	According to the yields and silvicultural activities of the plantation	Prior to each verification report	100%	Each stratum and crop established, associated with an alphanumeric identifier.
Localization	Geographic coordinates (Latitude/Longitude)	Measured	Prior to each verification report	100%	Using Global Position System (GPS).
Ai	Hectares	Calculated	Prior to each verification report	100%	Polygons of the areas planted by stratum.
Site preparation	Hectares	Measured	At the beginning of each establishment	100% of the planted areas	Intervened area for crop establishment.
Planted species for each stratum	NA	Defined	Prior to each verification event	100% of the planted areas	Species planted by each stratum within project boundaries.
Survival	Trees ha-1	Measured and calculated	When mortality exceeds 10%[176]	100% of the planted area	
Planting date	Alphanumeric	Measured	Start date of each establishment	100%	Date of the planting of each stand.

(Source: South Pole, based on information from the Biocarbon Registry, 2022)

3.2.2 Monitoring of GHG Removal Activities within project boundaries

The project boundaries will be verified through the evaluation of satellite images of the existing plantations in the Caribbean Region CCMP, taking into account the areas of the project that were considered eligible during the validation and in accordance Section 0.

3.2.3 Monitoring of crop management and biomass growth

The monitoring plan of the Caribbean Region CCMP GHG removal activities has reliable and precise procedures to evaluate project performance and to verify net removals of anthropogenic GHG emissions. In addition, it establishes procedures that are in line with the provisions of GHG Removal Activities Methodological Document and the AR-ACM0003 methodology.

3.2.3.1 Stratification and field sampling design of GHG removal activities

In accordance with the GHG Removal Activities Methodological Document, the monitoring plan for biomass growth will be conducted as follows:

[175] Gestión de la información\Secciones Anexas\Anexo 12_Parámetros_ActividadesRemocion.
[176] Plant material is replaced 30-40 days after planting.

Table 29: Monitoring of parameters for GHG removal activities

Parameter	Description[177]
Stratification	It will be carried out based on the establishment, forest management plan and plantation yields.
Sample plots, sample unit size and sample size	Temporary or permanent plots will be designated through random stratified sampling, following adequate procedures for the collection of reliable data to ensure credibility in the estimation of the baseline, project emissions, leakages, and GHG removals.
Calculation of the number of plots and location of plots in the field	The number of plots required to measure the variation of project boundaries and strata will be estimated using the "*A/R Methodological Tool for Calculation of the number of sample plots for measurements within A/R CDM project activities - V 02.1.0*".
Monitoring frequency	Prior to each verification period.
Measurement and estimation of carbon content changes	**Tree marking** All trees within the plot will be marked (alive, standing dead, and sprouts with a diameter of 3 cm or more at the time of marking). Trees will be numbered within the parcel starting with the one closest to the center of the plot in a northerly direction and continuing throughout the entire plot in a clockwise direction. All living individuals will have their diameter at breast height (DBH) marked using a pole with a height of 1.30 m above ground level. After marking and measuring the diameter, a horizontal band approximately 2 cm wide will be painted around the diameter of the tree with enamel paint. On this mark the living trees will be listed. For standing dead trees, dasometric information is not collected nor are they numbered. Instead, they will be marked with an (x) and included on the spreadsheet. **Measurement of dasometric variables in trees** Variables such as DBH and Total Tree Height (H) will be measured. In addition, the following information is recorded: ● Species ● Establishment year ● Monitoring date ● Parcel number ● Location and area (m^2) of each plot ● Parcel number ● Observations related to the conditions. For example: forks.
Monitoring of the quantification of project removals	**Emissions removal by sinks** The requirements of the BCR Standard for GHG removal activities will be followed. **Sampling error** To estimate the uncertainty, the A/R tool *"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"* of the AR-ACM0003 methodology will be used.

(Source: South Pole, 2022)

3.3 Monitoring plan for special categories related to co-benefits

The BCR Standard document refers to the co-benefits according to the additional positive benefits of climate change mitigation initiatives, such as the GHG emissions reduction or removal

[177] The details of the activities implementation in accordance with the monitoring plan are presented in Section **¡Error! No se encuentra el origen de la referencia.**.

projects[178,179]. These co-benefits are comprised in three components: 1) biodiversity conservation, 2) community benefits, and 3) gender equity. Depending on the co-benefits presented, the project may also claim the Orchid, Wax Palm or Andean Condor special categories of recognition.

Thus, for each component, the delivery of each co-benefit associated with the REDD+ and GHG Removal Activities (listed in the management plans and activity reports,[180] and further detailed in Section 4.4: REDD+ project activities, in the Safeguards,[181] the Sustainable Development Goals (SDGs) and the Standard Operating Procedures (SOPs)[182]) will be described.

In each project verification, the compliance of the co-benefits will be analyzed according to the special categories. Therefore, it will be determined if the project continues registered in the same category or, otherwise, it applies to a different one as shown in Annex 9: Co-benefits[183].[184]

3.4 Monitoring plan for SDGs and REDD+ safeguards

For each monitoring period, an evaluation of the Sustainable Development Goals will be carried out based on the national SDG Priorities and the REDD+ Safeguards as shown in Annex 4: SDGs and safeguards[185].

3.5 Monitoring plan for normative requirements

The normative requirements will be evaluated in each verification period, analyzing the following:

- Compliance with national legislation, in accordance with Section 8 of the BCR Standard as detailed in Annex 1: Compliance with national legislation.
- Applicability conditions of each project component[186] as detailed in Section 1.7: Applicability conditions.
- Carbon ownership and rights, in accordance with Section 12 of the BCR Standard as further developed in Section 1.5: Carbon ownership and rights.

3.6 Project impact monitoring plan

For the project impact monitoring plan, environmental and socioeconomic aspects will be taken into account, including corrective and/or mitigation measures as in Section 7: Impact assessment.

3.7 Risk management monitoring plan

The biophysical, financial, social and permanence risks of REDD+ activities will be assessed as mentioned in Section 8: Risk management.

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[178] Smith P., Bustamante, H., Ahammad, H., Clark, H., Dong, E. A., Elsiddig, H., Haberl, R., Harper, J., House, M., Jafari, O., Masera, C., Mbow, N. H., Ravindranath, C. W., Rice, C., Robledo, A., Romanovskaya, F., Sperling, & Tubiello. (2014). Agriculture, Forestry and Other Land Use (AFOLU). In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schl mer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge.

[179] Stickler, C. M., Nepstad, D. C., Coe, M. T., McGrath, D. G., Rodrigues, H. O., Walker, W. S., & Davidson, E. A. (2009). The potential ecological costs and cobenefits of REDD: a critical review and case study from the Amazon region. *Global Change Biology, 15*(12), 2803-2824.

[180] Annual activity reports are available at: Gestión de la información\General\Informes_actividades.

[181] Gestión de la información\Secciones Anexas\ODS & Salvaguardas.

[182] Available at: Gestión de la información/SOP.

[183] Gestión de la información\Secciones Anexas\Anexo 9_Cobeneficios.

[184] Available at: Gestión de la información/SOP.

[185] Gestión de la información\Secciones Anexas\Anexo 4_ODS & Salvaguardas.

[186] In accordance with the GHG Removal Activities Methodological Document and the REDD+ Methodological Document.

4 REDD+ Component

4.1 Project boundaries

4.1.1 Spatial boundaries

REDD+ eligible areas

For the selection of the eligible areas of the project's REDD+ component, a supervised classification of land covers was carried out using multispectral images. Satellite images from 2006-2016[187] were used and stable forest during said period was classified as eligible areas, while zones without stable forest or with forest cover gains or losses were classified as non-eligible.

- Historical deforestation period in the PA[188]

AVNIR-2, Sentinel 2ª and Landsat OLI multispectral images with level-two processing were used to guarantee outcomes with atmospheric correction at the surface level, pixel-by-pixel geometric correction without displacement and quality band to process pure pixels. Table 30 shows the optical images downloaded by date and location for the entire project zone.

Table 30: List of images used

Center	Mission	Processing Level	Acquisition Date	Path	Row
Monterrey	ALOS2	L2	2006-01-26	NA	NA
	ALOS2	L2	2010-09-02	NA	NA
	OLI	L2	2014-01-24	009	053
	S2	L2	2015-12-24	T18PWR	NA
	OLI	L2	2016-02-05	009	053
Punto Nuevo	ALOS2	L2	2006-11-02	NA	NA
	ALOS2	L2	2010-01-23	NA	NA
	OLI	L2	2014-02-02	008	053
	S2	L2	2015-12-11	T18PXR	NA
	OLI	L2	2016-02-24	008	053

(Source: South Pole, 2022)

- Cartographic processing

The project zone contains the properties of the Monterrey and Punto Nuevo centers, whose vocation is forest plantations and tropical dry forest conservation. Therefore, a meticulous and detailed classification was conducted by means of screen digitization on a 1:25,000 scale, with areas greater than or equal to 1 ha being classified as forest cover and the remaining areas being split into the no forest and water classes. For the screen identification and delimitation of the

[187] Information about Project Area processing is available at: Monterrey center: Gestión de la información/Cartografía/REDD+/LineaBase/NucleoMonterrey/ÁreaProyecto; Punto Nuevo center: Gestión de la información/Cartografía/REDD+/LineaBase/NucleoPuntoNuevo/ÁreaProyecto.

[188] The processing of the temporal limits and the period for REDD+ analysis, that is, Project Area, Reference Region and Leakage Area, is available at:
Monterrey center: Gestión de la información/Cartografía/REDD+/LineaBase/NucleoMonterrey/Reporte/20220309_Repote_Lineabase_Monterrey.
Punto Nuevo center: Gestión de la información/Cartografía/REDD+/LineaBase/NucleoPuntoNuevo/Reporte/20220309_Repote_Lineabase_Punto_Nuevo.

boundaries between plantations and forest, high resolution images (less than 1 m) were used, including Geo Eye from Google Earth and the free ArcGis worldwide available image (basemap).

- Eligibility analysis

Using the Forest and Non-Forest layers of the corresponding period, a cartographic cross-checking was performed between the years 2006, 2010, 2014, 2015 and 2016 in order to generate the layer of cover change and determine the eligibility. Table 31 shows the eligibility results according to the methodological requirement: the eligible area is a stable forest during the 2006-2016 period (gross deforestation approach). The areas without information have not been interpreted due to sensor failures, cloud cover and cloud shadow.

Table 31: Eligibility criteria in the Monterrey and Punto Nuevo centers

2006 Layer	2016 Layer	Change	Eligibility
Forest	Forest	Stable forest	Eligible
Forest	Non-forest	Deforestation	Non-eligible
Forest	No information	No information	No information
Non-Forest	Non-forest	Non-forest	Non-eligible
Non-Forest	No information	No information	No information
No information	Forest	No information	No information
No information	Non-forest	No information	No information
No information	No information	No information	No information

(Source: South Pole, 2022)

Table 32: Results of eligible and non-eligible areas in the Monterrey and Punto Nuevo centers in the 2006-2016 period

Category	Total	Monterrey	Punto Nuevo
Eligible forest	5,864.15	4,327.78	1,536,37
Non-eligible	962.74	796.08	166.66
No information	0	0	0
Total	6,826.89	5,123.86	1,703.03

(Source: South Pole, 2022)

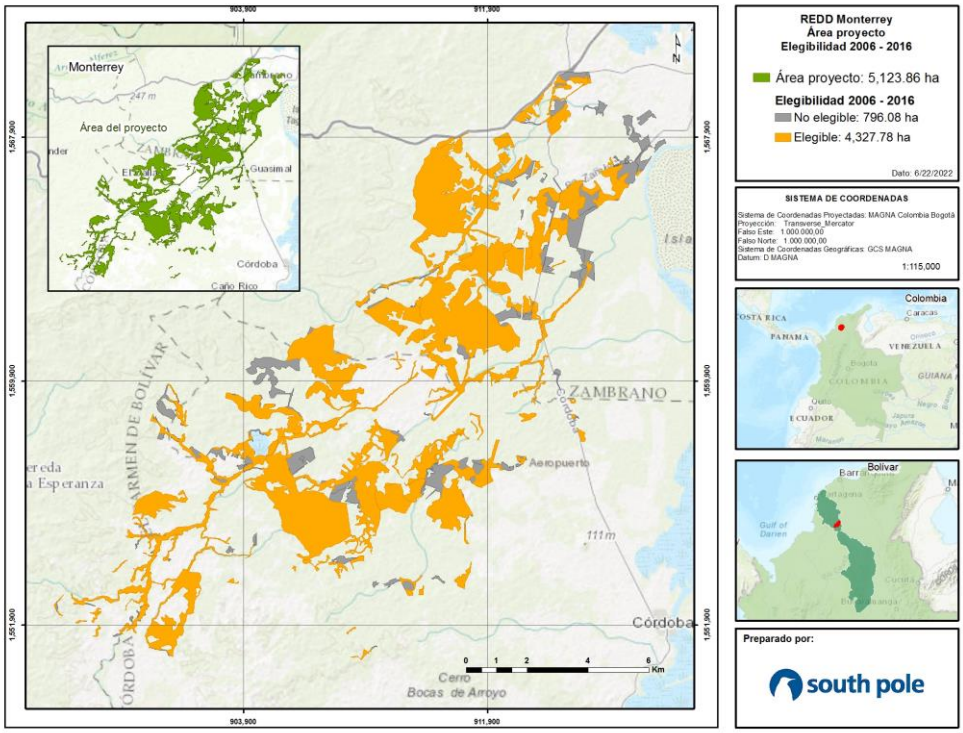


Figure 20: 2006-2016 Eligibility Map of the Monterrey center

(Source: South Pole, 2022)

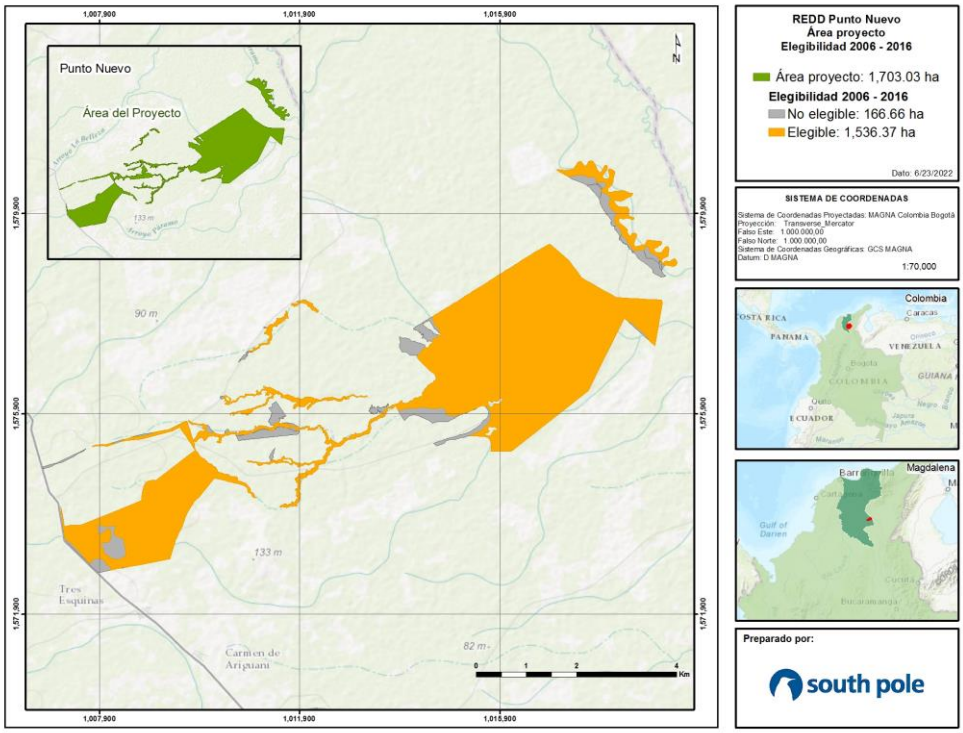


Figure 21: 2006-2016 Eligibility Map of the Punto Nuevo center

(Source: South Pole, 2022)

4.1.1.1 Reference Region for the estimation of the REDD+ baseline

The Reference Region (RR) was delimited according to the guidelines of the REDD+ Methodological Document[189]. In this sense, the RR may include one or more areas and, due to the distance between the Monterrey and Punto Nuevo centers, two polygons called RRs are presented. They meet the following criteria:

- The PA was included in the RR.
- The agents and drivers of deforestation identified in Section 4.2: Causes and agents of deforestation[190] can access the PA.
- The PA is of interest to the agents identified in Section 4.2: Causes and agents of deforestation[191]. They may be interested in acquiring land in the project area in the absence of the Caribbean Region CCMP.
- The land tenure schemes and land use rights of the PA are represented in the RR.
- Areas with restricted access to agents and drivers of deforestation, such as the Los Colorados Fauna and Flora Sanctuary, were excluded[192].

4.1.1.1.1 Selection of the Reference Region

The geographic boundaries of the RR include two areas: the first one with 84,287 ha and the second one with 105,623 ha, corresponding to the Monterrey and Punto Nuevo centers, respectively. Both areas were selected taking into account their similar conditions to the project area in terms of access, deforestation agents and determinants, forest types, post-deforestation land uses, land tenure, political context, and enforceable regulations.

The two areas adjacent to the project centers, that is, the RR, meet the following criteria[193]:

- At least 90% of the project area has the forest classes existing in at least 90% of the rest of the RR in the baseline start year (year 2005, for which Forest/Non-Forest information is used).
- At least 90% of the project area is within the elevation range of at least 90% of the rest of the RR.
- The average slope of at least 90% of the project area is within ±10% of at least 90% of the rest of the RR.
- The average annual rainfall in at least 90% of the project area is within ±10% of the average annual rainfall of at least 90% of the RR.
- The average annual temperature in at least 90% of the project area is within ±10% of the average annual temperature of at least 90% of the RR.
- The area resulting from the assessment of the previous aspects was adjusted based on the departmental and municipal boundaries and the existing roads and railways.

4.1.1.1.2 Results of the Reference Region eligibility assessment

In the Reference Region, an eligible area of 27,861 ha was obtained for Monterrey and 13,723 ha for Punto Nuevo, which is equivalent to 33% and 13%, respectively, of the total RR boundary. Table 33 breaks down the information corresponding to each polygon, and Figure 22 and Figure 23 present the spatial distribution of eligible areas.

[189] Information about Reference Region processing is available at: Monterrey center: Gestión de la información/Cartografía/REDD+/LineaBase/NucleoMonterrey/RegionReferencia; Punto Nuevo center: Gestión de la información/Cartografía/REDD+/LineaBase/NucleoPuntoNuevo/RegionReferencia.
[190] Annex 3: Causes and agents of deforestation.
[191] Annex 3: Causes and agents of deforestation.
[192] Protected area attached to the National System of Protected Areas (SINAP) and administered by the National Natural Parks of Colombia (NNPC).
[193] Information on the procedure for defining the Reference Region is available at: Monterrey center: Gestión de la información/Cartografía/REDD+/DefinicionRegionReferencia/NucleoMonterrey; Punto Nuevo center: Gestión de la información/Cartografía/REDD+/DefinicionRegionReferencia/NucleoPuntoNuevo.

Table 33: Results of eligible and non-eligible areas in the Reference Region in the zone of the Monterrey and Punto Nuevo centers, in the 2006-2016 period

Category	Total	Monterrey	Punto Nuevo
Eligible forest	41,584	27,861	13,723
Non-eligible	148,326	56,426	91,900
No information	0	0	0
Total	189,910	84,287	105,623

(Source: South Pole, 2022)

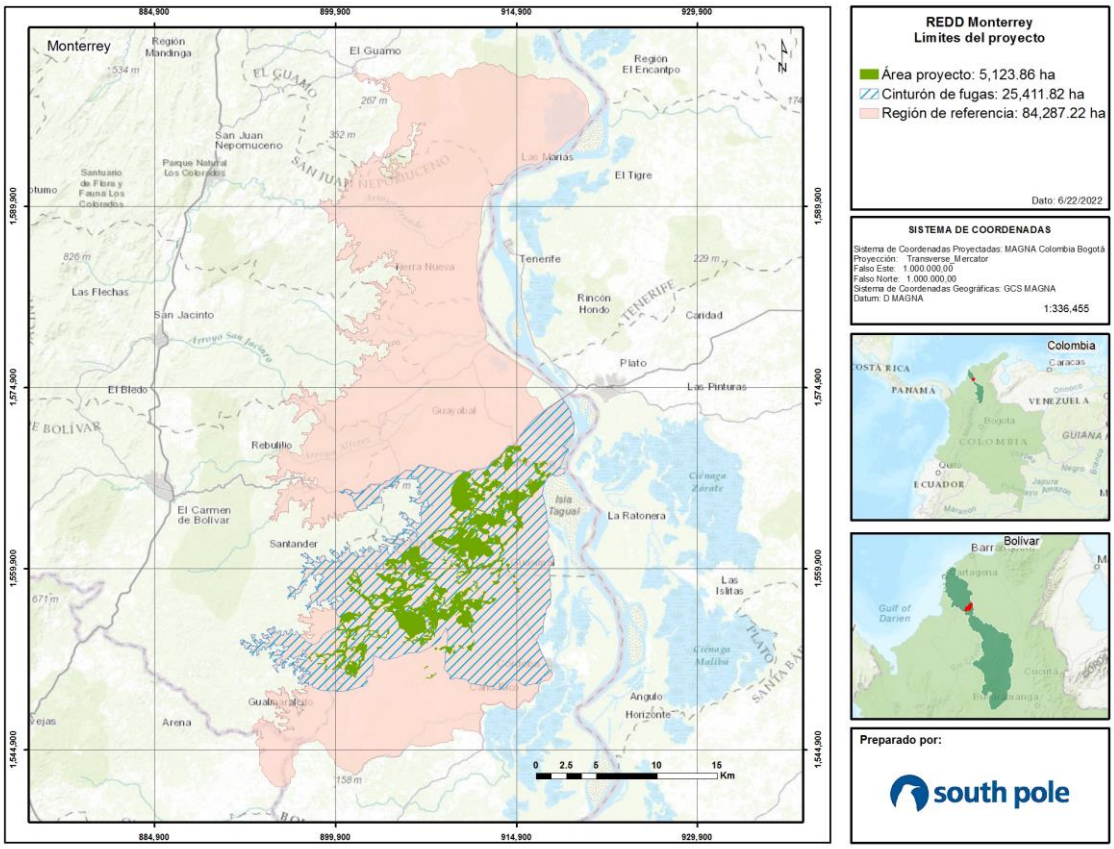


Figure 22: Eligibility Map of the RR and LA in the Monterrey center

(Source: South Pole, 2022)

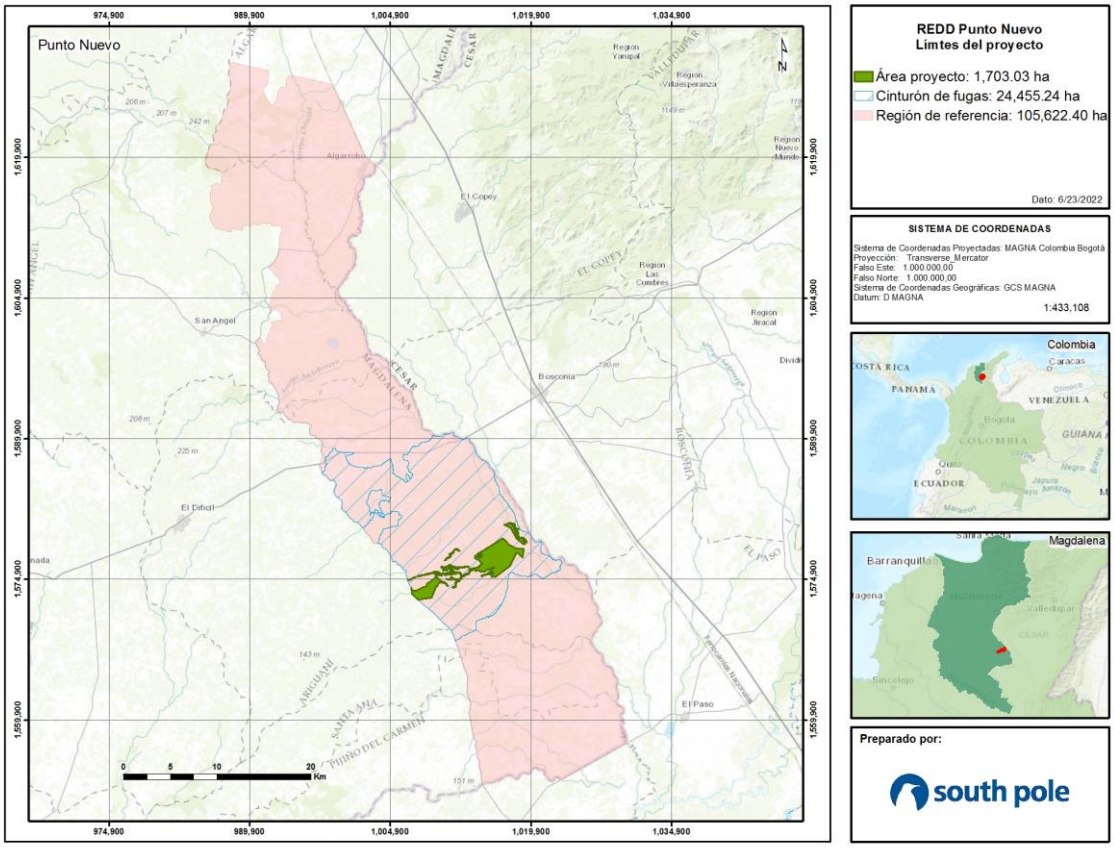


Figure 23: Eligibility Map of the RR and LA in the Monterrey center

(Source: South Pole, 2022)

4.1.1.2 REDD+ Leakage Area

The forest area where deforestation can be displaced as a consequence of the implementation of project activities has an extension of 25,412 ha in the Monterrey center and 24,455 ha in the Punto Nuevo center. This was delimited based on the following criteria:

- The forest areas of intervention by the agents identified and characterized through the EPCAC were included in the project's area of influence[194].
- The Leakage Area is located around the Project Area, where the stakeholders listed in the EPCAC are located.
- The Leakage Area of the Monterrey center does not include the areas of the northern sector outside the PA since the El Carmen de Bolívar-Zambrano road interrupts communication and prevents direct threats to the forest. Likewise, the stakeholders in this area are not considered neighbors because they do not share boundaries with the property and were not included in the EPCAC Stakeholder Mapping.
- A multi-criteria analysis was carried out by weighting variables in Table 34. These were identified and valued taking into account the underlying and direct causes of deforestation[195] and the intervention area of the agents[196].

[194] Interviews and surveys carried out within the EPCAC: Gestión de la información\EPCAC.
[195] The underlying and direct causes of deforestation are described in Section 4.2: Causes and agents of deforestation.
[196] Information on the procedure for defining the Leakage Area is available at: Monterrey center: Gestión de la información/Cartografía/REDD+/DefinicionÁreaFugas/NucleoMonterrey; Punto Nuevo center: Gestión de la información/Cartografía/REDD+/DefinicionÁreaFugas/NucleoPuntoNuevo.

Table 34: Weight assigned to each variable in the multicriteria analysis carried out for the definition of the leakage area

Variable	Weight (%)
Distance to project area	20%
Distance to deforested areas	15%
Distance to oil palm crops	5%
Distance to clean pastures	25%
Distance to populated centers	15%
Distance to roads	15%
Distance to mining areas	5%
Total	**100%**

(Source: South Pole, 2022)

4.1.1.2.1 Results of the eligibility assessment in the Leakage Area

In the Leakage Area, an eligible area of 5,284 ha was obtained for the zone of the Monterrey center and 2,830 ha for the Punto Nuevo center. Table 35 breaks down the information corresponding to each polygon representing the leakage areas, and Figure 22 and Figure 23 show the spatial distribution of the eligible areas.

Table 35: Results of eligible and non-eligible areas in the Leakage Area in the zone of the Monterrey and Punto Nuevo centers, in the 2006-2016 period

Category	Total	Monterrey	Punto Nuevo
Eligible forest	8,118	5,288	2,830
Non-eligible	41,750	20,125	21,625
No information	0	0	0
Total	49,868	25,413	24,455

(Source: South Pole, 2022)

Figure 22 and Figure 23 show the leakage belt for the Monterrey and Punto Nuevo centers.

4.1.1.3 Historical deforestation period in the Reference Region and the Leakage Area

The methodology used to carry out the deforestation analysis in the LA and the RR consists of five stages, which are described below:

4.1.1.3.1 Stage 1: Data acquisition

Multispectral Landsat 5, 7 and 8 images of the TM, ETM+ and OLI missions, respectively, were downloaded for each year evaluated (Table 17). The images have a spatial resolution ranging from 15 m to 100 m, covering an area of 185 km and with a revisit time of the same ground point on Earth of 16 days. These images are provided by the United States Geological Survey (USGS) and can be consulted and downloaded for free at: https://earthexplorer.usgs.gov/. Landsat 5 images were downloaded for the year 2010, Landsat 7 for the years 2006 and 2016, and Landsat 8 for the years 2014 and 2016.

Table 36: Archive of images downloaded for the Reference Region and the Leakage Belt

Number	Satellite	Collection	Path	Row
1	Landsat 7 (ETM+)	L2SP	8 & 9	53
2	Landsat 5 (TM)	L2SP	8 & 9	53
3	Landsat 8 (OLI)	L2SP	8 & 9	53
4	Landsat 8 (OLI)	L2SP	8 & 9	53

(Source: South Pole, 2022)

4.1.1.3.2 Stage 2: Geometric correction

The Landsat images were downloaded with level-two processing to guarantee outcomes with atmospheric correction at the surface level, pixel-by-pixel geometric correction without displacement and quality band to process pure pixels.

4.1.1.3.3 Stage 3: Forest cover classification

For land cover classification, supervised remote sensing techniques (based on pixels) are used, using the Support Vector Machine (SVM) classifier to generate the forest and non-forest cover, and water classes.

Visual inspection is used to generate training areas, which are homogeneously distributed on the image (based on GIS and remote sensing expert knowledge). Then, class separability statistics (Jeffries-Matusita) are used to guarantee the independence of the training data, with values close to 2 indicating that training areas have a different spectral signature and values close to 0 indicating that they are identical. Once the seeds and separability have been defined, the classification is carried out using the supervised SVM method from the ENVI 5.5.3 software.

The outcome is a raster file in TIFF format with the representation of the classified cover for the years 2006, 2010, 2014 and 2016. Likewise, the results are visually validated, and a filter is applied with the Majority/Minority Analysis function to improve the classification and ensure the minimum mappable area (1 ha).

4.1.1.3.4 Stage 4: Calculation of classification accuracy

Control points throughout the RR were analyzed to identify the veracity of the cartographic information generated and to make sure that the results of the supervised classification can be replicable and comparable as described in Section 4.1.1.4: Accuracy of the supervised classification.

4.1.1.3.5 Stage 5: Forest/Non-Forest final layer

Once the land covers for the years 2006, 2010, 2014 and 2016 have been obtained, they are reclassified into forest and non-forest classes, according to the national definition of forest between the years 2006 and 2016. Table 37 shows the result of the reclassification and the land cover classes obtained.

Table 37: Cover reclassification: forest and non-forest layer

Number	Land Cover	Reclassified Classes
1	Forest	Forest
2	Non-forest	Non-forest
3	Water	Non-forest
4	Clouds	No information
5	Cloud shadow	No information
6	No information	No information

(Source: South Pole, 2022)

4.1.1.4 Accuracy of the supervised classification

The 2016 classification for the RR was validated with satellite images from 2016, using a set of statistics that allow for verifying if the cartographic information generated is well classified, replicable and comparable, as follows:

- The sampling design is based on random points for the validation of the Forest/Non-Forest thematic map of the year 2016.
- The sample size is based on the finite population methodology at a minimum distance of 1,000 m.
- The inspection was done point by point through a Sentinel 2ª image from the year 2016.
- The control points of the forest and non-forest classes were located at a visual scale of 1:5,000.

Methodologically, the accuracy of the forest distribution must be equal to or greater than 95%. This was assessed in 2016 based on gross deforestation in the 2006-2016 baseline. The sampling design and the results obtained in the confusion matrix for the accuracy assessment are shown below.

4.1.1.4.1 Sample design

The inspection is carried out point by point, using a visual scale of 1:25,000 on the Sentinel 2ª image (see Figure 24). This is complemented by the archive of multispectral images from Google Earth, Microsoft Bing Maps and Esri Basemap, which contain mosaics of GeoEye images in the RR between 2012-2016, with a spatial resolution of 1 m that allows for visualizing in greater detail whether a point with no information (for example, due to clouds or cloud shadows) at a visual scale of 1:5,000 belongs to the eligible or non-eligible class.

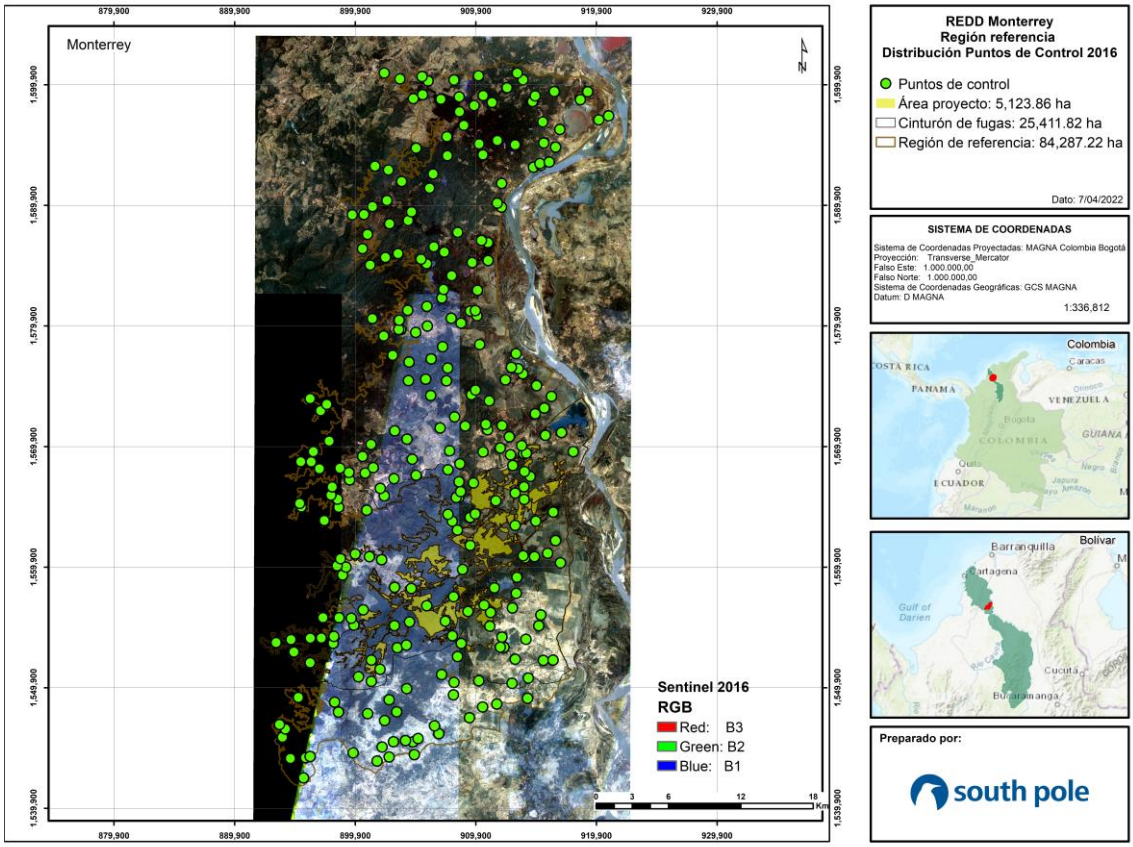


Figure 24: Example of control points distribution in the RR of the Monterrey sector

(Source: South Pole, 2022)

The sample size is defined by the number of segments within a finite population according to the area of the RR. In the case of the forest and non-forest layer of the Monterrey sector, there is a population of 879 segments, with a maximum expected margin of error of 5%. Therefore, the sample size for a 95% confidence level is 275 points. In the Punto Nuevo sector, for its part, there is a population of 1,128 segments, with a maximum expected margin of error of 5%. Therefore, the sample size for a 95% confidence level is 300 points.

4.1.1.4.2 Confusion matrix

The assessment of the forest/non-forest thematic accuracy for the year 2016, on a 1:100,000 scale, is validated by means of a confusion matrix, where the classification obtained is compared with respect to the validation mesh points created by visual inspection. The ArcMap 10.7.1 *Compute Confusion Matrix* tool is used to do the calculations:

- The calculation set includes total, producer, and user precision; kappa coefficient; and commission, and omission errors.
- The commission error corresponds to a false detection of the category and is associated with user accuracy. The latter relates the pixels correctly classified in each category to the total number of pixels that were classified in that category.
- The omission error corresponds to the non-detection of the real category and is associated with the producer accuracy. The latter relates the number of pixels correctly classified in each category to the number of reference pixels used for that category.
- The Kappa (k) index measures the degree of accuracy merely based on classification, removing errors caused by random factors.

Table 38 shows the object-oriented confusion matrix of the 2016 forest/non-forest classification, which was obtained by using the Support Vector Machine (SVM) supervised classifier. Additionally, an average Kappa coefficient of 88% was obtained, which means that the SVM supervised classification is a better class discriminator than an unsupervised (random) classification.

Table 38: Confusion matrix of the 2016 forest/non-forest classification

Validation of Unit Points							
Center	**Classification**	**Non-Forest**	**Forest**	**Total**	**User Accuracy**	**Overall Accuracy**	**Kappa**
Monterrey	Non-forest	125	7	132	94.70%		
	Forest	10	133	143	93.01%		
	Total	135	140	275			
	Producer accuracy	92.59%	95.00%				
	Overall accuracy					**93.82%**	
	Kappa						**87.63%**
Punto Nuevo	Non-forest	159	4	163	97.55%		
	Forest	13	124	137	90.51%		
	Total	172	128	300			
	Producer accuracy	92.44%	96.88%				
	Overall accuracy					**94.33%**	
	Kappa						**88.52%**

(Source: South Pole, 2022)

4.1.2 Temporal limits and analysis period of the REDD+ initiative

Table 39: Quantification period of the REDD+ initiative

Initiative Type	Start Date	End Date	Monitoring Period
REDD+	April 2, 2016	April 2, 2046	April 2, 2016 and December 31, 2020.

(Source: South Pole, 2022)

4.2 Causes and agents of deforestation

The causes and agents of deforestation were identified through the behavior of natural cover changes, from forest to non-forest, according to the historical background and current dynamics within the project boundaries. To achieve the results, the steps of the REDD+ Methodological Document of the BCR Standard were followed and the analysis focused on (1) the spatial and temporal dimensions of deforestation; (2) the description of the territorial, sociocultural, economic and historical contexts; (3) the interests and motivations of key stakeholders to carry out different economic activities; (4) the alternative economic activities; (5) the importance of alternative activities in the territory; (6) the direct and indirect impacts of the processes that cause the transformation of natural covers; (7) the relationship of the direct and underlying causes of

deforestation with the deforestation actors or agents; and (8) the chain of deforestation events (these are widely described in Annex 1[197]).

4.2.1 Key stakeholders

Based on the methodological roadmap described in the EPCAC document[198], stakeholder mapping first focuses on the inventory and description of the stakeholders according to key variables such as stakeholder, sector, territorial scale of action, role, interest, and ownership rights over the project area. These variables are described below:

Stakeholder(s): An individual or a social organization with a specific identity, role and interest, who interacts with the social and physical environment of the territory. In the same way, the stakeholder is the one whose participation impacts the achievement of the objectives proposed in the Caribbean Region CCMP.

Sector(s): Group of stakeholders who share some characteristics regarding role, interest, vision, mission or competence. In the field of forest governance, WWF has identified and proposed the definition of some sectors, including the institutional, employee, community and educational ones. The productive sector is also proposed in the case of the municipalities impacted by the Caribbean Region CCMP and the FMS properties.

- **Employee sector:** It is made up of the stakeholders of the communities in the area of influence of the Caribbean Region CCMP, who, in turn, are direct employees or contractors of the companies Forestal Monterrey Colombia (FMC) and Greenwood Resources Colombia S.A.S. (GWR). These are the stakeholders that can be positively or negatively affected by the activities carried out by the initiative. In the Stakeholder Map, this sector is divided into three subgroups: GreenWood Resources Colombia S.A.S., Forestal Monterrey Colombia S.A.S. and contractors.
- **Institutional sector:** It refers to government entities and those actors who legislate on forest resources and climate change, who administer and manage them or who monitor them with the purpose is to exercise surveillance and control.
- **Educational sector:** It includes universities, schools and non-formal educational entities that contribute to GHG removal and REDD+ activities based on their knowledge and actions.
- **Community sector:** It groups community-based organizations such as associations or community action boards that are impacted or exposed to risks associated to forestry activities, as well as non-profit organizations or entities that work to promote the conservation and well-being of the territory and its communities. Similarly, local residents are included in this group, whether they are landowners, non-unionized peasants or inhabitants of lands adjacent to the properties of Forestal Monterrey Colombia. In the case of individuals, they can carry out subsistence economic activities or even informally sell their products, but they shall not be part of union organizations, since they would be part of the productive sector.
- **Productive sector:** It is made up of associations, companies and other types of organizations that are organized to carry out a specific productive activity and accrue economic benefits derived from it.

4.2.1.1 Direct and underlying causes of deforestation

The underlying causes or basic conditions behind deforestation and forest degradation or the depletion of other key ecosystems are common to the Momposina Depression, the Montes de María and surrounding areas (reference region); the municipalities of Zambrano, Córdoba, El Carmen de Bolívar and Ariguaní (area of influence); and the properties of FMC S.A.S. (project area) (South Pole. 2021[199]). These causes are: (1) unawareness of the commercial and

[197] Gestión de la información\Secciones Anexas\Anexo 3_CausasyAgentesDeforestación
[198] Stakeholder map document: Mapa_actores de la EPCAC en la ruta: Gestión de la información\EPCAC
[199] Strategy for Participation, Communication and Knowledge Appropriation. Gestión de la información\EPCAC

environmental value of the territory and the risks associated with the occupation and alteration of dynamic and unstable lands; (2) the loss of the agricultural, port and commercial vocation of some of the municipalities; (3) the absence of enabling conditions, such as exploitation infrastructure, roads, basic sanitation equipment, job-oriented training, and socioeconomic development; (4) the disturbance to the peace; and (5) worsening of climate change effects, particularly of droughts, floods and variations in seasonality.

The above-mentioned underlying conditions reduce the possibilities of local stakeholders to innovate in systems of extensive livestock farming and agriculture that use little technology and are distanced from the natural order of the territory. At the same time, they encourage stakeholders to colonize new territories once the ones under current use lose productivity or viability. In other words, the underlying causes drive intermediate phenomena, better known as drivers or direct causes of deforestation and ecosystem degradation, in the project boundaries, including (1) the uncontrolled expansion of the agricultural frontier, (2) the lack of planning or poor design for the establishment of road infrastructure, (3) inadequate water management of water bodies and tributaries, and (4) mining, especially that of an illegal nature (South Pole, 2021[200]).

The direct causes of deforestation in the 2006-2016 period resulted in the clearing of around 15,804 ha of forest in the RR of the Monterrey center and 13,807 ha in the RR of the Punto Nuevo center. The highest percentage is attributed to the uncontrolled expansion of the agricultural frontier since the main landscape changes are linked to grass cover, followed by permanent and transitory crops, and oil palm. Deforestation due to inadequate water management is related to the transition to covers such as artificial water bodies (104 ha), modified lagoons, aquatic vegetation on water bodies, and changes in the course of the Magdalena River (0.1%).

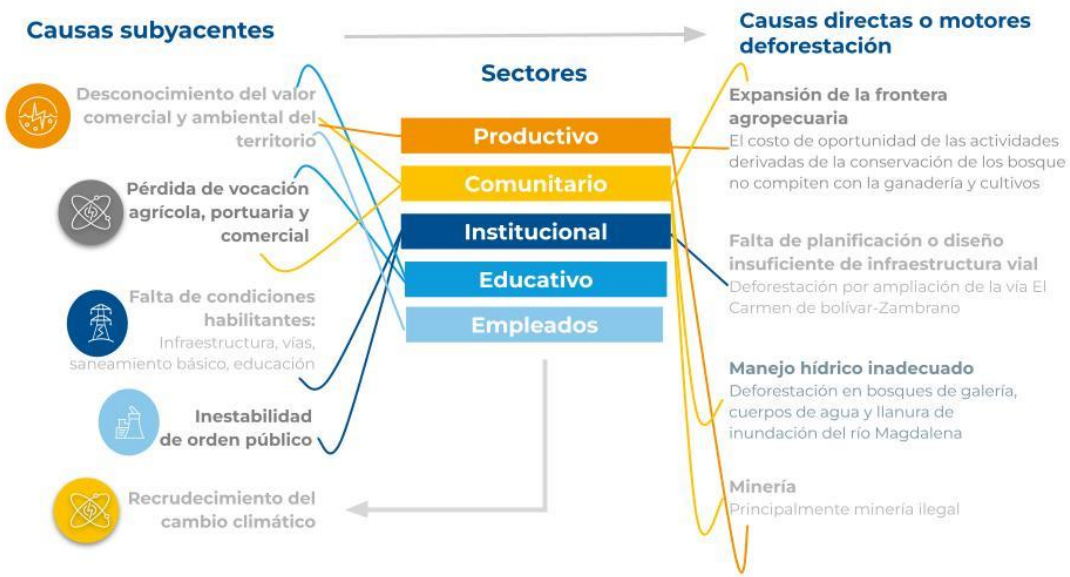


Figure 25: Diagram of the relationship of stakeholders of the Caribbean Region CCMP, by sector, with the direct causes or drivers of deforestation

(Source: South Pole, 2022)

[200] Strategy for Participation, Communication and Knowledge Appropriation. Available at: Gestión de la información\EPCAC

Table 40: Influence of stakeholders in the underlying and direct causes of deforestation

Sector	Stakeholders	Underlying Causes	Direct Causes or Drivers	Influence o Deforestation
Community	Neighbors: Landowners of neighboring properties, and social and community organizations.	1. Unawareness of the commercial and environmental value of the territory and the risks associated with the occupation and alteration of dynamic and unstable lands. 2. Loss of the agricultural, port and commercial vocation of some of the municipalities. 3. Absence of enabling conditions. 4. Worsening of climate change effects.	1. Uncontrolled expansion of the agricultural frontier 3. Inadequate water management	Direct agents of deforestation and forest degradation. Deforestation in the Leakage Area went from -5.68% and -7.90% during the baseline period (2006-2016) to -6.7% and -7.4% in the monitoring period in the Monterrey and Punto Nuevo centers, respectively. These changes occurred, to a large extent, on neighboring properties. The forest cover was transformed mainly to mosaics of crops and pastures, other lands, and pastures (Table 42 and Table 43).
Education	-Primary, middle, and secondary educational institutions in the area of influence. -SENA. -Universities.			Although these stakeholder groups are not directly linked with the phenomenon of deforestation, they are highly important for project permanence. As they relate to four underlying causes of deforestation, they are considered within the strategic lines of the project and included in the EPCAC.
Employees	-Contractors -Forestal Monterrey Colombia S.A.S. -Greenwood Resources Colombia S.A.S.	1. Unawareness of the commercial and environmental value of the territory and the risks associated with the occupation and alteration of dynamic and unstable lands. 4. Worsening of climate change effects.		
Productive	-FMC clients. -Local and national productive associations and unions.	1. Unawareness of the commercial and environmental value of the territory and the risks associated with the occupation	1. Uncontrolled expansion of the agricultural frontier. 3. Inadequate water management.	The productive sector has historically influenced the reference region and the project's area of influence since some of its members are benefited by State policies and legislation gaps that allow them to increase the agricultural frontier, transform natural cover and, in some cases, inadequately manage the

Sector	Stakeholders	Underlying Causes	Direct Causes or Drivers	Influence o Deforestation
		and alteration of dynamic and unstable lands. 2. Loss of the agricultural, port and commercial vocation of some of the municipalities. 4. Worsening of climate change effects.	4. Mining.	water systems (which are vital in areas such as the Momposina Depression and neighboring municipalities that depend on the Magdalena River and its tributaries).
Institutional	-COPAMAG -Ministry of Environment and Sustainable Development. -Ministerio de Ambiente y Desarrollo Sostenible. -CARDIQUE -FEDEMADERAS -ICA -ANT - Mayor's offices of the project's area of influence	1. Unawareness of the commercial and environmental value of the territory and the risks associated with the occupation and alteration of dynamic and unstable lands. 2. Loss of the agricultural, port and commercial vocation of some of the municipalities. 3. Absence of enabling conditions. 4. Worsening of climate change effects.	1. Uncontrolled expansion of the agricultural frontier. 2. Lack of planning or poor design of road infrastructure. 3. Inadequate water management. 4. Mining.	Institutional actors are important for the oversight and monitoring of landscape transformation. Therefore, as explained in Section **¡Error! No se encuentra el origen de la referencia.**, despite the different efforts led by the State and other institutions, deforestation in has an increasing trend in the reference region, specifically in the Monterrey center, considering the large forest areas in the San Jacinto Mountain Range. On the contrary, this trend is stable in the sector of the Punto Nuevo center, maybe be due to the few forest remnants existing in the area.

(Source: South Pole based on information from the project holder)

Regarding landscape transformation due to lack of planning or the inefficient design of infrastructure, changes are evident in the expansion of the El Carmen de Bolívar-Zambrano road as registered in the cover change control points in 2021 in the surroundings of the Monterrey center, as well as in the areas converted into artificial territories. Finally, mining, as a direct cause, is found in open areas without vegetation (109 ha), but given the predominant illegal nature of this activity, there is no official record of it and, therefore, only 46 ha have been reported to be dedicated to mining extraction in the RR of the Monterrey center and 11 ha in the Punto Nuevo center.

Table 41: Natural cover in deforested areas during the 2006-2016 period in the RR of the Caribbean Region CCMP

Natural cover in deforested areas of the Reference Region during 2006-2016	RR of the Monterrey center		RR of the Punto Nuevo center	
	Area (ha)	%	Area (ha)	%
Open shrubland	1,349	8.5	730	5.3
Dense shrubland	1,440	9.1	722	5.2
Open areas without vegetation	77	0.5	32	0.2
Low open forest	0	0.0	39	0.3
Gallery and riparian forest	191	1.2	683	4.9
Low dense forest	154	1.0	129	0.9
Fragmented forest with pastures and crops	526	3.3	0	0.0
Fragmented forest with secondary vegetation	246	1.6	0	0.0
Artificial water body	104	0.7	0	0.0
Permanent crops	0	0.0	40	0.3
Transitory crops	0	0.0	7	0.1
Lagoon	140	0.9	99	0.7
Mosaic of crops and pastures	1,272	8.1	136	0.9
Mosaic of crops, pastures and natural spaces	29	0.2	218	1.6
Mosaic of pastures with natural spaces	41	0.3	191	1.4
Mosaic of pastures and natural spaces	1,632	10.3	869	6.3
Oil palm	42	0.3	159	1.1
Pastures	6,788	42.9	9.243	66.9
Forest plantation	184	1.2	247	1.8
River	19	0.1	0	0.0
Artificialized territory	18	0.1	4	0.0
Aquatic vegetation on water bodies	0	0.0	4	0.0
Secondary vegetation	1,532	9.7	31	0.2
Swampy areas	20	0.1	224	1.6
Total	**15,804**	**100**	**13,807**	**100**

(Source: South Pole based on IDEAM, 2017)[201]

[201] IDEAM (2017). Ecosistemas continentales, costeros y marinos de Colombia.

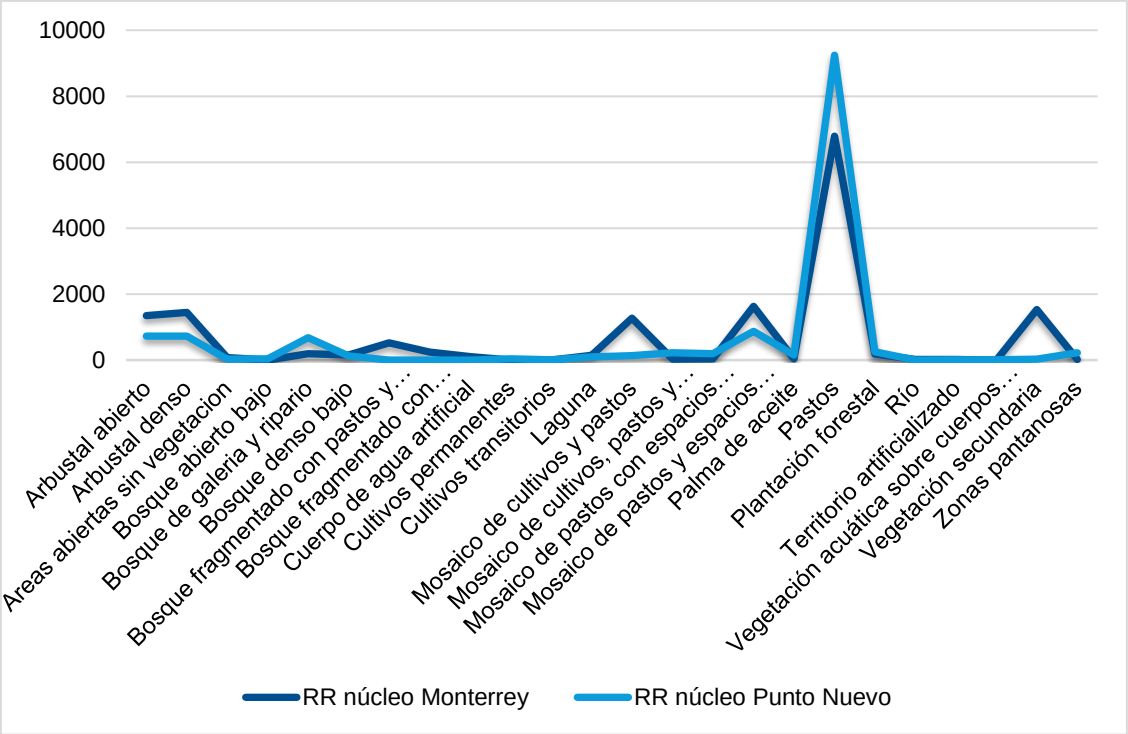


Figure 26: Behavior of natural cover in deforested areas of the RR during 2006-2016

(Source: South Pole, based on information from IDEAM, 2017)[202]

Table 42: Cover change matrix in 2016 and 2020 in the Monterrey leakage area, in hectares

		Cover in 2020						
		Water	Settlement	Forest	Crop	Mosaic of crops and pastures	Other lands	Pastures
Cover in 2016	**Water**	63.9	0.00	0.00	0.00	0.00	0.00	0.00
	Settlement	0.00	151.2	0.00	0.00	0.00	0.00	0.00
	Forest	2.91	3.07	8,370.8	23.72	118.78	822.83	273.24
	Crop	0.00	0.00	0.0	6,878.48	353.8	4.57	1.59
	Mosaic of crops and pastures	0.00	0.00	0.00	0.03	1,374.8	7.66	0.51
	Other lands	0.00	0.00	0.00	37.25	31.49	3,469.11	304.27
	Pastures	0.00	0.00	0.00	23.27	0.01	26.62	7,621.79
	Total	636.82	154.28	8,370.75	6,962.75	1,878.88	4,330.80	8,201.40

(Source: Prepared by South Pole, 2022)[203]

[202] IDEAM. (2017). *Ecosistemas continentales. Costeros y marinos de Colombia.*

[203] The procedure for obtaining this information can be consulted at: Gestión de la información\Cartografía\REDD+\Monitoreo\NucleoMonterrey\Reporte

Table 43: Cover change matrix in 2016 and 2020 in the Punto Nuevo leakage area, in hectares

		Cover in 2020						
		Water	Settlement	Forest	Crop	Mosaic of crops and pastures	Other lands	Pastures
Cover in 2016	Water	197.89	0.00	0.00	0.00	0.63	147.36	1.17
	Settlement	0.00	14.40	0.00	0.00	0.00	0.00	0.00
	Forest	10.88	0.00	3,640.55	1.36	30.47	344.84	338.69
	Crop	0.00	0.00	0.00	830.70	0.00	0.00	92.76
	Mosaic of crops and pastures	0.00	0.00	0.00	0.00	1,377.40	0.00	0.00
	Other lands	0.00	0.00	0.00	7.59	0.00	5,622.00	43.03
	Pastures	0.00	0.00	0.00	27.91	0.00	11.11	13,417.53
	Total	208.77	14.40	3,640.55	867.55	1,408.51	6,125.31	13,893.18

(Source: Prepared by South Pole, 2022)[204]

The ***pressure on the conservation areas in the Monterrey property is considered high and direct***, since inhabitants of the municipalities of Zambrano and Córdoba who attended the participatory events did not identify another nearby forest area and the neighboring farms are mainly dedicated to extensive livestock farming. In addition, the average deforestation rate in the RR went from -4.41% in the baseline scenario to -7.98% between 2016 and 2020, that is, around 15,804 ha of forest were lost during the 2006-2016 period and 7,607 ha in the monitoring period (Table 47). Forest transition in the leakage area is mainly due to mosaics of crops and pastures, other lands, and pastures.

In the case of ***the Punto Nuevo conservation area, the pressure is also high, direct, and (additionally) dynamic***, since it is a place that serves as a corridor between the Momposina Depression and the foothills of the Snow-Covered Mountain Range of Santa Marta. Although it should be a priority area for conservation, unfortunately few forested hectares remain in the RR. Only between 2006 and 2016, 13% of the area was transformed, excluding 78,092 ha that in 2006 no longer corresponded to forest cover, which further confirms the need to continue with the implementation of REDD+ activities in this territory; otherwise, the different causes of deforestation, institutional and investment barriers, and the intensification of climate change will make one of the country's most fragile ecosystems cease to exist.

4.2.2 Relations and synergies between direct and underlying causes and key stakeholders of the Caribbean Region CCMP

Through the Caribbean Region CCMP, a complex network of synergies was identified between sectors or agents related to the use of the territory in the municipalities of interest (Figure 26). In these, the institutional sector, the educational system, the communities and the productive structures have played a role in the processes leading to high rates of deforestation and forest degradation or the depletion of other key ecosystems (Figure 27). On the other hand, the condition of private land tenure in the project area protects the chain of deforestation events from

[204] The procedure for obtaining this information can be consulted at: Gestión de la información\Cartografía\REDD+\Monitoreo\NucleoPuntoNuevo\Reporte

fluctuations or erroneous decisions by the institutional, educational and productive sector, but in the absence of this scheme or of the REDD+ activities, the forest would be in permanent danger, facing the imminent possibility of land use change due to the expansion of the agricultural frontier. For its part, the neighbors' sub-sector has a direct and permanent incidence that can be addressed through the activities described in the strategic lines of the project (Figure 27).

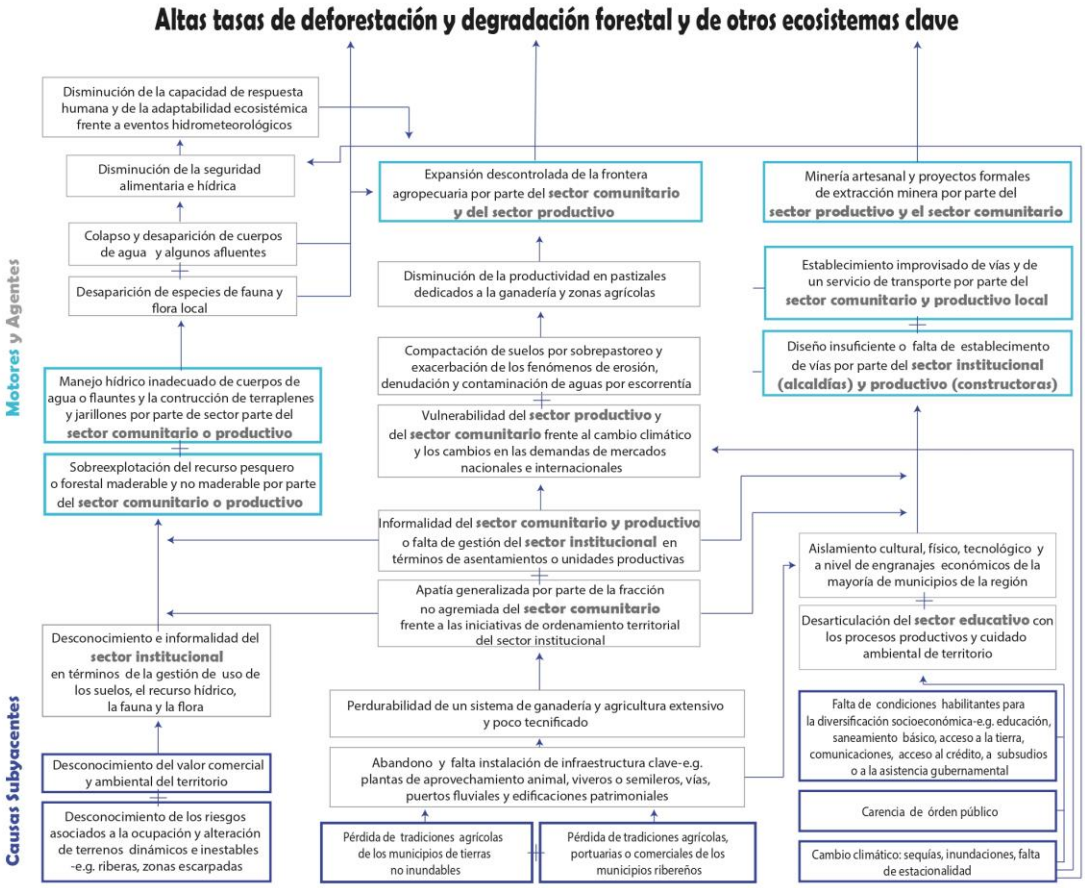


Figure 27: Underlying causes, drivers and agents of deforestation and forest degradation and the depletion of other key ecosystems in the area of influence[205]

(Source: South Pole, 2022)

Note: The underlying causes are inside the dark blue boxes, and the drivers or direct causes are in the light blue ones. Agents related to each driver can be identified by the gray font.

[205] This figure is available in PDF format at: Gestión de la información\Secciones Anexas\ CausasyAgentesDeforestación\Figuras_PDF.

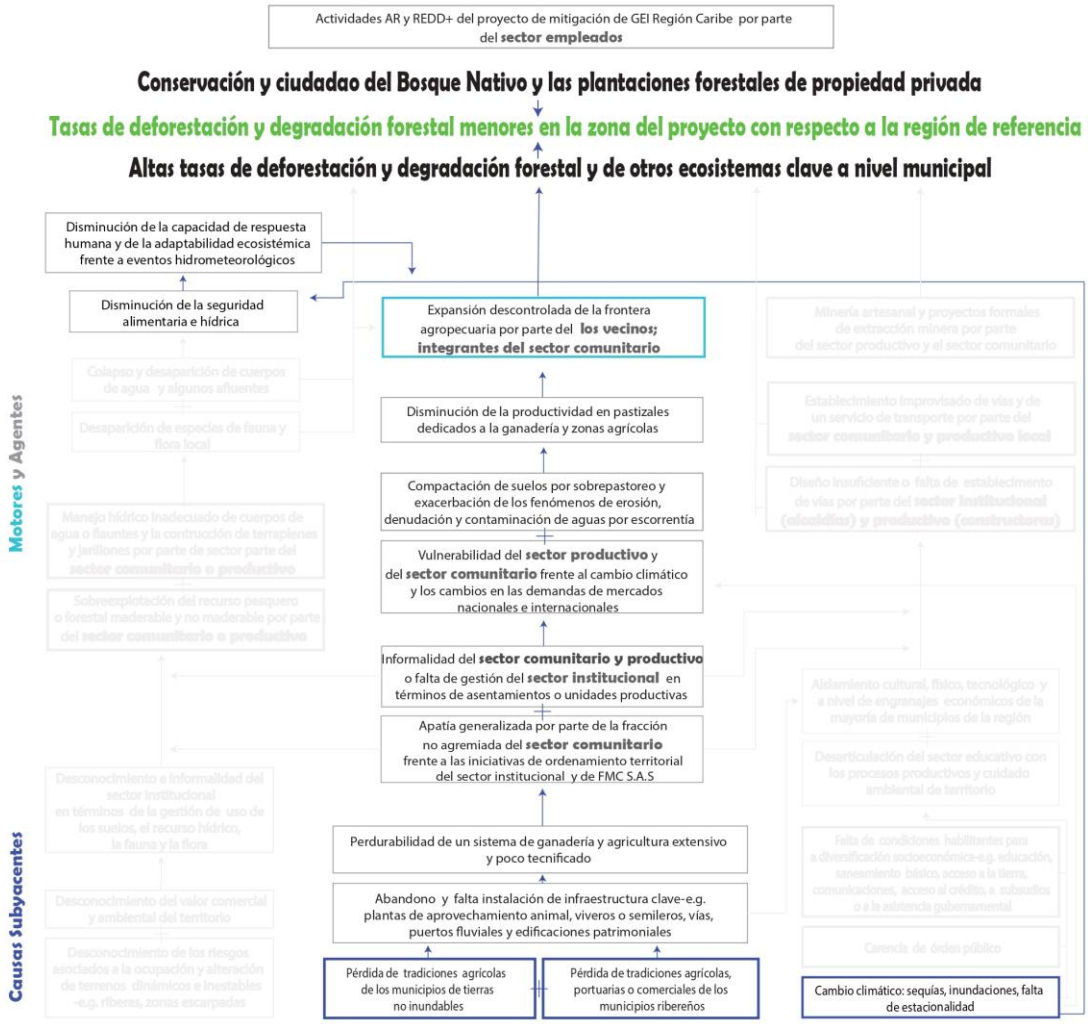


Figure 28: Underlying causes, drivers and agents of deforestation and forest degradation and the depletion of other key ecosystems in the project area[206]

(Source: South Pole, 2022)

Note: The underlying causes are inside the dark blue boxes, and the drivers or direct causes are in the light blue ones. Agents related to each driver can be identified by the gray font. The watermarked boxes are all the portions that disappear from the chain of deforestation and degradation events given the private nature of the properties.

The five sectors identified include the actors or agents of deforestation and are directly related to the underlying causes of deforestation as shown in Figure 27 and Figure 28. In the case of the project area, the neighbors included in the community sector are the actors that continue with the expansion of the agricultural frontier as a direct cause of deforestation, forest degradation or depletion of other strategic ecosystems. Likewise, the productive sector is mostly made up of direct agents of deforestation and forest and environmental degradation due to their high dedication to extensive livestock farming and monocultures throughout the municipal territories. The interest of this sector is to ensure sustained profits in a territory that is less and less productive

[206] This figure is available in PDF format at: Gestión de la información\Secciones Anexas\CausasyAgentesDeforestación\Figuras_PDF.

and more sensitive to climate change (Bueno et al, 2008[207]; Ötker and Loyola, 2017[208]; Taylor, 2011[209]), at the same time increasing speculation on land price and weakening the incentives related to biodiversity conservation and protection, which cannot economically compete with the productive activities.

The foregoing is clear since in the absence of the forest-use activities carried out by FMC S.A.S. and in the without-project scenario, the surrounding cattle farms would occupy the current Project Area, as it happened before the purchase of the property, in 1980, by the previous owner (see project activities Section). Likewise, the community would be more restricted to access the remnants of natural forest in the area, which would result in the extraction of greater amounts of wood and other forest goods, therefore increasing the deforestation rate.

The complete analysis of the agents and drivers of deforestation can be found in Annex 3[210].

4.3 REDD+ safeguards

The National REDD+ Strategy is part of the actions considered in the National Development Plan 2010-2014 of the Colombian Government with the aim at fighting climate change. It is led by the Ministry of Environment and Sustainable Development and seeks to reduce climate change impacts generated by deforestation and forest degradation in Colombia. In this sense, REDD+ projects are a strategy to mitigate climate change by improving forest governance, forest conservation, and sustainable management in alignment with international, national, and local policies.

The REDD+ initiative of the Caribbean Region CCMP reduces GHG emissions by avoiding deforestation and generating community and environmental benefits. For this, compliance with the seven REDD+ safeguards proposed by the BCR Standard is presented. In general, these are aimed at preventing that social, economic or environmental rights are affected, and the negative impacts identified during the design and implementation phases of the REDD+ activities.

The complete document on safeguards can be found in Annex 4: SDGs and safeguards.[211]

4.4 REDD+ project activities[212]

4.4.1 Historical context

FMC has implemented activities aligned with conservation and environmental education in the project area since before the start date of the Caribbean Region CCMP. To present these initiatives, Figure 29 lists them together with their relevant dates as part of the REDD+ component of the project before 2016.

[207] Bueno, R., Hezfeld, C., Stanton, E. & Ackerman, F. (2008). *The Caribbean and climate change. The cost of Inaction*. Report commissioned by the Environmental Defense Fund. SEI- US Centre.
[208] Ötker, İ., Loyola, F. (2017). Unleashing Growth and Strengthening Resilience in the Caribbean, in: Alleyne, T., ÖTker, İ., Ramakrishnan, U., Srinivasan, K. (Eds.), Unleashing Growth and Strengthening Resilience in the Caribbean. Washington D.C., pp. 79–100. Available at: https://doi.org/10.5089/9781484315194.071.
[209] Taylor, M. (2011). Climate change in the Caribbean – learning lessons from Irma and Maria. Available at: https://www.theguardian.com/environment/2017/oct/06/climate-change-in-the-caribbean-learning-lessons-from-irma-and-maria
[210] Gestión de la información\Secciones Anexas\Anexo 3_CausasyAgentesDeforestación.
[211] Gestión de la información\Secciones Anexas\Anexo 4_ODS & Salvaguardas.
[212] The entire section on strategic lines is developed in Annex 5: Project activities. Available at: Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto.

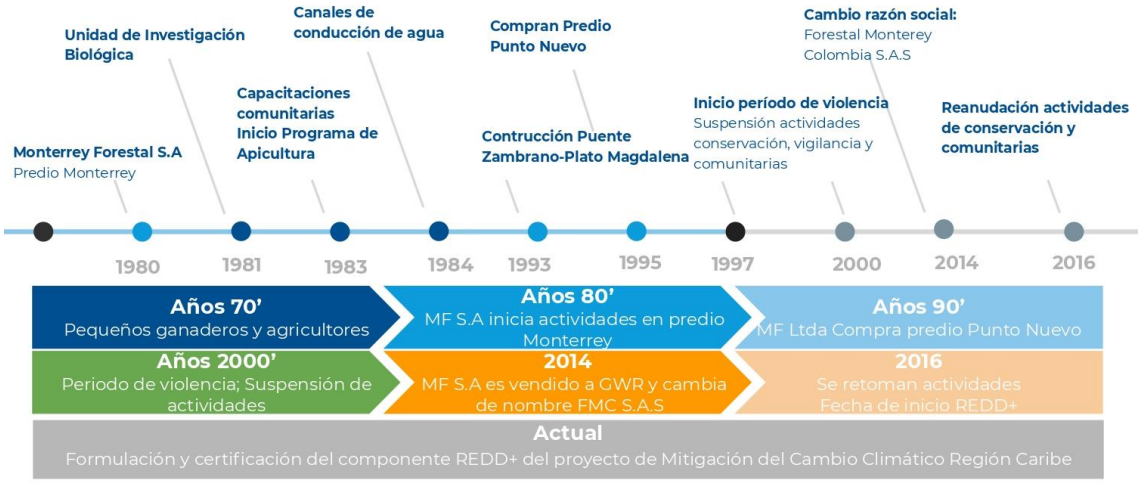


Figure 29: Timeline of relevant activities and milestones in the project area prior to the Caribbean Region CCMP

(Source: South Pole, based on interviews in the area of influence of the project and the archive of FMC, 2022)

In the middle of 1980, the company was established under the name of Monterrey Forestal S.A. in the area that is currently known as Monterrey Property. The business activity focused on forest plantations, but in addition to carrying out silvicultural work, the Biological Research Unit was open in 1981 within the Ecosystem Research Program to study flora and fauna. Then, in 1983, social issues began to be addressed through the Beekeeping Program with training on beehive installation and honey production, as well as community workshops on dressmaking, nurseries and technical training in education. Between 1984 and 1985, support for the community of the municipalities of Zambrano and Córdoba also included the adaptation of roads and the construction of water conduction canals to modify the flow of water bodies with the purpose to provide water supply for a longer period of the year.

In 1995, the company bought the Punto Nuevo property in El Carmen de Ariguaní to expand its activities in this area, where it operated until the mid-2000s. But unfortunately, all conservation, monitoring, and community works were suspended beginning of the new millennium, that is, before the start date of the Caribbean Region CCPM. Below are some milestones related to the cease of corporate activities in this project center and the increase in deforestation in the project area:

- Construction of the bridge that connects the municipalities of Zambrano (Bolívar) and Plato (Magdalena) in the 1983-1987 period. This modified the productive activities of the communities when the Ciénaga de Zambrano swamp was dried up and filled in for the road and bridge construction. With these changes, the fishermen lost their jobs and the municipality of Zambrano, which was a consolidated river port, ceased to be one and all the commercial activities and cultural practices were negatively impacted. In this way, a large part of the area lost its fishing vocation and over time many of the ecosystem resources associated with natural forests were and continue to be threatened by neighbors and stakeholders the productive sector.
- Disturbance to the peace and the presence of illegal armed groups from the late 1990s to the mid-2000s led the activities carried out on the properties to be suspended and deforestation to increase in the Project Zone and RR. Almost all the areas set aside for monitoring and surveillance, known at that time as Ranger Houses, were imploded or abandoned, and therefore, the biological research activities, the beekeeping program,

community workshops and other processes were suspended, both on the Monterrey and the Punto Nuevo properties.

- The economic problems of the company as a result of failures in the commercialization of forest products before 2014 led Pizano S.A., owner of Forestal Monterrey S.A. assets, to sell it to Greenwood Resources and Forestal Monterrey Colombia S.A.S. All these changes allowed forest protection and community activities to be resumed only as of 2016.

The history of the company has a strong impact on research and protection of tropical dry forest fragments, which have endured in the historical memory of the inhabitants of Zambrano, Córdoba, El Carmen de Bolívar and El Carmen de Ariguaní to this day.

4.4.2 Current activities

Currently, the activities implemented by the project holder focus both on the silvicultural management of plantations and REDD+ activities. And according to the internal policies and project objectives, four strategic lines have been designed[213] in order to promote GHG emissions reduction and contribute to education and community engagement. Each activity of the strategic lines has a scope that has been established based on the analysis of causes and agents of deforestation and the implementation of the EPCAC.

4.4.2.1 Strategic Line 1: Climate change mitigation and biodiversity conservation and monitoring

Conservation activities have their foundations in biodiversity management and monitoring in the remnants of tropical dry forest (Bs-T) in both properties, since they are part of a priority ecosystem for preservation at the national level. These actions are intended to mitigate the impact of neighboring productive activities related to the expansion of the agricultural frontier, which is the main direct cause of deforestation and forest degradation in the RR.

In the area where the REDD+ component takes place, plant associations of the Tabebuia and Astronium genera with dominant alliances of the species *Bulnesia arborea* and *Myrsopermun frutescens* have been registered. In addition, there is the presence of species such as *Pachira quinata, Platymisciun pinnatun, Lonchocarpus spp*, and in the low stubble covers legume species such as *Acacia farnesiana, Prosopis juliflora* and *Pithecellobium dulce*, and other species such as *Guazuma ulmifolia* and *Bursera simarouba* were inventoried. On the other hand, studies of flora, monitoring of the species *Belencita nemorosa* and fauna sightings have been implemented.

4.4.2.2 Strategic Line 2: Community engagement and local environmental education

The company's Social Policy has two strategic programs: the Community Engagement Plan and the Training Plan. Both have been oriented towards strengthening stakeholders from the community and educational sectors through activities with community leaders, neighbors and primary, secondary and tertiary education institutions, in order to impact the main underlying cause of deforestation (unawareness of the commercial and environmental value of the territory and the risks associated with the occupation and alteration of dynamic and unstable lands).

4.4.2.3 Strategic Line 3: Support for local job creation and economic diversification

As part of its Social Policy, FMC establishes the principle that "Community development is driven by self-management, the recognition of communities' independence and the respect for their beliefs". Thus, through the activities of the Caribbean Region CCMP, the company gathers community entities or people interested in training to improve their competitiveness in the labor market, and promotes flagship spaces for collaborative work and community capacity building, as

[213] The strategic lines are related to the direct and underlying causes of the deforestation and forest degradation phenomenon in the RR, as well as to the consultation mechanism for the definition of activities, responsibilities and roles of the participating stakeholders, and the schedule and indicators for progress reporting.

well as local projects that generate new economic alternatives for locals in the company's area of influence, such as the community beekeeping productive project and the support provided to the recycling foundation of the municipality of Zambrano.

4.4.2.4 Strategic Line 4: Forest fire prevention and control

This strategic line is covered by the FMC's Forest Fire Control and Prevention procedure (SOP-PRO-002).

4.5 GHG emissions reduction due to the REDD+ initiative

4.5.1 Emission factor

In compliance with Resolution 1447 of 2018, the project applies the emission factor defined for the Caribbean biome in the 2018-2022 period as part of the reconstructed national FREL, which uses the IPCC values. Table 44 presents the emission factors for the Caribbean biome FREL used to estimate the reduction of GHG emissions of the REDD+ component of the Caribbean Region CCMP.

Table 44: Carbon emission factors in total biomass and soil of natural forests in the Caribbean biome

Above-ground biomass	Below-ground biomass	Total biomass	Carbon content of total biomass	CO_2 equivalent in BT	Soil carbon content		
AB (tC/ha)	BB (tC/ha)	TB (tC/ha)	CCB (tC/ha)	CBFeq (tCO_2e/ha)	SOC (tC/ha)	$SOC_{20years}$ (tC/ha)	SOC_{eq} (tCO_2e /ha)
130	30	160	75	277	101	5.05	18.5

(Source: MADS & IDEAM, 2019)[214]

4.5.1.1 Uncertainty management

In accordance with the methodology, the uncertainty for the activity data was estimated ensuring accuracy based on the Forest/Non-Forest layers obtained as detailed in Section 4.1.1.4: Accuracy of the supervised classification. For the emission factors, an uncertainty of 9.7% was used in the carbon contents of the aboveground biomass and 8.9% of the belowground biomass[215], complying with the 10% accepted by the BCR Standard, as indicated in the REDD+ Methodological Document.

The average accuracy for activity data in the forest and non-forest layers was 93.99% for the Monterrey sector and 94.33% for the Punto Nuevo sector, as detailed in Section 4.1.1.4.2.

4.5.2 Methodology deviations

Table 45 presents the methodology deviations from the Biocarbon Registry's REDD+ Methodological Document for the quantification of the net GHG emission reductions of the REDD+ component of the Caribbean Region CCMP and their respective justifications.

[214] MADS & IDEAM. (2019). *Propuesta de nivel de referencia de las emisiones forestales por deforestación para en Colombia para pago por resultados de REDD+ Bajo la CMNUCC.* https://redd.unfccc.int/files/02012019_nref_colombia_v8.pdf

[215] Data reported for the Caribbean biome in the national FREL. Available at: https://redd.unfccc.int/files/02012019_nref_colombia_v8.pdf

Table 45: Methodology deviations from the REDD+ Methodological Document

<table>
<tr><th>Deviation</th><th>Justification</th></tr>
<tr><td>Base information for the selection of eligible areas of the REDD+ component of the Caribbean Region CCMP</td><td>The REDD+ Methodological Document states that the eligible areas for REDD+ projects are those under the stable forest category, according to the definition of the Clean Development Mechanism, and that the cartographic inputs for defining stable forest both in the Project Area and the Reference Region shall be consulted in the country's data, in this case generated by IDEAM.

Nevertheless, when using IDEAM's information from the 2006-2016 period for the initial analyzes, an underestimation of the forest and an overestimation in the trends of the deforestation rates were identified. In consequence, a supervised classification for the selection of eligible areas was conducted to obtain more conservative and accurate data, as explained in Section 4.1.1.4: Accuracy of the supervised classification.

In addition, according to the REDD+ Methodological Document, uncertainty management is determined by the accuracy of the maps used to estimate the activity data values. The methodology mentions that accuracy should be greater than 90%, and the selection of the baseline scenario activity data in the PA and RR showed a precision over 90% thanks to the use of the supervised classification data, as shown below:
<table>
<tr><th>Center</th><th>Accuracy of the supervised classification</th></tr>
<tr><td>Monterrey</td><td>93.82%</td></tr>
<tr><td>Punto Nuevo</td><td>94.33%</td></tr>
<tr><td>Average</td><td>94.0%</td></tr>
</table>
</td></tr>
</table>

4.5.3 Deforestation in the without-project scenario

The data of change in forest (CCF) area for deforestation estimation obtained from the historical average of deforestation between 2006 and 2016[216].

4.5.3.1 Baseline activity data: without-project scenario

4.5.3.1.1 Estimation of the deforestation rate based on the historical average

For the analysis of the change in the surface covered by forest (forest to non-forest), the years 2006, 2010, 2014 and 2016 were analyzed in the RR, as explained in Section 4.1.1: Spatial boundaries. Taking into account the changes in the forest area reported in the two RR polygons, the annual rates of change were estimated using the following equation proposed by Puyravaud (2003):

$$TDRR_t = \left(\frac{1}{t_2 - t_1}\right) \times ln\left(\frac{A_2}{A_1}\right) \times 100$$

Where:

$TDRR_t$	Baseline annual deforestation rate; %
t_1	Initial year of the reference period; year
t_2	Final year of the reference period; year
A_1	Forest surface of the area under control in the initial moment; ha

[216] The estimates of the REDD+ component of the Caribbean Region CCMP for the without-project scenario are available in the following link: Gestión de la información/Estimaciones/20220402_Estimaciones_REDD_MAM

A_2 Forest surface of the area under control in the final moment; ha

The average change rate of the RR is applied to both centers comprising the project area. Table 46 shows the deforestation data for each subperiod analyzed in each of the polygons of the RR. The average historical deforestation rate in the Monterrey center is -4.35% and in Punto Nuevo is -7.33% as presented in Figure 30 and Figure 31.

Table 46: Deforestation data in the 2006-2016 period in the RR

Center	Period t_1-t_2	Forest surface (ha)		Deforestation rate (%)	Average deforestation rate (%)
		A_1	A_2		
Monterrey	2006-2010	43,497	35,038	-5.41%	-4.35%
	2010-2014	35,038	30,095	-3.80%	
	2014-2016	30,095	27,861	-3.86%	
Punto Nuevo	2006-2010	27,432	18,349	-10.05%	-7.33%
	2010-2014	18,349	16,545	-2.59%	
	2014-2016	16,545	13,723	-9.35%	

(Source: South Pole, 2022)

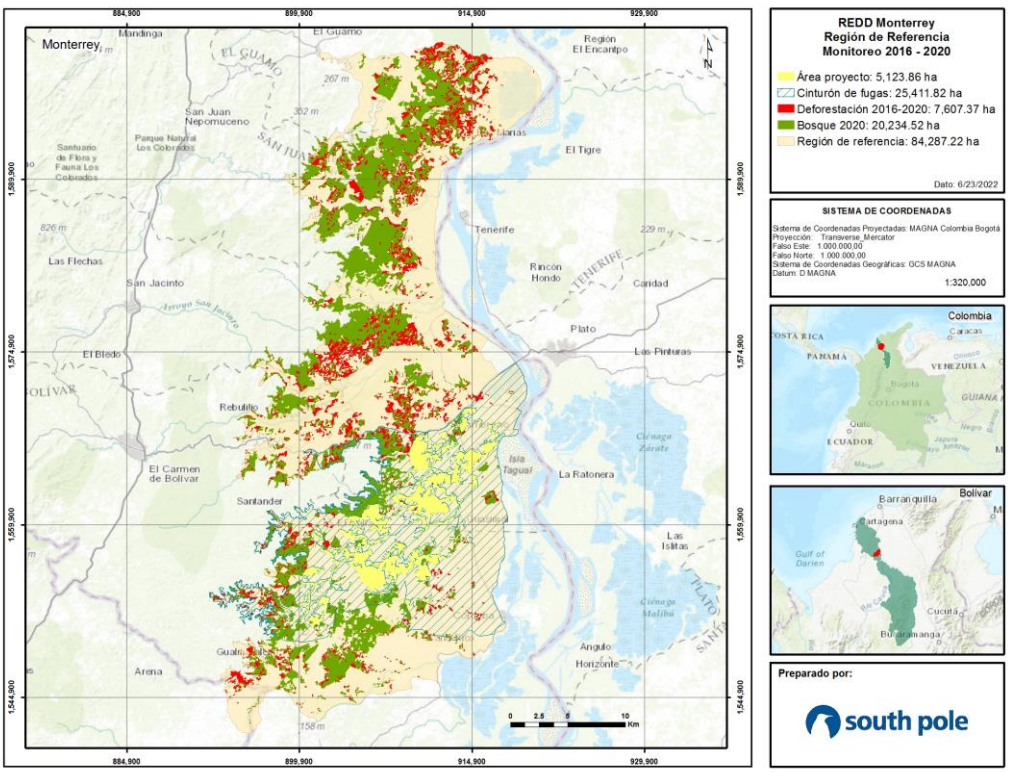


Figure 30: Deforestation in the reference region of the Monterrey center in the 2006-2016 period
(Source: South Pole, 2022)

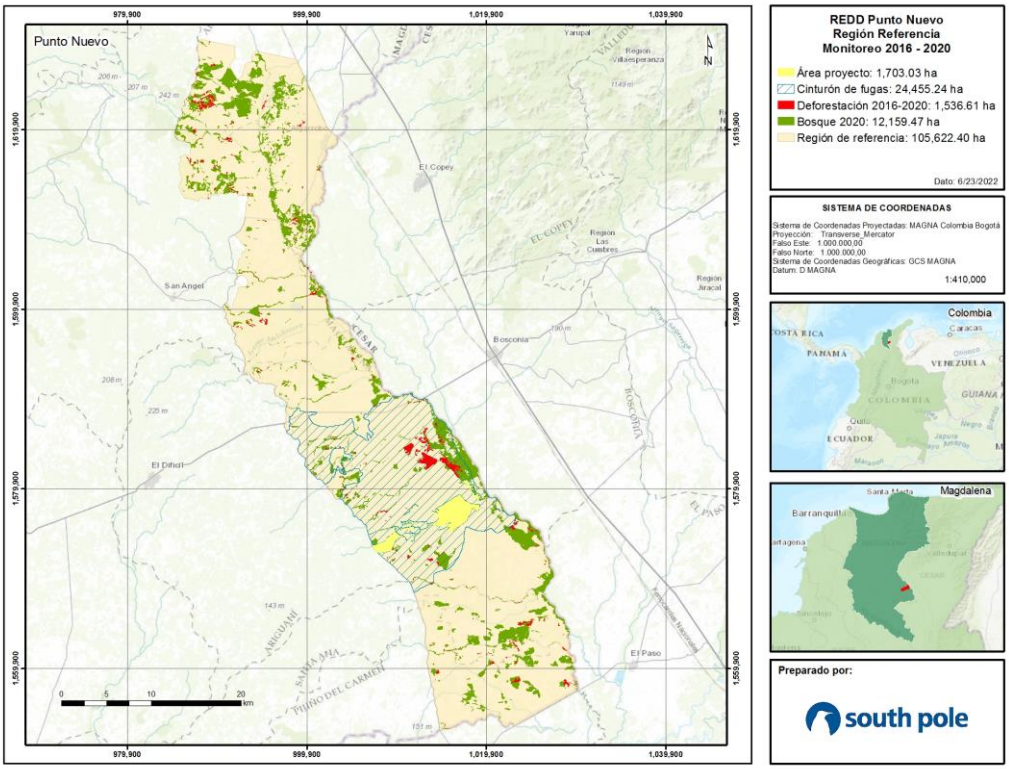


Figure 31: Deforestation in the reference region of the Monterrey center in the 2006-2016 period
(Source: South Pole, 2022)

4.5.3.1.2 Annual historical deforestation in the project area in the without-project scenario

For the Project Area, the following equation was used, taking into account the average deforestation rates of the RR described in Table 48. The results are presented in Table 47:

$$CSB_{lb} = AP_{t-1} \times TDRR_t$$

Where:

CSB_{lb}	Annual change in the surface covered by forest in the project area in the baseline scenario; ha.
AP_{t-1}	Forest area in the project area at time t-1; ha.
$TDRR_t$	Deforestation rate in the RR; %.

4.5.3.1.3 Annual historical deforestation in the leakage area in the without-project scenario

The following equation was used. The results are presented in Table 47:

$$CSB_{lb.f} = AF_{t-1} \times TDRR_t$$

Where:

$CSB_{lb.f}$	Annual change in the surface covered by forest in the leakage area in the baseline scenario; ha.
AF_{t-1}	Forest area in the leakage area at time t-1; ha.
$TDRR_t$	Deforestation rate in the RR; %.

Table 47 shows the projected deforestation in the project area and the leakage area in the Monterrey and Punto Nuevo centers in the without-project scenario[217].

Table 47: Projection of future deforestation in the Project Area and Leakage Area in the Monterrey and Punto Nuevo centers under the baseline scenario

Year	Baseline Deforestation (ha)					
	CSB_{lb} Project Area			$CSB_{lb.f}$ Leakage Area		
	Monterrey	Punto Nuevo	Total	Monterrey	Punto Nuevo	Total
2016	141	84	**226**	173	156	**328**
2017	188	113	**301**	230	207	**438**
2018	182	106	**289**	223	196	**419**
2019	174	98	**272**	213	181	**393**
2020	166	90	**257**	203	167	**369**
2021	159	83	**242**	194	153	**347**
2022	151	77	**228**	185	141	**326**
2023	144	70	**215**	176	130	**306**
2024	138	65	**203**	168	119	**288**
2025	132	60	**191**	161	110	**271**
2026	126	55	**180**	153	101	**255**
2027	120	51	**170**	146	93	**239**
2028	114	47	**161**	140	86	**225**
2029	109	43	**152**	133	79	**212**
2030	104	39	**144**	127	73	**200**
2031	99	36	**136**	121	67	**188**
2032	95	33	**128**	116	61	**177**
2033	91	31	**121**	111	57	**167**
2034	86	28	**115**	106	52	**158**
2035	82	26	**108**	101	48	**149**
2036	79	24	**103**	96	44	**140**
2037	75	22	**97**	92	41	**132**
2038	72	20	**92**	88	37	**125**
2039	68	19	**87**	84	34	**118**
2040	65	17	**82**	80	32	**111**
2041	62	16	**78**	76	29	**105**
2042	59	15	**74**	73	27	**99**
2043	57	13	**70**	69	25	**94**
2044	54	12	**66**	66	23	**89**
2045	52	11	**63**	63	21	**84**

[217] The results of the analyzes can be found at: Gestión de la información\Estimaciones\Estimaciones_REDD+.

(Source: South Pole, 2022)

4.5.3.2 Activity data in the project scenario

4.5.3.2.1 Projected annual deforestation in the REDD+ project scenario

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

Where:

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

4.5.3.2.2 Projected annual deforestation in the leakage area in the project scenario

$$CSB_{REDD+proy.faño} = CSB_{f.lb}\ \times\ (1 + \%E_f)$$

Where:

$CSB_{REDD+proy.faño}$	Annual change in the surface covered by forest in the leakage area in the project scenario; ha.
$CSB_{f.lb}$	Annual change in the surface covered by forest in the baseline scenario; ha.
$\%E_f$	Percentage of emissions increase in the leakage area due to the implementation of REDD+ activities. The use of a default value of 10% is allowed in this methodology.

Table 48 shows the projected of deforestation in the project area and leakage area in the Monterrey and Punto Nuevo centers in the project scenario[218].

Table 48: Projection of future deforestation in the Project Area and Leakage Area in the Monterrey and Punto Nuevo centers under the project scenario

Calendar Year	Deforestation in the project scenario					
	$CSB_{REDD+proy.año}$ Project Area			$CSB_{f.año}$ Leakage Area		
	Monterrey	Punto Nuevo	Total	Monterrey	Punto Nuevo	Total
2016	42	15	57	190	171	**361**
2017	57	20	77	314	228	**481**
2018	55	19	74	304	216	**461**

[218] The results of the analyzes can be found at: Gestión de la información\Estimaciones\Estimaciones_REDD+.

Calendar Year	Deforestation in the project scenario					
	$CSB_{REDD+proy.año}$			$CSB_{f.año}$		
	Project Area			Leakage Area		
	Monterrey	Punto Nuevo	Total	Monterrey	Punto Nuevo	Total
2019	52	19	71	287	199	**433**
2020	50	18	68	271	183	**406**
2021	48	17	64	255	169	**382**
2022	45	16	62	241	155	**358**
2023	43	15	59	227	143	**337**
2024	41	15	56	214	131	**317**
2025	39	14	53	201	121	**298**
2026	38	13	51	190	111	**280**
2027	36	13	49	179	102	**263**
2028	34	12	46	169	94	**248**
2029	33	12	44	159	87	**233**
2030	31	11	42	150	80	**220**
2031	30	11	40	141	73	**207**
2032	28	10	39	133	68	**195**
2033	27	10	37	126	62	**184**
2034	26	9	35	118	57	**173**
2035	25	9	34	112	53	**164**
2036	24	8	32	105	49	**154**
2037	23	8	31	99	45	**146**
2038	22	8	29	94	41	**137**
2039	21	7	28	88	38	**130**
2040	20	7	27	83	35	**123**
2041	19	7	25	78	32	**116**
2042	18	6	24	74	29	**109**
2043	17	6	23	70	27	**103**
2044	16	6	22	66	25	**98**
2045	16	6	21	62	23	**92**

(Source: South Pole, 2022)

4.6 Projected GHG emissions in the analysis period

4.6.1 Annual emission due to deforestation in the baseline scenario

The quantification of baseline emissions reductions associated with changes in carbon values within the project area for year *t* due to deforestation include all emissions that would have occurred in the project area in the absence of project implementation.

$$EA_{lb} = DA_{lb} \times CT_{eq}$$

Where:

EA_{lb}	Annual emission in the baseline scenario; tCO_2eq.
DA_{lb}	Historical annual deforestation in the baseline scenario; ha.
CT_{eq}	Total carbon dioxide equivalent; $tCO_2eq\ ha^{-1}$

Table 49: GHG emissions due to deforestation in the PA of the Monterrey and Punto Nuevo centers in the baseline scenario[219]

Calendar Year	Emissions in the project area in the baseline scenario: EA_{lb} (tCO_2eq)						
	Monterrey			Punto Nuevo			Total
	Total biomass emissions	Soil emissions	Monterrey total emissions	Total biomass emissions	Soil emissions	Punto Nuevo total emissions	Total emissions in both centers
2016	39,154	2,617	**41,771**	23,398	1,564	**24,962**	**66,733**
2017	52,205	3,489	**55,694**	31,198	2,085	**33,283**	**88,977**
2018	50,500	3,375	**53,875**	29,483	1,970	**31,453**	**85,328**
2019	48,227	3,223	**51,450**	27,196	1,817	**29,013**	**80,463**
2020	46,027	3,076	**49,103**	25,034	1,673	**26,707**	**75,810**
2021	43,927	2,936	**46,863**	23,040	1,540	**24,580**	**71,443**
2022	41,923	2,802	**44,725**	21,205	1,417	**22,622**	**67,347**
2023	40,010	2,674	**42,684**	19,516	1,304	**20,820**	**63,504**
2024	38,184	2,552	**40,736**	17,961	1,200	**19,161**	**59,897**
2025	36,442	2,436	**38,878**	16,531	1,105	**17,636**	**56,514**
2026	34,779	2,324	**37,103**	15,214	1,017	**16,231**	**53,334**
2027	33,192	2,218	**35,410**	14,002	936	**14,938**	**50,348**
2028	31,677	2,117	**33,794**	12,887	861	**13,748**	**47,542**
2029	30,232	2,020	**32,252**	11,860	792	**12,652**	**44,904**
2030	28,852	1,928	**30,780**	10,915	729	**11,644**	**42,424**
2031	27,536	1,840	**29,376**	10,046	671	**10,717**	**40,093**
2032	26,279	1,756	**28,035**	9,246	618	**9,864**	**37,899**

[219] The results of the analyzes can be found at: Gestión de la información\Estimaciones\Estimaciones_REDD.

Calendar Year	Emissions in the project area in the baseline scenario: EA_{lb} (tCO_2eq)						
	Monterrey			Punto Nuevo			Total
	Total biomass emissions	Soil emissions	Monterrey total emissions	Total biomass emissions	Soil emissions	Punto Nuevo total emissions	Total emissions in both centers
2033	25,080	1,676	**26,756**	8,509	568	**9,077**	**35,833**
2034	23,936	1,600	**25,536**	7,831	523	**8,354**	**33,890**
2035	22,843	1,527	**24,370**	7,208	481	**7,689**	**32,059**
2036	21,801	1,457	**23,258**	6,633	443	**7,076**	**30,334**
2037	20,806	1,390	**22,196**	6,105	408	**6,513**	**28,709**
2038	19,857	1,327	**21,184**	5,619	375	**5,994**	**27,178**
2039	18,951	1,266	**20,217**	5,171	345	**5,516**	**25,733**
2040	18,086	1,209	**19,295**	4,759	318	**5,077**	**24,372**
2041	17,261	1,153	**18,414**	4,380	292	**4,672**	**23,086**
2042	16,473	1,101	**17,574**	4,031	269	**4,300**	**21,874**
2043	15,721	1,050	**16,771**	3,710	248	**3,958**	**20,729**
2044	15,004	1,002	**16,006**	3,414	228	**3,642**	**19,648**
2045	14,319	957	**15,276**	3,142	210	**3,352**	**18,628**

(Source: South Pole, 2022)

Table 50: GHG emissions due to deforestation in the LA of the Monterrey and Punto Nuevo centers in the baseline scenario

Calendar Year	Emissions in the leakage area in the baseline scenario: $EA_{lb,f}$ (tCO_2eq)						
	Monterrey			Punto Nuevo			Total
	Total biomass emissions	Soil emissions	Monterrey total emissions	Total biomass emissions	Soil emissions	Punto Nuevo total emissions	Total emissions in both centers
2016	47,809	3,195	**51,004**	43,107	2,881	**45,988**	**96,992**
2017	63,745	4,261	**68,006**	57,476	3,842	**61,318**	**129,324**
2018	61,663	4,122	**65,785**	54,316	3,630	**57,946**	**123,731**
2019	58,887	3,936	**62,823**	50,102	3,349	**53,451**	**116,274**
2020	56,202	3,756	**59,958**	46,120	3,083	**49,203**	**109,161**
2021	53,638	3,585	**57,223**	42,447	2,837	**45,284**	**102,507**
2022	51,190	3,421	**54,611**	39,066	2,611	**41,677**	**96,288**
2023	48,854	3,265	**52,119**	35,954	2,403	**38,357**	**90,476**
2024	46,625	3,116	**49,741**	33,090	2,212	**35,302**	**85,043**
2025	44,497	2,974	**47,471**	30,455	2,035	**32,490**	**79,961**
2026	42,467	2,838	**45,305**	28,029	1,873	**29,902**	**75,207**
2027	40,529	2,709	**43,238**	25,796	1,724	**27,520**	**70,758**
2028	38,680	2,585	**41,265**	23,741	1,587	**25,328**	**66,593**
2029	36,915	2,467	**39,382**	21,850	1,460	**23,310**	**62,692**
2030	35,230	2,355	**37,585**	20,110	1,344	**21,454**	**59,039**
2031	33,623	2,247	**35,870**	18,508	1,237	**19,745**	**55,615**
2032	32,088	2,145	**34,233**	17,034	1,138	**18,172**	**52,405**
2033	30,624	2,047	**32,671**	15,677	1,047	**16,724**	**49,395**

Calendar Year	Emissions in the leakage area in the baseline scenario: $EA_{lb,f}$ (tCO_2eq)						
	Monterrey			Punto Nuevo			Total
	Total biomass emissions	Soil emissions	Monterrey total emissions	Total biomass emissions	Soil emissions	Punto Nuevo total emissions	Total emissions in both centers
2034	29,227	1,953	**31,180**	14,428	964	**15,392**	**46,572**
2035	27,893	1,864	**29,757**	13,279	887	**14,166**	**43,923**
2036	26,620	1,779	**28,399**	12,221	816	**13,037**	**41,436**
2037	25,406	1,698	**27,104**	11,247	751	**11,998**	**39,102**
2038	24,246	1,620	**25,866**	10,351	692	**11,043**	**36,909**
2039	23,140	1,546	**24,686**	9,527	636	**10,163**	**34,849**
2040	22,084	1,476	**23,560**	8,768	586	**9,354**	**32,914**
2041	21,076	1,408	**22,484**	8,070	539	**8,609**	**31,093**
2042	20,114	1,344	**21,458**	7,427	496	**7,923**	**29,381**
2043	19,197	1,283	**20,480**	6,835	456	**7,291**	**27,771**
2044	18,321	1,224	**19,545**	6,291	420	**6,711**	**26,256**
2045	17,485	1,168	**18,653**	5,790	387	**6,177**	**24,830**

(Source: South Pole, 2022)

4.6.1.1 Annual emission due to deforestation in the project scenario

The annual emission of the REDD+ component of the Caribbean Region CCMP corresponds to the changes due to unplanned deforestation that cannot be avoided, taking into account the behavior of deforestation in the PA and the success of the mitigation activities included in the strategic lines of the project.

$$EA_{REDD+proy,año} = DA_f \times CT_{eq}$$

Where:

$EA_{REDD+proy,año}$	Annual emission in the project scenario; tCO_2eq.
DA_f	Annual projected deforestation with the REDD project activities; ha.
CT_{eq}	Total carbon dioxide equivalent; $tCO_2eq\ ha^{-1}$.

Table 51: GHG emissions due to deforestation in the PA of the Monterrey and Punto Nuevo centers in the projected project scenario[220]

Calendar Year	Emissions in the project area in the projected project scenario: $EA_{REDD+proy,año}$ (tCO_2eq)						
	Monterrey			Punto Nuevo			Total
	Total biomass emissions	Soil emissions	Monterrey total emissions	Total biomass emissions	Soil emissions	Punto Nuevo total emissions	Total emissions in both centers
2016	11,746	785	**12,531**	7,019	469	**7,488**	**20,019**
2017	15,661	1,046	**16,707**	9,359	625	**9,984**	**26,691**
2018	15,150	1,012	**16,162**	8,844	591	**9,435**	**25,597**
2019	14,468	967	**15,435**	8,158	545	**8,703**	**24,138**
2020	13,808	923	**14,731**	7,510	502	**8,012**	**22,743**
2021	13,178	880	**14,058**	6,912	462	**7,374**	**21,432**
2022	12,576	840	**13,416**	6,361	425	**6,786**	**20,202**
2023	12,003	802	**12,805**	5,854	391	**6,245**	**19,050**
2024	11,455	765	**12,220**	5,388	360	**5,748**	**17,968**
2025	10,932	730	**11,662**	4,959	331	**5,290**	**16,952**
2026	10,433	697	**11,130**	4,564	305	**4,869**	**15,999**
2027	9,957	665	**10,622**	4,200	280	**4,480**	**15,102**
2028	9,503	635	**10,138**	3,866	258	**4,124**	**14,262**
2029	9,069	606	**9,675**	3,558	237	**3,795**	**13,470**
2030	8,655	578	**9,233**	3,274	218	**3,492**	**12,725**
2031	8,260	552	**8,812**	3,013	201	**3,214**	**12,026**
2032	7,883	527	**8,410**	2,773	185	**2,958**	**11,368**

[220] Los resultados de los análisis se encuentran en la ruta: Gestión de la información\Estimaciones\Estimaciones_REDD.

Calendar Year	Emissions in the project area in the projected project scenario: $EA_{REDD+proy,año}$ (tCO_2eq)						
	Monterrey			Punto Nuevo			Total
	Total biomass emissions	Soil emissions	Monterrey total emissions	Total biomass emissions	Soil emissions	Punto Nuevo total emissions	Total emissions in both centers
2033	7,524	502	**8,026**	2,552	170	**2,722**	**10,748**
2034	7,180	480	**7,660**	2,349	157	**2,506**	**10,166**
2035	6,853	458	**7,311**	2,162	144	**2,306**	**9,617**
2036	6,540	437	**6,977**	1,990	133	**2,123**	**9,100**
2037	6,241	417	**6,658**	1,831	122	**1,953**	**8,611**
2038	5,957	398	**6,355**	1,685	112	**1,797**	**8,152**
2039	5,685	380	**6,065**	1,551	103	**1,654**	**7,719**
2040	5,425	362	**5,787**	1,427	95	**1,522**	**7,309**
2041	5,178	346	**5,524**	1,314	87	**1,401**	**6,925**
2042	4,942	330	**5,272**	1,209	80	**1,289**	**6,561**
2043	4,716	315	**5,031**	1,113	74	**1,187**	**6,218**
2044	4,501	300	**4,801**	1,024	68	**1,092**	**5,893**
2045	4,295	287	**4,582**	942	63	**1,005**	**5,587**

(Source: South Pole, 2022)

4.6.1.2 Annual emission due to deforestation in the leakage area

The quantification of leakage emissions due to the displacement of deforestation corresponding to the REDD+ component was estimated using a 10% discount as follows.

$$EA_{f,año} = DA_f \times CT_{eq}$$

Where:

$EA_{f,año}$	Annual emission in the leakage area; tCO_2 ha^{-1}.
DA_f	Annual projected deforestation in the leakage area; ha.
CT_{eq}	Total carbon dioxide equivalent; tCO_2eq ha^{-1}.

Table 52 shows the discounts applicable for leakage in order to estimate net emission reductions in each of the properties of the Caribbean Region CCMP.

Table 52: GHG emissions due to deforestation in the LA of the Monterrey and Punto Nuevo centers in the projected project scenario[221,222]

Calendar Year	Leakage emissions: tCO_2eq					
	Monterrey		Punto Nuevo		Totals	
	Baseline emissions $EA_{lb,f,año}$	With-project emissions $EA_{REDD+proy,f,año}$	Baseline emissions $EA_{lb,f,año}$	With-project emissions $EA_{REDD+proy,f,año}$	Baseline emissions $EA_{lb,f,año}$	With-project emissions $EA_{REDD+proy,f,año}$
2016	52,590	3,515	**56,105**	47,417	3,169	**50,586**
2017	70,120	4,687	**74,807**	63,223	4,226	**67,449**
2018	67,830	4,534	**72,364**	59,747	3,993	**63,740**
2019	64,776	4,330	**69,106**	55,112	3,684	**58,796**
2020	61,822	4,132	**65,954**	50,732	3,391	**54,123**
2021	59,001	3,944	**62,945**	46,692	3,121	**49,813**
2022	56,309	3,764	**60,073**	42,973	2,872	**45,845**
2023	53,740	3,592	**57,332**	39,550	2,643	**42,193**
2024	51,287	3,428	**54,715**	36,399	2,433	**38,832**
2025	48,947	3,272	**52,219**	33,500	2,239	**35,739**
2026	46,714	3,122	**49,836**	30,832	2,061	**32,893**
2027	44,582	2,980	**47,562**	28,376	1,896	**30,272**
2028	42,548	2,844	**45,392**	26,115	1,745	**27,860**
2029	40,606	2,714	**43,320**	24,035	1,606	**25,641**
2030	38,753	2,590	**41,343**	22,121	1,478	**23,599**

[221] The results of the analyzes can be found at: Gestión de la información\Estimaciones\Estimaciones_REDD.
[222] The results of the analyzes can be found at: Gestión de la información\Estimaciones\Estimaciones_REDD.

Calendar Year	Leakage emissions: tCO_2eq					
	Monterrey		Punto Nuevo		Totals	
	Baseline emissions	With-project emissions	Baseline emissions	With-project emissions	Baseline emissions	With-project emissions
	$EA_{lb,f,año}$	$EA_{REDD+proy,f,año}$	$EA_{lb,f,año}$	$EA_{REDD+proy,f,año}$	$EA_{lb,f,año}$	$EA_{REDD+proy,f,año}$
2031	36,985	2,472	**39,457**	20,359	1,360	**21,719**
2032	35,297	2,359	**37,656**	18,737	1,252	**19,989**
2033	33,687	2,251	**35,938**	17,244	1,152	**18,396**
2034	32,149	2,149	**34,298**	15,871	1,060	**16,931**
2035	30,682	2,051	**32,733**	14,607	976	**15,583**
2036	29,282	1,957	**31,239**	13,443	898	**14,341**
2037	27,946	1,868	**29,814**	12,372	827	**13,199**
2038	26,671	1,782	**28,453**	11,387	761	**12,148**
2039	25,454	1,701	**27,155**	10,480	700	**11,180**
2040	24,292	1,623	**25,915**	9,645	644	**10,289**
2041	23,184	1,549	**24,733**	8,877	593	**9,470**
2042	22,126	1,479	**23,605**	8,169	546	**8,715**
2043	21,116	1,411	**22,527**	7,519	502	**8,021**
2044	20,153	1,347	**21,500**	6,920	462	**7,382**
2045	19,233	1,285	**20,518**	6,369	425	**6,794**

(Source: South Pole, 2022)

4.6.2 GHG emissions reduction in the project scenario

Net GHG emissions reduction were calculated using the following equation:

$$RE_{Def,REDD,+proy} = (t_2 - t_1) \times (EA_{Def,lb,año} - EA_{Def,REDD+proy,año} - EA_{Def,f,año})$$

Where:

$RE_{Def,REDD,+proy}$	Net emissions reduction due to avoided deforestation in the project scenario; tCO_2eq.
t_1	Initial year of the reference period; year.
t_2	Final year of the reference period; year.
$EA_{Def,lb,año}$	Annual emission by deforestation in the baseline scenario; tCO_2eq.
$EA_{Def,REDD+proy,año}$	Annual emission by deforestation in the project scenario; tCO_2eq.
$EA_{Def,f,año})$	Annual emission by deforestation in the leakage area in the project scenario; tCO_2eq.

Table 53 presents the results of total net emissions. During the crediting period of the REDD+ component of the Caribbean Region CCMP (30 years) an average net annual reduction of 25,418 tCO_2eq is expected: 19,188 tCO_2eq for Monterrey and 6,229 tCO_2e for Punto Nuevo.

Table 53: Total net emissions results[223]

Calendar Year	Annual emissions in the baseline scenario	Annual emissions in the PA in the project scenario	Discount for annual emissions in the LA in the project scenario	Net emissions reduction
	EA_{lb}	$EA_{REDD+proy.año}$	$EA_{Def.f.año}$	$RE_{Def.REDD+proy}$
	tCO_2eq			
2016	66,733	20,019	6,673	**36,296**
2017	88,977	26,691	8,898	**48,396**
2018	85,328	25,597	8,533	**46,480**
2019	80,463	24,138	8,046	**43,927**
2020	75,810	22,743	7,581	**41,480**
2021	71,443	21,432	7,144	**39,180**
2022	67,347	20,202	6,735	**37,017**
2023	63,504	19,050	6,350	**34,980**
2024	59,897	17,968	5,990	**33,065**
2025	56,514	16,952	5,651	**31,265**
2026	53,334	15,999	5,333	**29,567**
2027	50,348	15,102	5,035	**27,970**
2028	47,542	14,262	4,754	**26,464**
2029	44,904	13,470	4,490	**25,046**
2030	42,424	12,725	4,242	**23,710**

[223] The results of the analyzes can be found at: Gestión de la información\Estimaciones\Estimaciones_REDD.

Calendar Year	Annual emissions in the baseline scenario EA_{lb}	Annual emissions in the PA in the project scenario $EA_{REDD+proy.año}$	Discount for annual emissions in the LA in the project scenario $EA_{Def.f.año}$	Net emissions reduction $RE_{Def.REDD+proy}$
	tCO_2eq			
2031	40,093	12,026	4,009	**22,450**
2032	37,899	11,368	3,790	**21,261**
2033	35,833	10,748	3,583	**20,140**
2034	33,890	10,166	3,389	**19,082**
2035	32,059	9,617	3,206	**18,083**
2036	30,334	9,100	3,033	**17,139**
2037	28,709	8,611	2,871	**16,250**
2038	27,178	8,152	2,718	**15,409**
2039	25,733	7,719	2,573	**14,613**
2040	24,372	7,309	2,437	**13,864**
2041	23,086	6,925	2,309	**13,151**
2042	21,874	6,561	2,187	**12,480**
2043	20,729	6,218	2,073	**11,844**
2044	19,648	5,893	1,965	**11,244**
2045	18,628	5,587	1,863	**10,675**

(Source: South Pole, 2022)

4.7 Monitoring of the REDD+ component

Data available for validation

Below are all the data and parameters that will be available at the validation event and that will remain to be available throughout the crediting period of the REDD+ component of the Caribbean Region CCMP.

Data	PA	
Unit	Hectares (ha)	
Source	See Section 1.8.1.	
Description	Project area of the **Monterrey center**	Project area of the **Punto Nuevo center**
Applied value	4,328 ha	1,536 ha
Justification of the choice of the parameter or description of the measurement methods or procedures applied	For the selection of the eligible area of the project, a supervised classification of satellite images taken from the ALOS AVNIR-2, Sentinel 2 and Landsat OLI remote sensors was carried out. Forest, non-forest and water areas were identified through the visual inspection methodology and an expert in spatial solutions conducted the manual digitization. Satellite images from 2006 to 2016 were used and the stable forest identified during this period was classified as a project area.	
Purpose	Estimation of the emissions reduction in the baseline scenario and the project scenario (projected).	

Comments	The calculations were made separately for the two centers that are part of the project area, i.e., Monterrey and Punto Nuevo.

Data	$CSB_{año}$	
Unit	Hectares (ha)	
Source	See Section 4.1.1. Spatial boundaries	
Description	Average annual deforestation in the RR of the **Monterrey** center.	Average annual deforestation in the RR of the **Punto Nuevo** center.
Applied value	447 ha $year^{-1}$	413 ha $year^{-1}$
Justification of the choice of the parameter or description of the measurement methods or procedures applied	Supervised classification of satellite images of sensor ALOS AVNIR-2, Sentinel 2 y Landsat OLI. Forest, non-forest and water areas were identified through the visual inspection methodology and an expert in spatial solutions conducted the manual digitization. Satellite images from 2006 to 2016 were used and the stable forest identified during this period was classified as a project area.	
Purpose	Estimation of the emissions reduction in the baseline scenario and the project scenario (projected).	
Comments	Taking into account that the two centers are separated and have different environmental and socioeconomic conditions, an RR and a leakage belt were determined for each of them.	

Data	$TDRR_t$	
Unit	Percentage (%)	
Source	See Section 4.5.3.1.1: Estimation of the deforestation rate based on the historical average, which breaks down RR data for each center.	
Description	Average annual deforestation rate in the RR of the **Monterrey center**.	Average annual deforestation rate in the RR of the **Punto Nuevo center**.
Applied value	-4.35%	-7.33%
Justification of the choice of the parameter or description of the measurement methods or procedures applied	The deforestation rate was estimated using the equation proposed by Puyravaud (2003)[224]. The forest and non-forest data resulted from the supervised classification of Landsat 7 and Landsat 8 multispectral images of medium resolution in the 2006-2016 period.	
Purpose	Estimation of the emissions reduction in the baseline scenario and the project scenario (projected).	
Comments	The calculations were made separately for the two centers that are part of the RR, i.e., Monterrey and Punto Nuevo, since they have different environmental and socioeconomic conditions.	

Data	CBF_{eq}
Unit	Tons of carbon dioxide (tCO_2) in total biomass for the Caribbean biome per hectare (tCO_2 ha^{-1}).
Source	MADS & IDEAM (2019)[225].

[224] Puyravaud, J. (2003). Standardizing the calculation of the annual rate of deforestation. *Forest Ecology an Management*. Volume 177, Issues 1-3.
[225] MADS., IDEAM. (2019). *Propuesta de nivel de referencai de las emisioens forestales por deforestación en Colombia para pago por resultados de REDD+ bajo la CMNUCC*. Bogotá, Colombia.

Description	Carbon emission factor in the total biomass of the forests of the Caribbean biome (including aboveground and belowground biomass).
Applied value	277 tCO_2 ha^{-1}
Justification of the choice of the parameter or description of the measurement methods or procedures applied	The national FREL defines the carbon contents for the five Colombian biomes. The total biomass was estimated from the sum of the aboveground and belowground biomass per hectare in the Caribbean biome. Subsequently, the carbon content of the total biomass was determined as the product of the total biomass and the carbon fraction of the dry matter as suggested by the 2006 IPCC Guidelines (0.47). The baseline values are selected in compliance with the provisions of Resolution 1447 of 2018 of the Ministry of Environment and Sustainable Development (MADS) regarding mitigation actions at the national level.
Purpose	Estimation of the emissions reduction in the baseline scenario and the project scenario.
Comments	The same CBF_{eq} was used for the Monterrey y Punto Nuevo centers.

Data	COS_{eq}
Unit	Tons of carbon dioxide (tCO_2) in soils of the Caribbean biome per hectare (tCO_2/ha).
Source	MADS & IDEAM (2019).
Description	Carbon emission factor in the soils of the forests of the Caribbean biome.
Applied value	18.5 tCO_{2e} ha^{-1}
Justification of the choice of the parameter or description of the measurement methods or procedures applied	The national FREL assumes a gross value for the estimation of the emissions of the soil pools due to deforestation, considering that carbon content of the soil is emitted in equal amounts during 20 years after the occurrence of the deforestation event. The baseline values are selected in compliance with the provisions of Resolution 1447 of 2018 of the Ministry of Environment and Sustainable Development (MADS) regarding mitigation actions at the national level.
Purpose	Estimation of the emissions reduction in the baseline scenario and the project scenario.
Comments	The same CBF_{eq} was used for the Monterrey y Punto Nuevo centers.

Data	*DD*
Unit	Percentage %
Source	Calculated by South Pole based on the results of the first deforestation monitoring period carried out by different REDD+ projects formulated in the country.
Description	Projected decrease in deforestation due to the implementation of REDD+ activities.
Applied value	70%
Justification of the choice of the parameter or description of the	Based on the success of REDD+ mitigation activities in the country, decrease in deforestation was projected to be 70%. This estimate

measurement methods or procedures applied	considered the actual effectiveness of the following six REDD+ projects registered in the country during their first monitoring period: **Amazon biome:** Unified Indigenous Reservation–Selva de Mataven REDD+ Project, and TICOYA Indigenous Reservation Forest Mitigation Project in the Amazon Biome. **Pacific Biome:** Chocó-Darién Conservation Corridor REDD+ Project and Cajambre REDD+ Project. **Andean biome:** Conservation of the Galilea-Amé Forest Emissions Offsetting Project. **Caribbean biome:** "Mangrove Life" Blue Carbon Project in the Gulf of Morrosquillo.
Purpose	Estimation of emissions reduction in the project scenario.
Comments	The same DD% was used for Monterrey and Punto Nuevo centers.

Data	E_f
Unit	Percentage %
Source	REDD+ Methodological Document
Description	Percentage of the emissions increase in the leakage area due to the implementation of REDD+ activities.
Applied value	10%
Justification of the choice of the parameter or description of the measurement methods or procedures applied	The methodology accepts a default value of 10% for the emissions increase in the leakage area due to the implementation of REDD+ activities.
Purpose	Estimation of emissions reduction in the project scenario.
Comments	The same E_f% was used for Monterrey and Punto Nuevo centers.

Data available for verification

Below are all the data and parameters to be monitored in the REDD+ initiative of the Caribbean Region CCMP.

Data	$CSB_{proy.año}$
Unit	Hectares (ha).
Description	Annual change in the surface covered by forest in the project area.

Source	Classification of Landsat 8 multispectral images from the OLI mission for the years 2016, 2017 and 2020.
Description of the measurement and processing methods applied	Between the years 2016, 2017 and 2020, a cartographic cross-check was carried out to generate the change layer (gross deforestation approach) between each pair of years for the entire time series. Detailed information on image processing is presented in Section 4.1.1: Spatial boundaries.
Monitoring frequency	At least every 5 years.
Purpose	Estimation of the emissions reduction in the project scenario.
Estimation method	The estimation methods are detailed in Section 4.5: GHG emissions reduction due to the REDD+ initiative.
Comments	$CSB_{REDD+proy.año}$ is estimated for both centers integrating the PA: Monterrey and Punto Nuevo.

Data	$CSB_{f.proy.año}$
Unit	Hectares (ha).
Description	Annual change in the surface covered by forest in the leakage area.
Source	Classification of Landsat 8 multispectral images from the OLI mission for the years 2016, 2017 and 2020.
Description of the measurement and processing methods applied	Between the years 2016, 2017 and 2020, a cartographic cross-check was carried out to generate the change layer (gross deforestation approach) between each pair of years for the entire time series. Detailed information on image processing is presented in Section 4.1.1: Spatial boundaries.
Monitoring frequency	At least every 5 years.
Purpose	Estimation of the emissions reduction in the project scenario.
Estimation method	The estimation methods are detailed in Section 4.5: GHG emissions reduction due to the REDD+ initiative.
Comments	$CSB_{f.proy.año}$ is estimated in each leakage area for both centers integrating the PA: Monterrey and Punto Nuevo.

4.7.1 Monitoring of the project boundaries of the REDD+ initiative[226]

Deforestation/disturbance is monitored in the Project Area (PA) and Leakage Area (LA), whose boundaries are defined in the LA project validation. All the boundaries demarcated for the

[226] For further information on the processing during the monitoring period for the project area, go to: Monterrey center: Gestión de la información/Cartografía/REDD+/Monitoreo/NucleoMonterrrey/Reporte/20220315_Reporte_Monitoreo_Monterrey.
Punto Nuevo center: Gestión de la información/Cartografía/REDD+/Monitoreo/NucleopuntoNuevo/Reporte/20220315_Reporte_Monitoreo_Punto_Nuevo.

Monterrey and Punto Nuevo centers are detailed in Section 4.1: Project boundaries (see Figure 32 and Figure 33).

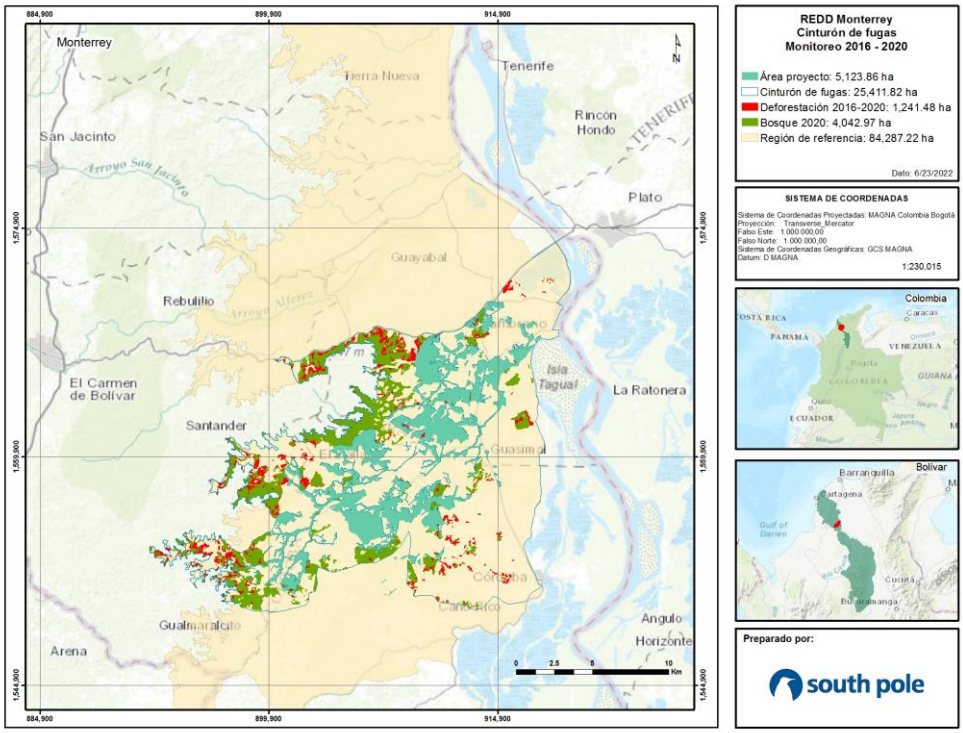


Figure 32: Project boundaries in the Monterrey center zone

(Source: South Pole, 2022)

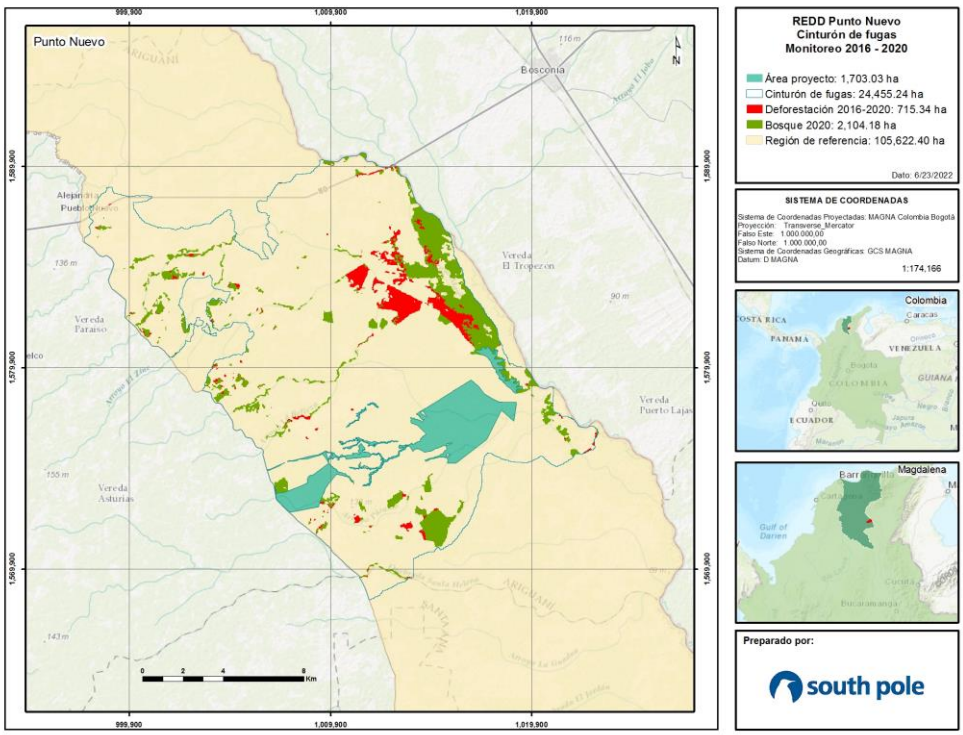


Figure 33: Project boundaries in the Monterrey center zone

(Source: South Pole, 2022)

The estimation of the emission reductions of the REDD+ component of the Caribbean Region CCMP corresponds to the 2016-2020 period. The monitoring analysis is conducted in compliance with the REDD+ Methodological Document as detailed below:

4.7.1.1 Processing of project boundaries during the monitoring period[227]

In the project area, which is made up of 5,124 ha in Monterrey and 1,705 ha in the Punto Nuevo center, forest areas are monitored during the years 2016, 2017, 2018, 2019 and 2020, while the Leakage Area is monitored only in 2016 and 2020. For the monitoring, satellite images from the Landsat 8 OLI sensor are used, identifying forest, non-forest and water covers through the visual inspection methodology and carrying out manual digitization by an expert in spatial solutions.

The processing used the same methodology applied for the baseline quantification (see Section 4.1.1). By means of the acquisition of **Base Information** listed in Table 54, the results of Table 55 were obtained.

Table 54: List of Landsat images obtained

Mission	Processing Level	Acquisition Date	Path	Row
OLI	L2	05-02-2016	008 - 009	053
OLI	L2	02-10-2017	008 - 009	053
OLI	L2	01-28-2018	008 - 009	053
OLI	L2	01-15-2019	008 - 009	053
OLI	L2	03-22-2020	008 - 009	053

(Source: Prepared by South Pole, 2022)

Table 55: Forest distribution in the PA, by year

PA Center	2016	2017	2018	2019	2020
Monterrey	4,328	4,328	4,328	4,328	4,328
Punto Nuevo	1,536	1,536	1,536	1,536	1,536

(Source: Prepared by South Pole, 2022)

4.8 Monitoring of project emissions in the 2016-2020 period

4.8.1 Annual deforestation in the monitoring period

4.8.1.1 Annual deforestation in the PA

Deforestation in the Monterrey and Punto Nuevo centers in the 2016-2020 period was reduced to 0 ha, that is, the REDD+ component of the Caribbean Region CCMP was 100% efficient, maintaining 4,328 ha of stable forest in the Monterrey center and 1,537 ha in the Punto Nuevo center. In this sense and taking into account the high rates of deforestation in the LA and RR, different control points are presented in the PA to verify this behavior.

[227] The cartographic information of the Project Area, Reference Region and Leakage Area is available at: Monterrey center: Gestión de la información/Cartografía/REDD+/Monitoreo/NucleoMonterrrey; Punto Nuevo center: Gestión de la información/Cartografía/REDD+/Monitoreo/NucleopuntoNuevo.

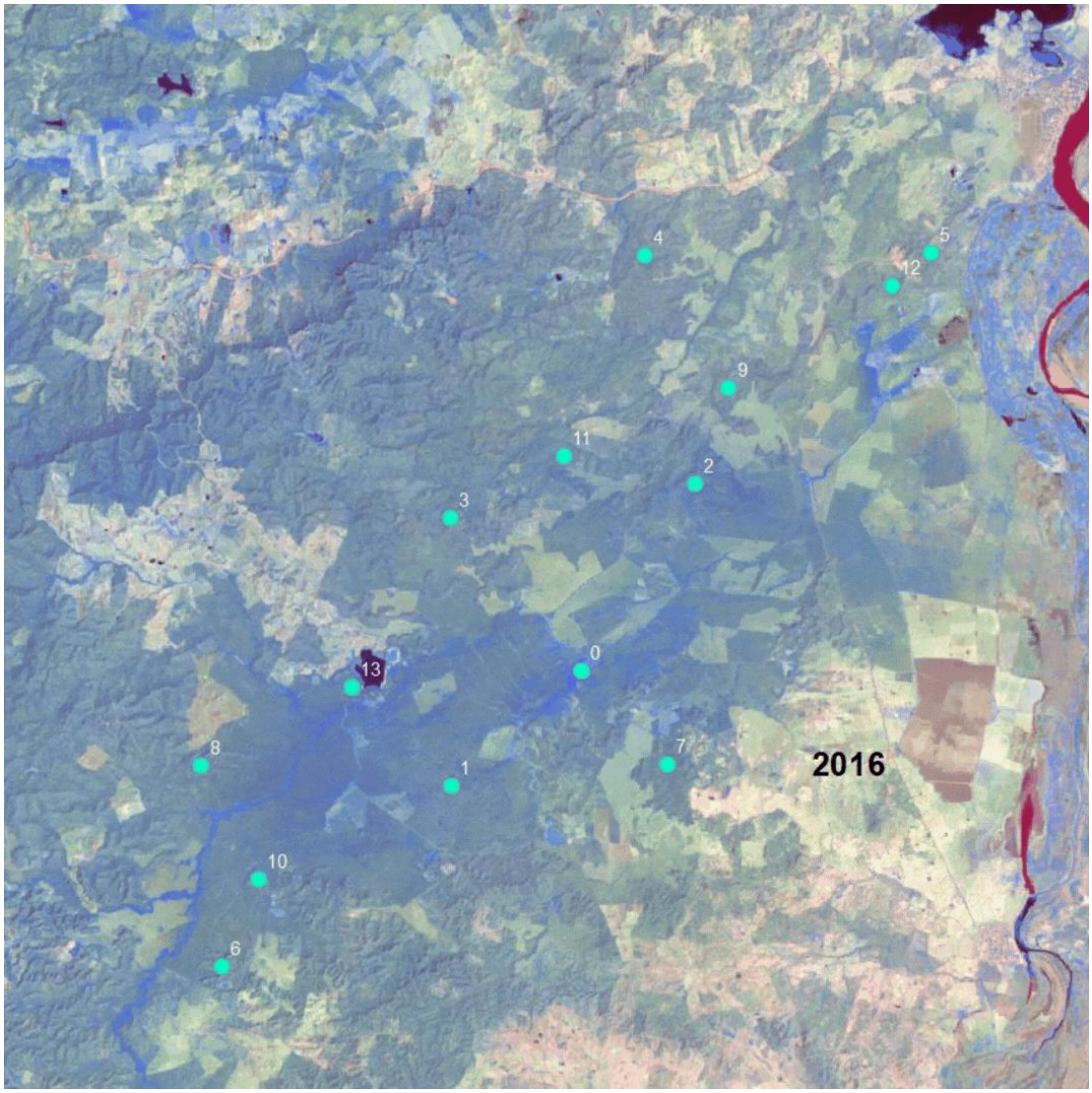


Figure 34: Cover changes in the Monterrey center during the monitoring period

(Source: South Pole, 2022, and OLI Landsat images from the years 2016, 2017, 2018, 2019 and 2020)

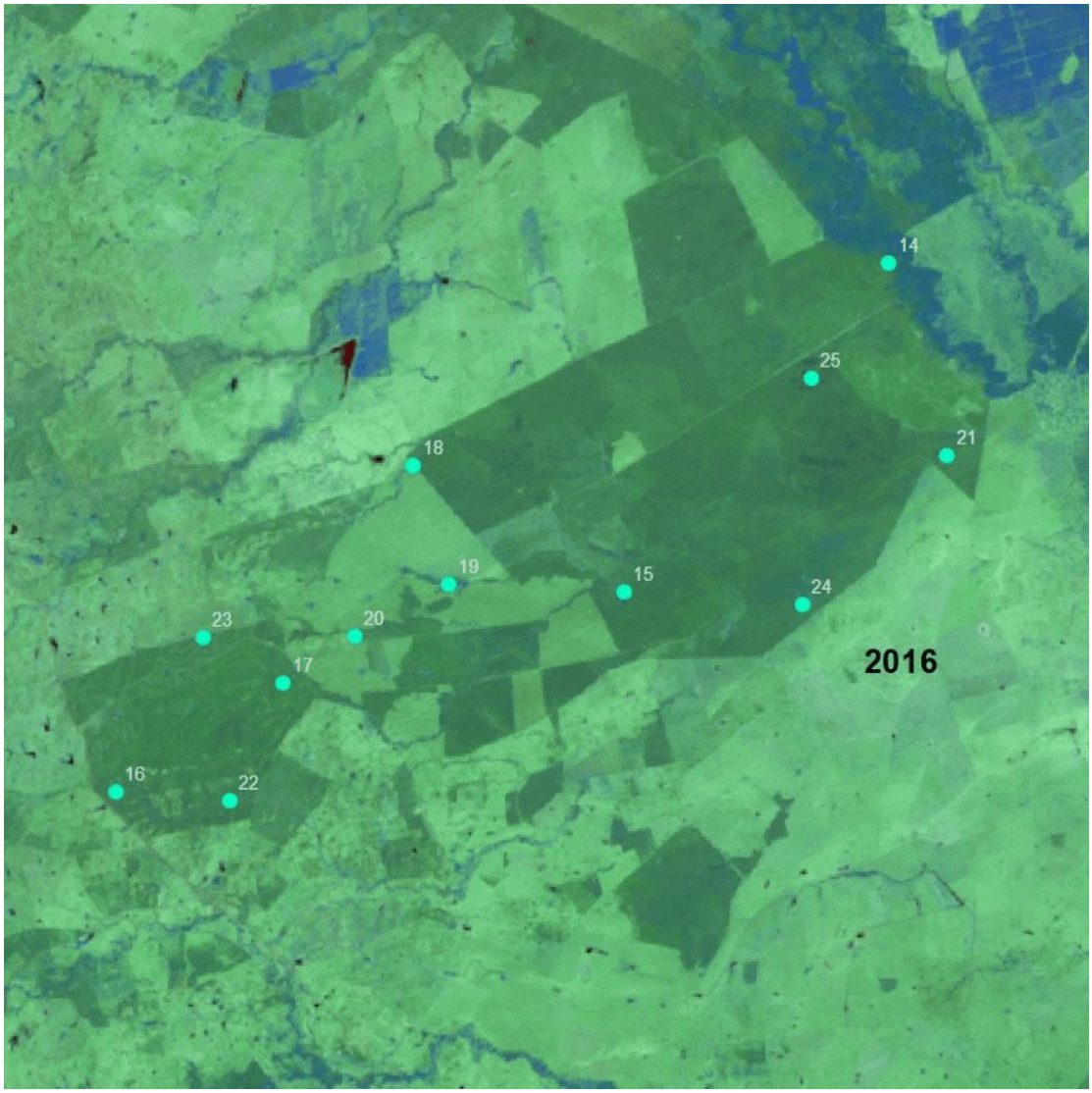


Figure 35: Cover changes in the Punto Nuevo center during the monitoring period

(Source: South Pole, 2022, and OLI Landsat images from the years 2016, 2017, 2018, 2019 and 2020)

4.8.1.2 Annual deforestation in the leakage area

- Punto Nuevo center

Taking into account the changes in the surface covered by forest observed in the analysis of the supervised classification information, the changes in the LA were estimated according to the following equation:

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

Where:

$CSB_{f,año}$	Annual change in the surface covered by forest in the leakage area; ha.
t_1	Initial year of the monitoring period; year.
t_2	Final year of the monitoring period; year.

$A_{f,1}$	Forest surface in the leakage area at the beginning of the monitoring period; ha.
$A_{f,2}$	Forest surface in the leakage area at the end of the monitoring period; ha.

- Monterrey center

Based on the deforestation trend in the Monterrey leakage area (see Figure 36), which goes from 5.68% in the baseline period (2006-2016) to 6.7% between 2016 and 2020 and is consistent with the behavior of the reference region, deforestation in the leakage area was calculated using the following equations:

$$CSB_{fMonterrey,año} = CSB_{f,RR,m} - CSB_{f,año})$$

Where:

$CSB_{fMonterrey,año}$	Annual change in the surface covered by forest in the Monterrey leakage area; ha.
$CSB_{f,RR,m}$	Annual change in the area covered by forest in the projected leakage area according to the deforestation trend in the reference region of the Monterrey center; ha.
$CSB_{f,año}$	Annual change in the surface covered by forest in the leakage area; ha.

And,

$$CSB_{f,RR,m} = (A_{f,t} \times TDRR_{RR,m,})$$

Where:

$A_{f,t}$	Surface covered by forest in the leakage area at year t of the monitoring period; ha.
$ATDRR_{RR,m}$	Deforestation rate in the reference region during the monitoring period; ha.

This interpretation is based on a significant increase in deforestation in the 2016-2020 period (Figure 36) both in the reference region and the leakage area, which may have occurred due to the return of peasant families who had been previously subject to forced displacement during the civil war intensification and the expansion of the road d that connects El Carmen de Bolívar with Plato (Magdalena). In addition, this behavior is supported in Section 4.2.1.1 and Table 42 and Table 43.

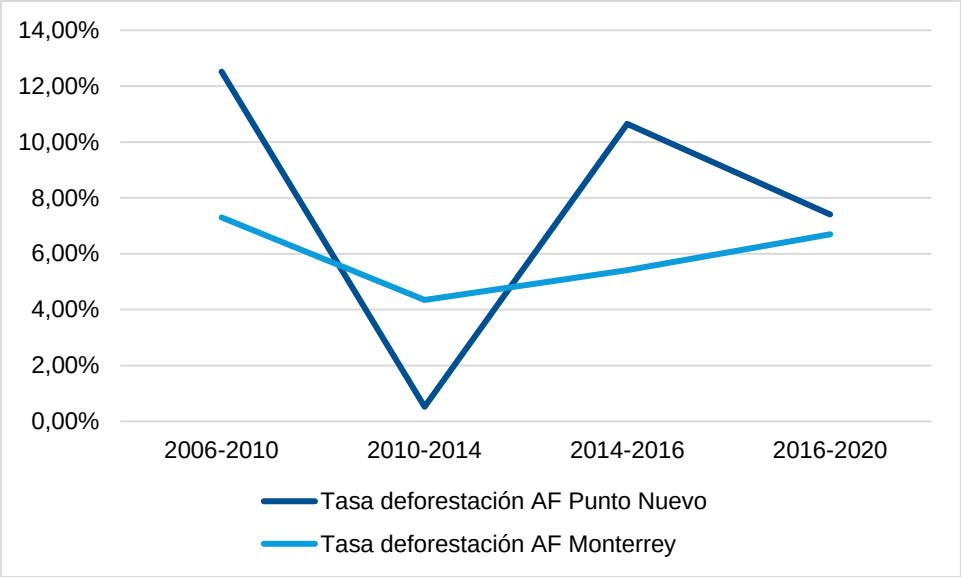


Figure 36: Behavior of the deforestation rate in the leakage area of the Monterrey and Punto Nuevo centers

(Source: South Pole, 2022)

The results of unplanned deforestation in the PA and LA are presented in Table 56, Figure 37 and Figure 30. Deforestation in the PA was zero for the entire monitoring period in both the Monterrey and Punto Nuevo centers.

Table 56: Annual deforestation in the PA and LA of the Monterrey and Punto Nuevo centers in the monitoring period

Year	Deforestation in the monitoring period (ha)					
	$CSB_{proy,año}$ Project Area			$CSB_{f,año}$ Leakage Area		
	Monterrey	Punto Nuevo	Total	Monterrey	Punto Nuevo	Total
2016	0	0	0	233	136	370
2017	0	0	0	311	182	493
2018	0	0	0	311	182	493
2019	0	0	0	311	182	493
2020	0	0	0	311	182	493

(Source: South Pole, 2022)

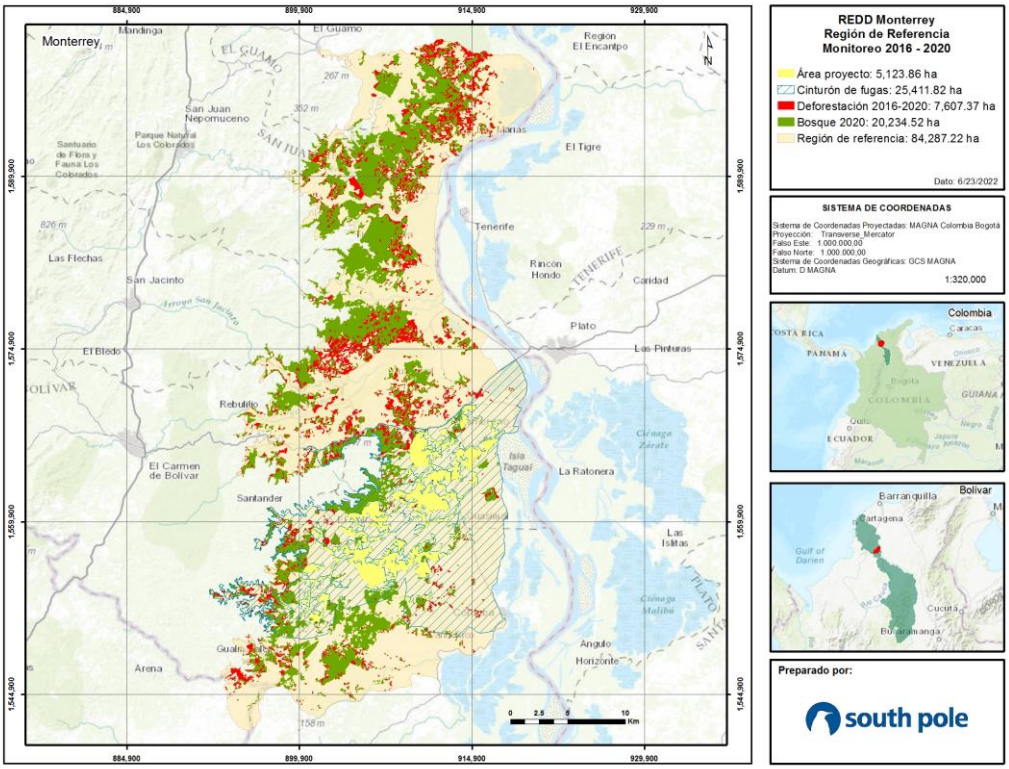
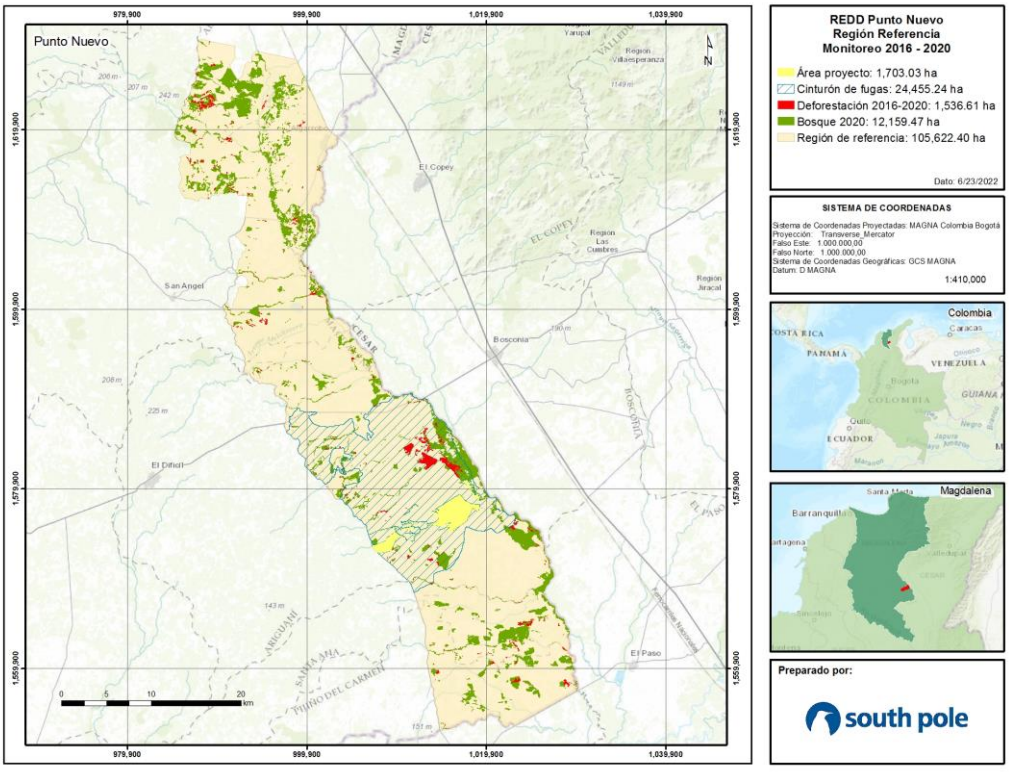


Figure 37: Map of deforestation in the project area and leakage area of the Monterrey center during the monitoring period



(

Figure 38: Map of deforestation in the project area and leakage area of the Punto Nuevo center during the monitoring period

(Source: South Pole, 2022)

4.8.2 GHG emissions in the monitoring period (2016-2020)

Once deforestation in the PA and LA in the 2016-2020 period was estimated, the project's total emissions due to deforestation were calculated using the following equations in accordance with section 14.5.2 of the Biocarbon Registry's REDD+ Methodological Document.

4.8.2.1 Project emissions in the monitoring period

The annual emission in the PA during the monitoring period was zero, taking into account the total deforestation reduction between 2016 and 2020. Table 57 shows the emissions in the LA during 2016-2020 that were calculated based on the following equation:

$$EA_{f.año} = EA_{lb.f.año} - (DEF_{f.año} \times tCO_{2eq})$$

Where:

$EA_{f.año}$	Annual emission in the leakage area; tCO_2 ha^{-1}.
$DEF_{f.año}$	Annual deforestation in the leakage area; ha.
tCO_{2eq}	Total carbon dioxide equivalent; tCO_2eq ha^{-1}.
$EA_{lb.f.año}$	Annual emission in the leakage area, in the baseline scenario; tCO_2e.

Table 57: Annual emission in the LA of the Monterrey and Punto Nuevo centers in the monitoring period

Calendar Year	Leakage area total emissions: EA_f (tCO_2eq)					
	Monterrey			Punto Nuevo		
	Total biomass	Soils	Annual emission	Total biomass	Soils	Annual emission
2016	23,115	1,545	26,344	37,718	2,521	5,749
2017	30,820	2,060	35,126	50,291	3,361	7,666
2018	23,831	1,593	40,361	50,291	3,361	4,294
2019	14,512	970	47,341	50,291	3,361	-201
2020	5,751	384	53,823	50,291	3,361	-4,449

(Source: South Pole, 2022)

4.8.3 Quantification of project emissions reduction

The emissions reduction of the Caribbean Region CCMP due to avoided deforestation in the period 2016-2020 was quantified under the criteria of Section 14.5.2 of the Biocarbon Registry's REDD+ Methodological Document.

$$RE_{DEF,REDD+proy} = (t_2 - t_1) \times (EA_{DEF,lb,año} - EA_{DEF,REDD+proy,año} - EA_{DEF,f,año})$$

Where:

$RE_{DEF,REDD+proy}$	Emissions reduction due to avoided deforestation in the monitoring period; tCO_2e.
t_1	Initial year of the monitoring period; year.
t_2	Final year of the monitoring period; year.

$EA_{DEF,lb,año}$	Annual emission by deforestation in the project area in the baseline scenario; tCO_2e.
$EA_{DEF,REDD+proy,año}$	Annual emission by deforestation in the project area, in the monitored period; tCO_2e.
$EA_{DEF,f,año}$	Annual emission by deforestation in the leakage area, in the monitored period; tCO_2e.

Table 58 presents the results of the total net emissions reduction due to avoided deforestation by the Caribbean Region CCMP in the 2016-2020 period. In the first monitoring period, a net reduction of 375,978 tCO_2eq and an annual average of 75,196 tCO_2eq were achieved. These calculations do not include the reversal risk, which corresponds to 15%[228] of the net emissions reduction, in accordance with Section 13.1: Reversal risk management of the BCR Standard.

Table 58: Total net emissions reduced by the REDD+ component in the monitoring period

Calendar Year	Reducción de emisiones netas (tCO_2eq) $RE_{DEF,REDD+proy}$		
	Monterrey	Punto Nuevo	Total
2016	31,328	18,722	**50,050**
2017	55,694	33,283	**88,977**
2018	53,875	31,453	**85,328**
2019	51,450	28,812	**80,262**
2020	49,103	22,258	**71,361**
Total	**241,450**	**134,528**	**375,978**
Average	**48,290**	**26,906**	**75,196**

(Source: South Pole, 2022)

The total emissions reduced by the REDD+ initiative in the monitoring period is greater than the GHG emissions reduction in the project scenario. The reason for this is the excessive increase in deforestation in the reference region, compared to the total deforestation reduction in the project area. In addition, as detailed in Section 4.8.1.2: Annual deforestation in the leakage area, there are also external factors to the implementation of the Caribbean Region CCMP that influence these results.

4.8.4 Monitoring of the implementation of REDD+ activities

FMC, as the holder of the Caribbean Region CCMP, is responsible for the monitoring of the actions described in section 4.4: REDD+ project activities in order to meet the objective related to GHG emissions reduction. The activities monitoring consists of:

- Monitoring of the investments in the strategic lines and project activities.

The monitoring plan is presented for each strategic line, program or activity, according to their degree of progress. They are related to the REDD+ safeguards, the SDGs or co-benefits.

[228] In accordance with Section 13.1: Reversal risk management of the BCR Standard, the discount is 15% of the total emissions reduction for each verified period.

4.8.4.1 Strategic Line 1: Climate change mitigation and biodiversity conservation and monitoring

Strategic line	Climate change mitigation and biodiversity conservation and monitoring
Objective	To strengthen ecosystem management and knowledge through biodiversity monitoring to comprehensively manage tropical dry forests.
SDGs	**SDG 3.** Good health and well-being **SDG 6.** Clean water and sanitation **SDG 9**. Industry, innovation and infrastructure **SDG 13**. Climate action
Goal	**Medium term:** Comprehensive conservation of the natural forest and joint management of the bs-T biodiversity to foster positive impacts and mitigate negative impacts and the direct and underlying causes of deforestation and degradation of the bs-T.

Program	Activity	Unit of measurement	Methodology	Type	Frequency	Responsible for the measurement	Indicator ID	Result of the indicator in the reporting period	Documents to support the information
Maintenance and monitoring of High Conservation Value Attributes (HCVA) in High Conservation Value Forests (HCVF).	Monitoring of HCV 1: Landscape and mosaic-level ecosystems	Forest area	Annual measurement using Landsat 8 and Sentinel 2 satellite images, in a period of 5 years to make quantitative comparisons of vegetation indices.	Result	Every 5 years	FMC technical staff	A1-1	Safety reports and HCVF monitoring report.	HCVF monitoring report[229] Control and security supporting documents.
	Monitoring of HCV 2: Species diversity (*Belencita nemorosa*)	Diversity index	Evaluation every 5 years in the permanent plots established during the Second Phase of the activity (2020 and 2021).	Result Outcome	Every 5 years	FMC technical staff	A1-2	Characterization of the species and establishment of permanent plots.	Species characterization reports[230].
	Monitoring of HCV 2: Species diversity (*Malagoniella astyanax*)	Diversity index.	To be defined.	Result Outcome	To be defined.	FMC technical staff National University of Colombia, Bogotá campus, Faculty	A1-3	Initial formulation of the activity.	Inter-administrative agreement and initial formulation of the project [231].

[229] Supporting documents of HCV 1 Monitoring Activity (Ecosystems at landscape and mosaic level): Gestión de la información/ActividadesProyecto/LineaEstrategica1/Monitoreo AVC1_Ecosistemas a nivel de paisaje y Mosaico/.
[230] Supporting documents of the HCV2 Monitoring Activity (Species diversity: *Belencita nemorosa*): Gestión de la información/ActividadesProyecto/LineaEstrategica1/Monitoreo AVC2 Diversidad de especies/Belencita_nemorosa.
[231] Supporting documents of the HCV2 Activity Monitoring (Species diversity: *Malagoniella astyanax*): Gestión de la información/ActividadesProyecto/LineaEstrategica1/Monitoreo AVC2 Diversidad de especies/Malagoniella_astyanax.

Strategic line	Climate change mitigation and biodiversity conservation and monitoring
Objective	To strengthen ecosystem management and knowledge through biodiversity monitoring to comprehensively manage tropical dry forests.
SDGs	**SDG 3.** Good health and well-being **SDG 6.** Clean water and sanitation **SDG 9**. Industry, innovation and infrastructure **SDG 13**. Climate action
Goal	**Medium term:** Comprehensive conservation of the natural forest and joint management of the bs-T biodiversity to foster positive impacts and mitigate negative impacts and the direct and underlying causes of deforestation and degradation of the bs-T.

Program	Activity	Unit of measurement	Methodology	Type	Frequency	Responsible for the measurement	Indicator ID	Result of the indicator in the reporting period	Documents to support the information
						of Sciences			
Identification of species with restricted distribution and/or of special observance.	Fauna sightings and recording.	Number of individuals per hectare.	Indicators of the status of endangered species and annual monitoring reports.	Result	Annual	FMC technical staff	A1-4	Species lists and annual monitoring reports[232].	

(Source: South Pole, 2022)

[232] Supporting documents of fauna sighting and recording: Gestión de la información/ActividadesProyecto/LineaEstrategica1/Avistamientos y Registros de fauna.

4.8.4.2 Strategic Line 2: Community engagement and local environmental education

Strategic line	Community engagement and local environmental education
Objective	To strengthen relationships and collaborative work with the different sectors and strategic stakeholders in the area of influence, promoting community capacities and leadership around local environmental management and education.
SDGs	**SDG 3.** Good health and well-being **SDG 5.** Gender equality **SDG 6.** Clean water and sanitation **SDG 13.** Climate action
Goal	**Short and medium term:** • Two annual training sessions with the community sector. • Two annual meetings on the progress of the Caribbean Region CCMP

Program	Activity	Unit of measurement	Methodology	Type	Frequency	Responsible for the measurement	Indicator ID	Result of the indicator in the reporting period	Documents to support the information
Community engagement to promote education in the area of influence.	Project structuring and planning.	Number of projects planned.	Support to project formulation and implementation through training activities with the community sector.	Result	Every 5 years	-FMC personnel responsible for community relations. -Leaders of the community sector.	A2-1	Proyecto Reciclando con alegría soy feliz.	Project structuring and planning report.[233].
	Training sessions, practical workshops and guided tours.	Number of training sessions, practical workshops and guided tours.	-Training sessions for the community sector and FMC personnel. -Workshops with the educational sector. -Ecological mountain biking tours.	Result	Annual	-FMC personnel responsible for community relations. -Leaders of the community sector.	A2-2	-Training sessions for the community sector: 3 -Theoretical-practical workshops with the educational sector: 9 -Ecological mountain biking tours: 2	Annual reports in 2018, 2019 and 2020.[234].
	Financial contributions to	Colombian pesos	FMC Annual Investment Plan	Result	Annual	-FMC personnel responsible for	A2-3	-Annual reports. -Improvements in	Reports of the investment plan of

[233] Supporting documents of the project structuring and planning activity: Gestión de la información/ActividadesProyecto/LineaEstrategica2/PlaneacionProyectos.

[234] Supporting documents of the training, practical workshops and guided tour activity: Gestión de la información/ActividadesProyecto/LineaEstrategica2/CapacitacionesTalleres.

Strategic line	Community engagement and local environmental education
Objective	To strengthen relationships and collaborative work with the different sectors and strategic stakeholders in the area of influence, promoting community capacities and leadership around local environmental management and education.
SDGs	**SDG 3.** Good health and well-being **SDG 5.** Gender equality **SDG 6.** Clean water and sanitation **SDG 13.** Climate action
Goal	**Short and medium term:** • Two annual training sessions with the community sector. • Two annual meetings on the progress of the Caribbean Region CCMP

Program	Activity	Unit of measurement	Methodology	Type	Frequency	Responsible for the measurement	Indicator ID	Result of the indicator in the reporting period	Documents to support the information
	the Monterrey Forestal Mixed School.					community relations. - Educational sector (Directors and teachers of the Monterrey Forestal Mixed School).		the infrastructure of the school. -Improvement of the educational offer.	the Monterrey Forestal Mixed School.[235].

(Fuente: South Pole, 2022)

4.8.4.3 Strategic Line 3: Support for local job creation and economic diversification

Strategic line	Support for local job creation and economic diversification.
Objective	To support capacity building activities and local projects that generate new economic alternatives for the community benefit.
SDGs or co-benefits	**SDG 2.** Zero hunger **SDG 6.** Clean water and sanitation **SDG 8.** Decent work and economic growth **SDG 13.** Climate action
Goal	**Medium and long term:** Support capacity building among stakeholders to develop new economic alternatives such as beekeeping and recycling projects.

Program	Activity	Unit of	Methodology	Type	Frequency	Responsible for	Indicator	Result of the indicator	Documents to

[235] Supporting documents of the economic contributions to the Monterrey Forestal Mixed School: Gestión de la información/ActividadesProyecto/LineaEstrategica2/EscuelaMixtaMF.

		measurement				the measurement	ID	in the reporting period	support the information
Local production and use of natural resources.	Community beekeeping in tropical dry forest and forest plantations.	• Number of families. • Annual production of honey and wax. • Number of hives.	• Follow-up, promotion and incorporation of new families to the beekeeping activity. • Annual evaluation of the amount of honey produced. • Annual evaluation of the number of existing hives on the property.	Result	Annual	• FMC personnel responsible for community relations. • Leaders of the beekeeping project.	A3-1	• Evaluation of the annual honey production. • 2016: Reactivation of beekeeping production with 14 families. • 2017-2020: 4 families continue carrying out beekeeping work in the Monterrey center.	• 2016 Beekeeping Report[236] • Annual production reports.
	"Reciclando con alegría soy feliz" Program.	• Investment in Colombian pesos. • Tons of recycled material.	• Monetary investment for annual alliance activities between FMC and the recycling foundation. • Monthly supplies of recycled material.	Result	Annual	• FMC personnel responsible for community relations. • Leaders of the recycling project.	A3-2	• 2016: Consolidation of the project. • 2017-2018: Creation of the working group and first progress report. • 2019: Second project progress report. • Consolidation of the recycler's foundation. • Good management of solid waste. • Increase in job offer.	Annual reports[237].

(Source: South Pole, 2022)

4.8.4.4 Strategic Line 4: Forest fire prevention and control

Strategic line	Strategic Line 4: Forest fire prevention and control
Objective	To prevent and control the impacts of fires on natural forests and forest plantations.
SDGs or co-benefits	**SDG 3.** Good health and well-being **SDG 8.** Decent work and economic growth **SDG 13.** Climate action
Goal	**Short term:** • Prevent the occurrence of fires.

[236] Evidencias actividad Apicultura comunitaria en Bosque seco Tropical y plantaciones forestales. Gestión de la información/ActividadesProyecto/LineaEstrategica3/Apicultura comunitaria

[237] Evidencias actividad Reciclando con Alegría soy Feliz: Gestión de la información/ActividadesProyecto/LineaEstrategica3/Reciclando.

		• Reduce the impacts of the fire events that have occurred.								
Program	**Activity**	**Indicator**	**Unit of measurement**	**Methodology**	**Type**	**Frequency**	**Responsible for the measurement**	**Indicator ID**	**Result of the indicator in the reporting period**	**Documents to support the information [238]**
Forest protection	Fire prevention plan.	Number of fire prevention activities carried out per year.	Unit	Annual training in fire management and brigade course.	Result	Annual	FMC and GRC personnel.	A4-1.1	• Annual report of prevention activities for fire management = 8 • *Trainings = 22.	Annual activity report.
		Firebreaks.	Kilometers	Firebreaks preparation.	Result	Annual		A4-1.2	2012 = 0 2013 = 11.0 2014 = 11.0 2015 =94.0 2016 = 118.8 2017 = 145.0 2018 = 172.1 2019 = 3.4 2020 = 3.4	Annual activity report.
	Forest fire control.	Number of controlled events per year.	Events	Images from remote sensors and field measurement of the impacted area.	Result	Annual	FMC and GRC personnel.	A4-2.1	3 events occurred and controlled	Annual activity report.
		Impacts of fires on the natural forest and the forest plantation.	Hectares		Result	Annual		A4-2.2	• 23.65 ha affected. • 0.65 unplanted stands. • 11.5 ha in natural forests, in non-eligible areas.	

(Source: South Pole, 2022)

[238] The annual activity reports are available at: Gestión de la información\General\Informes_actividades.

4.8.5 Monitoring of the REDD+ safeguards

The description of the REDD+ Safeguards and their monitoring are presented in Section 4.3 and in Annex 4: SDGs and safeguards[239].

Following is the compliance with the safeguards monitored in each of the strategic lines of the Caribbean Region CCMP.

4.8.6 Monitoring of the REDD+ project permanence

4.8.6.1 Biophysical risks

This section presents the disturbances to the project area of the REDD+ initiative, taking into account the risks included in Section 8.3: Risks associated with stakeholder participation, where the potential biophysical risks of the project are described.

Fires

To analyze fire occurrence in the project area, the records completed by FMC on yearly forest fire events were taken into account as described in Section 8.1: Natural and human-induced risks. This section presents the number of hectares impacted and registered in the project area. It is worth mentioning that, considering the verification period of the REDD+ component (2016-2020), an impact on 28 ha outside the PA was reported, but it was not considered within the estimates as described in Table 20.

Floods

According to the UNGRD[240], between 2012 and 2020 there were 16 flood events in the area of influence with minor impacts. Despite the possibility of floods in the project area during the verification period (2016-2020), no event was identified.

Table 59: 15% Reversal Risk Discount

Table 59: 15% reversal risk discount

Concept	Result
When the area affected by natural or anthropogenic disturbances had generated mitigation results in previous verifications, the total net change in carbon stocks and the GHG emissions in that area will be estimated and an amount of credits equivalent to 15% will be discounted from the risk reserve.	Given that the project is being verified for the first time, there is no 15% risk reserve discount.

(Source: South Pole based on Biocarbon Registry and FMC, 2022)

4.8.6.2 Socioeconomic risks

These risks are addressed in Section 8.3: Risks associated with stakeholder participation.

[239] Gestión de la información\Secciones Anexas\Anexo 4_ODS & Salvaguardas.

[240] SNGRD (National Disaster Risk Management System) is the highest instance in charge of guiding the entire national disaster-related system. It is headed by the President of the Republic and, subsequently, by the ministers, the National Planning Department and the Director of the National Unit for Disaster Risk Management (UNGRD). Available at: http://portal.gestiondelriesgo.gov.co/Paginas/Consolidado-Atencion-de-Emergencias.aspx. Accessed on 03/05/2022.

5 GHG Removal Activities component

5.1 Project limits

5.1.1 Spatial limits

5.1.1.1 Eligible areas for GHG removal activities

Eligible areas for the project's GHG removal activities were evaluated according to the guidelines of the BCR Standard and the GHG Removal Activities Methodology Document.

The eligibility analysis was carried out based on the forest and non-forest cartographic information available in the Forest and Carbon Monitoring System (SMBYC),[241] which is developed by the Institute of Hydrology, Meteorology and Environmental Studies (Cabrera et al., 2011;[242] Galindo et al., 2014[243]) and presents cover classification according to the Corine Land Cover[244] methodology adapted for Colombia. It also allows for carrying out different analyzes of the deforestation based on the forest/non-forest layers. Considering this information and Section 9: Eligible areas for GHG projects in the AFOLU sector of the GHG Removal Activities Methodological Document, it was determined that the eligible areas:

a) are not covered by forest or natural vegetation cover other than forest; and
b) are not part of a forest area that is temporarily unstocked or have natural vegetation covers other than forests or are not covered by young natural stands.

The areas seeking the certification of GHG Removal Activities were not under the categories of forest or natural vegetation cover other than forest at the beginning of the project activities, nor five years before the project start date[245]. This means that areas are considered eligible since they meet the definition of non-forest[246] for at least five years before the start of the project. For this, an analysis covering the years from 2006 to 2012 was conducted.

Table 60: Methodology used for the eligibility analysis of the areas being part of the GHG Removal Activities component

Methodology	Eligibility criteria
Start date: 2012 - Satellite images were acquired and analyzed for the 2006 and 2021 cover analysis and a cover identification was performed.[247]	The project areas were non-forest covers for more than 5 years prior to the project start date.

(Source: South Pole based on satellite images and information from SMBYC, 2022)

[241] http://smbyc.ideam.gov.co/MonitoreoBC-WEB/reg/indexLogOn.jsp

[242] Cabrera, E., Vargas, D. M., Galindo, G., García, M. C., Ordoñez, M. F., Vergara, L. K. & Giraldo, P. (2011). *Technical report on the quantification of national historical deforestation – coarse and fine scales*. Institute of Hydrology, Meteorology and Environmental Studies.

[243] Galindo, G., Espejo, O. J., Ramírez, J. P., Forero, C., Valvuena, C. A., Rubiano, J. C. & Cabrera, E. (2014). *Technical report on the quantification of the area of natural forest and deforestation at national level*. Institute of Hydrology, Meteorology and Environmental Studies – IDEAM.

[244] Cabrera E., Vargas D. M., Galindo G. García, M.C., Ordoñez, M.F., Vergara, L.K., Pacheco, A.M., Rubiano, J.C. & Giraldo, P. (2011). *Memoria técnica de la cuantificación de la deforestación histórica nacional – escalas gruesa y fina*. Institute of Hydrology, Meteorology and Environmental Studies – IDEAM. Available at: http://www.ideam.gov.co/documents/13257/13817/Memoria+T%25C3%25A9cnica+Deforestaci%25C3%25B3n+.pdf/5f2741b4-ffa1-4b58-b986-f2fbefd6d006

[245] Taking into account that the project was registered to apply to a previous version of the Biocarbon standard, there is a letter requesting the extension of the project start date, which can be found at: Gestión de la información_V2\General\Extensión

[246] According to the forest definition of Colombia, for AR project activities forest means a piece of land covered by trees with a minimum height of 5 m, a minimum canopy density of 30%, in an area extending over more than 1 ha. In this sense, the non-forest cover corresponds to the lands that do not have the criteria to be considered forests. (http://cdm.unfccc.int/DNA/index.html).

[247] Gestión de la información\Cartografía\ARGEI\Elegibilidad

In order to obtain the forest and non-forest areas for the years 2006 and 2012, the supervised classification methodology based on visual digitization through satellite images of medium spatial resolution (15 m and 30 m) was followed. For the project zone, the images corresponding to the years 2006 and 2012 were taken from the sensors ALOS Palsar 2 and Landsat 7 (ETM+ mission) and downloaded from the Earth Resources Observation and Science Center (EROS) server of the United States Geological Survey (USGS)[248]. Through these images, land cover was identified through the visual inspection methodology and an expert in spatial solutions conducted the manual digitization. Figure 39 shows the four main methodological steps for the identification of eligible areas of the Caribbean Region CCMMP using satellite images.

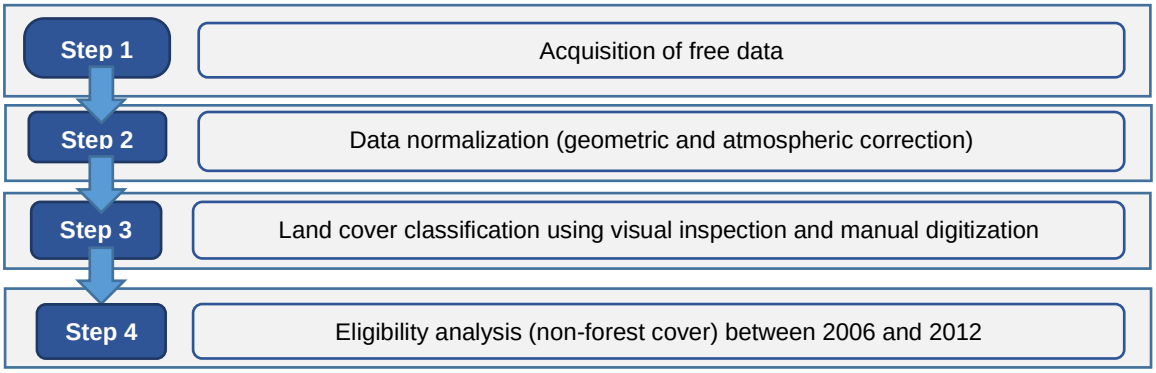


Figure 39: Methodological process for cover classification in the project area

(Source: South Pole, 2022)

- Input data

ALOS AVNIR-2 and Landsat 7 OLI multispectral images with level two processing were used. The first ones were used as a basis to digitize the land covers of the year 2006 and the second ones, to digitize the land covers of the year 2012 (Table 61).

Table 61: List of Landsat images obtained

Mission	Processing Level	Acquisition Date	Path	Row
ALOS AVNIR-2	L2	2006-01-26	NA	NA
ALOS AVNIR-2	L2	2006-11-02	NA	NA
Landsat 7 OLI	L2	2012-03-15	009	053
Landsat 7 OLI	L2	2012-01-04	008	053
Landsat 7 OLI	L2	2012-01-20	008	053

(Source: ALOS AVNIR-2 and Landsat 7)

- Digitization of land covers

The project area has different types of land cover. Therefore, a meticulous and detailed classification process of the land covers in the years 2006 and 2012 was taken by means of a screen digitization on a 1:10,000 scale. This process was based on the categories defined by the Corine Land Cover methodology that has been adapted for Colombia, the IPCC Guidelines for National GHG Inventories, and the cover classification (forest/non-forest) proposed in the GHG Removal Activities Methodological Document.

For the years 2006 and 2012, the predominant land cover in the project area was forest plantations, with a total of 8,433.26 ha (87.87%) and 8,642.68 ha (90, 05%), respectively (Table 62 and Table 63).

[248] https://earthexplorer.usgs.gov/

Table 62: Covers in Corine Land Cover for the year 2006

Center	ID	2006 IPCC Category	Level I in 2006	Level II in 2006	Level III in 2006	Definition in 2006	Area (ha)
Monterrey	7	Forest land	Forests and semi-natural areas	Forests	Natural forest	Forest	172.44
	8	Forest land	Forests and semi-natural areas	Forests	Forest plantation	Non-forest	6,246.45
	9	Forest land	Forests and semi-natural areas	Areas with herbaceous and/or shrubby vegetation	Areas with shrubby vegetation	Non-forest	85.91
	10	Grasslands or pastures	Forests and semi-natural areas	Areas with herbaceous and/or shrubby vegetation	Areas with herbaceous vegetation	Non-forest	42.29
	11	Forest land	Forests and semi-natural areas	Areas with herbaceous and/or shrubby vegetation	Secondary or transitional vegetation	Non-forest	59.72
	13	Forest land	Forests and semi-natural areas	Open areas, with little or no vegetation	Other areas without vegetation	Non-forest	787.26
	14	Wetlands	Humid areas	Inland humid areas	Inland humid areas	Non-forest	11.63
Punto Nuevo	7	Forest land	Forests and semi-natural areas	Forests	Natural forest	Forest	5.37
	8	Forest land	Forests and semi-natural areas	Forests	Forest plantation	Non-forest	2,186.81
Total							**9,597.86**

Table 63: Covers in Corine Land Cover for the year 2012

Center	ID	2006 IPCC Category	Level I in 2006	Level II in 2006	Level III in 2006	Definitio n in 2006	Area (ha)
Monterrey	7	Forest land	Forests and semi-natural areas	Forests	Natural forest	Forest	137.07
	8	Forest land	Forests and semi-natural areas	Forests	Forest plantation	Non-forest	6,455.87
	9	Forest land	Forests and semi-natural areas	Areas with herbaceous and/or shrubby vegetation	Areas with herbaceous and/or shrubby vegetation	Non-forest	75.84
	10	Grasslands or pastures	Forests and semi-natural areas	Areas with herbaceous and/or shrubby vegetation	Areas with herbaceous and/or shrubby vegetation	Non-forest	18.38
	11	Forest land	Forests and semi-natural areas	Areas with herbaceous and/or shrubby vegetation	Secondary or transitional vegetation	Non-forest	46.71
	13	Forest land	Forests and semi-natural areas	Open areas, with little or no vegetation	Other areas without vegetation	Non-forest	669.57
	14	Wetlands	Humid areas	Inland humid areas	Inland humid areas	Non-forest	2.25
Punto Nuevo	7	Forest land	Forests and semi-natural areas	Forests	Natural forest	Forest	5.37
	8	Forest land	Forests and semi-natural areas	Forests	Forest plantation	Non-forest	2,186.81
Total							**9,597.86**

- Accuracy of the classification

The accuracy of the digitization-based classification for the years 2006 and 2012 was validated through a confusion matrix with commission (pixels classified as a land cover they are not part of) and omission (pixels that correspond to a land cover class but were not classified as being part of it) errors, which results in a percentage of the overall accuracy of the classification, comparing the classification obtained with randomly distributed control points.

With 295 polygons in total for the forest and non-forest layers of 2006 and 2012, and based on the Morillas (2007) methodology, 168 points were randomly created for the assessment of the classification accuracy. The results are presented below:

Table 64: Classification accuracy values

Year	Class	Non-forest	Forest	Total	User Accuracy
2006	**Non-forest**	162	3	165	98,18%
	Forest	0	3	3	100,00%
	Total	162	6	168	-
	Producer accuracy	100.00%	50,00%	-	**98,21%**
2012	**Class**	**Non-forest**	**Forest**	**Total**	**User accuracy**
	Non-forest	164	2	166	98,80%
	Forest	1	1	2	50,00%
	Total	165	3	168	-
	Producer accuracy	99.39%	33,33%	-	**98,21%**

(Source: South Pole, 2022)

- Exclusion areas

The exclusion areas are those that cannot be intervened by the project activities given their environmental fragility, social issues, legal status, sensitivity, vulnerability and particular areas, reasons why they must be protected or otherwise be subject to special management measures at the time the activities start. These areas are categorized as non-eligible.

Tabla 65: Excluded areas

Variable	Year	Source	Comment
Other climate change mitigation projects in the project area	-	CDM[249]	
Jaguey	-	Project holder	
Project's REDD component	-	Project holder	
Easement	-	Project holder	
Roads	-	Project holder	
Double drain	2017	IGAC	30 m buffer
Simple drain	2017	IGAC	30 m buffer
Ecosystems	2018	IDEAM	Type of aquatic ecosystem

*In the project area there are no protected areas registered in the RUNAP, nor Ramsar wetlands.

(Source: South Pole, based on information from the sources)

[249] Areas of the CDM's Forestry Project in Strategic Ecological Areas of the Colombian Caribbean Savannas Project were excluded. Available at: https://cdm.unfccc.int/Projects/DB/TUEV-SUED1300299280.25/view

- Eligibility analysis

Using the land cover layers for the years 2006 and 2012, the forest and non-forest categories are defined as follows:

Table 66: Eligibility criteria

2006 Layer	2012 Layer	Change	Eligibility
Forest	Forest	Stable forest	Non-eligible
Forest	Non-forest	Deforestation	Non-eligible
Non-forest	Forest	Regeneration	Non-eligible
Non-forest	Non-forest	Non-forest	Eligible

(Source: South Pole, 2022)

Table 67: Results of the eligibility analysis of the areas of the GHG Removal Activities component

Classification	BCR Standard	Percentage (%)
Eligible	8,861.64	92.33%
Non-eligible	736.22	7.67%
Total	9,597.86	100.00%

(Source: South Pole based on satellite images and information from SMBYC, 2022)

According to the table above, 8,861.64 ha are eligible to apply to the BCR Standard (Figure 40).

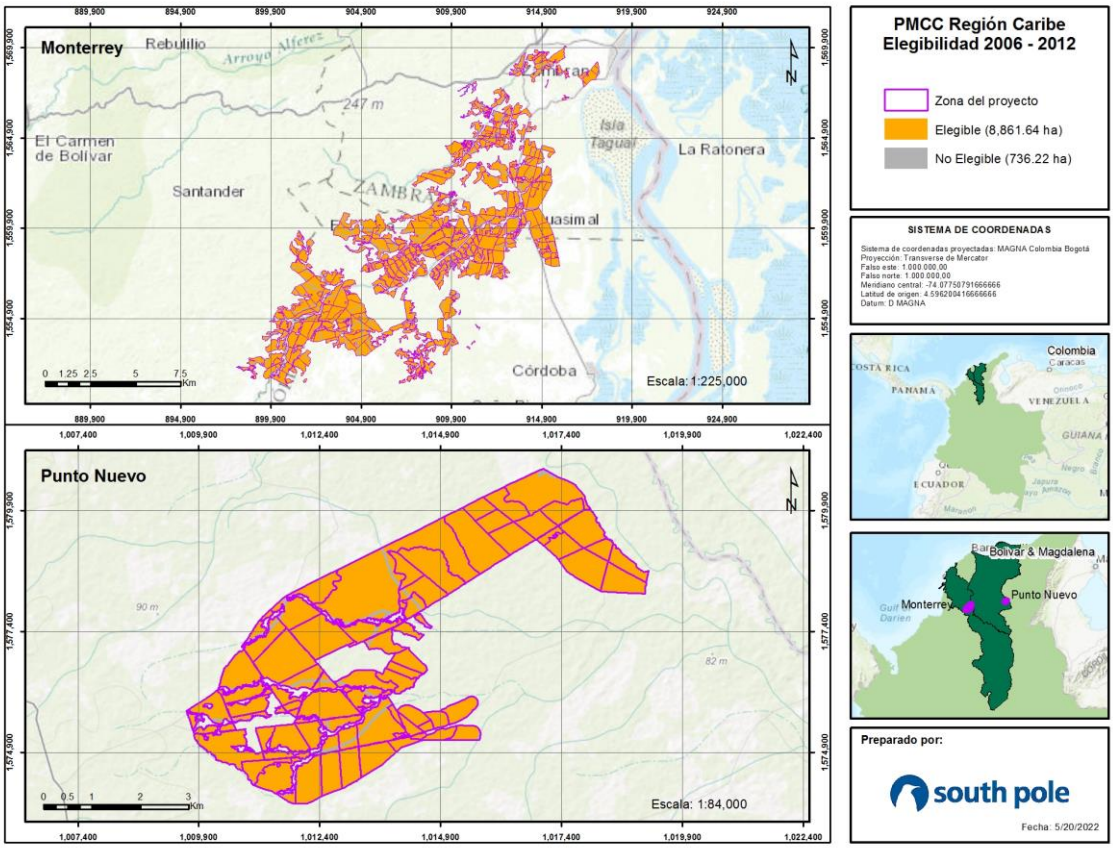


Figure 40: Eligibility map of the GHG Removal Activities component according to the BCR standard

(Source: South Pole based on the SMBYC, 2022)

The methodology for the selection of the analysis layers and the cartographic cross-checks, among other procedures, can be found in the eligibility documents[250], where the analyzes are presented separately for the areas applying to the BCR Standard[251].

5.1.2 Temporal limits

5.1.2.1 Quantification and monitoring periods

Table 68: Start date, monitoring periods and end date

Initiative type	Start date	End date	Monitoring period
GHG removal activities	March 29, 2012	June 21, 2032	June 1, 2012 – December 31, 2021

(Source: South Pole, based on information from FMC, 2022)

[250] The eligibility analysis for the GHG Removal Activities initiative is available at: Gestión de la información\Cartografía\Elegibilidad.

[251] The start date was taken into account in accordance with Section 10.4 :Start date of the BCR Standard.

5.2 Activities of the GHG Removal component

Table 69: Monitoring of GHG removal activities

Concept	Compliance
Verification of soil preparation, site selection and other silvicultural activities carried out in accordance with the forest establishment and management plans and the Project Document.	All silvicultural activities were implemented in alignment with the Forest Management Plan[252], which is described in Section 3.2.1.
• **Planted areas will be monitored at each verification event.** • **The survival of the plantations and the changes in the validated areas will be monitored in each verification event.**	See Section 5.2.2: Monitoring of GHG removal activities within project boundaries.

(Source: South Pole, based on information from Biocarbon Registry, 2022)

5.2.1 Monitoring of project activities implementation

In Annex 12: Parameters available for the validation and verification of the GHG Removal Activities initiative[253], a description of all the parameters and their application is included. The following is a summary of some variables taken into account for project monitoring.

Tabla 70: Monitoring of project activities implementation

Variable	Unit of measurement	Measured (m), calculated (c), estimated (e) or default (d)	Recording frequency	Coverage/Other measures or number of data collected	Observations
Stratum name (Ai)	Alphanumeric	Defined according to the project center, the species and the year of planting.	Prior to each verification report.	100%	Each established stratum and crop is associated with an alphanumeric identifier.
Localization	Geographic coordinates (Latitude/Longitude)	Measured 77 plots	Prior to each verification report.	100%	Measurement by Global Position System (GPS). By means of a cartographic software (QGIS 3.14.16), it was verified that the coordinates of the plots were within the project area.[254]
Ai	Hectares	Calculated	Prior to each verification report.	100%	Polygons of the planted areas, according to the strata definition. Each stratum was defined taking into account the project center,

[252] Gestión de la información\Actividad_Remocion_GEI\PEMF.
[253] Gestión de la información\Secciones Anexas\Anexo 12_Parámetros_ActividadesRemocion.
[254] The shapefile document with the plot coordinates is available at: Gestión de la información\Monitoreo\Coord_Parcelas.

Variable	Unit of measurement	Measured (m), calculated (c), estimated (e) or default (d)	Recording frequency	Coverage/Other measures or number of data collected	Observations
					the species and the year of planting.
Site preparation	Hectare	Measured	At the beginning of each establishment.	100% of the planted areas.	Intervened area for forest crop establishment.
Planted species for each stratum	NA	Defined. The species *Gmelina arborea* y *Pachira quinata* were planted.	Prior to each verification report.	100% of the planted areas.	Species planted by each stratum within the project boundaries.
Survival	Trees ha^{-1}	Measured and calculated	Between 30 and 40 days after being planted.	100% of the planted area.	
Planting date	Alphanumeric	Measured	Start date of each establishment.	100%	Date of planting date of each stand.[255]

(Source: South Pole, based on FMC's information, following the guidelines of the GHG Removal Activities Methodological Document, 2022)

Forest plantation establishment (Table 71), maintenance, and silvicultural activities were carried out taking into account the indications described in the 2020-2024 Forest Management Plan[256].

Table 71: Planting plan for GHG removal activities

Center	Species	Establishment Date	Area
Monterrey	GA	06/01/2012	64.17
Monterrey	GA	06/01/2013	170.17
Monterrey	GA	06/01/2014	253.00
Monterrey	GA	06/01/2015	150.29
Monterrey	GA	06/01/2016	570.65
Monterrey	GA	06/21/2017	43.52
Monterrey	PQ	06/01/2015	67.79
Monterrey	PQ	08/26/2016	90.26
Total			**2,016.75**

*GA: *Gmelina arborea*; PQ: *Pachira quinata*

(Source: South Pole based on information from FMC, 2021)

[255] The planting date of each stand can be found at: Gestión de la información\Estimaciones.
[256] Available at: Gestión de la información\Actividad_Remocion_GEI\PEMF.

5.2.2 Monitoring of GHG removal activities within project boundaries

The eligible area of the project for the GHG Removal Activities component is 8,861.64 ha, as presented in Table 72 below.

Table 72: Monitoring within the project boundaries for the GHG Removal Activities component according to eligibility

Project boundary	BCR Standard
Eligible area[257]	8,861.64
Gmelina arborea	1,567.17
Pachira quinata	449.59
Total area to be monitored	**2,016.75**

(Source: South Pole, 2022)

As shown in the table above, of the 8,861.64 eligible hectares of the project 2,016.75 will be verified in the first monitoring period (22.8%).

In accordance with Section 16.1: Monitoring of the project boundaries of the GHG Removal Activities Methodological Document, periodic verification of the project boundaries must be carried out by evaluating satellite images, consistent with the eligibility analysis of the areas in the project. The results are presented below:

Table 73: Monitoring within the project boundaries for the GHG Removal Activities component

Plantations	Analysis
Plantations established between 2016 and 2017	The *Gmelina arborea* and *Pachira quinata* plantations were validated by means of satellite images from the multispectral image archive of the Google Earth, Microsoft Bing Maps and Esri Basemap platforms, which contain GeoEye image mosaics of the project area between December 2020 and April 2021, with a spatial resolution of 1 m that allows for visualizing in greater detail if a lot has been planted or not on a visual scale of 1:5,000[258].
Plantations established between 2012 and 2015	Between the months of March and December 2022, according to the review of images and considering the strong spectral response of the soil (which generated a greater margin of uncertainty about the detection of land use dynamics) it was not possible to perform a detailed analysis on the plantation. However, in a qualitative way, it can be evidenced that the analyzed area corresponds to forest plantations. The sites with the greatest uncertainty were verified by carrying out a field tour[259].

(Source: South Pole, 2022)

5.2.3 Monitoring of crop management and biomass growth

a) Permanence and growth

FMC annually monitors 100% of the plantations, including the areas outside the Caribbean Region CCMP. For the monitoring, high quality standards are put in place to apply the 500 m^2 circular plot methodology, which consists of distributing the plots systematically over the area of

[257] The complete eligibility analysis is detailed in Section 5.1.2: Temporal limits.
[258] Analysis results can be checked at: Gestión de la información\Cartografía\Área verificación\Plantaciones2017-2018\Análisis_Verificacion.
[259] Analysis results can be checked at: Gestión de la información\Cartografía\Área verificación\Plantaciones2012-2015\Analisis_Verificacion.

each stand, with an average sampling intensity of 3.4%. Next, the dendrometric and quality data of the trees in the sample plots are taken to estimate current commercial volumes and feed the databases for the company's future stock projections. The first inventory of the plantation's rotation is carried out in the third year.

In the case of GHG removals monitoring, permanent plots are established and monitored prior to each verification (see Section 5.2.3.1: Stratification and field sampling design of GHG removal activities).

b) Disturbance events

In the forest plantations that are part of the Caribbean Region CCMP, the following disturbance events have occurred:

- Fires: 0.65 ha of the eligible areas were affected by fires in January 2013, particularly the Carreto lot, which did not have a planted area that year[260].
- Pests and diseases: In the 2012-2020 period, the forest plantations of the project have not been affected by pests or diseases that put carbon stocks at risk. However, in 2020, the dieback of some isolated individuals was identified during the dry season. In consequence, the corrective measure taken was a destructive sampling; next, samples were sent to the ICA laboratory to evaluate the possible disease outbreak.

Figure 41: Destructive sampling to assess damage caused by dieback

(Source: FMC, 2020)

In the results of the ICA analysis, it was suggested that the dieback could have been caused by a soil pathogen or abiotic climatological factors, especially water deficit. The recommendations focused on monitoring natural or pruning-caused wounds and developing silvicultural activities in accordance with the management plan[261].

It should be noted that this event was unusual, as determined by the ICA evaluator, and its occurrence affected only a few individuals, so no changes in carbon stocks were generated. The study included 106.2 hectares of the *Gmelina arborea* species established in 2016 (corresponding to 1.2% of the project area and 5.3% of the area to be verified).

As an additional measure to counteract the effects of drought on the planted species, FMC has been working on the selection of genetic material resistant to prolonged droughts. To date, the project holder has 20 clonal selections with these characteristics (which are stored in a clonal bank located in the nursery area) (Figure 42) and has performed some tests to assess their performance. Additionally, an adaptation measure has been defined: scheduling new plantations based on the likelihood of occurrence of the El Niño phenomenon in the planting year. In other

[260] The Carreto lot was established on June 1, 2015.
[261] Gestión de la información\Actividad_Remocion_GEI\ControlFito.

words, if in September of a given year, the El Niño prediction models show a probability of occurrence greater than 60% in the first quarter of the coming year, planting is ruled out. In this way, the implementation of climate change adaptation measures is demonstrated in order to guarantee the permanence of the project beyond the quantification period.

Figure 42: Genetic material selected due to its resistance to drought

(Source: South Pole, 2022)

5.2.3.1 Stratification and field sampling design of GHG removal activities

5.2.3.1.1 Stratification

In accordance with Section 13 of the GHG Removal Activities Methodological Document, stratification in the project scenario shall be based on crop establishment plans. Taking this into account, the stratification for the Caribbean Region CCMP project was based on the establishment plans, considering the project center, the species and the planting year. The description of each stratum is presented in Table 76.

5.2.3.1.2 Sample plots, sample unit size and sample size

75 plots were established[262] (see Figure 43) through a stratified random sampling. Based on them, the volume contents were obtained to estimate the carbon of the aboveground and belowground biomass.

[262] 36 plots of 250 m^2 and 39 of 500 m^2.

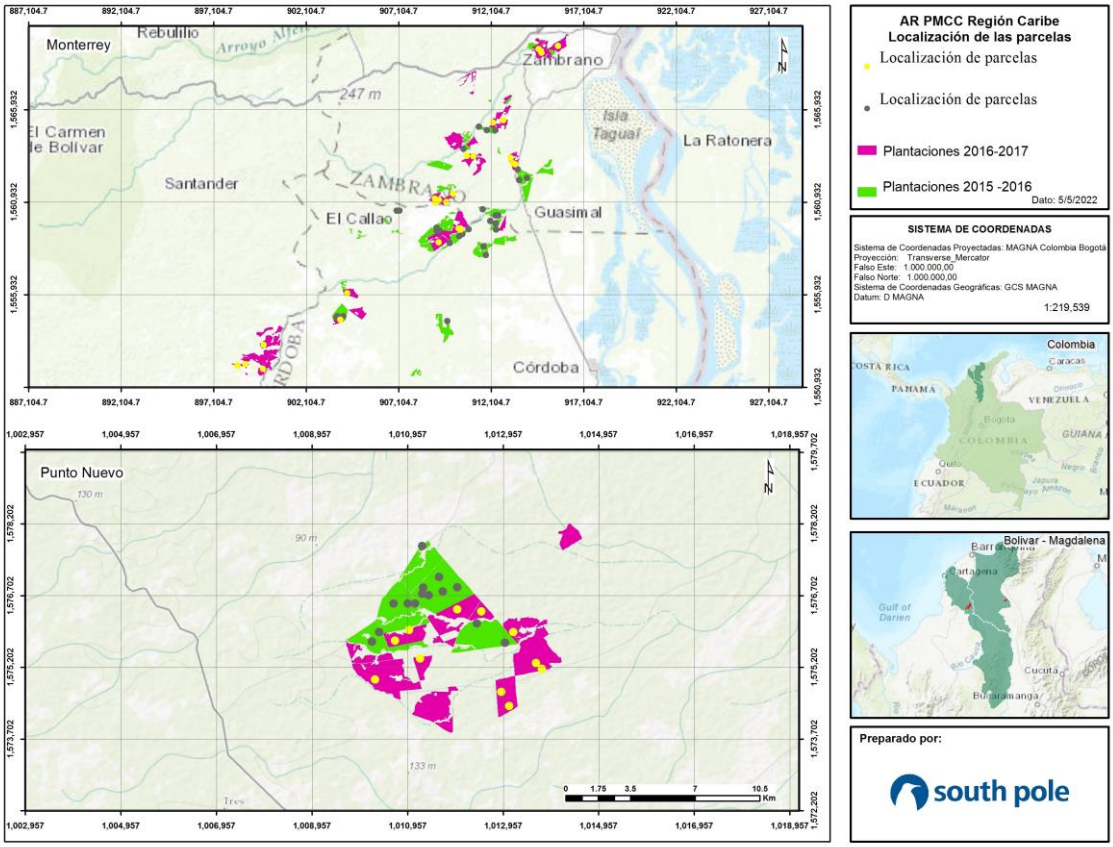


Figure 43: Location of plots assigned for GHG removal activities

(Source: South Pole, based on information from FMC, 2022)

5.2.3.1.3 Calculation of the number of plots and location of plots

The number of plots required to measure the variance between the project limits and strata were estimated using the *A/R Methodological Tool for Calculation of the number of sample plots for measurements within A/R CDM project activities, V 02.1. 0*. The equation used was:

$$n = \frac{N * t_{VAL}^2 * (\sum_i w_i * S_i)^2}{N * E^2 + t_{VAL}^2 * \sum_i w_i * S_i^2}$$

Where:

n Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless.

N Total number of possible sample plots within the project boundary (i.e., the sampling space or the population); dimensionless.

t_{VAL}^2 Two-sided Student's *t*-value, at infinite degrees of freedom, for the required confidence level; dimensionless.

wi Relative weight of the area of stratum *i* with respect to the total area of the project boundary (i.e., the area of the stratum *i* divided by the project area); dimensionless.

s_i Estimated standard deviation of biomass stock in stratum *i*; t d.m. (or t d.m. ha^{-1}).

E^2 Acceptable margin of error in estimation of biomass stock within the project boundary; t d.m. (or t d.m. ha^{-1}).

i *1, 2, 3*, … biomass stock estimation strata within the project boundary.

The number of plots allocated by stratum was determined with the following equation:

$$n_i = n * \frac{wi * s_i}{\sum_{i=1}^{I} wi * s_i}$$

Where:

n_i Number of sample plots allocated to stratum *i*; dimensionless.

n Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless.

wi Relative weight of the area of stratum *i* (i.e., the area of the stratum *i* divided by the project area); dimensionless.

s_i Estimated standard deviation of biomass stock in stratum *i*; t d.m. (or t d.m. ha^{-1}).

i *1, 2, 3,* … biomass stock estimation strata within the project boundary.

Pursuant to the above, the number of plots by type of GHG removal project was selected as follows[263]:

Table 74: Number of plots allocated for GHG removal activities

Plantations	Methodology
Plantations established between 2016 and 2017	After estimating the number of plots required by stratum, these were spatially located in a random and systematic stratified manner, using the Create Random Points tool of the Arcgis 10.3 software and Regular Points. The selection of this sample is aimed at controlling the effect of the variance on the estimates, which is generated by the type of species, location and planting dates. 35 permanent random plots of 250 m^2 were established by carrying out a stratified random sampling.
Plantations established between 2012 and 2015	Having the systematic sampling performed by FMC to determine the volume of forest assets, 42 points were randomly selected from the points grid to be permanently marked. For this, the *"aleatorio.entre"* Excel tool was used, taking into account the number of estimated plots required by stratum. 42 permanent plots were established[264]: 1 plot of 250 m^2 [265] and 41 plots of 500 m^2 by stratified random sampling.

[263] Se puede encontrar el número de parcelas estimado en la ruta: Gestión de la información\Monitoreo\Error_muestreo.
[264] 35 parcelas que aplican para las plantaciones 2016 - 2017 y 42 Estándar para las plantaciones 2012 - 2015 certificación y registro de iniciativas voluntarios de mitigación de GEI
[265] La parcela se estableció de 250 m^2 debido a que se encuentra sobre el borde del rodal.

Plantations	Methodology
	19 plots were established in 2020 and 23 during 2021. These were selected in reference to the annual inventory plan that FMC has for guiding its forestry activity.

(Source: South Pole based on information from FMC, 2022)

Figure 44: Central point in *Pachira quinata* sample plots (plantations established in 2016 and 2017)

(Source: Gesamfor, 2021)

Figure 45: Central point in sample plots (plantations established beteween 2012 and 2015)

(Source: Ecologic, 2022)

5.2.3.1.4 Monitoring frequency

FMC carries out an annual sampling to assess the state of its forest plantations. However, the monitoring of permanent plots to determine the carbon contents is carried out prior to each verification event.

5.2.3.1.5 Measurement and estimation of changes in carbon contents

5.2.3.1.5.1 Plantations established between 2016-2017

Tree marking

For locating the plots in the field, Garmin-branded GPS navigation receivers of the reference 64s (approximation ± 3 meters) were used. Once the indicated point was located, it was marked with the GPS for its georeference, and a tube was stuck into the ground, in the central point of the plot, and labeled with the plot code (name + number) and the date of establishment of the plot[266].

To identify the trees within the plot, a line was drawn in a northerly orientation with a radius of 8.92 m. For this, a nylon rope was used, measuring the radius outwards from the central point of the plot in clockwise (at the beginning of each day, the engineer responsible for establishing the plots measured the nylon rope to ensure a constant length of 8.92 meters).

On the other hand, in order to determine if the trees found on the border of the plot should be considered to be part of it, the graph represented in Figure 46 was consulted.

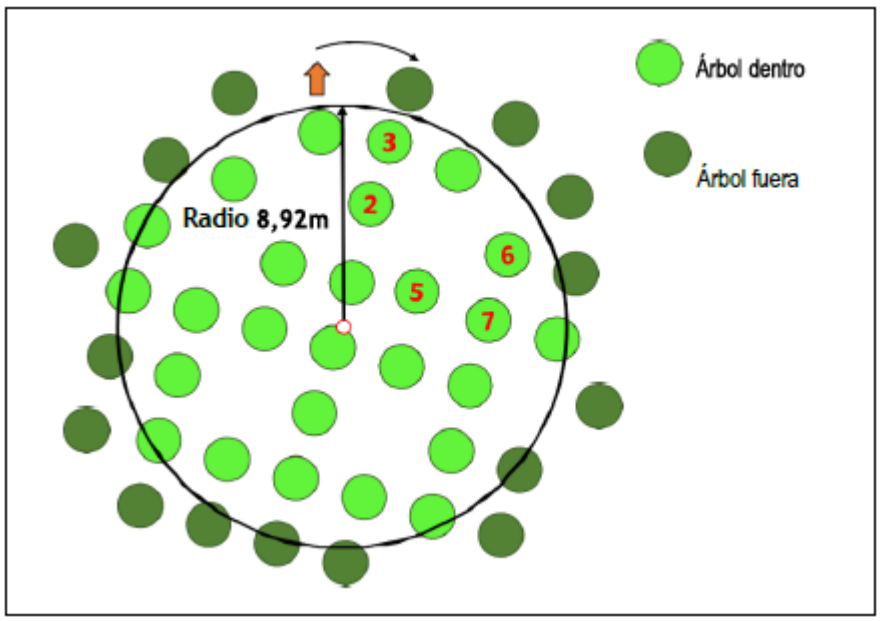


Figure 46: Plot boundaries for areas of plantations established in 2016-2017

(Source: South Pole, 2020)

All the trees within the plot were marked (alive, standing dead, and sprouts with a diameter of 4 cm or more at the time of marking), according to the following criteria:

- In *Pachira quinata* plantations where pruning had not yet been carried out and the trees had multiple stems or forks below 1.30 m in height, only the main stems were marked and measured, taking into account that minor branches or forks would be removed when pruning.
- In the *Gmelina arborea* stands, only trees that would not be thinned were marked and measured.

Trees were numbered within the parcel starting with the one closest to the center of the plot in a northerly direction and continuing throughout the entire plot in a clockwise direction. All living individuals had their diameter at breast height (DBH) marked using a pole with a height of 1.30 m above ground level. After marking and measuring the diameter, a horizontal band approximately 2 cm wide was painted around the diameter of the tree with enamel paint. On this mark the living

[266] The shapefile document with the plot coordinates is available at: Gestión de la información\Monitoreo\Coord_Parcelas.

trees were listed.

Figure 47: Marking and numbering of trees in stands of *Pachira quinata*

(Source: Gesamfor, 2021)

For standing dead trees, dasometric information was not collected nor were they numbered. Instead, they were marked with an (x) and included on the spreadsheet.

Measurement of dasometric variables in trees

Variables such as DBH and Total Tree Height (H) were measured. In addition, the following information was recorded:

- Species
- Establishment year
- Monitoring date
- Parcel number
- Location and area (m^2) of each plot
- Parcel number
- Observations related to the conditions. For example: forks.

(See forest inventory of plantations).[267]

Diameter at breast height (DBH): All numbered trees had their diameter measured at 1.30 m in height. Values were recorded in centimeters, with one decimal. The diameter measurements were always made in a perpendicular direction to the central axis of the stem, making sure that the measurement and marking points coincided exactly. Some special conditions considered when marking the diameter at breast height were:

- *Leaning trees:* The diameter for trees with leaning stems was marked perpendicular to the tree axis, with 1.3 m as the shortest distance above the ground, in parallel to the stem.
- *Forks:* When there are bifurcations below the height of the diameter, the branches are considered two separate trees and marked individually.

[267] Plot Protocol for Plantations 2016-2017: Gestión de la información\Monitoreo\Protocolo_parcelas.

- *Thickening:* When there was an abnormality in the stem at the height of the diameter (widening, tumor), the same was marked at the height immediately above.

Total height (h): In each plot, the height of 40% of the trees was measured. The instrument used was a Nikon Forestry Pro hypsometer and the values were recorded in meters.

All the information was recorded on printed forms[268] and later their data was transcribed into a digital database[269]. These forms also included general aspects of the plots and the project considered relevant by the responsible engineer.

5.2.3.1.5.2 Plantations established between 2012 and 2015

Inventory plots were considered, taking stock of the company's forest assets in order to prepare an analysis and projections of volumes and growth. In this inventory, 42 plots[270] were randomly selected, following the procedure described below:

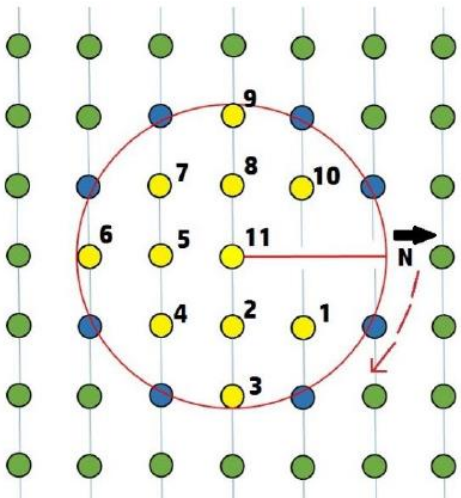
- The farms and/or stands to be measured were defined, based on the list of standing stands and their corresponding years of establishment.
- A stake was placed and marked, being later georeferenced in the GPS with the number assigned to the plot, which is found in the tabular data delivered to the contractor company.
- Taking the stake placed in the center as a reference point, a rope with a length of 12.6 meters was stretched out.
- Upon identifying the stake, the first operator tied a rope of the aforementioned length, turning clockwise and "enclosing" the trees that remained within the traced circumference. This is the area called plot.
- The crew chief qualitatively evaluated the abnormal conditions of the stand in each inventory plot as established in the form[271].
- Inside the plot, only the trees touched by the rope (i.e., from the end up to its central axis) were considered. These were painted with a serial number, starting at the northernmost point in a clockwise direction. In the cases where two trees were found on the same line, the lowest number was assigned to the tree closest to the center of the plot.
- 

Figure 48: Plot boundaries for stands of plantations established between 2012 and 2015

(Source: FMC, 2019)

[268] Information available at: Gestión de la información\Monitoreo\Protocolo_parcelas\Planillas_campo.
[269] BD sheet of the Estimaciones_actuales_PP file, located at: Gestión de la información\Estimaciones\RemociónGEI.
[270] From a grid of points, using the "aleatorio.entre" tool.
[271] The digital file is par ot the BD sheet of the Estimaciones_actuales_EVP file, which is available at: Gestión de la información\Estimaciones\RemociónGEI.

After the delimitation of the plot, the following aspects of the individuals were measured:

- *DBH*: All the living trees inside the plot, measured in centimeters, approximately 0.1 cm.
- *Total height* of 50% of the trees inside the plot, measured in meters, approximately 0.1 m.
- *Tree crown base height* of 50% of the trees inside the plot, measured in meters, approximately 0.1 m.
- The shape, straightness and quality attributes of all the trees within the plot.
- Each tree identified within the plot was marked with a line at the height of the measured DBH.

For the plots established in the year 2020, the inventory information was digitized by using a mobile application in the field, while for the plots established during the year 2021, the information was reported in field printed forms[272].

For greater detail, the procedure for plot establishment in plantations from 2012 to 2015 is available in SOP-BIO-001_Plantations Inventory[273].

5.2.3.2 Monitoring of the quantification of project removals

5.2.3.2.1 Sampling error and uncertainty

Sampling error

The Protocolo para la estimación nacional y subnacional de biomasa-carbono en Colombia (*Protocol for estimating biomass-carbon at the national and sub-national levels in Colombia*) by IDEAM was used.

$$S_y = \sqrt{\frac{\sum_{i=1}^{h} S^2}{n}}$$

$$E(\%) = \frac{t * S_y}{\overrightarrow{x}} * 100$$

Where:

E: Current sampling error.

n: Number of plots included in the sampling to estimate the biomass stock within the project boundary.

$\overrightarrow{x}$: Average value of the biomass stock estimated in the sampling.

t: t-student value, for infinite degrees of freedom and for the given degree of confidence.

$S^2{}_i$: Estimated variance of the biomass stock in stratum *i*.

S_y: Estimated standard error of the biomass stock in the stratum.

i: 1, 2, 3, … estimation stratum of the biomass stock within the project boundary.

The uncertainty and sampling error for the plantations that are part of the GHG Removal Activities component is presented in Table 75.

[272] The digital inventory of the plots established in 2020 by Ecologic is located in the folder: Gestión de la información\Monitoreo\Protocolo_parcelas\Planillas_campo. The printed field sheets of the plots filled in 2021 are digitized with the "Plant_2012-2015_Moni2021" file name and available in the folder: Gestión de la información\Monitoreo\Protocolo_parcelas\Planillas_campo.

[273] Protocolo_parcelas_2012-2015 is available at: Gestión de la información\Monitoreo\Protocolo_parcelas.

Uncertainty

To estimate the uncertainty, the A/R tool "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*" of the AR-ACM0003 methodology was used[274].

$$b_{TREE} = \sum_{i=1}^{M} w_i \times b_{TREE,i}$$

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

Where:

b_{TREE}	Mean tree biomass per hectare in the biomass estimation strata.
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 the tree biomass estimation strata; t d.m. ha^{-1}.
u_C	Uncertainty in the sampling (%).
t_{VAL}	Two-sided Student's *t*-value for a given confidence level and infinite degrees of freedom.
${s_i}^2$	Variance of mean biomass per hectare in stratum *i* (t d.m. ha^{-1})^2.
n_i	Number of sample plots in stratum *i*.

Table 75: Uncertainty results for GHG removal activities

Sampling error[275]	Uncertainty	Description
7.6%	7.5%	This indicates that the estimation of the carbon stocks stored by the project has low uncertainty since the values are below 10%.

***** For the estimation of the uncertainty and the sampling error, a confidence level of 95% was taken into account.

(Source: South Pole, 2022)

5.3 GHG removal by sinks

5.3.1 Uncertainty management

The GHG Removal Activities Methodological Document states that uncertainty management is determined by a guide for applying discounts for quality and applicability of the data and parameters used to estimate the GHG emissions' reduction or removal. This percentage is different and additional to the 15% reserve determined in Section 13.1: Reversal risk management of the BCR Standard[276].

According to Table 3. Quality discounts and applicability of GHG estimation models of the GHG Removal Activities Methodological Document, the discount factor (%) is zero, since GHG biomass (aboveground and belowground) data used for the estimation of GHG emissions removal come

[274] Tools are available online: https://cdm.unfccc.int/methodologies/DB/C9QS5G3CS8FW04MYYXDFOQDPXWM4OE
[275] The sampling error can be found in the folder: Gestión de la información\Monitoreo\Error_muestreo.
[276] In accordance with Section 13.1: Reversal risk management, once the GHG emission removals have been registered, a 15% discount over the total GHG removals quantified for each verified period will be held in a reserve account.

from the project's own equations, as presented in Section 5.3.4.1: Changes in carbon stocks in tree biomass.

Additionally, the data and parameters used to calculate the GHG emissions reduction or removal are consistent with the emission factors, activity data, GHG emission projection variables and the other parameters used for the construction of the national GHG inventory and the national reference scenario. However, when the discounts mentioned in Table 3 of the GHG Removal Activities Methodological Document are not applied, the uncertainty must be estimated in accordance with section 6.2 of the CDM *Methodological tool for Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities* as previously presented in Section 5.2.3.2.1: Sampling error and uncertainty. For this, a value of 7.6% was obtained.

5.3.2 Stratification

Table 76: Stratification for estimates of GHG removal activity sinks[277]

Center	Year	Species	Stratum	Area (ha)
Monterrey	2012	*Gmelina arborea*	Mon - GA - 2012	64.2
Monterrey	2013	*Gmelina arborea*	Mon - GA - 2013	170.2
Monterrey	2014	*Gmelina arborea*	Mon - GA - 2014	253.0
Monterrey	2015	*Gmelina arborea*	Mon - GA - 2015	150.3
Punto Nuevo	2015	*Gmelina arborea*	PtN - GA - 2015	105.4
Monterrey	2015	*Pachira quinata*	Mon - PQ - 2015	67.8
Punto Nuevo	2015	*Pachira quinata*	PtN - PQ - 2015	163.3
Monterrey	2016	*Gmelina arborea*	Mon - GA - 2016	570.6
Punto Nuevo	2016	*Gmelina arborea*	PtN - GA - 2016	210.0
Monterrey	2016	*Pachira quinata*	Mon - PQ - 2016	90.3
Punto Nuevo	2016	*Pachira quinata*	PtN - PQ - 2016	101.5
Monterrey	2017	*Gmelina arborea*	Mon - GA - 2017	43.5
Monterrey	2017	*Pachira quinata*	Mon - PQ - 2017	26.7
Total				**2,016.75**

(Source: South Pole, based on information provided by FMC, 2022)

5.3.3 GHG removal by sinks in the baseline scenario

The activities of Forestal Monterrey Colombia[278] began in 1981 with the first industrial project where the species of *Pinus caribaea* from Guatemala was established. The objective of the company was to supply Pizano S.A.'s production plant, located in Barranquilla. Before purchasing the property for the Monterrey project[279], the main land use was clean pastures for livestock, which covered 75% of the area[280].

[277] The shapelife document with the areas to be verified and their stratification are available at: Gestión de la información\Cartografía\Actividades de Remoción\Área verificación
[278] Monterrey Forestal was the company that began industrial activities in 1980. During 2014, the forestry assets became the property of Forestal Monterrey Colombia S.A.S.
[279] Monterrey was the name given to the center located in Zambrano.
[280] The remaining 25% was forest, according to the 1980 Activity Report. Available at: Gestión de la información\Actividad_Remocion_GEI\LineaBase.

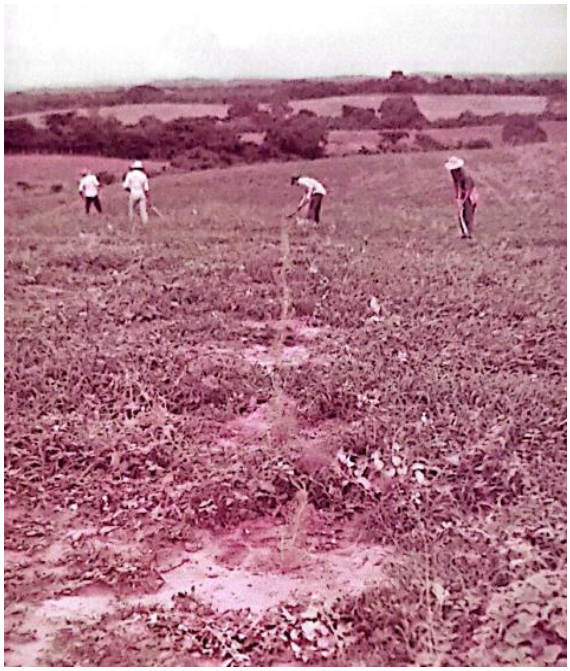


Figure 49: Site preparation (pastures)

(Source: Monterrey Forestal, 1980[281])

According to what is established in the Biocarbon Registry's GHG Removal Activities Methodological Document, the baseline carbon stock in trees can be accounted as zero if the following conditions are met:

(a) The pre-project trees are neither harvested, nor cleared, nor removed throughout the project horizon.

Before the establishment of the areas that are part of the verification process, there were forest plantations distributed in 28 stands[282]. These were harvested within the 5 years prior to the start date of the GHG removal activities as part of the silvicultural activities developed by FMC in the project area. Additionally, 39.1 ha were classified as shrub or secondary vegetation during the eligibility assessment[283].

Considering the above, **this criterion is not met.**

(b) The pre-project trees do not suffer mortality because of competition from trees planted by the project, or damage because of implementation of the project activity at any time during the project horizon.

The native trees present in the project area are not felled for the establishment of new stands and do not suffer mortality caused by silvicultural activities. In consequence, **this criterion is met.**

[281] Currently called Forestal Monterrey Colombia.
[282] The stands are described in the "LB" tab of the Estimaciones actuales_ARGEI spreadsheet, which is available at: Gestión de la información\Estimaciones\ARGEI
[283] This information is detailed in the "LB" tab of the Estimaciones actuales_ARGEI spreadsheet, which is available at: Gestión de la información\Estimaciones\ARGEI

Figure 50: Survival of native trees in a *Gmelina arborea* plantation

(Source: South Pole, 2021)

(c) The pre-project trees are not inventoried along with the project trees during carbon stocks monitoring (and quantification).

During of carbon stocks quantification, trees that are not part of the project activity are excluded[284]. Therefore, **this criterion is met**.

Taking into account that criteria in the paragraph a) is not met, **the baseline cannot be counted as zero**. Hence, the removals in the baseline scenario are calculated as follows:

$$\Delta C_{LB,t} = \Delta C_{ARB\_LB,t} + \Delta C_{ARBUST\_LB,t} + \Delta C_{MM\_LB,t} + \Delta C_{HOJ\_LB,t}$$

Where:

$\Delta C_{LB,t}$	GHG removals by sinks in the baseline scenario, in year *t*; tCO_2-e.
$\Delta C_{ARB\_LB,t}$	Changes in carbon stocks in tree biomass within the project boundary in year *t*, in the baseline scenario, estimated with the *Methodological tool for Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*; tCO_2-e.
$\Delta C_{ARBUST\_LB,t}$	Changes in carbon stocks in shrub biomass within the project boundary in year *t*, in the baseline scenario, estimated with the *Methodological tool for Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*; tCO_2-e.
$\Delta C_{MM\_LB,t}$	Changes in carbon stocks in dead wood within project boundary in year *t*, estimated using the *A/R Methodological tool for Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*; tCO_2-e.
$\Delta C_{HOJ\_LB,t}$	Changes in carbon stocks in litter within project boundary in year *t*, estimated using the *A/R Methodological tool for Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*; tCO_2-e.

The forest plantations in the project baseline consist of *Gmelina arborea, Pachira quinata* and *Eucalyptus sp* species. $\Delta C_{ARB\_LB,t}$ is **nonzero**.

[284] The forest inventory database is included in the "BD" tab of the Estimaciones actuales_ARGEI spreadheet at: Gestión de la información\Estimaciones\ARGEI.

Considering the use of forest plantations and the existing secondary and shrubby vegetation, these stocks are accounted for. Carbon stocks in dead wood and litter are maintained at the plantation site, which is why these are considered **zero**.

$$\Delta C_{MM\_LB,t} = 0$$

$$\Delta C_{HOJ\_LB,t} = 0$$

Due to the above:

$$\Delta C_{LB,t} = \Delta C_{ARB\_LB,t} + \Delta C_{ARBUST\_LB,t}$$

It is important to highlight that the final destination of the harvested wood in the 28 stands was the production of chipboard and plywood by the company Pizano S.A.[285,286], which had a contract with the project holder for the supply of harvested and standing wood[287]. Bearing in mind that carbon is stored in long-lasting timber products and that, depending on the species, a percentage[288] of the trunk is destined to produce chipboard and plywood, the tree carbon to be discounted from the baseline is estimated based on the percentage of the tree that is lost due to the forest activities[289,290]. The leaves and branches that remain after logging are burned for site preparation[291] and left on the ground in order to add nutrients to the soil and prevent fires.

For the estimation of carbon of trees and shrubs[292] within the category of shrubby and secondary transitional vegetation, the tropical dry forest carbon estimated for Colombia was taken into account according to Philips, et al (2010)[293].

Table 77: Tree carbon in the baseline scenario

Stratum	Stratum area (ha)	C_{ARB_LB} (tCO_2e)[294]
Mon - GA - 2012	64.17	4,433.00
Mon - GA - 2013	170.17	445.00
Mon - GA - 2014	253.00	496.00
Mon - GA - 2015	150.29	208.00
PtN - GA - 2015	105.40	-
Mon - PQ - 2015	67.79	-
PtN - PQ - 2015	163.34	-
Mon - GA - 2016	570.65	18,626.00
PtN - GA - 2016	209.97	2,925.00

[285] Pizano S.A. was a company dedicated to the manufacture of wood veneer sheets (plywood, laminated, particle boards and other panels). Information available at: https://www.lasempresas.com.co/barranquilla/pizano-sa-en-reestructuracion/
[286] In 2018 it was judicially liquidated. Information available at: https://www.supersociedades.gov.co/delegatura_insolvencia/consulta_jurisprudencia/Jurisprudencia/2018-01-275879.PDF
[287] Information available at: Gestión de la información\Actividad_Remocion_GEI\LineaBase\Contrato_Pizano_Intro_Final.
[288] *Gmelina arborea*: 40%, *Pachira quinata*: 45%, *Eucalyptus* sp: 30 – 40%.
[289] Moya-Roque, R., Muñoz-Acosta, F., Salas-Garita, C., Berrocal-Jiménez, A., Leandro, L. & Esquivel-Segura, E. (2010). Tecnología de madera de plantaciones forestales: Fichas técnicas. *Revista Forestal Mesoamericana Kurú 7*(18-19). www.tec.ac.cr/revistaforestal.
[290] Baseline estimates can be found at: Gestión de la información\Estimaciones.
[291] Emissions from crop residue burning for site preparation are considered. See Section 5.3.4.4 Non-CO2 GHG emissions.
[292] Baseline estimates can be found at: Gestión de la información\Estimaciones.
[293] Phillips J.F., Duque A.J., Yepes A.P., Cabrera K.R., García M.C., Navarrete D.A., Álvarez E., Cárdenas D. 2011. Estimación de las reservas actuales (2010) de carbono almacenadas en la biomasa aérea en bosques naturales de Colombia. Estratificación, alometría y métodos analíticos. Institute of Hydrology, Meteorology, and Environmental Studies -IDEAM. Bogotá D.C., Colombia. 68 pp.
[294] The previous cover of the strata were clean pastures. Therefore, their baseline discount is zero.

Stratum	Stratum area (ha)	C_{ARB_LB} (tCO_2e)[294]
Mon - PQ - 2016	90.26	5,900.00
PtN - PQ - 2016	101.54	-
Mon - GA - 2017	43.52	2,144.00
Mon - PQ - 2017	26.67	1,648.00
Total	**2,016.75**	**36,825.00**

*Mon: Monterrey center; PtN: Punto Nuevo center

(Source: South Pole, 2022)

5.3.4 GHG removals by sinks

The actual net GHG removals by carbon sinks are estimated for the entire area of the plantation, in accordance with Section 15.2 of the GHG Removal Activities Methodological Document:

$$\Delta C_{ACTUAL,t} = \Delta C_t - GEI_{E,t}$$

Where:

$\Delta C_{ACTUAL,t}$	Actual net GHG removals by sinks, in year *t*; tCO_2-e.
ΔC_t	Change in the carbon stocks in project, occurring in the selected pools, in year *t*; tCO_2-e.
$GEI_{E,t}$	Increase in non-CO_2 GHG emissions within the project boundary as a result of the implementation of project activities, in year *t*; tCO_2-e[295].

Change in the carbon stocks in project, occurring in the selected carbon pools in year *t* shall be calculated as follows:

$$\Delta C_{P,t} = \Delta C_{ARB\_PROY,t} + \Delta C_{ARBUST\_PROY,t} + \Delta C_{MM\_PROY,t} + \Delta C_{HOJ\_PROY,t} + \Delta COS_{A,t}$$

Where:

$\Delta C_{P,t}$	Change in the carbon stocks in project, occurring in the selected pools, in year *t*; tCO_2-e.
$\Delta C_{ARB\_PROY,t}$	Change in carbon stock in tree biomass in year *t*, as estimated in the tool *Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*; tCO_2-e.
$\Delta C_{ARBUST\_PROY,t}$	Change in carbon stock in shrub biomass in project year t, as estimated in the tool *Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*; tCO_2-e.
$\Delta C_{MM\_PROY,t}$	Change in carbon stock in dead wood in project in year *t*, as estimated in the tool *Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*; tCO_2-e.

[295] Calculated with the tool *Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity*; t CO_2-e.

$\Delta C_{HOJ\_PROY,t}$ Change in carbon stocks in litter in project in year *t*, as estimated in the tool *Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*; tCO_2-e.

$\Delta COS_{A,t}$ Change in soil organic carbon, in year *t*, in the areas of land meeting the applicability conditions of the *Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*, as estimated in the same tool; tCO_2-e.

5.3.4.1 Changes in carbon stocks in tree biomass

5.3.4.1.1 Estimation of actual GHG removals in the 2012-2021 monitoring period

Methodological description

According to the tool *Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities* of the AR-ACM0003 methodology, cited in the GHG Removal Activities Methodological Document, the biomass in the plantations was estimated based on allometric equations and monitored growth data as follows:

$$B_{ARB,j,i,t} = V_{ARB,j,i,t} \times D_j \times FEB_j \times (1 + R_j)$$

Where:

$B_{ARB,j,i,t}$ Tree biomass of species *j* in stratum *i* in year *t* per ha; t of dry matter.

$V_{ARB,j,i,t}$ Stem volume of trees of species *j*, at a point in time in year *t*, estimated by using the tree dimension(s) as entering data into a volume table or volume equation; m^3/ha.

Dj Basic wood density of tree species *j*; t d m/m^3.

FEB_j Biomass expansion factor for conversion of stem biomass to aboveground biomass, for tree species *j*; dimensionless.

R_j The root-aboveground biomass ratio for species *j*; dimensionless.

The estimation of carbon in trees from the previously calculated biomass was performed using the following equation:

$$C_{ARB} = \frac{44}{12} \, x \, CF_{ARB} \, x \, B_{ARB,j,i,t}$$

Where:

C_{ARB} Carbon stock in tree biomass (tCO2e) per ha.

CF_{ARB} Carbon fraction of tree biomass (tC/t.d.m.[296]).

$B_{ARB,j,i,t}$ Tree biomass of species *j*, in stratum *i* in year *t*; t of dry matter.

And,

$$C_{ARB,j,i,t} = A \, x \, C_{ARB,j,i,t}$$

Where:

[296] t.d.m. stands for tons of dry matter.

$C_{ARB,j,i,t}$ Total carbon stock in tree biomass (tCO_2e) by stratum.

A Strata area (ha).

$C_{ARB,j,i,t}$ Carbon stock in tree biomass (tCO_2e) per ha.

Tree biomass estimation

The total biomass accumulated by the individuals sampled in each of the plots was estimated following the guidelines of the *AR Tool 14. Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities. Version 4.2 AR Tool 14. Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities. Version 4.2*, specifically in paragraph 12 of the stock change method. The allometric equations presented below were later converted to aboveground biomass by using expansion factors.

Table 78: Equations used to estimate tree biomass

Species	Model	Variables	R	Source
Gmelina arborea	h=21,1059/(1+exp(-(x-3,2495)/3,691)	h: Total height (m). x: Age.	R2: 0.7977	Obando, 2004; MADR, 2011[297]
Gmelina arborea	$Vcc=0,00006543646*Dg^{1,791673}*h^{0,996855}$	Vcc: Volume with bark (m^3). Dg: Diameter at breast height (cm). h: Total height (m).		Forestal Monterrey Ltda., 2004[298].
Pachira quinata	$V=-0,218967+0,0206983(DBH)$	V: Wood volume (m^3). DBH: Diameter at breast height (cm).	R2: 0.93	Obando, 2004; MADR 2011[299].

(Source: South Pole, based on sources cited in the table, 2022)

The volume per individual was extrapolated to volume per ha and, subsequently, multiplied by the biomass conversion and expansion factor from the *2006 Guidelines for National Greenhouse Gas Inventories* (IPCC) in order to obtain the aboveground biomass per hectare in each stratum. It is important to highlight that this factor already includes the species density, so it is not necessary to carry out further calculations to obtain this value.

On the other hand, data and parameters used to calculate GHG emissions removal are consistent with the emission factors used to feed the national GHG inventory. For this reason, the $BCEF_S$ values for the expansion of the growing volume to aboveground biomass from the IPCC 2006 were used, considering paragraph 3 of Article 3 of Decree 0831:

- All methodologies developed by GHG certification programs or carbon standards or by national entities must have mechanisms to ensure and demonstrate the methodological consistency of sectoral projects using emission factors, variable activity data for GHG emissions projection and other parameters included for the construction of the national

[297] South Pole. (2022). *Modelo estimado con información de la plantación*. Available at: Gestión de la información\Estimaciones\220326_Estimaciones actuales_Coltax\Pestaña-DAP-H.
[298] Obando (2004). *Estudio de crecimiento de Gmelina arborea y Pachira quinata en los departamentos de Bolívar, Magdalena y Cesar*. Cited in the Directrices para la selección de ecuaciones, parámetros y datos para calcular las remociones de GEI de actividades forestales – Proclima, 2020.
[299] Obando (2004). Cited in the Directrices para la selección de ecuaciones, parámetros y datos para calcular las remociones de GEI de actividades forestales – Proclima, 2020.

GHG inventory and the national reference scenario, in compliance with MRV principles[300] and the technical concept[301].

- IDEAM, which has the function of preparing the Colombian INGEI (National Inventory of Greenhouse Gas Emissions and Absorptions), has used the default emission factors of the 2006 IPCC Guidelines, based on the specific conditions of the country[302].

Tabla 79: Biomass conversion and expansion factor

Volume stocks (m^3)	Biomass conversion and expansion factor (t/m^3) - BECFs Broadleaf (Lower limit)
<10	4
11 - 20	2,5
21 - 40	1,4
41 - 60	1,2
61 - 80	1,2
80 - 120	1
120 - 200	0,9
> 200	0,7

(Source: Guidelines for National Greenhouse Gas Inventories, IPCC, 2006)

Once the aboveground biomass per hectare and per stratum was calculated, the resulting value was multiplied by the Root-Aboveground Biomass ratio (Rj). The default values for each of the species were taken from the document *Directrices para la selección de ecuaciones, parámetros y datos para calcular las remociones de GEI de actividades forestales* of ProClima (version 1.1 of September 17, 2020). Based on this outcome, the total biomass (aboveground and root) per ha and per stratum was obtained.

Table 80: Root ratio

Parameter	Symbol	Value	Source
Root ratio	R_j	*Pachira quinata*: 0.329 *Gmelina arborea*: 0.201	Table 3. Relación Raíz: Biomasa aérea (Rj). *Directrices para la selección de ecuaciones, parámetros y datos para calcular las remociones de GEI de actividades forestales.*

(Source: South Pole, based on Biocarbon Registry, 2022)

Conversion of aboveground biomass to tCO_2e

Table 81: Parameters of the carbon fraction and conversion factor from C to CO_2e

Parameter	Symbol	Value	Source
Carbon fraction of tree biomass (tC/t.d.m.)	FC_j	*Pachira quinata*: 0.399 *Gmelina arborea*: 0.426	Table 4. Fracción de carbono (FCj) para especies forestales en Colombia. *Directrices para la selección de ecuaciones, parámetros y datos*

[300] MADS. (2020). Resolution 0831 of September 30, 2020.
[301] IDEAM. (2020). *Respuesta a consulta técnica para los proyectos forestales* – Oficio ICONTEC 01002200-CD9938.
[302] IDEAM. (2020). *Respuesta a consulta técnica para los proyectos forestales* – Oficio ICONTEC 01002200-CD9938.

Parameter	Symbol	Value	Source
			para calcular las remociones de GEI de actividades forestales.
Conversion factor from C to CO_2		3.667	2006 IPCC *Guidelines for National Greenhouse Gas Inventories*

(Source: South Pole, based on Biocarbon Registry, 2022)

Thus, the total tree biomass (aboveground and root) was multiplied by the carbon fraction of the tree biomass and by the conversion factor from C to CO_2, whose result was the carbon removed in the tree biomass (tCO_2e) per ha. This value was finally multiplied by the area of the stratum, obtaining the total carbon stock in the tree biomass (tCO_2e).

Tabla 82: Tree carbon

Stratum	Stratum area (ha)	C_{ARB} (tCO_2e)
Mon - GA - 2012	64.17	11,533.12
Mon - GA - 2013	170.17	28,492.08
Mon - GA - 2014	253.00	41,651.45
Mon - GA - 2015	150.29	26,812.41
PtN - GA - 2015	105.40	17,014.29
Mon - PQ - 2015	67.79	7,322.28
PtN - PQ - 2015	163.34	27,701.96
Mon - GA - 2016	570.65	74,002.78
PtN - GA - 2016	209.97	26,111.41
Mon - PQ - 2016	90.26	9,097.74
PtN - PQ - 2016	101.54	10,636.68
Mon - GA - 2017	43.52	4,322.57
Mon - PQ - 2017	26.67	2,655.86
Total	**2,016.75**	**287,354.63**

Mon: Monterrey center; PtN: Punto Nuevo center

(Source: South Pole, 2022)

5.3.4.2 Carbon in dead wood and litter

Carbon in dead wood and litter was calculated using the results of the study on radiation interception, biomass accumulation and distribution, and carbon content in *Gmelina arborea* Roxb and *Pachira quinata*, which was carried out in forest plantations located on the Monterrey and Punto Nuevo farms owned by the Forestal Monterrey company, and El Cerrejón owned by the farmer Donaldo del Toro, located in the municipalities of Zambrano (department of Bolívar), El Difícil de Ariguaní and Plato (department of Magdalena). Based on the results of the study (Obando, D, 2014)[303], the amount of carbon equivalent per hectare was averaged for coarse and

[303] Obando, D. (2004). *Interceptación de la radiación, acumulación y distribución de biomasa y contenido de carbono en Gmelina arborea Roxb y Pochota quinata (Jacq) Dugand*. [Undergraduate thesis, University of Tolima]. Faculty of Forest Engineering. Cited in Directrices para la selección de ecuaciones, parámetros y datos para calcular las remociones de GEI de actividades forestales – Proclima, 2020.

fine necromass and fine litter (Table 83) and the same value was applied to all strata according to the species

Table 83: Parameters for dead wood and litter

Parameter	Value	Description
$\Delta C_{MM\_LB,t} = 0$	*Gmelina arborea*: 1.12 $tCO_2e\ ha^{-1}$ *Pachira arborea*: 1.65 $tCO_2e\ ha^{-1}$	Value determined per hectare for the Monterrey, Punto Nuevo and El Cerrejón properties, owned by the company Forestal Monterrey Ltda., and the individual Donaldo del Toro, located in the municipalities of Zambrano (department of Bolívar), El Difícil de Ariguaní and Plato (department of Magdalena) (Obando, 2004[304]).
$\Delta C_{HOJ\_LB,t} = 0$	*Gmelina arborea*: 3.24 $tCO_2e\ ha^{-1}$ *Pachira arborea*: 2.92 $tCO_2e\ ha^{-1}$	

(Source: South Pole, based on Biocarbon Registry, 2022)

Based on the above:

Table 84: Estimation of carbon in dead wood and litter

Stratum	Stratum area (ha)	C_{HOJ} (tCO_2e)	C_{MM}(tCO_2e)
Mon - GA - 2012	64.17	207.87	71.84
Mon - GA - 2013	170.17	551.27	190.53
Mon - GA - 2014	253.00	819.59	283.26
Mon - GA - 2015	150.29	486.87	168.27
PtN - GA - 2015	105.40	341.45	118.01
Mon - PQ - 2015	67.79	198.14	111.65
PtN - PQ - 2015	163.34	477.43	269.02
Mon - GA - 2016	570.65	1,848.62	638.91
PtN - GA - 2016	209.97	680.20	235.09
Mon - PQ - 2016	90.26	263.82	148.65
PtN - PQ - 2016	101.54	296.79	167.23
Mon - GA - 2017	43.52	140.98	48.72
Mon - PQ - 2017	26.67	77.96	43.93
Total	**2,016.75**	**6,391.00**	**2,495.11**

(Source: South Pole, based on information from FMC, 2020)

5.3.4.3 Estimation of soil organic carbon (SOC)

Soil organic carbon (SOC) stocks are counted for stand models with species whose rotation period is greater than 20 years (*Pachira quinata*).

[304] Obando, D. (2004*). Interceptación de la radiación, acumulación y distribución de biomasa y contenido de carbono en Gmelina arborea Roxb y Pochota quinata (Jacq) Dugand*. [Undergraduate thesis, University of Tolima]. Faculty of Forest Engineering. Cited in Directrices para la selección de ecuaciones, parámetros y datos para calcular las remociones de GEI de actividades forestales – Proclima, 2020.

Soil organic carbon was calculated according to the procedure described in Section 15.2.3 of the GHG Removal Activities Methodological Document:

$$COS_{INICIAL,i} + COS_{REF,i} \times fLU_i \times fMG_i \times fIN_{IN,i}$$

Where:

$COS_{INICIAL,i}$	SOC stock at the beginning of the project activity in stratum *i* of the project areas; tC ha^{-1}.
$COS_{REF,i}$	Reference SOC stock corresponding to the reference condition with natural covers by climate region and soil type applicable to stratum *i* of the project areas; tC ha^{-1}.
fLU_i	Relative stock change factor for baseline land-use in stratum *i* of the land areas; dimensionless.
fMG_i	Reserve change factor, relative to the baseline management regime in stratum i, of the land areas; dimensionless.
$fIN_{IN,i}$	Relative stock change factor for the baseline input regime in stratum *i* of the land areas; dimensionless.
i	1, 2, 3, strata of land areas; dimensionless.

For COS estimation, the default values of $COS_{REF,i}$, $f_{LU,i}$, $f_{MG,i}$ and $f_{IN,i}$ were taken from tables 7 to 10 of the GHG Removal Activities Methodological Document since transparent and verifiable information could not be provided to justify the use of different values.

If soil disturbance occurs in an area greater than 10% of the stratum, in the baseline, the carbon loss is accounted as:

$$COS_{PERDIDA,i} = COS_{INICIAL,i} * 0{,}1$$

Where:

$COS_{PERDIDA,i}$	Loss of SOC caused by soil disturbance attributable to the project activity, in stratum *i* of the project areas in the project; tC ha^{1}.
$COS_{INICIAL,i}$	SOC stock at the beginning of the project activity, in stratum *i* of the project areas; tC ha^{-1}.
0,1	The approximate proportion of SOC loss during the first five years from site preparation.
i	1, 2, 3, … strata of project area; dimensionless.

The rate of change in SOC until SOC content reaches a steady state is estimated as follows[305]:

$$dCOS_{t,i} = \frac{COS_{REF,i} - (COS_{INICIAL,i} - COS_{PERDIDA,i})}{20\ años} \; for\ t_{PREP,i} < t < t_{PREP,i} + 20$$

[305] Equation taken from the CDM/AR Tool 16 of the ACM0003 methodology. Available at https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-16-v1.1.0.pdf.

Where:

$dCOS_{t,i}$	The rate of change in SOC stock in stratum *i* of the project areas, in year t; tC ha^{-1} yr^{-1}.
$COS_{REF,i}$	Reference SOC stock corresponding to the natural condition of soils with similar characteristics; tC ha^{-1}.
$COS_{INICIAL,i}$	SOC stock at the beginning of the project activity in stratum *i;* t C ha^{-1}.
$COS_{PERDIDA,i}$	Loss of SOC caused by soil disturbance attributable to the project activity in stratum *i* of the project areas; t C ha^{-1}.
$t_{PREP,i}$	The year in which the first soil disturbance takes place, in stratum *i* of year *t*.
i	1, 2, 3, ... strata of the project area.
t	1, 2, 3, ... years elapsed since the start of the project activity.

SOC stock change for all strata in the project areas, in year *t*, is calculated as:

$$\Delta COS_{AL,t} = \frac{44}{12} \times \sum A_i \times dCOS_{t,i} \times 1año$$

Where:

$\Delta COS_{AL,t}$	Change in SOC stock in the areas that meet the applicability conditions of the AR Tool16 of the AR-ACM 0003 methodology, in year *t*; tCO_2e.
A_i	The area of stratum *i*; ha.
$dCOS_{t,i}$	The rate of change in SOC stocks in stratum *i*; tC ha^{-1} yr^{-1}.
i	1, 2, 3, ... strata of the project area.

Table 85: Soil organic carbon

Stratum	Stratum Area (ha)	SOC (tCO_2e)[306]
Mon - GA - 2012	64.17	-
Mon - GA - 2013	170.17	-
Mon - GA - 2014	253.00	-
Mon - GA - 2015	150.29	-
PtN - GA - 2015	105.40	-
Mon - PQ - 2015	67.79	323.21
PtN - PQ - 2015	163.34	793.84
Mon - GA - 2016	570.65	-
PtN - GA - 2016	209.97	-

[306] SOC estimates are available at: Gestión de la información\Estimaciones\ARGEI

Stratum	Stratum Area (ha)	SOC (tCO_2e)[306]
Mon - PQ - 2016	90.26	364.28
PtN - PQ - 2016	101.54	412.01
Mon - GA - 2017	43.52	-
Mon - PQ - 2017	26.67	89.80
Total	**2,016.75**	**1,983.15**

(Source: South Pole, 2022)

5.3.4.4 Non-CO_2 GHG emissions

During site preparation, the resulting waste is piled up and 15 days later, controlled burning is carried out with the participation of the Fire Control Brigade. These burns comply with the provisions of Resolution 532/2005[307] "By means of which requirements, terms, conditions, and obligations are established for controlled open-field burning in agricultural and mining activities in rural areas" (MADS, 2005, p.1) and Resolution 1807 of 2018 issued by Cardique, which authorizes Forestal Monterrey Colombia to carry out controlled open-field burning of residual plant material produced by harvests (forest use) for soil incorporation and preparation in the farms or lots of its property (MADS, 2018)[308]..

To estimate the emissions resulting from biomass burning, the tool *A/R Methodological Tool for Estimation of non-CO_2 GHGs emissions resulting from burning of biomass attributable to an A/R CDM project activity (Version 04.0.0)* is used.

$$GHG_{E,T} = GHG_{SPF,T} + GHG_{FMF,T} + GHG_{FF,T}$$

Where:

$GHG_{E,T}$	Emission of non-CO_2 GHGs resulting from burning of biomass and forest fires within the project boundary in year *t*; t CO_2-e.
$GHG_{SPF,T}$	Emission of non-CO_2 GHGs resulting from use of fire in site preparation in year *t*; t CO_2-e
$GHG_{FMF,T}$	Emission of non-CO_2 GHGs resulting from use of fire to clear the land of harvest residue prior to replanting of the land or other forest management, in year *t*; t CO_2-e.
$GHG_{FF,T}$	Emission of non-CO_2 GHGs resulting from fire in year *t*; t CO_2-e.
t	1, 2, 3, … years counted from the start of the A/R CDM project activity[309].

Taking into account that FMC only performs controlled burning for crop residues prior to replanting, $GHG_{SPT,t}$ is considered **zero**. Additionally, according to the above-mentioned tool, for non-CO_2 GHG emissions resulting from tree loss due to natural or human-induced forest fires the first verification ($GHG_{FF,t}$) is considered **zero**[310].

$$GHG_{SPF,T} = 0$$

[307] Ministry of Environment, Housing Territorial Development. https://www.minvivienda.gov.co/normativa/resolucion-0532-2005

[308] Resolution 1807 of 2018 and the request for its extension are available at: Gestión de la información\General\Cumplim_legal.

[309] Afforestation/Reforestation.

[310] "*A/R Methodological Tool Estimation of non-CO2 GHGs emissions resulting from burning of biomass attributable to an A/R CDM project activity (Version 04.0.0)*".

$$GHG_{FF,T} = 0$$

This means that for the Caribbean Region CCMP:

$$GHG_{E,T} = GHG_{FMF,T}$$

Non-CO_2 GHG emissions resulting from the use of fire to clear the site of harvest residue prior to replanting of the land is estimated on the basis of the ratio of the biomass left at site to biomass harvested.

The non-CO_2 GHG emission resulting from the use of fire to clear land of harvest residue prior to replanting the land ($GHG_{FMF},t,$) is estimated as follows:

$$GHG_{FMF,t} = 0{,}07 \times \frac{44}{12} \times B_{HARVES,t} \times f_{BL} \times CF_{TREE}$$

Where:

$GHG_{FMF,t}$	Emission of non-CO_2 GHGs resulting from use of fire to clear the land of harvest residue prior to replanting of the land, in year *t*; t CO_2-e.
$B_{HARVES,t}$	Biomass harvested from area subjected to use of fire to clear the land of harvest residue prior to replanting of the land in year *t*; t d.m.
f_{BL}	The fraction of aboveground tree biomass out of total harvest left on-site; dimensionless. A value of 0.10 for temperate forest and 0.25 for tropical forest is used. These values of the parameter have been conservatively adapted from Table 3A.1.11 of the IPCC GPG LULUCF 2003.
CF_{TREE}	Carbon fraction of biomass of trees harvested; t C (t d.m)$^{-1}$. IPCC default value of 0.50 tC (t d.m)$^{-1}$ is used.
t	1, 2, 3, ... years counted from the start of the project activity.

In accordance with the above, non-CO_2 GHG emissions are presented in Table 86[311]:

Table 86: Non-CO_2 GHG emissions

Stratum	Stratum Area (ha)	$GHG_{E,t}$
Mon - GA - 2012	64.17	-
Mon - GA - 2013	170.17	-
Mon - GA - 2014	253.00	-
Mon - GA - 2015	150.29	90
PtN - GA - 2015	105.40	-
Mon - PQ - 2015	67.79	-
PtN - PQ - 2015	163.34	-

[311] The analysis of non-CO_2 GHG emissions can be found in the "GHG" sheet of the file "Estimaciones actuales_ARGEI" at: Gestión de la información\Estimaciones\ARGEI

Stratum	Stratum Area (ha)	$GHG_{E,t}$
Mon - GA - 2016	570.65	1.046
PtN - GA - 2016	209.97	128
Mon - PQ - 2016	90.26	103
PtN - PQ - 2016	101.54	-
Mon - GA - 2017	43.52	27
Mon - PQ - 2017	26.67	30
Total	**2,016.75**	**1,423.54**

Mon: Monterrey center; PtN: Punto Nuevo center

(Source: South Pole, based on information from FMC, 2020)

5.3.4.5 Leakage

As described in Section 5.3.3: GHG removal by sinks in the baseline scenario, in 1980 Forestal Monterrey Colombia acquired the properties where the Monterrey project is currently located. At that moment, 75% of the areas were clean pastures for livestock[312] and one year after the acquisition of the properties, the Forestal Monterrey company expressed its intention to strengthen the livestock sector by using the areas of the Andaluz stand to have 302 units of fattening cattle. At the beginning of 1982, the company had 192 cattle units, and at the end of the same year the number had risen to 208[313].

Figure 51: Livestock in the project zone (1982)

(Source: Monterrey Forestal, 1982-1983[314])

Even though fattening cattle production was present in the first years of project development, it is important to mention that cattle units were located in areas previously delimited by Forestal Monterrey Colombia, which represented 1,159 ha[315] of the Monterrey center. This area was home to approximately 250 units of fattening cattle, therefore carrying 0.22 UGG/ha, i.e., without

[312] According to some discussions held during the development of the EPCAC, the Monterrey land area had been destined for cattle ranching. See EPCAC document (EPCAC_PMCC_RegionCaribe) at: Gestión de la información\EPCAC

[313] Page 47 of the 1982-1983 Activity Report, Volume 1. Available at: Gestión de la información\Actividad_Remocion_GEI\Fugas.

[314] Page 49 of the 1981-1982 Activity Report, Volume 2. Available at: Gestión de la información\Actividad_Remocion_GEI\Fugas.

[315] Page 32 of the 1982-1983 Activity Report, Volume 2. Available at: Gestión de la información\Actividad_Remocion_GEI\Fugas.

exceeding the average carrying capacity at the country level (0.6 units/ha)[316]. Over time, the cattle were sold, and production was not replaced, so there was no displacement to other areas[317].

In accordance with Section 15.3 Leakage of the GHG Removal Activities Methodological Document, leakage emission occurs when the displacement of agricultural activities leads to an increase in GHG emissions attributable to project activities.

Leakage emission attributable to the displacement of agricultural activities is considered insignificant and hence accounted as zero under the following conditions:

a) Animals are displaced to existing grazing land, and the total number of animals on the receiving grazing land (displaced and existing) does not exceed the carrying capacity of the grazing land;

b) Animals are displaced to existing non-grazing grassland, and the total number of animals moved does not exceed the carrying capacity of the receiving grassland;

c) Animals are moved to cropland that has been abandoned in the last five years;

d) Animals are displaced to forested lands, and no clearance of trees, or decrease in crown cover of trees and shrubs occurs due to the displaced animals;

e) Animals are moved to a zero (or mechanical) grazing system.

In compliance with paragraph a), considering that cattle ranching continued in the project area below the carrying capacity and there was a gradual transition to zero cattle units due to the commercialization of the existing ones, the leakage of the GHG Removal Activities component is considered insignificant and is not accounted for.

5.3.4.6 Net GHG removals by sinks

According to Section 15.2 of the GHG Removal Activities Methodological Document, net anthropogenic GHG removals by sinks were estimated based on the following equation:

$$\Delta C_{PROY} = \Delta C_{ACTUAL,t} - \Delta C_{LB,t} - Fuga_t$$

Where:

ΔC_{PROY}	Net GHG removals by sinks, year *t*; tCO_2e.
$\Delta C_{ACTUAL,t}$	Actual GHG removals by sinks, in year *t*; tCO_2e.
$\Delta C_{LB,t}$	Baseline GHG removals, in year *t*; tCO_2e.
$Fuga_t$	GHG emissions due to leakage, in year *t*; tCO_2e.

The results of the net estimates are presented below, including the 15% discount to cover permanence-related aspects:

- Net GHG removals by sinks (from plantations established between 2012 and 2017) applying to the BCR Standard were 259,975 tCO_2e in the monitoring period between June 1, 2012 and December 31, 2021 (excluding the reversal risk) (see Table 87)[318].

[316] Colombian Federation of Cattle Farmers - Fedegan (2019). Plan Estratégico de la Ganadería Colombiana 2019.
[317] Page 47 of the 1981-1982 Activity Report, Volume 2. Available at: Gestión de la información\Actividad_Remocion_GEI\Fugas.
[318] The results of net GHG removals by sinks are available at: G:\Unidades compartidas\Projects ColTax\AQ Projects\303152_Monterrey GWR Bolivar AR Colombia\2_Registration\PDD\Gestión de la información\Estimaciones\ARGEI

Table 87: Net GHG removals by sinks

Year	GHG removals by sinks - C_{actual} (tCO_2e)	Baseline emissions (tCO_2e)	Leakage (tCO_2e)	Net GHG removals by sinks - C_{proy} (tCO_2e)
2012	720.0	270.0	-	450.0
2013	3,538.0	498.0	-	3,040.0
2014	8,478.0	561.0	-	7,918.0
2015	18,787.0	608.0	-	18,180.0
2016	37,430.0	3,561.0	-	33,872.0
2017	51,807.0	6,996.0	-	44,812.0
2018	52,678.0	7,443.0	-	45,234.0
2019	52,678.0	7,443.0	-	45,234.0
2020	51,283.0	7,453.0	-	43,831.0
2021	19,401.0	1,992.0	-	17,404.0
Total	**296,800.0**	**36,825.0**	**-**	**259,975.0**

(Source: South Pole, 2022)

6 Stakeholder consultation

In order to conduct the stakeholder consultation for the Caribbean Region CCMP, the Strategy for Participation, Communication and Knowledge Appropriation (EPCAC)[319], was designed and executed, with the main objectives to:

- Promote spaces for participation, consultation and dialogue with direct stakeholders of the project area and other identified interested parties.
- Identify the most appropriate impacts and mitigation measures.
- Foster multiple benefits, guaranteeing the social and environmental safeguards adopted by Colombia.

The EPCAC for the Caribbean Region CCMP uses methodologies and instruments that guide project development from a participatory, differential and transparent approach. Its general objective is to make the projects known, understood and managed by the different actors, in order for them to be sustainable over time by promoting the recognition of positive impacts and identifying mitigation measures for potential negative impacts or risks that project activities could generate. In this sense, the specific objectives of the EPCAC are to:

- Present the connection of the Caribbean Region PMCC with climate change mitigation, based on carbon removals by plantations and emissions reduction by avoiding deforestation.
- Identify, discuss and agree with the stakeholders or interested parties on project impacts and agree on corrective measures.
- Communicate project progress, strategic lines and measures taken in the project area with impacts on the area of influence.
- Carry out a socioeconomic, cultural, territorial and environmental characterization of the project's area of influence.
- Participatively define the appropriate mechanisms to collect the questions, complaints or comments made by the key stakeholders.
- Map the key stakeholders, who are defined by the standard as the local interest groups directly affected and benefited, as well as the representatives of the local environmental and governmental authorities, and other actors that are relevant to the project due to their activities in the territory.
- Disseminate clear and reliable information through appropriate, context-oriented communication channels, considering the different stakeholders involved.
- Define actions to guarantee continuity in information access, impact mitigation and compliance with other requirements of the BioCarbon Registry standard.
- Contribute to the dissemination of possible impacts and their management through timely and assertive communication between the stakeholders and the holder of the initiative.

6.1 Methodological phases

The EPCAC is transversal to the Caribbean Region CCMP cycle and its purpose is to promote spaces for participation, consultation and dialogue with the direct stakeholders of the project area and other interested parties; reduce environmental and social risks; comply with safeguards; identify impacts and benefits; generate climate change awareness-raising spaces; and align this type of project with the Sustainable Development Goals. For this project, the EPCAC is developed in five interconnected phases, as shown in Figure 52.

[319] Gestión de la información\EPCAC.

Figure 52: Phases of the Strategy for Participation, Communication and Knowledge Appropriation (EPCAC)

(Source: South Pole, 2022)

6.1.1 Phase 1: Preparation

The necessary secondary information was collected to get to know the territory and to approach the key actors, understanding the context beforehand. Likewise, the groups or sectors of interest were identified, and the stakeholder mapping and analysis were carried out. This knowledge was constructed through the review and analysis of various sources of information, some of them being provided by the project holder and others by entities such as municipal administrations (in these cases, presentation letters of the Caribbean Region CCMP and requests for specific information were submitted).[320]

6.1.2 Phases 2 y 3: PBL,[321] feedback and monitoring plan

Phases 2 and 3 are interlinked as both focus on stakeholder dialogue and primary information gathering. For phase 3, specifically, face-to-face and virtual meetings for the Caribbean Region CCMP presentation were held with the different stakeholders (from the community, institutional, educational, and employee sectors), where project perceptions were identified, questions were answered, impacts and benefits were recognized, a diagnosis of the context where the initiative is located was prepared, and communication mechanisms and their preparation (official letters, invitation cards, and flyers) were explained.

In this phase, the preliminary socioeconomic and cultural characterization was complemented with primary information, which was collected during consultation meetings through different qualitative techniques and instruments. In the same way, the preliminary identification of key actors was completed, and spaces were generated for the discussion about the initiative, its importance and contribution to climate change mitigation actions in the region.

In addition, in the workshops and worktables, the perceptions of the key actors about the initiative, its importance in the territory, and the recognition of the stakeholders about regional natural elements such as water sources, forests, animal species, among others, were compiled in order

[320] The information request letters are available at: EPCAC/Fase 1 y 2.
[321] Participatory baseline ("LPB_PMCC" file) is available at: Gestión de la información\EPCAC

to identify the pressures on these aspects and, ultimately, to know stakeholders' perceptions on the positive and negative impacts.[322]

6.1.3 Phase 4: Communication of results

Face-to-face and virtual meetings were held to inform project results and, therefore, to complement the dissemination and feedback process of the Caribbean Region CCMP. Information presented included topics such as the project cycle, the project area, GHG and REDD+ Removal Activities, the PQC mechanism, progress and findings regarding impacts, mitigation measures, strategic lines, co-benefits, contribution to the SDGs and compliance with the REDD+ Safeguards.

On the other hand, a space for the exchange of experiences was created, so that local stakeholders presented projects previously developed by them and strengthened with the support of FMC. This exercise facilitated the recognition of the importance of the company in the territory, its role in revitalizing social processes in its area of influence, and the need to promote alliances between stakeholders and joint responsibility actions to successfully conclude the implementation phase[323].

The summary of EPCAC phases for the Caribbean Region CCMP is presented in Figure 53.

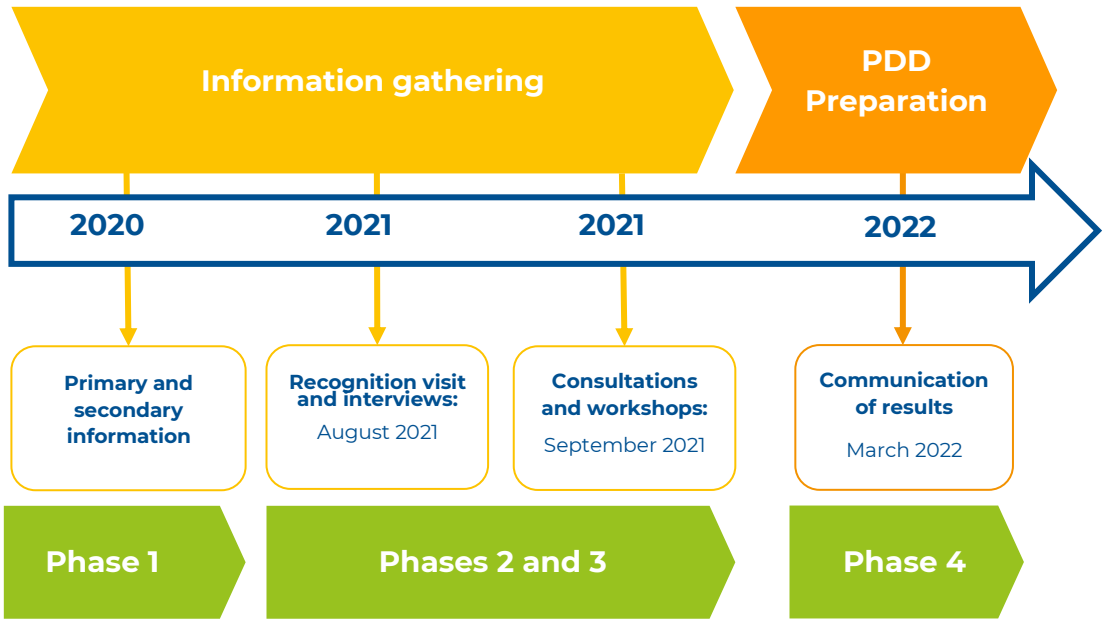


Figure 53: EPCAC phases for the Caribbean Region CCMP

(Source: South Pole, 2022)

[322] The supporting documents of the activities carried out in this phase are found in: EPCAC/Fase 3.
[323] The supporting documents of the activities carried out in this phase are available at: EPCAC/Fase 4.

7 Impact assessment

7.1 Environmental and socioeconomic aspects

Regarding the impacts of an initiative in a given territory, it is important to understand not only the benefits, but also the possible risks to prevent or mitigate them if necessary. In this sense, the comprehensive analysis of the impacts for the Caribbean Region CCMP took into account the type of impact, its description, and action or mitigation measure, depending on whether it is positive or negative.

The classification of the risks, impacts and benefits is proposed according to the REDD+ safeguards, since these are the set of instruments, agreements, processes and tools that make it possible to address REDD+ measures and actions in the best possible way, ensuring respect for and guaranteeing the rights of the communities in the territories, as well as the integrity of the forests and ecosystems where such actions are implemented.

As a result of the participatory and dialogue process, the following impacts were identified by the key actors in the framework of the Caribbean Region CCMP[324]:

Table 88: Project environmental assessment

Positive Impacts	Negative Impacts
• **Comprehensive and organic conservation of the tropical dry forest (strategic ecosystem).** • **Offer of fauna habitats.** • **Growth of tree biomass due to maintenance of the plantation.** • **Establishment of plantations with native forest species.** • **Timber supply and certified plant material.** • **Reduced pressure on natural ecosystems.** • **GHG removal.** • **Fire prevention and control.** • **Reduction of soil erosion.** • **Water regulation.** • **Creation of local jobs.** • **Protection of bee populations.** • **Support to local entrepreneurship through the local beekeeping project.** • **Sustainable and participatory forest management.** • **Strengthened legal land use.** • **Strengthened forest governance.** • **Promotion of spaces for environmental education.** • **Contribution to municipal economic growth.**	• Poor perception of the alignment of public-private environmental competencies. • Loss of space and visibility of the road, with risk of traffic collisions. • Generation of noise and air pollution due to the use of machinery and vehicles. • Generation of erosion in the site to be planted and harvested. • High initial demand for water resources by forest plantations. • Use of agrochemicals. • Migration of fauna due to the use of plantations. • Generation of hazardous waste (containers and packaging of agrochemicals). • Pest and disease outbreaks due to forest plantations.
Total = 18	Total = 9

(Source: South Pole, based on the EPCAC and FMC, 2022)

In accordance with the above, the results of the description and analysis of the social context, and the conversations held with the key stakeholders in the workshops, the most appropriate mitigation actions were compiled in order to manage negative impacts in the territory where the Caribbean Region CCMP is carried out, in addition to those that have already been advanced by

[324] The impact assessment by component, together with the description of the action/mitigation measure, can be found at: Gestión de la información\Secciones Anexas\Anexo 8_Evaluación Ambiental.

FMC. Some of these actions are related to the short-, medium- and long-term strategic lines and projects that are being developed and will continue to be developed during project implementation, once the incentives have been received.

The analysis of each one of the impacts with its description, mitigation measures or action are detailed in Annex 8: Impact assessment[325].

[325] Gestión de la información\Secciones Anexas\Anexo 8_Evaluación Ambiental.

8 Risk management

For the project risk assessment, South Pole's "Risk Tool" was used. The tool offers a global risk measurement that can be incorporated into the contingency funds of each of the financing instruments linked to the corresponding project. This function allows the designed and implemented strategies to ensure their permanence and sustainability in the long term.

The methodology is focused on identifying adverse situations that may arise during the implementation of a project, preventing the development of certain activities or the achievement of the proposed objectives. This methodology covers the risk identification, management, monitoring and feedback phases, and is summarized in the following steps (see Figure 54):

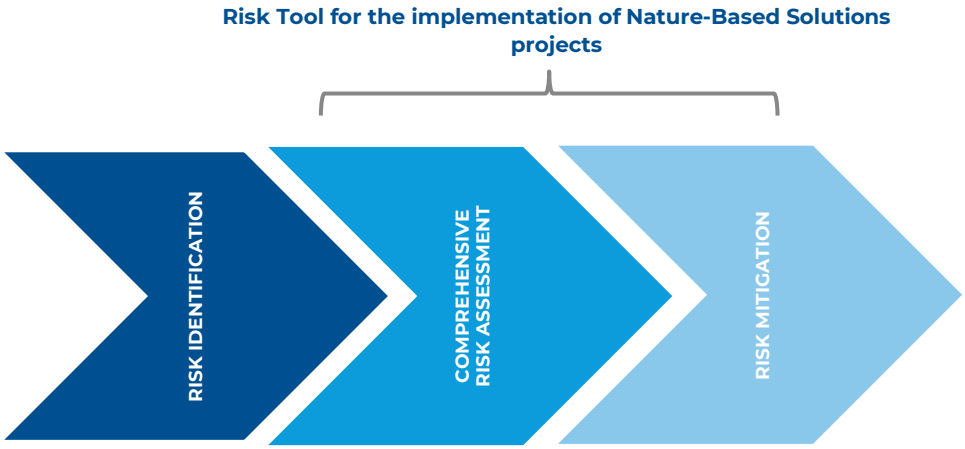


Figure 54: Risk management process

(Source: South Pole, 2022)

As part of the first phase of the risk management process, threats are identified based on the criteria and expertise of professionals in the environmental area, the discussions on this regard during the development of the EPCAC, and the risks found during project development.

The second phase is risk assessment, which is based on two main variables: likelihood and impact. A reference framework was established to assess and quantify these variables and thus, determine the level of inherent or pure risk, that is, an existing risk in absence of any mitigation measures. The importance of this phase lies in the fact that it allows for a baseline to demonstrate the risk evolution through its management process.

The third phase is mitigation, which aims to avoid, reduce and manage risks. If they persist despite being managed, the residual risk (that is, the one that remains even after having applied the necessary control measures) is obtained. The principle that the risk can never be zero and its management has the purpose to generate a reasonable degree of confidence for the achievement of the project objectives, bringing the risks to an acceptable level, guides the entire process. Figure 55 shows the process flow to obtain the residual risk.

Figure 55: Risk process flow

(Source: South Pole, 2022)

For the assessment of risks related to the implementation of the Caribbean Region CCMP, natural, human-induced, financial and stakeholder participation risks were considered. The description, mitigation measures and application of the Risk Tool to obtain the results presented were included in Sections **¡Error! No se encuentra el origen de la referencia.** to **¡Error! No se encuentra el origen de la referencia.**. The full description of the risk methodology and analysis can be found in Annex 7: Risk management [326].

8.1 Natural and human-induced risks

For the identification of natural and human-induced risks, socio-environmental impacts[327] and project permanence risks due to natural events[328] were taken into account as follows:

Table 89: Natural and human-induced risks

Type	Risks	Risk Score
Human-induced	Social conflict and deterioration of the company's reputation - Associated with Impact C[329].	Low risk
	High accident rate and legal actions against the company and the local government - Associated with Impact D.	Low risk
	Human health disorders caused by air or water pollution - Associated with Impact A.	Low risk
	Reduction of populations of fauna species - Associated with Impact B.	Low risk
Natural	Pest and disease outbreaks.	Low risk
	Fire propagation in forest covers and forest plantations due to fire vulnerability.	Low risk
	Floods	Low risk
	Impacts on forests due to the El Niño phenomenon.	Low risk

[326] Gestión de la información\Secciones Anexas\Anexo 7_Gestion del Riesgo. The type, description, and mitigation measures can be found in the "Desr_Riesgos_PMCC Region Caribe" file. The methodology for risk assessment and its qualification can be found in the "Risk Tool_PMCC Region Caribe" file.
[327] The impact assessment can be found in Section 5: Impact analysis of the "EPCAC_PMCC_RegionCaribe" file in the "Gestión de la información\EPCAC" folder.
[328] According to Section 14.4: Monitoring of the project permanence of the REDD+ Methodological Document.
[329] The association of a risk with an impact comes from the result of the impact analysis in Annex 8: Impact assessment and the development of the EPCAC.

(Source: South Pole, 2022)

Human-induced risk: Social conflict (0.75%), high accident rate and legal actions (0.09%), human health disorders (0.11%), and the reduction of populations of fauna species (0.32%). **Total risk:** 1.27%, being classified as **low risk**.

Naturals risk: Fires (2%), floods (1%) and pests and diseases (2%). **Total risk:** 4%, being classified as **low risk**. The risk of impacts on forests due to the El Niño phenomenon is considered **low**, while for the other risks associated to landslides, droughts, volcanic eruptions, earthquakes, or extreme events no major threats were identified, reason why the score is **0**.

8.2 Financial risks

In order to determine the financial risk of the project, both financial and market risks were assessed. For financial risks, the break-even point, the net present value and the opportunity cost were analyzed, according to the project's cash flow. Market Risks include the variables of credit, prices, liquidity, operationality and additionality.

The results[330] showed that the financial risk (financial + market) for the Caribbean Region CCMP is 13.74%, which is equivalent to a **medium** risk.

Table 90: Total financial risk

Risk Type	Total Risk
General financial risk (financial + market)	Medium risk.

(Source: South Pole, 2022)

8.3 Risks associated with stakeholder participation

The identification of the risks associated with stakeholder participation was based on the assessment of socio-environmental impacts[331] and project permanence risks due to natural events[332], as presented below:

Table 91: Risks associated with stakeholders

Type	Risks associated with the impact	Risk Score
Associated with participation	Participation of local communities and interested parties in the activities proposed by the project holder: imbalance in food security, loss of livelihoods, and incidents based on human-animal competition in forest areas.	Low risk
	Loss of land tenure.	Low risk
	Conflict between project stakeholders due to economic expectations derived from project benefits or from activities competing with the project.	Low risk
	No ownership of project activities.	Low risk
	Diversion of investment of resources and non-continuity of project-associated processes.	Low risk

(Source: South Pole, 2022)

[330] Gestión de la información\Secciones Anexas\Anexo 7_Gestion del Riesgo.
[331] The impact assessment can be found in Section 5 of the EPCAC.
[332] Section 14.4: Monitoring of the project permanence of the REDD+ Methodological Document.

Risk associated with participation: Loss of land tenure (0.40%), community participation (0.02%), conflict between stakeholders (0.10%), no ownership of project activities (0 0.02%) and the diversion of resources (0.02%). **Total risk:** 0.56%, being classified as **low risk**.

9 Project permanence

The permanence of the PMCC focuses on three items:

- Experience to successfully carry out all project activities

FMC has more than 35 years of experience in the forestry sector, guaranteeing the quality of wood production. It is the entity in charge of the implementation of the project activities, including the establishment and monitoring of forest plantations and other activities of the forestry chain, added to the protection of the tropical dry forest where the company has conducted flora and fauna characterization studies[333].

During the validation and verification process, FMC is supported by South Pole, which is the carbon project developer with an extensive technical experience in the design and implementation of initiatives in the AFOLU sector, as well as in-depth knowledge in carbon accounting and reporting, and in Emissions Trading Systems (ETS) around the world. Since 2010, South Pole has successfully managed at least 40 projects in the AFOLU sector through their validation, verification and the issuance of GHG credits[334].

Also, during project validation and verification, the forest plantations are monitored by randomly remeasuring stands in order to verify growth, the different project boundaries, and the Strategy for Participation, Communication, and Knowledge Appropriation (EPCAC). This makes it possible to provide technical and social support and propose appropriate measures during project implementation.

- Economic agreements for the validity period of the project.

Carbon stocks are protected thanks to the forest management activities carried out by FMC, as the project holder, in order to contribute to the supply of plywood in the national and international markets. For this, FMC has made alliances and investments that have resulted in the construction of a production plant, which will facilitate the constant supply of wood for board production beyond project length, which is 30 years. This activity together with the sale of carbon credits will generate the necessary cash flow with the purpose to sustain and widen the scope of the establishment, maintenance and management of forest plantations and the protection of the natural forest.

- Climate change adaptation measures

As an additional measure to guarantee the permanence of the project beyond the crediting period and to counteract the effects of drought on the planted species, FMC has been working on the selection of genetic material resistant to prolonged dry seasons. To date, it has 20 clonal selections with these characteristics (which are stored in a clonal bank located in the nursery area) and has performed some tests to assess their performance. Additionally, the schedule of new plantations is based on the likelihood of occurrence of the El Niño phenomenon in the planting year. In other words, if in September of a given year, the El Niño prediction models show a probability of occurrence greater than 60% in the first quarter of the coming year, planting is ruled out[335].

[333] See Section 4.8.4: Monitoring of the implementation of REDD+ activities.
[334] More information about the project developer is available at www.southpole.com.
[335] In Section 5.2.3: Monitoring of crop management and biomass growth the adaptation measures implemented and an illustrative photography.

10 Sustainable Development Goals (SDGs)

The Caribbean Region CCMP aims at sustainable development and the common good by being aligned with seven SDGs. The project contributes to:

			
No poverty: End poverty in all its forms everywhere.	Clean water and sanitation: Ensure availability and sustainable management of water and sanitation for all.	Decent work and economic growth: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.	Industry, innovation and infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
			
Responsible consumption and production: Ensure sustainable consumption and production patterns.	Climate action: Take urgent action to combat climate change and its impacts.	Life on land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.	

(Source: South Pole, 2022)

Table 92 contains the description of each SDG, its associated goal and the evidence for the contribution to the indicators. The application of the *Tool for the determination of contributions to the fulfillment of the Sustainable Development Goals (SDGs) of the Greenhouse Gas (GHG) projects* of the BCR Standard is included in Annex 4: SDG and safeguards.[336]

[336] Gestión de la información \Secciones Anexas\Anexo 4_ODS & Salvaguardas\ODS

Table 92: Contribution of the project to the SDGs

SDGs	Associated goals	Activities developed by the project	Evidence of the indicator
1. No poverty 	**1.4.2** Proportion of total adult population with secure tenure rights to land, (a) with legally recognized documentation, and (b) who perceive their rights to land as secure, by sex and by type of tenure.	Land tenure legalization process in accordance with current regulations. FMC continuously assesses the ownership of its properties in order to avoid disputes related to them.	Real estate registration number[337] with its location and cartographic database (including the spatial location of the project activities within the property boundaries). **Reference value: 1** **Results per year:** Year 1: 40 Year 2: 40 Year 3: 41 Year 4: 42 Year 5: 42 Year 6: 42 Year 7: 42 Year 8: 44 Year 9: 44
6. Clean water and sanitation 	**6.3.2** Proportion of bodies of water with good ambient water quality.	In the project area (19,678 ha), 29 bodies of water have been mapped during the monitoring period, which have increased in area and quantity during 2016-2020: **2016:** A total of 19 bodies of water corresponding to 264 ha were mapped. **2017:** Two new bodies of water were included, for a total of 21, equivalent to 282 ha. **2020:** During this year, 8 more bodies of water were digitized, for a total of 29 polygons with 287 ha.	**Reference value:** Representativeness of the bodies of water mapped in 2016 with respect to the total expanse of the project area (19,678 ha). **Caribbean Region CCMP:** Shapefile document with the bodies of water digitized by FMC during the monitoring period[338]. **Reference value:** 1,336 **Results per year:** Year 1: 1,336 Year 2: 1,433

[337] In accordance with the updated Certificate of Freedom and Tradition.
[338] The shapefile document can be consulted at: Gestión de la información\Secciones Anexas\Anexo 4_ODS & Salvaguardas\ODS\REDD\ODS6

SDGs	Associated goals	Activities developed by the project	Evidence of the indicator
			Year 3: 1,433 Year 4: 1,433 Year 5: 1,458
	6.4.1 Change in water-use efficiency over time.	Forest plantations require the use of water resources. FMC has environmental guidelines to make efficient use of water, so that it is reused and there is no shortage for neighboring communities. During the last years, forest plantations have been established in winter times in order to avoid irrigation. In addition, the planted species are deciduous adapted to the tropical dry forest, so their water requirement is lower compared to other species. For this reason, irrigation decreased between 2016 and 2020.	**Reference value:** The efficiency of water use in 2016 was calculated based on the number of liters used to irrigate the plantations planted in that year. **Caribbean Region CCMP:** Information on the liters of water used for new plantations can be found in the FMC activity reports.[339] **Reference value:** 23.4 **Results per year:** Year 1: 25
	6.6.1 Change in the extent of water-related ecosystems over time.	Through the REDD+ component, deforestation of the tropical dry forest in the project area has been reduced between the baseline period and the monitoring period.	**Reference value:** The mean deforestation rate of the project area (Monterrey and Punto Nuevo centers) in the baseline period was used[340]. **Reference value:** -0.36
8. Decent work and economic growth	**8.3.1** Proportion of informal employment in total employment, by sector and sex.	Forestry activities for commercial purposes developed by the Caribbean Region CCMP contribute to increased employment rates since plantation operations involve the direct and indirect hiring of personnel. **Reference value:** 94% of employment in the area of influence is informal. **Caribbean Region CCMP:**	**Caribbean Region CCMP:** Information on employment can be found in Section 4.7: Employment of the "Social, economic and cultural baseline" document of the Caribbean Region CCMP. 94% is calculated as the average informal employment rate for all the municipalities that are part of the project's area of influence

[339] Los informes de actividades para los años 2016, 2017, 2018, 2019 y 2020 se encuentran disponibles en: Gestión de la información\General\Informes_actividades
[340] Para revisar la obtención datos de actividad de deforestación en el período de línea base revisar la información disponible en: Gestión de la información\Cartografía\REDD+\LineaBase

SDGs	Associated goals	Activities developed by the project	Evidence of the indicator
8 DECENT WORK AND ECONOMIC GROWTH 		• Between 2016 and 2020, 100 people (33 women and 67 men) were directly hired. • Between 2016 and 2020, 1,338 people were outsourced.	(Córdoba, El Carmen de Bolívar, Zambrano and Ariguaní).
	8.5.2. Unemployment rate, by sex, age and persons with disabilities.	**Reference value:** • The unemployment rate of the population in the area of influence of the project is 93.5%. **Caribbean Region CCMP:** • Entre los años 2016 y 2020 hubo una contratación formal y directa de 100 personas, distribuidos por género de la siguiente manera: • Between 2016 and 2020, 100 people were formally and directly hired. They are distributed by gender as follows: 2016: 10 women and 14 men 2017: 9 women and 13 men 2018: 6 women and 12 men 2019: 4 women and 14 men 2020: 4 women and 14 men • Between 2016 and 2020, 1,338 people were hired by outsourcing. They are distributed by gender as follows: 2016: 41 women and 306 men 2017: 9 women and 385 men 2018: 9 women and 237 men 2019: 8 women and 246 men 2020: 7 women and 90 men	**Caribbean Region CCMP:** Information on employment can be found in Section 4.7: Employment of the "Social, economic and cultural baseline" document of the Caribbean Region CCMP. and in Section 4: Employment opportunities in the territory of the "Strategy for Participation, Communication and Knowledge Appropriation" document. The average unemployment rate for all the municipalities that are part of the project's area of influence is calculated as 93.5%.

SDGs	Associated goals	Activities developed by the project	Evidence of the indicator
9. Industry, innovation and infrastructure 	**9.b.1.** Proportion of medium and high-tech industry value added in total value added.	**Caribbean Region CCMP:** Resolution 00115971 issued by the Colombian Agricultural Institute (ICA), authorizes the registration of an orchard for the production and commercialization of selected sexual seeds of melina (*Gmelina arborea*); and Resolution 00013482 serves the same purpose for the *Pachira quinata* species[341]. Within the *Maintenance and monitoring of High Conservation Value Attributes (AAVC) in High Conservation Value Forests (BAVC)* program, 17 permanent plots have been established for monitoring the *Belencita nemorosa* species.	**Caribbean Region CCMP:** • Information on the monitoring of .*Belencita nemorosa*[342]. • ICA registrations[343]. **Reference value:** FMC began research processes for the genetic improvement of its species in 1983. In 2019, they obtained the ICA registration for their *Gmelina arborea* and *Pachira quinata* seed orchards. **Results per year:** Year 1: 81 Year 2: 2.7 Year 3: 2.7 Year 4: 2.7 Year 5: 2.7 Year 6: 2.7 Year 7: 2.7
12. Responsible consumption and production	**12.8.1** Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment.	**Reference value:** 36 (100%) training sessions for employees and the community are proposed per year, in accordance with the 2020 Social Plan. **Caribbean Region CCMP:** On an annual basis, FMC has generated participation opportunities for different employees on issues such as: • FMC Social Policy • Water savings and efficient use • Management and proper use of pesticides • Solid waste management • Separation of solid waste	**Reference value:** This value results from counting the number of training and education spaces proposed in the 2020 Social Plan, which is part of the FMC Social Policy.[344] The balance of these project spaces in different years can be consulted in sections 4.3: Employee training and 7: Community events, projects and training of the "Strategy for Participation, Communication and Knowledge Appropriation" [345].

[341] Resolution 00115971 and Resolution 00013482 can be accessed at: Gestión de la información\Actividad_Remocion_GEI\Prod_material_Veget.
[342] The information on the monitoring of *Belencita nemorosa* species can be consulted at: Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto\LineaEstrategica1\Monitoreo AVC2 Diversidad de especies\Belencita_nemorosa
[343] Resolution 00115971 and Resolution 00013482 can be accessed at: Gestión de la información\Actividad_Remocion_GEI\Prod_material_Veget.
[344] This document is located at: EPCAC/ Gestión de la información/ Compromiso_comunidades/ Plan_Social
[345] This document is located at: EPCAC/ Gestión de la información/ 20220512_EPCAC_PMCC_RegionCaribe

SDGs	Associated goals	Activities developed by the project	Evidence of the indicator
12 RESPONSIBLE CONSUMPTION AND PRODUCTION		• Cycle of environmental education talks for the student population • Presentation of an environmental cinema forum for the student population • First aid • Management of ophidian accidents • Management of agrochemicals	**Results per year:** Year 1: 87 Year 2: 294 Year 3: 561 Year 4: 228
13. Climate action 13 CLIMATE ACTION	**13.1.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population.	**Reference value:** According to the Disaster Risk Management Plan 2015-2025, "A development strategy"[346], Colombia has a national mortality rate caused by disasters of 5.9 per 100,000 people. **Caribbean Region CCMP:** During the implementation of project activities, no deadly disaster event has occurred in the project area.	**Reference value:** Disaster Risk Management Plan 2015-2025, "A development strategy"[347] **Caribbean Region CCMP:** No deadly event has occurred during the implementation of project activities.
	13.2.2 Total greenhouse gas emissions per year.	**Reference value:** Average estimates projected per year for the GHG Removal Activities component: 76,210 tCO_2e. **Results per year:** Year 1: 737 Year 2: 3,090 Year 3: 7,415 Year 4: 17,838 Year 5: 32,458 Year 6: 47,108 Year 7: 47,564 Year 8: 47,564	**Caribbean Region CCMP:** The establishment of the plantations, the conservation of the tropical dry forest and the project activities will contribute to the achievement of the zero-deforestation goal in Colombia. **Caribbean Region CCMP:** Review the projected[348] and project estimates in the monitoring period[349].

[346] The Disaster Risk Management Plan 2015-2025, "A development strategy" is located at: Gestión de la información\ODS_Salvaguardas\ODS\ARGEI
[347] The Disaster Risk Management Plan 2015-2025, "A development strategy" is located at: Gestión de la información\ODS_Salvaguardas\ODS\ARGEI
[348] The projected estimates for GHG Removal Actitivities are available at:Gestión de la información_V2\Estimaciones\ARGEI\Proyectadas
The projected estimates for REDD+ are available at: Gestión de la información\Estimaciones\REDD
[349] Projected estimates are available at: Gestión de la información_V2\Estimaciones\ARGEI
The estimates in the monitoring period are available at: Gestión de la información\Estimaciones\REDD+

SDGs	Associated goals	Activities developed by the project	Evidence of the indicator
		Year 9: 46,180 Year 10: 17,935 Average projected estimates per year in the 2016-2020 period for the REDD+ component: 43,315 tCO_2e **Results per year:** Year 1: 22,083 Year 2: 39,257 Year 3: 34,572 Year 4: 28,324 Year 5: 22,470	
	13.3.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment.	**Reference value:** 36 (100%) training sessions for employees and the community are proposed per year, in accordance with the 2020 Social Plan. **Caribbean Region CCMP:** On an annual basis, FMC has generated participation opportunities for different employees on issues such as: ● FMC Social Policy ● Water savings and efficient use ● Management and proper use of pesticides ● Solid waste management ● Separation of solid waste ● Cycle of environmental education talks for the student population ● Presentation of an environmental cinema forum for the student population ● First aid ● Management of ophidian accidents Management of agrochemicals	**Valor de referencia:** Este valor surge del conteo de la cantidad de espacios de capacitación y formación propuesto en el Plan Social del año 2020, que está enmarcado en la Política Social de FMC.[350] El balance de estos espacios, en los diferentes años del proyecto se pueden consultar en las secciones 4.3 Formación y capacitación de empleados y 7. Eventos, proyectos y capacitación con la comunidad del documento "Estrategia de Participación, Comunicación y Apropiación del Conocimiento"[351] **Resultados por año:** Año 1: 87 Año 2: 294 Año 3: 561 Año 4: 228
15. Vida de ecosistemas terrestres	**15.1.1** Forest area as a proportion of total land area.	**Reference value:** GHG Removal Activities	**PMCC Región Caribe** Área plantada anualmente[352]

[350] This document is located at: EPCAC/ Gestión de la información/ Compromiso_comunidades/ Plan_Social
[351] This document is located at: EPCAC/ Gestión de la información/ 20220512_EPCAC_PMCC_RegionCaribe
[352] Gestión de la información\Cartografía\ARGEI\Área verificación

<table>
<tr><th>SDGs</th><th>Associated goals</th><th>Activities developed by the project</th><th>Evidence of the indicator</th></tr>
<tr>
<td rowspan="2"> 
</td>
<td></td>
<td>
Extension of the area planted during the start date of the GHG Removal Activities initiative: 66.2 hectares.
<u>REDD+</u>
Number of hectares of tropical dry forest that under the Colombian forest category during the 2006-2016 period: 5,864 ha.
Caribbean Region CCMP
<u>GHG Removal Activities</u>
Establishment of forest plantations between 2012 and 2017.
<table>
<tr><th>Year</th><th>Total established area (ha)</th></tr>
<tr><td>2012</td><td>64.2</td></tr>
<tr><td>2013</td><td>234.3</td></tr>
<tr><td>2014</td><td>487.3</td></tr>
<tr><td>2015</td><td>974.2</td></tr>
<tr><td>2016</td><td>1,946.6</td></tr>
<tr><td>2017</td><td>2,016.8</td></tr>
</table>
<u>REDD+</u>
Conservation and protection of the tropical dry forest and project activities.
</td>
<td>Reference value:
<u>GHG Removal Activities</u>
Area planted in 2012[353].
<u>REDD+</u>
Stable forest between 2006-2016[354]
Caribbean Region CCMP:
Area planted annually[355]</td>
</tr>
<tr>
<td>15.2.1 Progress towards sustainable forest management.</td>
<td>Through the CCMP, 5,864 ha of forest have been conserved and activities have been implemented to prevent deforestation and land degradation.</td>
<td>Reference value: The proportion of areas categorized as with Very Severe Degradation</td>
</tr>
</table>

[353] Gestión de la información\Cartografía\ARGEI\Área verificación
[354] Gestión de la información\Cartografía\REDD+\LineaBase
[355] Gestión de la información\Cartografía\ARGEI\Área verificación

SDGs	Associated goals	Activities developed by the project	Evidence of the indicator
			in 2016[356] with respect to the total area of FMC properties was used [357].
	15.5.1 Red List Index	Through Strategic Line 1, the fauna species registered in the project area in the 2016-2020 period have been monitored, and the following activities have also been carried out[358]: • Monitoring of HCV 1: Landscape and mosaic-level ecosystems • Monitoring of HCV 2: Species diversity (*Belencita nemorosa*) • Monitoring of HCV 2: Species diversity (*Malagoniella astyanax*) • Fauna sightings and recording.	**Reference value:** The 2016 Red List Index (RLI) was calculated, taking into account the sightings carried out that year and the IUCN categories[359]. The RLI was calculated using the following equation[360]: $RLI = 1 - ((WCt,s)/(WEX * N))$ Where: RLI: Red List Index WC_{ts}: Weighting of the category at time *t*, for species *s* WEX: 5 N: Total number of species evaluated **Caribbean Region CCMP:** The RLI was calculated for each year of the monitoring period taking into account the species list.[361]

(Source: South Pole based on the project holder)

SDGs compliance by project activities, together with corresponding indicators and goals are available at: Annex 4: SDGs and safeguards [362].

[356] The information on degradation was consulted in the maps *Degradación de los suelos por salinización. 100K 2016 -2017* and *Degradación Suelos Salinización 2019. Versión 1.0* by IDEAM. Available at: http://www.ideam.gov.co/inicio?p_p_id=101&p_p_lifecycle=0&p_p_state=maximized&p_p_mode=view&_101_struts_action=%2Fasset_publisher%2Fview_content&_101_assetEntryId=91482640&_101_type=content&_101_urlTitle=capas-geo
[357] Gestión de la información\ODS_Salvaguardas\ODS\REDD+\ODS15
[358] Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto
[359] IUCN categories are available at: https://www.iucnredlist.org/es/#:~:text=Categor%C3%ADas%20y%20Criterios%20de%20La%20Lista%20Roja%20de%20UICN&text=Divide%20especies%20en%20nueve%20categor%C3%ADas,en%20Estado%20Silvestre%20y%20Extinto.
[360] The equation for calculating the RLI is available at: https://worldbank.github.io/sdg-metadata/metadata/es/15-5-1/
[361] Gestión de la información\ODS_Salvaguardas\ODS\REDD+\ODS15
[362] Gestión de la información\Secciones Anexas\Anexo 4_ODS & Salvaguardas.

11 Co-benefits

The implementation of the Caribbean Region CCMP makes it possible to align the conservation and preservation of 5,864 ha of tropical dry forest with different social projects that benefit the communities in the project's area of influence and to ensure the permanence of the forestry activities related to the species *Gmelina arborea* and *Pachira quinata*. The continuity of the GHG Removal and REDD+ activities secure the permanence of species' biodiversity through the four strategic lines[363], since they enable the protection of environmental conditions, the control of threats within the Forestal Monterrey properties to avoid hunting, deforestation and degradation, and maintain fundamental environmental services for life such as water resources, climate regulation, rooting in the territory, among others.

The synergies between the forest plantations and the natural forest contribute to ecosystem and social resilience since the plantations serve as a physical protection barrier for the forest, and the entire project's landscape unit prevents erosion, protects water sources, improves human health due to CO_2 capture and removal, and facilitates the development of economic activities such as harvesting and beekeeping. Regarding the latter, which has a community component, it consists of using bee products while strengthening ecosystem benefits through the pollination of species, both inside and outside the project area, which in turn facilitates natural pest control, soil fertility, and biodiversity in croplands. In summary, the above reflects community and ecosystem benefits both inside and outside the FMC properties.

In general terms, the project is considered as a landscape unit made up of both the remnants of tropical dry forest and forest plantations. These natural areas represent a fundamental corridor for the permanence of biological and ecosystem diversity, feeding the energy flow with the San Jacinto Mountain Range and the Momposina Depression in the department of Bolívar, and the foothills of the Snow-Covered Mountain Range of Santa Marta in Magdalena.

As previously described, the Caribbean Region CCMP is a climate change mitigation project that combines initiatives for GHG emissions reduction and removal and generates additional positive benefits (known as co-benefits or additional benefits)[364]. According to the BCR Standard, these co-benefits are classified in three categories: 1) biodiversity conservation, 2) benefits related to the community, and 3) gender equity; and depending on the co-benefits reported by the project, the Orchid, Wax Palm or Andean Condor special categories of recognition could be certified.

The first co-benefit category, *biodiversity conservation*, considers seven co-benefits, each of them considered in the activities carried out in the Caribbean Region CCMP. The second one, *benefits related to the community*, lists five co-benefits, of which the Caribbean Region CCMP covers four. And the third component, *gender equity*, is also made up of five co-benefits, four of them applicable to the project.

Co-benefits delivery in the Caribbean Region CCMP is supported by REDD+[365] and GHG Removal Activities (these are detailed in sections 4.8.4 and 5.2, respectively; and framed in the strategic lines, in Section 4.4; and in the safeguards, in Section 4.3). It is also supported by the SDGs[366] (Section 9), the EPCAC Strategy[367] (Section 6) and the Standard Operating Procedures (SOPs)[368]. This document describes the co-benefits, breaking down the components proposed by the BCR Standard[369] in such a way that the activities that make possible their compliance are mentioned.

[363] See Section 4.8.4: Monitoring of the implementation of REDD+ activities.
[364] BCR Standard.
[365] Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto.
[366] Gestión de la información\Secciones Anexas\Anexo 4_ODS y Salvaguarda.
[367] Available at: Gestión de la información/EPCAC.
[368] Available at: Gestión de la información/SOP.
[369] BCR Standard.

Based on the identification of the co-benefits considered for the project activities, it is concluded that the project falls within the Wax Palm category (Figure 56).

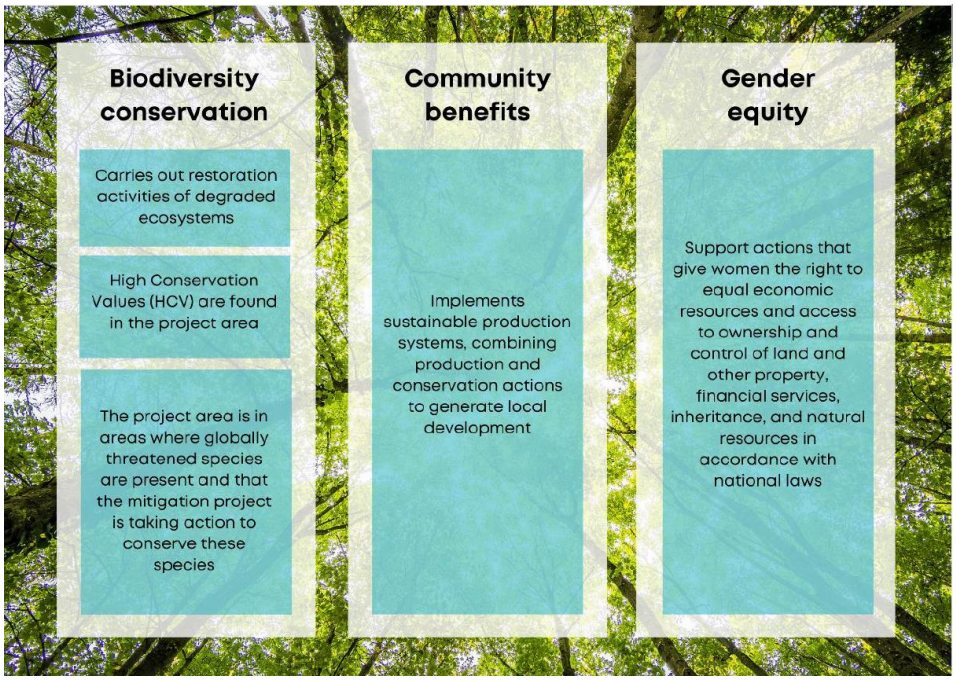


Figure 56: Requirements of the Wax Palm category

(Source: Biocarbon Registry, 2021)

11.1 Monitoring of co-benefits and sustainable development priorities

The description, monitoring plan, indicators and follow-up of the co-benefits are described in the "Co-benefits" document[370].

In the following section, the monitoring of the co-benefits considered for the project activities as part of the requirements of the Wax Palm category (presented in Figure 56) is detailed, and Table 93 expands the information in this regard.

[370] The Co-benefits document describes each of the components, as well as the co-benefits considered for the project. This document is available at: Gestión de la información\Cobeneficios.

Table 93: Monitoring of the co-benefits linked to the Wax Palm category

Component	Co-benefit	Compliance	Supporting document	SDG	Indicator	Follow-up	Frequency
Biodiversity conservation	c) Carries out restoration activities of degraded ecosystems.	FMC conserves 935.74 ha of dry forest, of which 3.78 ha are set aside for rehabilitation.	SIAC Report[371] Shapefile[372]	13. Climate action	Number of ha dedicated to passive restoration in the REAA.	Verification of areas dedicated to passive restoration in the RUNAP and the REAA.	Every 5 years.
	d) High Conservation Value Attributes (HCVA) are found in the project area.	FMC has identified relevant HCVFs and HCVAs. The HCVFs (relicts of bs-T) amount to more than 600 ha. The HCVFs are the species *Belencita nemorosa* (nearly endemic) and *Malagoniella astyanax* columbica (endemic).	SL 1[373]	15. Life on land	• Number of HCVF monitoring reports. • Number of characterization reports of HCVA species. • Number of wildlife sighting reports.	Through the monitoring plan corresponding to the SL 1.	• Every five years. • Every five years (*Belencita nemorosa*) and to be defined (*Malagoniella astyanax*). • Annual report.
	e) The project area is in areas where globally threatened species (according to the IUCN Red List) are present an that the mitigation project is taking action to conserve these species.	FMC has registered threatened species according to the IUCN Red List: *Saguinus oedipus, Chauna chavarria, Myrmecophaga tridactyla, Quadrella odoratissima Albizia niopoides, Lecythis minor* and *Guazuma ulmifolia*.	The application of SL 1[374] is complied with.	15. Life on land	Number of threatened species according to the IUCN Red List.	Through the monitoring plan corresponding to the SL 1.	Reports every five years.
Community benefits	b) Implements sustainable production systems, combining production and conservation actions to	FMC supports local job creation and economic diversification through activities such as community beekeeping and the	SL 3[375]	8. Decent work and economic growth 2. Zero hunger	• Number of beekeeping families. • Amount of usable waste.	Through the monitoring plan corresponding to the SL 3.	Annual[376]

[371] The consultation report of the Single Registry of Ecosystems and Environmental Areas (REAA) is issued at the request of the interested party through the SIAC Geoportal: www.siac.gov.co. Available at: Gestión de la información\Cobeneficios.
[372] Shapefile document with the REAA areas present in the project area. Available at: Gestión de la información/Secciones anexas/Anexo 9_Cobeneficios.
[373] Available at: Gestión de la información/Secciones anexas/Anexo 5_ActividadesProyecto/Línea estratégica1.
[374] Available at: Gestión de la información/Secciones anexas/Anexo 5_ActividadesProyecto/Línea estratégica1.
[375] Available at: Gestión de la información/Secciones anexas/Anexo 5_ActividadesProyecto Monitoreo AVC1/LineaEstrategica3
[376] All indicators have an annual frequency.

Component	Co-benefit	Compliance	Supporting document	SDG	Indicator	Follow-up	Frequency
	generate local development.	recycling project "Reciclando con alegría soy feliz".			• Percentage of local service and product providers.		
Gender equity	a) Supports actions that give women the right to equal economic resources an access to ownership and control of land and other property, financial services, inheritance, and natural resources in accordance with national laws.	The company's social policy strengthens gender equality.	EPCAC document[377]	8. Decent work and economic growth	• Invitation to the training plan (contractors and community) • Creation of local, direct jobs. • Job creation (outsourcing). • FMC has appointed women for different positions. • Number of women hired.	• 52 face-to-face and virtual training sessions. • Between 2016 and 2020, 74 women were hired. • List of women in managerial and administrative positions[378].	Annual[379]

(Source: South Pole, based on the information provided by the project holder, 2022)

[377] EPCAC_PMCC_Región Caribe, disponible en Gestión de la información\EPCAC
[378] Available at: Gestión de la información\Cobeneficios\Tabla 13
[379] All indicators have an annual frequency.

12 Climate change adaptation

Projects based on climate change mitigation measures must also aim at climate change adaptation. For the Caribbean Region CCMP, Section 10.8: Climate change adaptation of the BCR Standard was reviewed in order to identify the way it can be applied during project development. This section is subdivided into two parts, the first of which is made up of five points that explain some requirements to demonstrate contribution to climate change adaptation; and the second part, with four points that focus on the actions and measures to be developed.

Table 94 contains a summary of the analysis of project activities and their alignment with climate change adaptation. The detailed result of the analysis can be found in Annex 11: Climate change adaptation[380].

[380] Gestión de la información\Secciones Anexas\Anexo 11_Adaptación

Table 94: Caribbean Region CCMP activities related to climate change adaptation

Actions	Compliance	Indicator	Follow-up
i. The holder of the GHG mitigation initiative or GHG project demonstrates that:			
a) Considers one or more activities proposed in the National Climate Change Policy	FMC supports job creation and the economic diversification of communities through activities such as beekeeping.	• Number of beekeeping families • Amount of usable waste • Percentage of local service and product providers	SL 3[381]
	FMC carries out monitoring and conservation activities in dry forests.	Number of times the HCVF and HCVA are monitored.	SL 1[382]
	FMC strengthens relationships and collaborative work with different sectors and strategic stakeholders in the project's area of influence, contributing to capacity building and leadership around local environmental management and education.	• Number of training sessions for the community sector and FMC personnel • Number of workshops with the educational sector • Number of ecological mountain biking trails • Number of reports on the investment plan in the Monterrey Forestal Mixed School	SL 2[383]
b) Improves conditions for the conservation of biodiversity and its ecosystem services, in the areas of influence, outside the project boundaries (i.e., natural cover in environmentally key areas)	FMC performs maintenance and monitoring activities for High Conservation Value Forests (HCVF) and High Conservation Value Attributes (HCVA). In addition, it promotes community engagement and collaborative work with the different sectors and strategic stakeholders in the project's area of influence. Another activity that improves the conditions for the ecosystem conservation is fire prevention and control.	• Number of HCVF monitoring reports • Number of HCV species characterization reports • Number of wildlife sighting reports • Training sessions for the community sector and FMC personnel • Workshops with the educational sector • Number of fire prevention activities carried out per year • Firebreaks • Number of controlled events in the year • Impacts of fire on the natural forest and the forest plantations	SL 1, SL 2 and SL 4[384]

[381] Available at: Gestión de la información/Secciones anexas/Anexo 5_ActividadesProyecto Monitoreo AVC1/LineaEstrategica3
[382] Available at: Gestión de la información/Secciones anexas/Anexo 5_ActividadesProyecto Monitoreo AVC1/LineaEstrategica1
[383] Available at: Gestión de la información/Secciones anexas/Anexo 5_ActividadesProyecto Monitoreo AVC1/LineaEstrategica2
[384] Available at: Gestión de la información/Secciones anexas/Anexo 5_ActividadesProyecto Monitoreo AVC1/LineaEstrategica4

Actions	Compliance	Indicator	Follow-up
c) Implements activities that generate sustainable and low-carbon productive landscapes	FMC carries out GHG removal activities through forest plantations. FMC carries out REDD+ activities through the comprehensive conservation of natural forests and joint management of the bs-T biodiversity. FMC supports local employment and economic diversification, community beekeeping, and the recycling project "Reciclando con alegría soy feliz".	• Number of hectares of reforested and eligible lands • Number of HCVF monitoring reports • Number of HCV species characterization reports • Number of wildlife sighting reports • Monthly production of honey and wax • Annual collaborative activities between FMC and the recycling project	SL 1 and SL 3
d) Proposes restoration processes in areas of specific environmental importance	FMC carries out conservation activities on relicts of Bs-T (HCVF): passive restoration processes. In addition to the forest areas that are part of the REDD+ project, FMC conserves 166.66 ha in Bs-T (3.78 ha are rehabilitation areas according to the REAA)	• Number of HCVF monitoring reports • Number of HCV species characterization reports • Number of hectares with areas included in the REAA	SL 1 Verification of the areas in the RUNAP and the REAA
f) Strengthens the local capacities of institutions and/or communities to take informed decisions to anticipate negative effects derived from climate change as well as to take advantage of opportunities derived from expected or evidenced changes	FMC supports local employment and economic diversification through activities such as community beekeeping and the recycling project "Reciclando con alegría soy feliz".	• Amount of usable waste • Investment made (in Colombian pesos)	SL 3
II. The holder of the GHG mitigation project demonstrates the development of actions or measures to adapt to climate change, such as:			
a) Agricultural, forestry and fisheries production systems better adapted to high temperatures, droughts or floods	FMC has a genetic improvement program to produce plant material, capturing and massifying all the genetic gain [385].	• Maintenance and renovation of the clonal garden • Registration before the Colombian Agricultural Institute (ICA)	SL 4 Annual report of the maintenance of the *Gmelina arborea* clonal garden[386]

[385] Production of *Gmelina arborea* stakes from rooted stakes; SOP-VIV-006: Pollination of *Pachira quinata*; SOP-VIV-007: Production of *Pachira quinata* seeds; SOP-VIV-008: Production of *Gmelina arborea* seeds. Available at: Gestión de la información\SOP\Proponente proyecto.

[386] SOP-VIV-004: Maintenance of the *Gmelina* arborea clonal garden. Available at: Gestión de la información\SOP\Proponente proyecto

Actions	Compliance	Indicator	Follow-up
			Annual report of the clonal garden renovation[387]
b) Integrated actions that assist in the efficient use of soil, i.e., the conservation of existing natural cover, land use consistent with land vocation and agroecological conditions, family farming, and agricultural technology transfer that increases competitiveness by reducing vulnerability to climate change	FMC carries out maintenance and monitoring activities in existing natural areas. FMC supports local employment through activities such as community beekeeping and the recycling project "Reciclando con alegría soy feliz".	• Number of HCVF monitoring reports • Monthly production of honey and wax • Annual collaborative activities between FMC and the recycling project	SL 1 and SL 3
d) Actions directly related to climate change adaptation measures	FMC has a genetic improvement program to produce plant material, capturing and massifying all the genetic gain [388].	• Maintenance and renovation of the clonal garden • Registration before the Colombian Agricultural Institute (ICA)	SL 4 Annual report of the maintenance of the *Gmelina arborea* clonal garden Annual report of the clonal garden renovation

(Source: South Pole, based on information provided by the project holder, 2022)

[387] SOP-VIV-005: Renovation of *Gmelina arborea* clonal garden areas. Available at: Gestión de la información\SOP\Proponente proyecto

[388] SOP-VIV-002: Production of *Gmelina arborea* stakes from rooted stakes; SOP-VIV-006: Pollination of *Pachira quinata*; SOP-VIV-007: Production of *Pachira quinata* seeds; SOP-VIV-008: Production of *Gmelina arborea* seeds. Available at: Gestión de la información\SOP\Proponente proyecto.

13 Procedure for quality control and quality assurance of information

13.1 Review of information processing

13.1.1 REDD+

Table 95: REDD+ information processing review

Activity	Carried out by:	FMC	South Pole
Wildlife sighting	Externals and FMC	• Review in accordance with SOP-SGI-001_Información Documentada. • There is a basic sighting guide.[389]	Detailed review for information processing in accordance with the information management system.[390]
Flora monitoring	FMC	The PLM-ADM-005 AN and HCVA management plan is available.[391]	
EPCAC	South Pole	It is in line with FMC Social Policy[392].	

(Source: South Pole, 2022)

13.1.2 GHG removal activities

13.1.2.1 Data verification

13.1.2.1.1 Forestal Monterrey Colombia

FMC outsources the forest inventory of its plantations and forest assets in order to carry out analyzes and project volumes and growth. After the establishment of the plots, the Biometrics Coordinating Engineer together with a technical team remeasure 5% of the established plots as a quality control measure. In this process, plot diameters, heights and area are measured.

13.1.2.1.2 South Pole

South Pole exhaustively monitors the outcomes of each project from the pre-feasibility phase to the final phase, through an information QC/QA system. For this, it carries out a series of procedures that are classified as:

- General QC procedures (Level 1):

This phase includes the review of the information collected in the field and obtained from the inventories carried out by the project holder or the external consultants, which will be required for the GHG reduction and removal projects. In addition, South Pole performs an audit of the inventories, the processing of cartographic information and the procedures carried out. Subsequently, it provides feedback to the project holders regarding inaccuracies in the data, recommendations for future verifications, and suggested or required processes.

[389] Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto\LineaEstrategica1\Avistamientos y Registros de fauna.
[390] Gestión de la información\SOP.
[391] Gestión de la información\Secciones Anexas\Anexo 5_ActividadesProyecto\LineaEstrategica1.
[392] Gestión de la información\EPCAC \Compromiso_comunidades.

For this monitoring period (2012-2021), South Pole conducted two field visits to assess the procedures developed by Gesamfor and Ecologic during the establishment and measurement of permanent plots. In this way, the diameters and heights of 40% of the individuals in the plots for GHG removal activities were verified in the field. Additionally, it verified the planted areas through using cartographic information from satellite images and performing and a visual classification (2021) (Table 73).

- Specific QC procedures (Level 2):

In this phase, calculations are reviewed and audited to obtain the estimates of the GHG emission reductions and removals, as well as the activity and uncertainty data. For this, the suitability of the factors used in the calculations is assessed with respect to project conditions and standard requirements. In addition, the data and equations used, the calculations made, and the results obtained are cross-checked, being compared with similar projects and reported information or historical data.

- Document review and audit procedures (Level 3):

In this process, it is verified that the estimates are adequately presented and comply with all the technical guidelines and the requirements of the relevant standard and the selected methodologies.

After carrying out these processes, the documents are sent to the project holder for the review, approval and correction of the defined actions, using the track changes function in the documents in order to follow up on modifications and omissions. In the same way, it is verified that the resulting information is correctly reported in the official standard templates and the content is adjusted to all technical guidelines, the requirements of the standard, and the selected methodologies.

13.2 Recording and file system

13.2.1 Project holder: Forestal Monterrey Colombia

FMC's SOP-SGI-001_Documented Information establishes the procedures to create, update and control the relevant documented information and data required in the Integrated Management System and the Occupational Health and Safety Management System. This procedure involves all documented information and data used in all operational and administrative activities of Forestal Monterrey Colombia S.A.S. and GreenWood Resources Colombia S.A.S.[393]

13.2.2 Carbon project developer: South Pole

Archiving documents is a basic step when arranging project information, so it must be backed by an adequate repository plan. The life cycle of the documents to be used internally is explained below, based on the types of files:

- **Management file:** It contains the documents that are being processed, awaiting solutions to issues initiated, or continuously used and consulted (both for administrative and technical purposes) by the project team. This management file does not require a defined folder structure for handling the information of a project in its active phase (basically, from the feasibility until the validation/verification). The documents in this file are subject to technical revisions prior to their official issuance.

[393] FMC's information management procedure is available at: Gestión de la información\Secciones Anexas\Gestion de la información.

- **Central file:** It stores the documents transferred once a given process has been completed, while they are still valid and can be consulted by the project team and individuals in general (VVBs, relevant government entities such as MADS, etc.). Regarding the documents prepared during the project design phase (management file), only final products are stored here. Transfers from the management archive to the central archive are known as primary transfers.
- **Historical file:** This is where documents from the central or management file are transferred when, by decision of the project team, must be permanently saved given their value for the project throughout its crediting period. This file corresponds to the *Archive* folder. Transfers from the central or management file to the historical file are known as secondary transfers.

Every document saved must be named according to the following coding: date (yyyy/mm/dd), file name, and initials of who created the document like this: **20190322_FileName_XY**. The elements of the file name must be separated by low dashes and tildes should be avoided (for greater security). When the document has been modified by another person, it must be renamed with the new date and the modifier's initials must be added.

The supporting documents (i.e., those that are not specifically produced for the project but are required for its management) must be saved in the folders designated for this purpose since they are generally obtained from websites and links could stop being available in the short term. Technical review is not applied to these documents and each project holder must define which ones are relevant to be stored and which ones should be removed, either because they are easily accessed at any time or because copies of them are already within the organization.

Documents should only be saved digitally, except for agreements with project owners (contracts, cooperation agreements, memorandums of understanding, etc.), which require a physical backup. Therefore, all the documents and annexes associated to project development must be scanned and stored in the respective folders. The project will avoid the production of printed documents when it is not required for legal or historical preservation reasons, given the longevity of paper as a means of recording information. Figure 57 shows a general diagram of the life cycle of documents[394].

[394] The complete Information Management document is available at: Gestión de la información\Secciones Anexas\Gestion de la información.

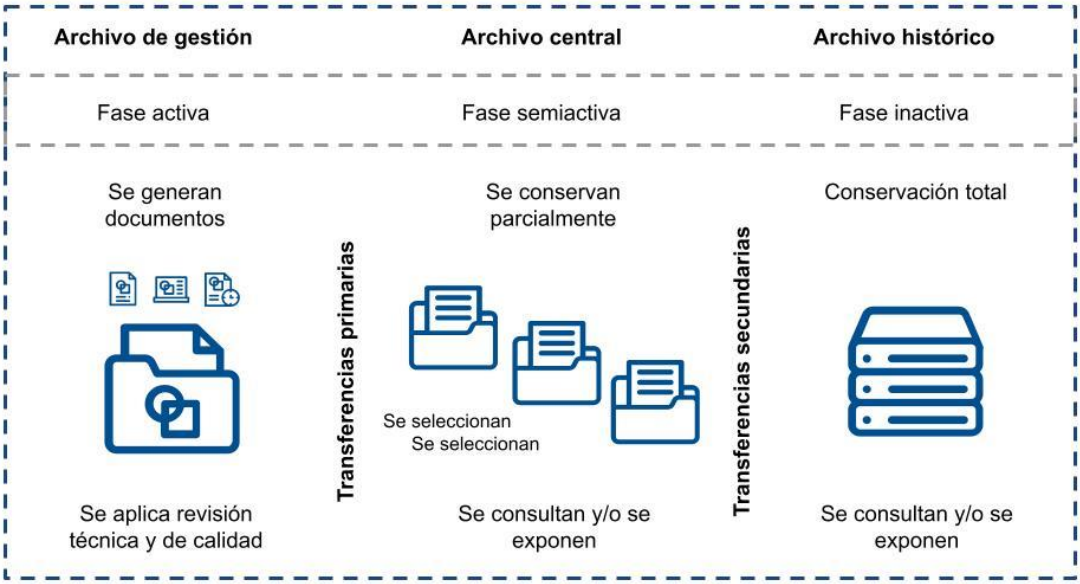


Figure 57: Project document life cycle

(Source: South Pole, 2022)

14 Net GHG removals and reductions for the Colombian carbon tax and the voluntary market

Article 17 of Resolution 1447 of 2018, modified by Article 2 of Resolution 0831 of 2020, mentions in Paragraph 3 that:

> As of January 1, 2020, the holders GHG mitigation initiatives shall only report and cancel in RENARE GHG mitigation results with a validity period no greater than five (5) years. However, this restriction will come into force from January 1, 2021 for those GHG mitigation initiatives that validated their baseline before July 1, 2020, whose evidence will be the respective validation report or equivalent document issued by a VVB (MADS, 2020, p.3).[395]

In accordance with the above, Table 96 and Table 97 present the total removals and reductions per year for the Caribbean Region CCMP (excluding the 15% discount for reversal risks).

Table 96: Net GHG removals and reductions per year for the Colombian carbon tax and the voluntary market

Component	Year	Net GHG removals by sinks - C_{proy} (tCO_2e)	Market
GHG Removal Activities	2012	450.0	Voluntary market
	2013	3,040.0	
	2014	7,918.0	
	2015	18,180.0	
	2016	33,872.0	
	2017	44,812.0	Carbon tax
	2018	45,234.0	
	2019	45,234.0	
	2020	43,831.0	
	2021	17,404.0	
REDD+	2016	50,050.0	Voluntary market
	2017	88,977.0	Carbon tax
	2018	85,328.0	
	2019	80,262.0	
	2020	71,361.0	
Total		**635,953.0**	

(Source: South Pole, 2022)

Table 97: Summary of removals/reductions by initiative and market

Net GHG removals/reductions by sinks - Cproy (tCO_2e) - 15%		
Component	**Market**	Total
GHG Removal Activities	Carbon tax	196,515.0
	Voluntary market	63,460.0

[395] MADS. (2020). Resolution 0831 of September 30, 2020 "by means of which Resolution 1447 of 2018 is modified and other provisions are issued".

Net GHG removals/reductions by sinks - Cproy (tCO_2e) - 15%		
Component	**Market**	Total
Subtotal of GHG Removal Activities		**259,975.0**
REDD+	Carbon tax	325,928.0
	Voluntary market	50,050.0
Subtotal of REDD+		**375,978.0**
Total		**635,953.0**

(Source: South Pole, 2022)

15 List of Annexes

The annexes and their respective supporting documents can be found in the path: Information Management\Annexed Sections. The annexes are listed below:

Annex 1: Compliance with national legislation

Annex 2: Baseline scenario and additionality

Annex 3: Causes and agents of deforestation

Annex 4: SDGs and safeguards

Annex 5: Project activities

Annex 6: Stakeholder consultation

Annex 7: Risk management

Annex 8: Impact assessment

Annex 9: Co-benefits

Annex 10: Information management

Annex 11: Climate change adaptation

Annex 12: Parameters available for the validation and verification of the GHG Removal Activities initiative.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