CAUAXI REDD+ GROUPED PROJECT

Document Developed By BRCarbon

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Project Title	Cauaxi REDD+ Grouped Project
Version	Version 00
Date of Issue	February 3, 2023
Project Location	Brazil, Pará (PA) state, encompass 7 municipalities: Dom Eliseu, Rondon do Pará, Paragominas, Tomé-Açu, Ipixuna do Pará, Ulianópolis and Goianésia do Pará
Project Proponent(s)	**BRcarbon Serviços Ambientais LTDA** | Mr. Bruno Melo da Matta – e-mail diretoria@brcarbon.com.br – Av. Cezira Giovanoni Moretti 655, sala 7, AgTech Garage Reserva Jequitibá - Piracicaba, SP – +55 (19) 3424-3583
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Project Lifetime	From **2022** to **2052 (PAI#1-PAI#20)**
GHG Accounting Period	May 02nd, 2022 to August 01st, 2121; 100-year total period
History of CCB Status	NA
Gold Level Criteria	**Exceptional Biodiversity Benefits** – Sustained by meeting the vulnerability criteria established in the CCB standard. Two Critically Endangered (CR) species *(Psophia obscura* and *Cebus kaapori*) and one Endangered (EN) species (*Pteroglossus bitorquatus*) are found within the project area. These species trigger the vulnerability criteria and classify the project area as a Key Biodiversity Area (KBA). The project aims the promotion of species conservation through the maintenance of forest habitats and avoidance of hunt pressure.
Expected Verification Schedule	1st vintage: December, 2023

Table of Contents

1 SUMMARY OF PROJECT BENEFITS

1.1 Unique Project Benefits

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) Climate benefits: during the first baseline period we aim to prevent 5,292,891 tCO2e from being emitted to the atmosphere over an area of 57,291.44 hectares, which is equivalent to 529.289 tCO2e per year on average. The avoided emissions will also be achieved by forest monitoring, using remote sensing images, and preventing forest fires. It will promote community awareness about forest fire risks and conduct training on good practices in fire management, which are culturally used to manage agricultural areas. Inappropriate fire management practices contribute to forest degradation and carbon emissions. Due to climate change, forest fires have been exacerbated by extreme drought events, forest monitoring, and fire use management is essential to maintaining forest integrity and mitigating climate change. As part of our monitoring efforts, it will also allow the development of degraded and second-growth forests, enabling carbon sequestration and stock growth.	3
2) Biodiversity benefits: protecting 57,291.44 hectares of native forest will safeguard the habitat of a high diversity of fauna and flora, including rare endemic and/or threatened species and pollinating animals, which are essential to agricultural production and food security.	5
3) Community benefits: We believe that social engagement with carbon projects is the most powerful way to reduce risks and ensure the permanence of forest conservation in the long term. Thus, we aim to make people aware of the importance of forest conservation, which also includes ecosystem services, and how natural resources can be used efficiently to ensure high production, income, and environmental conservation. So, we provide support for community development, including infrastructure, digital inclusion, and strengthening internal associations that support community education, culture, and leadership. We will hold periodic workshops and training with the community to increase ecological awareness and conduct practices about sustainable agriculture such as crop rotation and agroforestry systems, which can maintain soil quality, increase, and diversify production, and ensure food security.	4

1.2 Standardized Benefit Metrics

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
GHG emission reductions	Net estimated emission reductions in the project area, measured against the without-project scenario	5,292,891 tCO2e	3
Forest[1] cover	For REDD[2] projects: Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario	57,291.44 ha	2
Improved land management	Number of hectares of existing production forest land in which IFM[3] practices are expected to be occurred as a result of project activities, measured against the without-project scenario	Not applicable	-
	Number of hectares of non-forest land in which improved land management practices are expected to be occurred as a result of project activities, measured against the without-project scenario	Not applicable	-
Training	Total number of community members who are expected to have improved skills and/or knowledge resulting from training provided as part of project activities	200	4
	Number of female community members who are expected to have improved skills and/or knowledge resulting from training as part of project activities	60	4

[1] Land with woody vegetation that meets an internationally accepted definition (e.g., UNFCCC, FAO or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height and level of crown cover, and may include mature, secondary, degraded and wetland forests (*VCS Program Definitions*)
[2] Reduced emissions from deforestation and forest degradation (REDD) - Activities that reduce GHG emissions by slowing or stopping conversion of forests to non-forest land and/or reduce the degradation of forest land where forest biomass is lost (*VCS Program Definitions*)
[3] Improved forest management (IFM) - Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood and fuelwood (*VCS Program Definitions*)

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
Employment	Total number of people expected to be employed in project activities,[4] expressed as number of full-time employees[5]	04	4
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	02	4
Livelihoods	Total number of people expected to have improved livelihoods[6] or income generated as a result of project activities	400	4
	Number of women expected to have improved livelihoods or income generated as a result of project activities	150	4
Health	Total number of people for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	400	4
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	150	4
Education	Total number of people for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	300	4
	Number of women and girls for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	100	4

[4] Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, sub-contracted workers and community members that are paid to carry out project-related work.
[5] Full time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and/or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region or economic territory (adapted from the UN System of National Accounts (1993) paragraphs 17.14[15.102];[17.28])
[6] Livelihoods are the capabilities, assets (including material and social resources) and activities required for a means of living (Krantz, Lasse, 2001. *The Sustainable Livelihood Approach to Poverty Reduction*. SIDA). Livelihood benefits may include benefits reported in the Employment metrics of this table.

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
Water	Total number of people who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	120	4
	Number of women who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities. measured against the without-project scenario	40	4
Well-being	Total number of community members whose well-being[7] is expected to improve as a result of project activities	800	4
	Number of women whose well-being is expected to improve as a result of project activities	200	4
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation,[8] measured against the without-project scenario	57,291.44 ha	5
	Expected number of globally Critically Endangered or Endangered species[9] benefiting from reduced threats as a result of project activities,[10] measured against the without-project scenario	3 species	5

[7] Well-being is people's experience of the quality of their lives. Well-being benefits may include benefits reported in other metrics of this table (e.g., Training, Employment, Livelihoods, Health, Education and Water), and may also include other benefits such as strengthened legal rights to resources, increased food security, conservation of access to areas of cultural significance, etc.
[8] Managed for biodiversity conservation in this context means areas where specific management measures are being implemented as a part of project activities with an objective of enhancing biodiversity conservation, e.g., enhancing the status of endangered species
[9] Per IUCN's Red List of Threatened Species
[10] In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

All the social benefits data predicted above are estimates from a conservative perspective and there will be adaptations of the numbers, when necessary, it will be shown on Monitoring Reports (MR). But we must highlight that the project aims to impact in a positive way as many people as possible during its implantation and development.

2 GENERAL

2.1 Project Goals. Design and Long-Term Viability

2.1.1 Summary Description of the Project (G1.2)

The Cauaxi REDD+ Grouped Project (hereafter called GPD) aims to conserve forests in several private properties located in northeast portion of Pará, close to the border with Maranhão. The Cauaxi River, which gives the project its name, is one of the tributaries of the Capim River, located in the central portion of the project's reference region, at Paragominas municipality.

Located in the north of Brazil, Pará is one of the 27 Brazilian federative units and has an area of almost 1,3 million square kilometers, making it the second largest Brazilian state. GPD is in Pará's southeast mesoregion in the microregion of Paragominas with a total reference region of 5,268,809 ha and is approximately 453 km from Belém, the state capital (Figure 1). As GPD is in the “Deforestation Arc”, the region with historical highest rate of deforestation in the Amazon, its forests are under increased threat from deforestation.

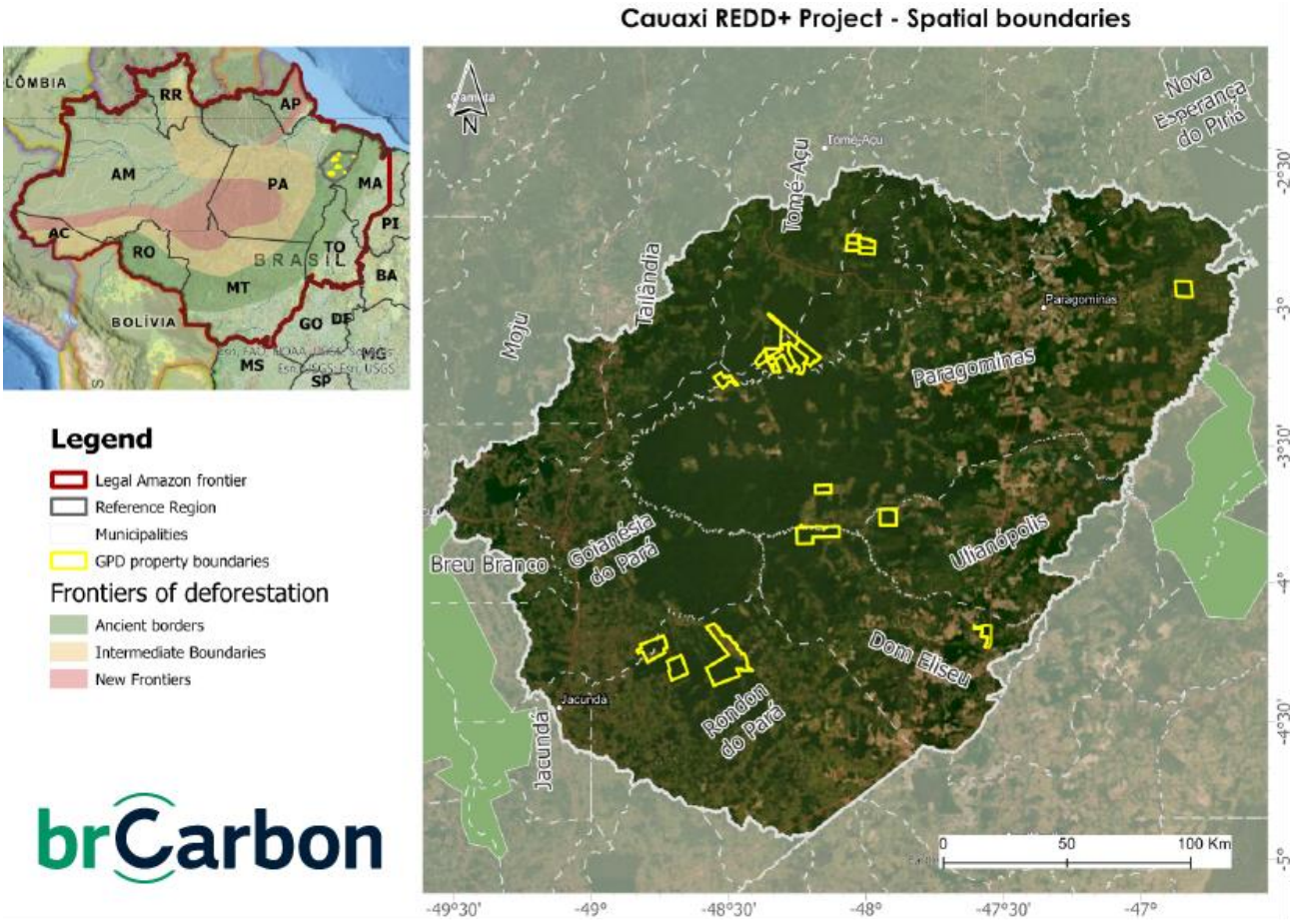


Figure 1 – Cauaxi REDD+ Grouped Project- Spatial boundaries

It is important to highlight that the actions involving the implementation of the REDD+ Cauaxi grouped project are complementary to the grouped project for the BRAZILIAN AMAZON APD GROUPED PROJECT (ID 2551[11]). Through these two projects, in accordance with current federal and state environmental laws, BRCarbon seeks to promote integral forest conservation actions in rural properties with remaining vegetation, promote solutions based on nature in its regions of influence, generating co-benefits not only for the climate (reduction and removal of emissions), but also for communities and local biodiversity.

The GPD aims to create positive economic incentives for landowners to conserve rainforests in private areas that are vulnerable to degradation and deforestation, while contributing to net positive climate impacts as well as benefit to traditional communities and conserve biodiversity. According to Brazilian Vegetation Law (national law 12.651), landowners are required to conserve 80% of the forest cover on properties located in the Legal Amazon. Since the law is not enforced in the Deforestation Arc, illegal logging and deforestation in the protected areas inside of the farms are common. One important aspect is that the conservation and monitoring costs can be prohibitive for the landowner, especially in non-productive and broad areas. The carbon project can therefore contribute to enforcing the law, providing landowners with an opportunity to monitor and conserve their lands, as well as engaging local communities in the project zone.

By joining BRCarbon (hereafter known as BRC) conservation program, forest owners can access financial funds from the carbon voluntary market to develop conservation and monitoring efforts in their forests. A partnership between BRC and landowners will result in the legal protection of forests, forest monitoring using satellite images, biodiversity inventory (including fauna and flora species), and forest biomass inventory in a broad scale, using an upscaling approach based on field collection, drone-borne and satellite sensors such as LiDAR (light detection and ranging). In addition, we will involve strength the surveillance of property, wildfire monitoring, fire prevention and fighting, threatened and monitoring biodiversity species and social activities with traditional communities in the project zone.

BRC will be responsible for the development, implementation, monitoring, and certification of the project instances. It is the landowners' responsibility to allow project activities to be implemented in their areas, as well as the voluntary commitment to their long-term conservation. As a result, BRC expects to enhance the climate impact of carbon projects, helping communities and biodiversity. This project is related to climate-positive impacts caused by the reduction of emissions caused by deforestation and avoided degradation (REDD+). Two voluntary carbon standards are used to certify all projects: the VCS (verified carbon standard) and the CCB (climate, community, and biodiversity).

This Project Description is related to twenty (20) project activities instances located in the Pará state. The project activity instances (PAIs) are split in seven municipalities: Dom Eliseu, Rondon do Pará, Paragominas, Tomé-Açu, Ulianópolis, Goianésia do Pará and Ipixuna do Pará. Since the project starting

[11] https://registry.verra.org/app/projectDetail/VCS/2551

date (2nd May, 2022), the project activities have been implemented in a total of 20 properties and in the project zone area, as it evidenced along the Project Description document.

The first twenty project activities instances have the main objective to conserve 57,291.44 ha of dense ombrophyllous forest, the climate benefits are directed related with the emission reduction of 529.289 tCO2e in average per year.

2.1.2 Project Scale

The project is categorized as a Large Project considering the proposed group design and its larger objectives. The GHG emission reductions or removals are more than twice of a Large Project minimum amount (529.289 ton of CO2e per year on average) on this first approach.

During the project, BRC will develop efforts to increase the protected forest area and increase project instances numbers.

Project Scale	
Project	
Large project	X

2.1.3 Project Proponent (G1.1)

The project´s primary proponent is the BRcarbon Serviços Ambientais LTDA company, as shown below:

Organization name	BRcarbon Serviços Ambientais LTDA.
Contact person	Mr. Bruno Melo da Matta
Title	CEO
Address	Av. Cezira Giovanoni Moretti 655, sala 7, AgTech Garage, Reserva Jequitibá - Piracicaba, São Paulo
Telephone	+55 (19) 3424-3583
Email	diretoria@brcarbon.com.br

2.1.4 Other Entities Involved in the Project

The project will be developed on **Floraplac Group** properties. Floraplac Group are made by Floraplac Industrial LTDA, Floraplac MDF LTDA, EXPAMA - Exportadora Paragominas de Madeiras LTDA and Rio Concrem Industrial LTDA companies. It will be developed also on Mr. Gilson Antônio Moreira Machado and Mr. Adão Ribeiro Soares properties.

Organization	**Floraplac Group**
Organization name	**Floraplac Industria LTDA**
Address	Colonia do Uraim Rod. No number. KM 01 – ZIP 68.627-400 – Industrial District – Paragominas. PA
Telephone	+55 (91) 3521-1310
Organization name	**Floraplac MDF LTDA**
Address	Colonia do Uraim Rod. No number. KM 02 – ZIP 68.627-400 – Industrial District – Paragominas. PA
Telephone	+55 (91) 3729-4697 / +55 (91) 3729-4636
Organization name	**EXPAMA - Exportadora Paragominas de Madeiras LTDA**
Address	Dos Pioneiros Rod. No number. Square 15 and 16 – ZIP 68.627-370 – Industrial District – Paragominas. PA
Telephone	+55 (91) 7293-420
Organization name	**Rio Concrem Industrial LTDA**
Address	BR-010 Rod. KM 30 – ZIP 68.633-000 – Dom Eliseu. PA
Telephone	+55 (91) 3351-005
Contact person	Mr. Carlos Guimarães
Title	PAI's #01 to #13 landowner
Email	juridico@floraplac.com

Owner name	**Mr. Gilson Antônio Moreira Machado**
Contact person	Bruno Machado
Title	PAI's #15 to #17 landowner
Address	Várzea Alegre extension line. 09. Vila Nova. Ipixuna do Pará/PA. ZIP 68.637-0000
Telephone	+55 (91) 9293-3163
Email	nelorebm@gmail.com

Owner name	**Mr. Adão Ribeiro Soares**
Contact person	Adão Ribeiro
Title	PAI's #18 to #20 landowner
Address	do Lago rod. Km 01. Jacundá. Pará
Telephone	+55 (94) 99182-6647
Email	adaoribeirosoares@hotmail.com

Owner name	**Mr. Adriano D´Agnoluzzo**
Contact person	Mr. Carlos Guimarães
Title	PAI #14 landowner
Address	Colonia do Uraim Rod. No number. KM 01 – ZIP 68.627-400 – Industrial District – Paragominas. PA
Telephone	+55 (91) 3351-005
Email	juridico@floraplac.com

Owner name	**Mr. Silvano D´Agnoluzzo**
Contact person	Mr. Carlos Guimarães
Title	PAI #14 landowner
Address	BR-010 Rod. KM 30 – ZIP 68.633-000 – Dom Eliseu. PA
Telephone	+55 (91) 3351-005
Email	juridico@floraplac.com

2.1.5 Physical Parameters (G1.3)

The Cauaxi REDD+ grouped project has twenty project activity instances located in Dom Eliseu, Ipixuna do Pará, Tomé Açú, Paragominas, Rondon do Pará, and Ulianópolis municipalities.

The table below list the properties include in this grouped project and a centroid geographical coordinate by each project activity instance (Table 1). Coordinates are also submitted separately as a KML file (GIS database).

Table 1 – Project Instance centroid coordinates and municipality.

PAI# number	Property Name	Municipality / UF	Geodetic coordinates	
			X (Long)	Y (Lat)
PAI#01	Fazenda Capinzal II	Ulianópolis	-47.92	-3.76
PAI#02	Fazenda Capinzal I	Dom Eliseu	-48.18	-3.82
PAI#03	Fazenda Concrem I	Dom Eliseu	-47.56	-4.18
PAI#04	Fazenda D'Graus I	Ipixuna do Pará	-48.25	-3.18
PAI#05	Fazenda D'Graus II	Ipixuna do Pará	-48.21	-3.16
PAI#06	Fazenda D'Graus V	Ipixuna do Pará	-48.52	-3.26
PAI#07	Fazenda Yollanda	Ipixuna do Pará	-48.33	-3.21
PAI#08	Fazenda Paraná	Paragominas	-46.84	-2.93
PAI#09	Fazenda D'Graus III	Tomé-Açu	-48.29	-3.17
PAI#10	Fazenda D'Graus IV	Tomé-Açu	-48.29	-3.09
PAI#11	Fazenda D'Graus VII	Tomé-Açu	-48.34	-3.16
PAI#12	Fazenda Nova Esperança	Tomé-Açu	-48.37	-3.18
PAI#13	Fazenda D'Graus VI	Tomé-Açu	-48.34	-3.19
PAI#14	Fazenda São Domingos	Paragominas	-48.16	-3.66
PAI#15	Fazenda Floresta Nubia	Ipixuna do Pará	-48.02	-2.79
PAI#16	Fazenda Várzea Alegre	Ipixuna do Pará	-47.99	-2.76
PAI#17	Fazenda Floresta I	Ipixuna do Pará	-48.05	-2.75
PAI#18	Fazenda Cajueiro	Rondon do Pará	-48.51	-4.27
PAI#19	Fazenda Ribeiro	Rondon do Pará	-48.69	-4.31
PAI#20	Fazenda União I	Rondon do Pará	-48.77	-4.24

2.1.5.1 Climate

The project area is in the tropical equatorial zone, and the prevailing climate is humid, marked by high temperatures and high levels of rain. This type of climate, which encompasses most municipalities in Pará, is found in low-latitude regions, close to the equator.

As demonstrated at Figure 2 bellow, according to Koppen Climate classification the project's reference region has three types of tropical climate: northernmost with a bit influence of Af (Humid or super humid tropical climate). However, the majority area was classified as monsoon climate -Am (Humid or subhumid tropical climate with a short dry season), and at south were classified as tropical savannah climate (Aw) with a distinct dry season.

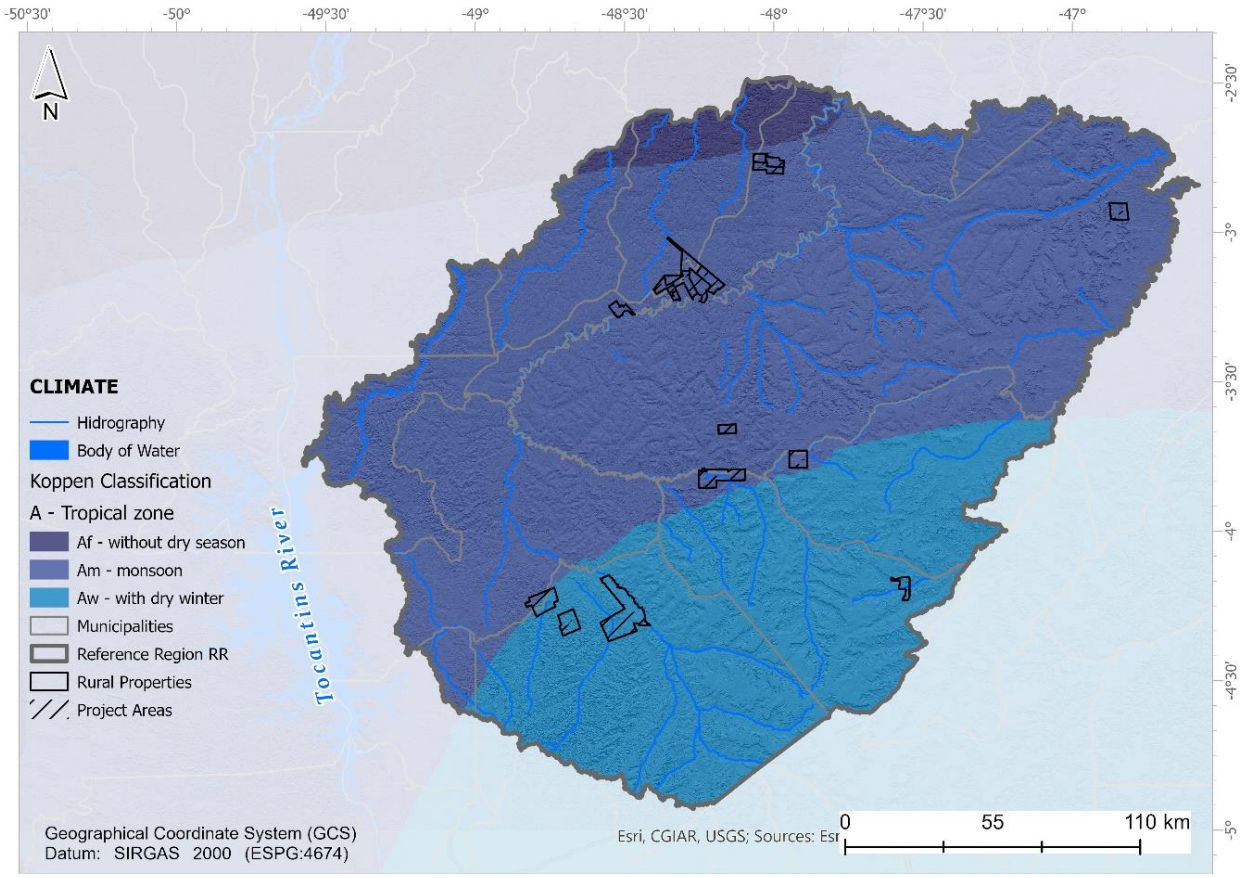


Figure 2 – Climate classification in Reference Region.

The monsoon climate is also occasionally known as humid tropical climate, tropical monsoon, and trade wind climate. According to Alvarez (2013), this climate is the most representative climate of the country, has average monthly temperatures above 18°C in all months of the year and is considered an intermediate climate type between types Af (equatorial climate) and Aw (tropical savanna climate)12. In

[12] https://www.cnpf.embrapa.br/pesquisa/efb/clima

essence, the monsoon climate tends to have more rainfall than the tropical savanna climate or less pronounced dry seasons. Furthermore, a characteristic of these climates tends to have less variation in temperatures leading to low annual temperature range.

2.1.5.2 Types of vegetation

The Amazonian vegetation that influences the climate is mostly dense, green, broadleaf (vegetation with broad leaves) and humid, due to the regularity of rainfall in these municipalities. According to the technical manual of Brazilian vegetation (IBGE, 2012) the predominant vegetation type is Dense Ombrophylous Forest, occurring in 60% of the study region. The Dense Ombrophylous Forest presents the subtypes Alluvial, Submontana, Montana.

In the context of the reference region of the project, as could be seen in the map below, the highlights are at north and northeast there is an alluvial, while at south submontane rainforest (Figure 3). Also, southeast has small open fragments of open plains of tropical forest represented by only 1,5% in the area.

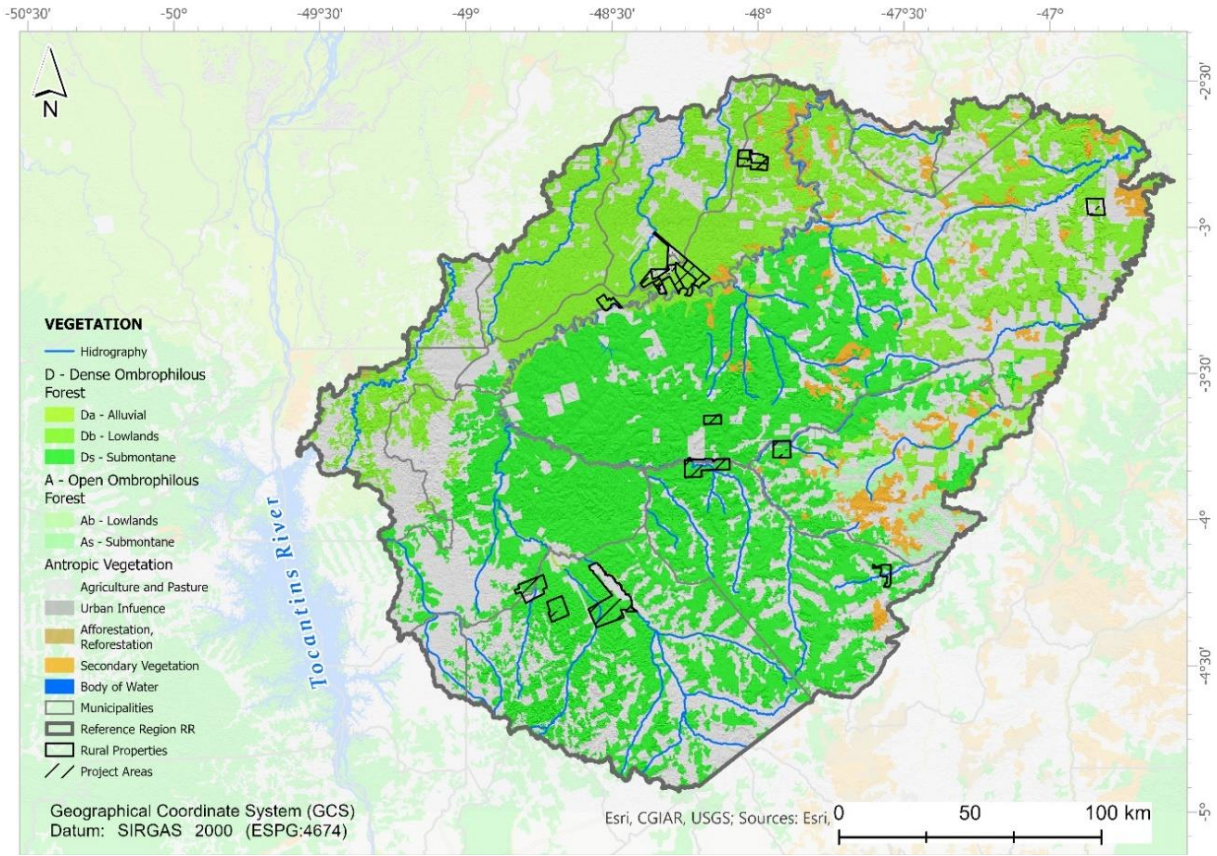


Figure 3 – Vegetation Map at Reference Region (IBGE. 2021).

It is notable that most of the original forest cover of the region has already undergone major changes, due to anthropic activities and the high degree of deforestation and degradation. At the same time, it is

essential to note that to the east, in the municipalities of Dom Eliseu, Paragominas and Ipixuna, there is a considerable area of secondary vegetation and recovery areas.

As described on the Table 2, at properties and project areas the vegetation classification is mainly composed by Dense Ombrophilous Forest types Submontane and Lowlands (Ds, Db) representing 90% of vegetation cover at the selected areas.

Table 2 – Vegetation types at project areas.

Vegetation Classification (IBGE)	**Area (ha)**	**Coverage (%)**
Dense Ombrophilous Forest (Ds, Db, Da)	53,849.81	94,10%
Secondary Vegetation (Vs)	3,348.18	5,90%

2.1.5.3 Topography

João et al., (2013) emphasizes that the physical geography of the state of Pará predominates vast domain of land with modest dimensions, less than 250 m, resulting from long and elaborate periods of widespread flattening in the regional relief of the state. The Figure 4 Below illustrates the variation of elevation (meters) in the project's reference region.

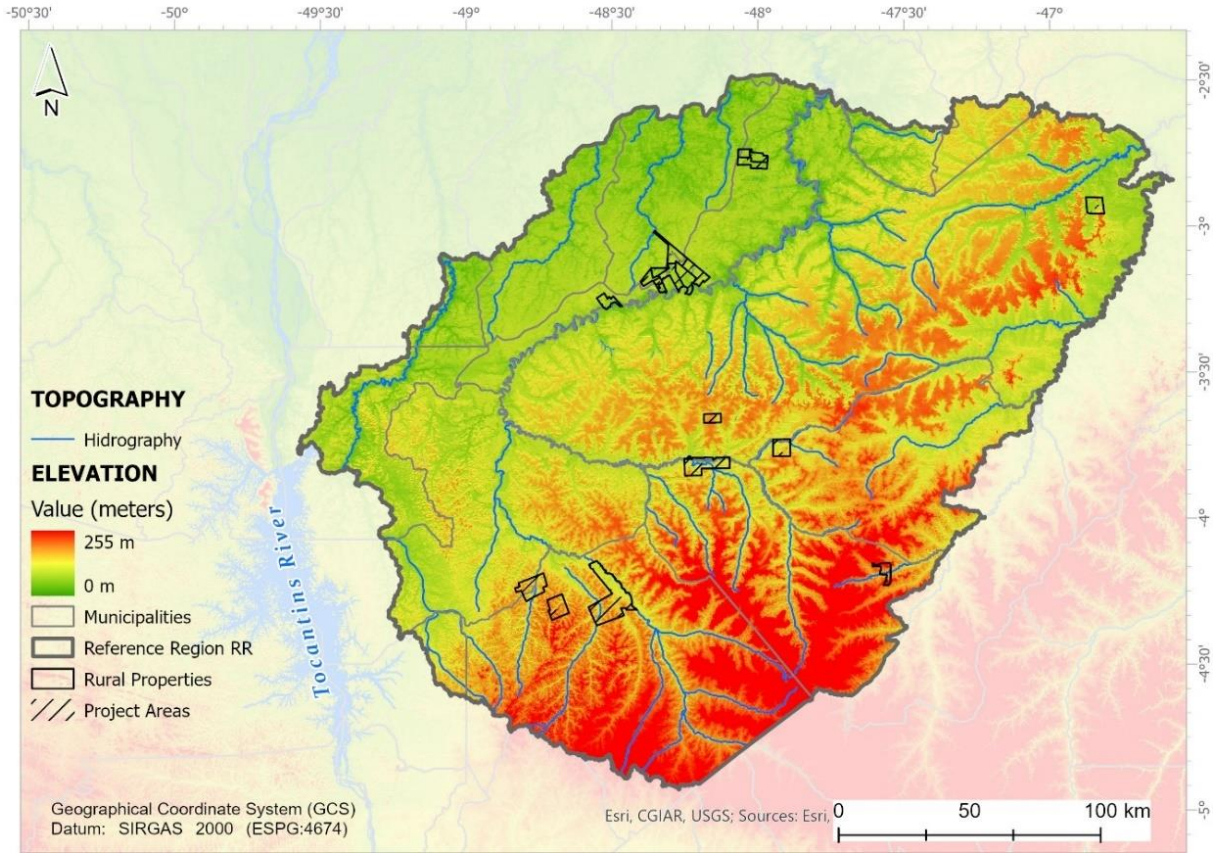


Figure 4 – Topography in the Reference Region.

The following table shows the percentage found in the project areas according to the terrain's elevation, relief, and slope class, according to the EMBRAPA classification (Table 3).

Table 3 – Elevation and Slope classes in project activity instances.

Elevation	Area (ha)	Coverage (%)	Slope	Area (ha)	Coverage (%)
< 50 meters	1,276.30	2.23%	**Plan**	20,222.80	35.4%
50 - 100 meters	22,845.24	39.94%	**Smooth Wavy**	23,761.82	41.5%
100 - 150 meters	19,088.36	33.37%	**Wavy**	7,753.42	13.6%
150 - 200 meters	12,560.45	21.96%	**Mountainous**	884.65	1.5%
200 - 250 meters	1,427.58	2.50%	**Strong wavy**	4,575.31	8.0%

The relief along the state territorial extension presents low altitudes, where 60 % of territory is composed by low altitudes (Figure 5). This low and flat relief is the result of the Amazonian plain, lowered by the waters of the rivers. However, a part of the state has higher areas of the Guiana and Brazilian Plateaus. Among them formations are Serra do Carajás, Serra do Cachimbo, and Serra do Acari.

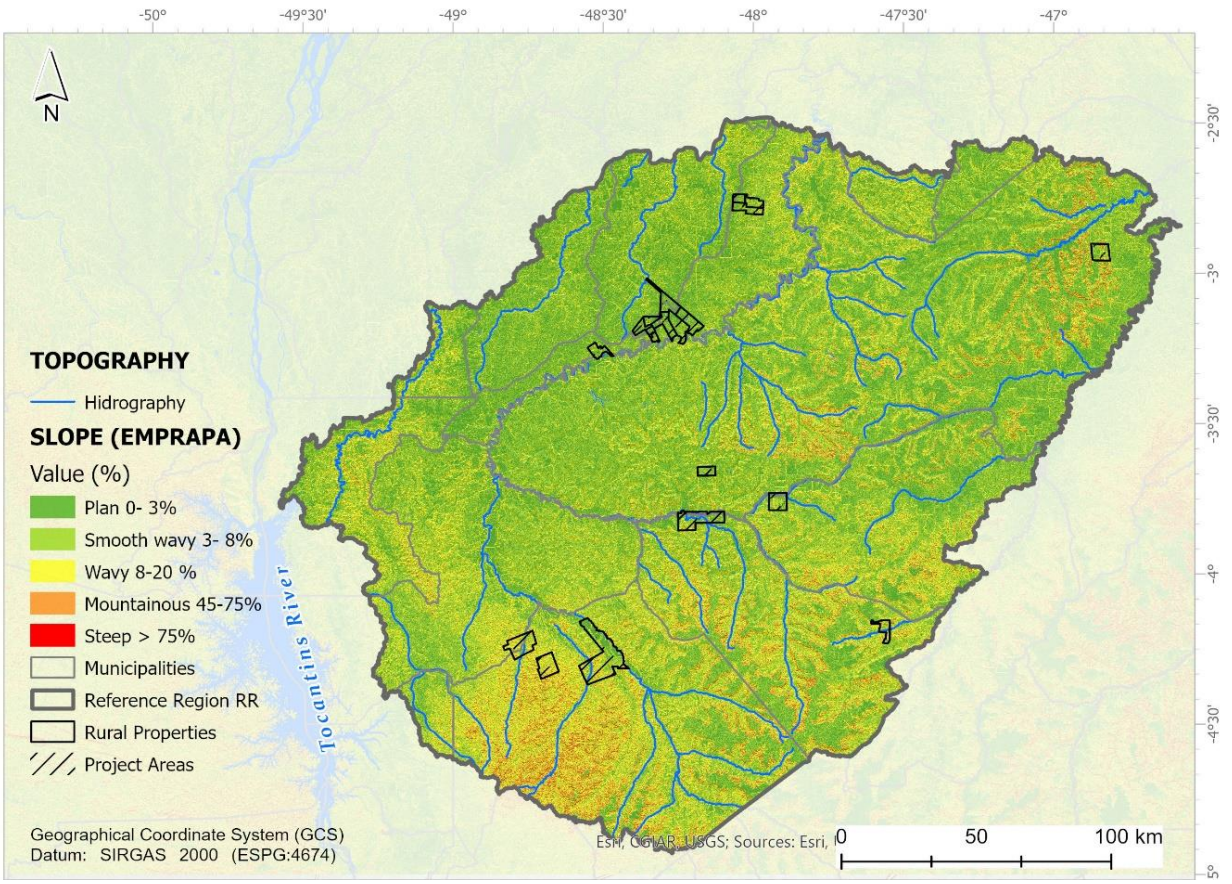


Figure 5 – Embrapa slope classification at project's reference region.

2.1.5.4 Hidrology

The reference region comprises the *Guamá / Capim* and *Pará* and *Maranhão's* coastal micro watersheds, bordering the Tocantins Araguaia basin at south – west (Figure 6). The main river of the region is the *Capim* and its tributaries *Ararandeua* and *Subiruju* where most of the grouped project properties are located. They are typical of the plain and exhibit a high sinuosity meandering channel pattern, while the tributaries that dissect the plateaus present a straight meandering pattern. Only the Project Instances at northeast of the reference region are under the influence of tributaries rivers of *Gurupi* River, as *Uraim* and *Concrein* River at the coastal micro basin.

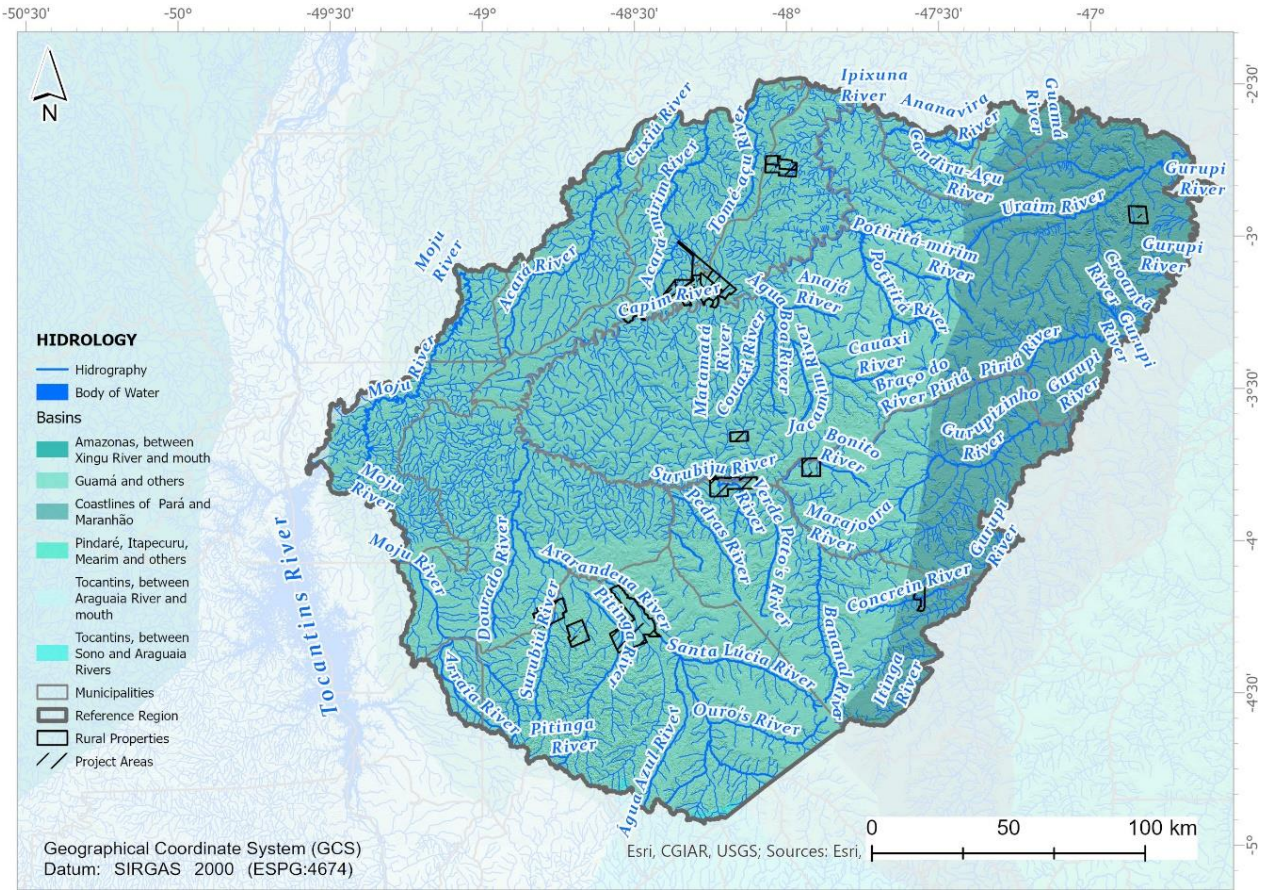


Figure 6 – Micro basins and hydrographic network in Reference Region.

2.1.5.5 Geomorphological

The project's reference region comprises the geomorphological domains of the Lower Plateaus of the Parnaíba Basin and the Lower Tocantins Araguaia Depression. The lower plateaus were named Plateau Setentrionial Pará-Maranhão (by Barbosa Novaes Pinto,1973) and occupied the northeast portion of the state of Pará and being also classified as Tabuleiros do Rio Gurupi/Grajaú (IBGE, 1995). The regional drainage network promoted a dissection of the low plateaus, generating lower elevations and a dissected relief in hills and hills.

2.1.5.6 Soil

The pedology of the predominant region (Figure 7) is of the dystrophic yellow Latosol type, which is yellow, with a high degree of weathering, deep, acidic, and rich in aluminum (Rodrigues et al., 2003). Over this region, well-drained soils of low natural fertility are developed, with a predominance of dystrophic red, yellow Argisoils, as can be seen in the south of the project region.

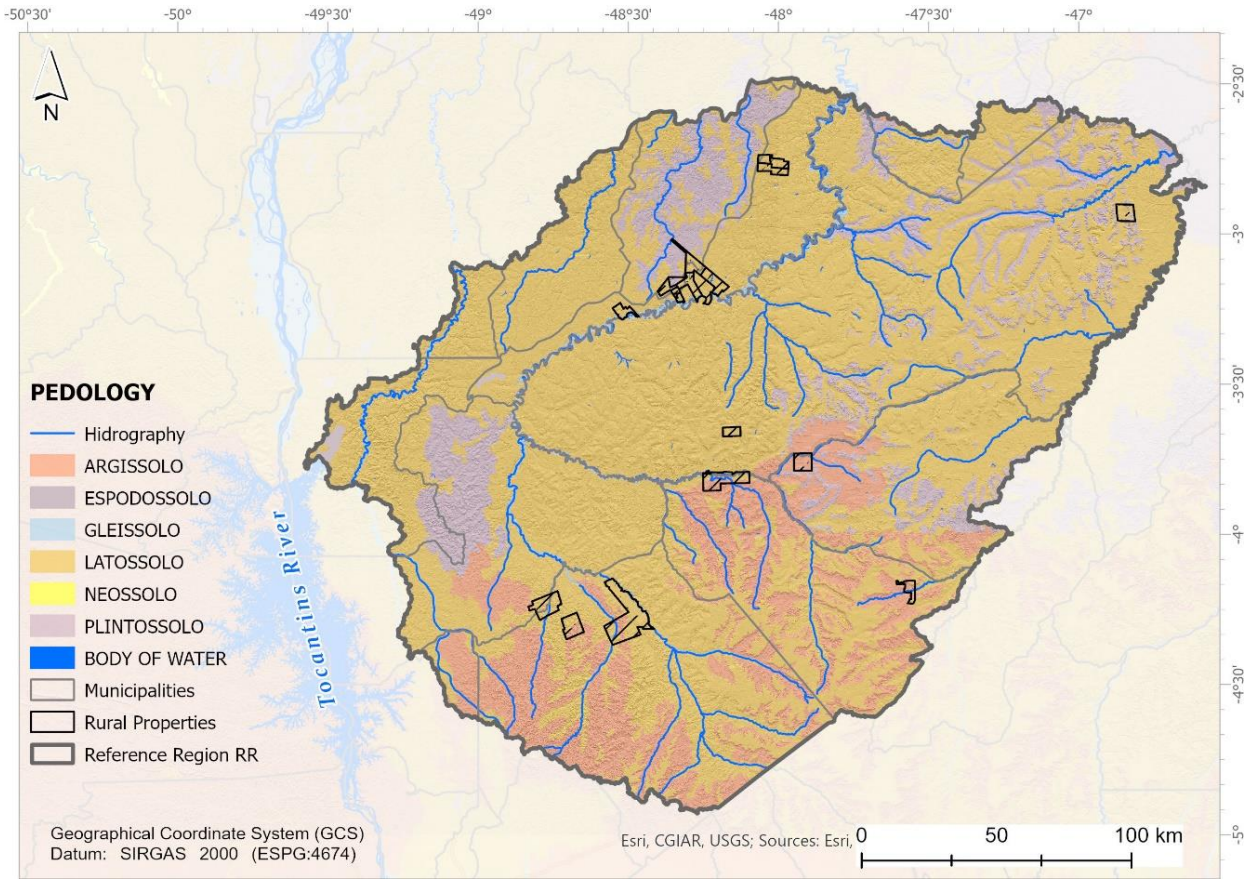


Figure 7 – Soil types at Reference Region and project areas.

These plateaus, for the most part, are composed of latosols and lateritic soils (enriched on their surfaces by iron or aluminum oxides), which are pedological types that do not hinder agricultural practice. Because of this potential, it is common to see the removal of forest cover with deforestation and fires, and the loss of soil horizons due to the mineral extraction that also occurs in the region. The Table 4 demonstrates the soil classes found in the project areas:

Table 4 – Soil Classes founded in project areas.

Soil classes	Area (ha)	Coverage
LATOSSOLO	**40,414.19**	71%
Amarelo	40,414.19	71%
ARGISSOLO	**11,287.78**	20%
Argissolo Amarelo	6,489.29	11%
Argissolo Vermelho- Amarelo	4,798.49	8%
GLEISSOLO	**3,019.84**	5%
Haplico	3,019.84	5%
PLINTOSSOLO	**2,476.21**	4%
Petrico	2,476.21	4%
TOTAL	**52,399.53**	

2.1.6 Social Parameters (G1.3)

According to Pará's socio-political division, the municipalities that touch the project's reference region are in the consolidation zone of the economic and ecological zoning. Covering part of the southeast mesoregion and part of the northeast, the first being the microregion of Paragominas with the municipalities of Dom Eliseu, Goianésia, Rondon do Pará, Ulianópolis, and to the northeast, the microregion of Guamá with Ipixuna do Pará Municipality and part of Tomé Açú microregion.

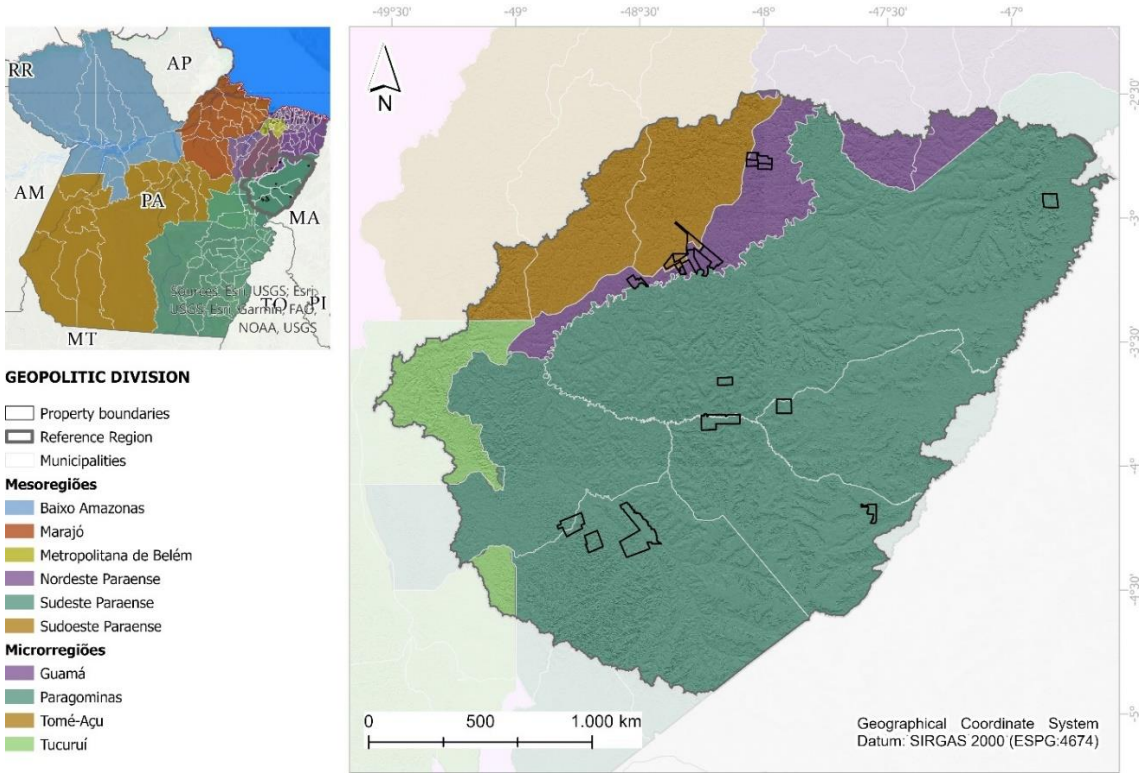


Figure 8 – Geopolitical division: mesoregion and microregion.

The creation of communities present in the territory varies greatly. Historically, in the region of "deforestation arc", the logging activity has a significant strength. However, some productive activities have become significant more recently, such as agriculture and livestock, the cultivation of soy as a monoculture and, on a smaller scale, palm oil and its derivatives (oil, bioenergy, etc.).

In a historical sense the region was massively occupied through a process encouraged by the national and state governments, thus the main symbol of the process in the region was the creation of Paragominas city. A planned city with the intention to populating the region. The cornerstone of its construction was laid in 1961, by an entrepreneur from Minas Gerais state and its partners, who financed it. Since most of the settlers came from Goiás state. The name of the city is directly connected with this history once it is an acronym of Pará (the state which it is located), Goiás and Minas Gerais – Paragominas.

This historical process has produced since then rural densifications all around the region, and has not just changed the villages, but cooperate to develop the occupation of territories as farms or federal non-productive areas, and for the creation of townships.

As shown in available data and Figure 9 below, 55 federal settlement projects coordinated by INCRA (For more information, see the lists available at Appendix I) were identified inside the reference region boundaries. Eight state settlement projects coordinated by ITERPA, six indigenous lands coordinated by FUNAI, five of which are regularized, traditionally occupied, and one is being regularized as an indigenous land. Of these, the Amanayé ethnic group and the others are found on the edges of the reference region. The Settlement Projects arise in a regional historical context of intense logging activity in the surrounding regions. In the heyday of this market, many migrants from different parts of Brazil were attracted to the regions where the communities are located today, to participate in this booming trade. Previously dense and native regions have become clearings, which were traditionally intended for livestock and successively gave rise to the monoculture of soy. The way in which the land is used is part of the "slash and burn" cycle. The presence of charcoal kilns is also normal in the region.

The Settlement Projects (PA) make productive use of agriculture and livestock occasionally; instead in the Indigenous Territory (TI) the use of livestock is not found, and agriculture is mainly for subsistence, while in the township the workforce is employed in industrial activities, having a link with the use of agriculture and livestock very occasionally, but exerting a link with fishing still strong.

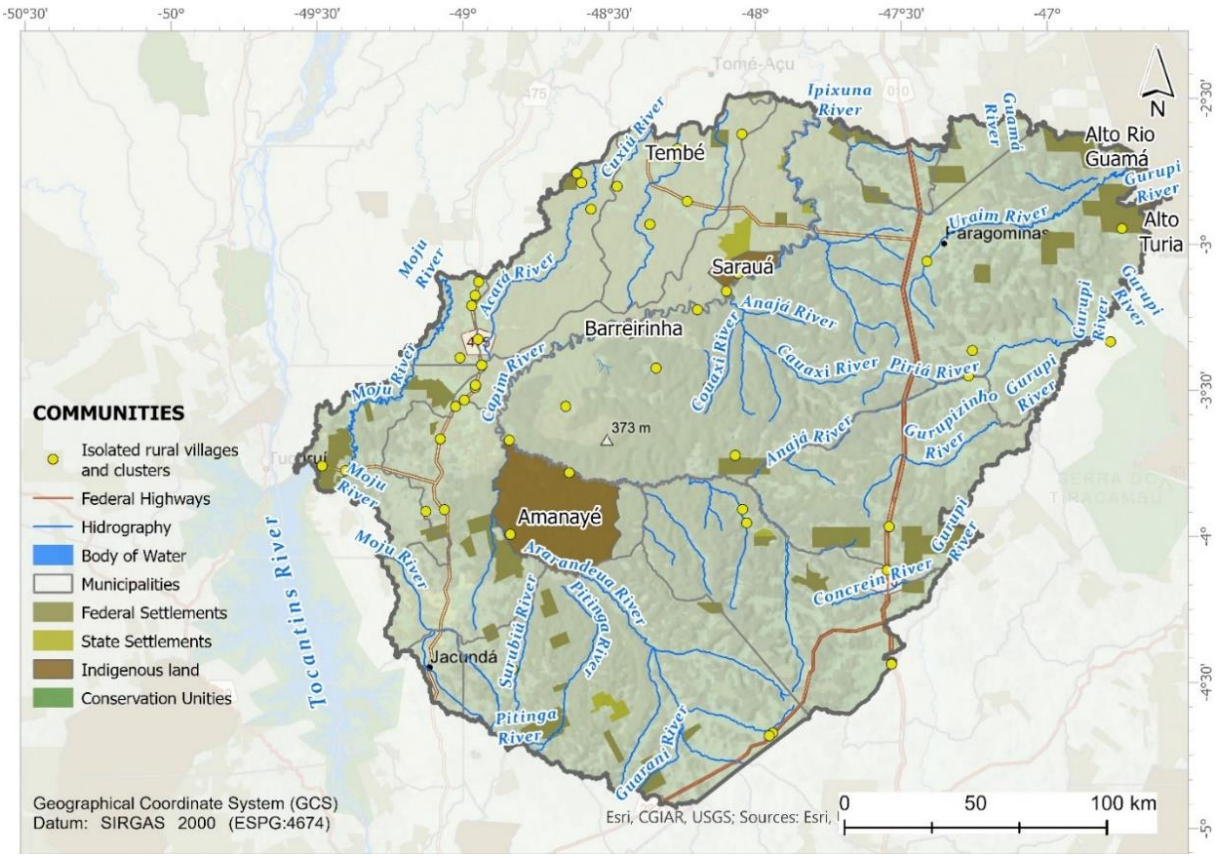


Figure 9 – Communities identified in Reference Region.

The Amanayé constitutes the current self-denomination of the indigenous who inhabit the upper course of the Capim River, better known as Amanayé. The name would mean “association of people” and appears in sources under the Manajo and Amanajo variants. A part of the Amanayé would have assumed the name Ararandeuara, in reference to the creek they inhabit (ISA, 2014).

In the settlement projects and in the indigenous territory, it was possible to identify temporary crops of rice, beans, corn, and cassava. The flour, derived from cassava, is the article with the greatest lucrative potential, and it is being marketed in the region and sold in bags. Besides this, açaí production proved to be more profitable in the communities present between the municipalities of Ipixuna do Pará and Paragominas, a region supplied by rivers and closer to the capital of the state of Pará. Trade in açaí and flour is even internal, making the economy of some communities circulate internally.

Fishing is another significant activity due to its location, on the banks of the Capim River and on the side of the federal highway – BR-010 (Belém-Brasília), which serves to supply the municipality of Paragominas. In the settlements, fish farming carried out in tanks is initially expanding, with some supporters still starting their first attempts and expressing great interest in improving this activity.

According to the Pará’s geodiversity study, the lands represented by the Low Plateaus at East are partially deprived of their forest cover, mainly along the road axis comprised by the BR-010 highway (Belém-

Brasília), where there is a notable agricultural development based on the planting of corn and soybeans and in forestry (eucalyptus and teak).

Livestock is the main land use activity and had the second highest percentage, with about 15.81% of the total area, the activity is concentrated in the northeast and southeast of the state. Vegetal extractivism and agricultural activity are also presented and concentrated in this region. Furthermore, Pará is one of the leading states in ore extraction, and the region has an industrial center for aluminum mining. The Land Use and Coverage at project reference region can be found on Figure 10.

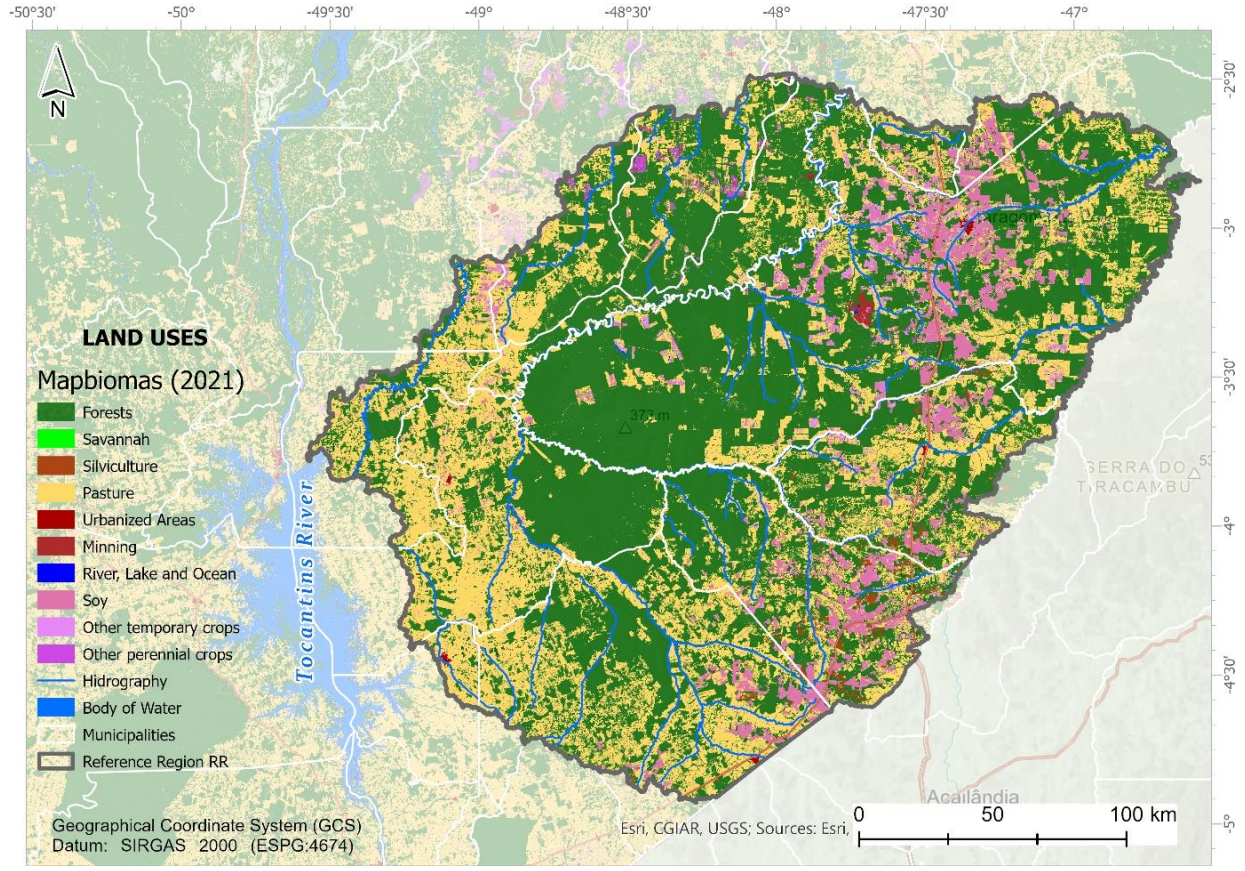


Figure 10 – Land Use and Coverage at project reference region (collection 7 - MapBiomas 2021)

Pará is the state with the lowest human development index in the northern region, according to *Atlas Brasil*[13] data (IDHM 2017 = 0,698). Analyzing the information by domicile situation, according to the Demographic Census (IBGE, 2010), the index of the population residing in the urban area of UF - Pará - was 0.690 in 2010, which placed it in the Medium Human Development range. While the IDH of the population residing in the rural area in that same year was 0.527, corresponding to the Low Human Development range. In absolute numbers, the difference between the two was 0.163 (Table 5).

[13] Atlas Brasil

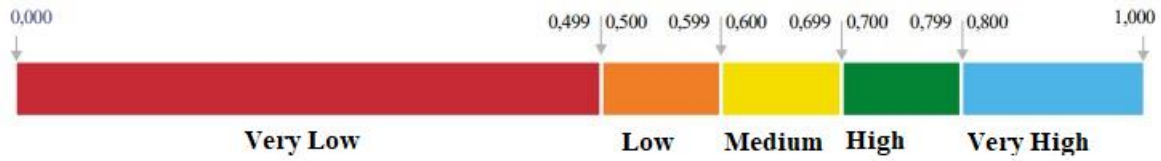
As the state has a large territorial extension, a third sociopolitical subdivision was necessary, integrating regions. This aims to define regions that may represent spaces with similarities in occupation, social level, and economic dynamism and whose municipalities maintain integration with each other.

Table 5 – Municipal human development index at project's municipalities.

Integration Region	Municipalities	State Ranking*	Municipal human development index			
			IDHM	IDHM Education	IDHM Longevity	IDHM Incomes
Capim River	**Dom Eliseu**	35º	0.615	0.502	0.763	0.606
	Goianésia do Pará	95º	0.560	0.404	0.743	0.585
	Ipixuna do Pará	136º	0.489	0.304	0.757	0.508
	Paragominas	20º	0.645	0.514	0.781	0.667
	Rondon do Pará	44º	0.602	0.457	0.788	0.606
	Tomé-Açu	69º	0.586	0.424	0.798	0.596
Tucuruí Lake	**Ulianópolis**	43º	0.604	0.425	0.759	0.682
IDHM (2021)	**Pará State**	-	**0.690**	**0.686**	**0.645**	**0.744**
	Brasil (average)	-	**0.730**	**0.730**	**0.690**	**0.770**

*Among 144 municipalities in the state

The following figure illustrates the levels of the score rates:



Among the values presented, it is noted that the municipality of Ipixuna presented the lowest values and Paragominas the highest, for the region. In addition, it is worth noting that in all municipalities they show very low values in the education index, which reveals basic issues such as illiteracy rate and school dropout.

Launched in 2021 and created by the "*Fundação Amazônia de Amparo a Estudos e Pesquisas*" (Fapespa), the Radar of indicators[14] for integration regions, systematizes and makes available demographic, social, economic, data, including population, poverty, education, health, financial and others, providing information of the main characteristics of the integration regions and the municipalities that integrate them.

[14] https://www.fapespa.pa.gov.br/sistemas/radar2021/

The Table 6 Below demonstrated the leading indicators of social, economic, and environmental aspects relevant to the description of the project region.

Table 6 – Socioeconomic development indicators.

INTEGRATION REGIONS		CAPIM RIVER						TUCURUI LAKE
Municipalities		Dom Eliseu	Ipixuna do Pará	Paragominas	Rondon do Pará	Tomé-Açu	Ulianópolis	Goianésia do Pará
DEMOGRAPHY	Territorial Area km²	5,268.81	5,215.56	19,342.57	8,246.39	5,145.36	5,088.47	7,023.95
	Total Estimated Population (2021)	61,206	67,170	115,838	53,242	64,604	62,286	41,678
	Demography density	11.62	12.88	5.99	6.46	12.56	12.24	5.93
ECONOMY	PIB per capita (R$/ ano/hab)	11,626.48	8,311.47	23,685.18	10,248.04	10,625.48	23,080.67	8,517.10
	State Ranking	37°	51°	12°	50°	39°	20°	78º
	Participation in region (%)	7.56	5.72	29.19	5.86	7.36	14.67	5.00
IPS AMAZÔNIA	Social Progress Index (IMAZON)	55.85	55.62	56.67	54.5	53.08	53.08	49.67

Finally, it is important to highlight that among the different sources of data presented, the Amazon Social Progress Index (IMAZON, 2021) also reveals that most municipalities are in the average score when compared to the Legal Amazon, while Goianésia has the lowest indicator. Among the indicators that stood out for low scores involved basic education and well-being such as access to water, housing, and basic sanitation.

2.1.7 Project Zone Map (G1.4-7. G1.13. CM1.2. B1.2)

Different maps will be presented in this section for the sake of scale. Tables will also be presented as supplementary information. The Cauaxi REDD+ Project is composed by 20 properties distributed in the municipalities of Paragominas, Ipixuna do Pará, Tomé Açu, Dom Eliseu, Rondon do Pará and Ulianópolis located at the deforestation frontier as illustrated in Figure 1.

Table 7 – Properties involved in the Cauaxi REDD+ Project. with total area. project area and SICAR number.

ID	Property Name	Property area (ha)	Project area (ha)	SICAR number
PAI#01	Fazenda Capinzal II	4,197.30	2,866.50	PA-1508126-0679A3F0CB4C48FAB65F4041A6679695
PAI#02	Fazenda Capinzal I	8,622.61	6,928.98	PA-1502939-1655CEB9198A4B59A25F31473CB7D707
PAI#03	Fazenda Concrem I	2,523.06	1,303.71	PA-1502939-85CEAE3605554C4DB53A33DE4A8B33BF
PAI#04	Fazenda D'Graus I	4,369.37	3,495.59	PA-1503457-E905B78A00A24EDBBC412671A7060502
PAI#05	Fazenda D'Graus II	4,226.62	3,381.32	PA-1503457-101D20EAEB2342CE81C13564447B068E
PAI#06	Fazenda D'Graus V	2,485.29	1,511.72	PA-1503457-F2F3CC5BFC84478CB05647A9DCCFF389
PAI#07	Fazenda Yollanda	724.02	364.26	PA-1503457-9CE05B3776194E94ADDD767EB096EDFC
PAI#08	Fazenda Paraná	3,917.10	2,275.32	PA-1505502-A4E9E78AD8B24DBBB4BEE90512A8E0B8
PAI#09	Fazenda D'Graus III	3,640.33	2,814.44	PA-1508001-A0C14F6378B54C1B99C9E1716E22384D
PAI#10	Fazenda D'Graus IV	4,182.01	1,991.39	PA-1508001-6F2971A041144E6EA4BC897452907096
PAI#11	Fazenda D'Graus VII	1,483.98	523.52	PA-1508001-B6657617633E4A399D83B5A4C3C18A79
PAI#12	Fazenda Nova Esperança	1,816.66	1,459.76	PA-1508001-2A8B26E4DBF742BE949CCA3E3BC7BEEF
PAI#13	Fazenda D'Graus VI	738.90	584.10	PA-1508001-DBFD721F95F1461B98CE7BE5F9B79906
PAI#14	Fazenda São Domingos	2,132.91	1,708.51	PA-1505502-3C55E3D459DC4631ACE3E2439CCC29F3
PAI#15	Fazenda Floresta Nubia	3,002.22	2,407.58	PA-1503457-4232561FBB754D5EAFBF24B55C0AED59
PAI#16	Fazenda Várzea Alegre	2,174.42	1,479.14	PA-1503457-A0D3A3C780564122B82902A9EFCCBB4E
PAI#17	Fazenda Floresta I	1,392.75	1,109.27	PA-1503457-A652D13A7E4648D8A55445C27992C4B7
PAI#18	Fazenda Cajueiro	18,941.85	13,154.69	PA-1506187-DB57FB5DCDF34B6B9900B5D6805798C9
PAI#19	Fazenda Ribeiro Rondon	5,061.30	4,162.82	PA-1506187-2BCED557F4D3421B964E7EBECE8D100E
PAI#20	Fazenda União I	6,910.81	3,768.83	PA-1506187-A9E9D135CB7E43979D621941D4E68118
Total		**82,543.52**	**57,291.44**	

The project zone was defined based on the political boundaries (Figure 11) and the similarity with hydrographic, climate, and topography regions, and presents the complex social, economic, and

environmental aspects of the region. Considering deforestation agents and drivers; landscape configurations and ecological conditions; and socio-economic and cultural factors.

Below there are some maps illustrating the geographical boundaries of the project, as well as the main resources and communities involved in its implementation. The first map (Figure 11) indicates the main political limits, the waterways, the main and secondary roads, and the main municipal headquarters in the reference region of the project. Finally, the boundaries of the properties involved in the grouped project and the project areas.

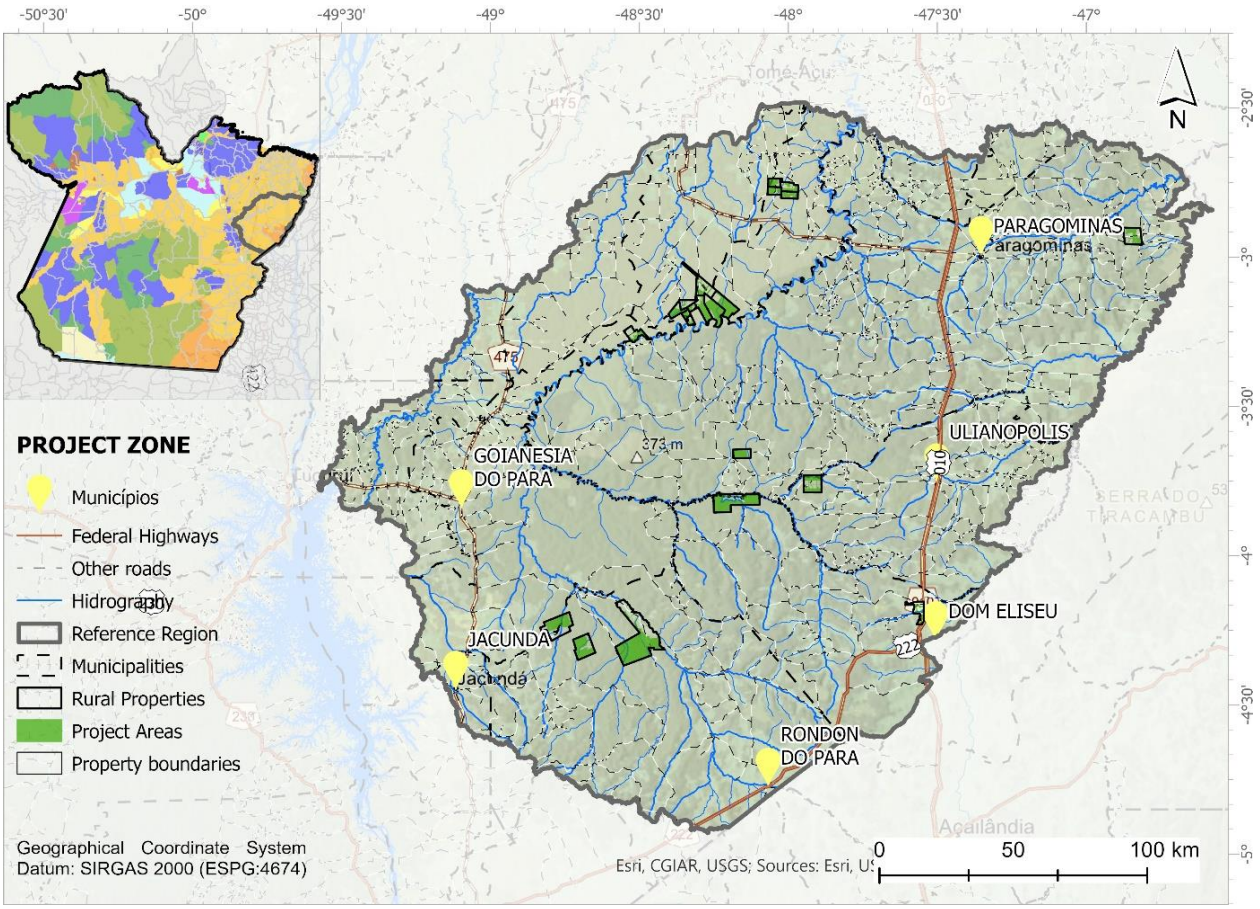


Figure 11 – Project zone- political boundaries

According to the economic and ecological zoning map at left, the project's reference region encompasses most of the zone of consolidation of productive activities. In the spatial modeling and projections of deforestation in the region, some indigenous land that were denoted within the territory were subtracted from the study area in the recovery zone of altered areas.

At landscape level, the existing remnants in the project zone are of great importance for biodiversity conservation. Located between Lago do Tucuruí Environmental Preservation Area (APA) and the Gurupi Biological Reserve (REBIO). Furthermore, in terms of biodiversity, the Belém Endemism Center (BEC) is one of the places that suffered from deforestation, losing more than 70% of its original habitat, with about

only 24% of mature forest remaining. Of the total area, another 24% is for agricultural use (Almeida and Vieira, 2010), and approximately 80% has no restrictions of uses, been only 1.5% fully protected (Braz et al., 2016). Despite the high level of deforestation, its forest remnants still harbor several species of endangered fauna, with 30 endemic species (which occur only in the CEB).

The project region is largely included in the Ministry of the Environment's priority conservation areas[15]. In according with the State's Ecological Economic Zoning, some project boundaries are in a zone of recovery of altered areas, which are represented by forest fragments that have suffered disturbances due to land use change and anthropic pressure from agricultural activities. Other high conservation values identified were present and discuss at sections 4.1.3 e 5.1.2

To define the project spatial boundaries, we use the map of coverage and land use of *Mapbiomas* collection and the accumulated deforestation data available at PRODES monitoring system, as illustrated in the figures bellow (Figure 12 and Figure 13).

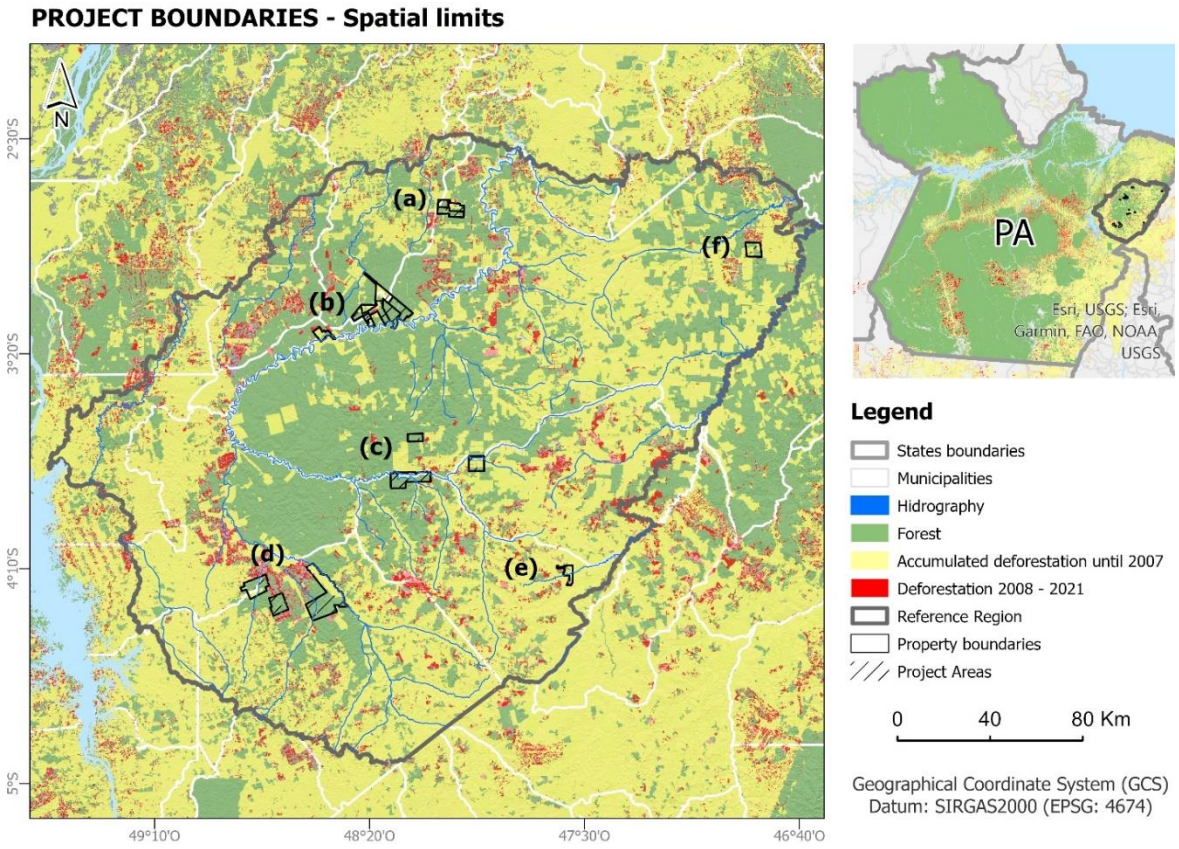


Figure 12 – Spatial boundaries and spatial limits

Next maps present indicate the properties and project boundary's location. It is important to highlight that as this region is the old frontier of deforestation, a large part of the deforestation occurred in the period

[15] https://www.gov.br/mma/pt-br/assuntos/ecossistemas-1/conservacao-1/areas-prioritarias/2a-atualizacao-das-areas-prioritarias-para-conservacao-da-biodiversidade-2018

prior to 2008, making many cases of areas converted into consolidated rural areas. Some of these areas are even in the process of vegetation succession, in a secondary stage. It is also a common practice in the region to clear these previously opened areas.

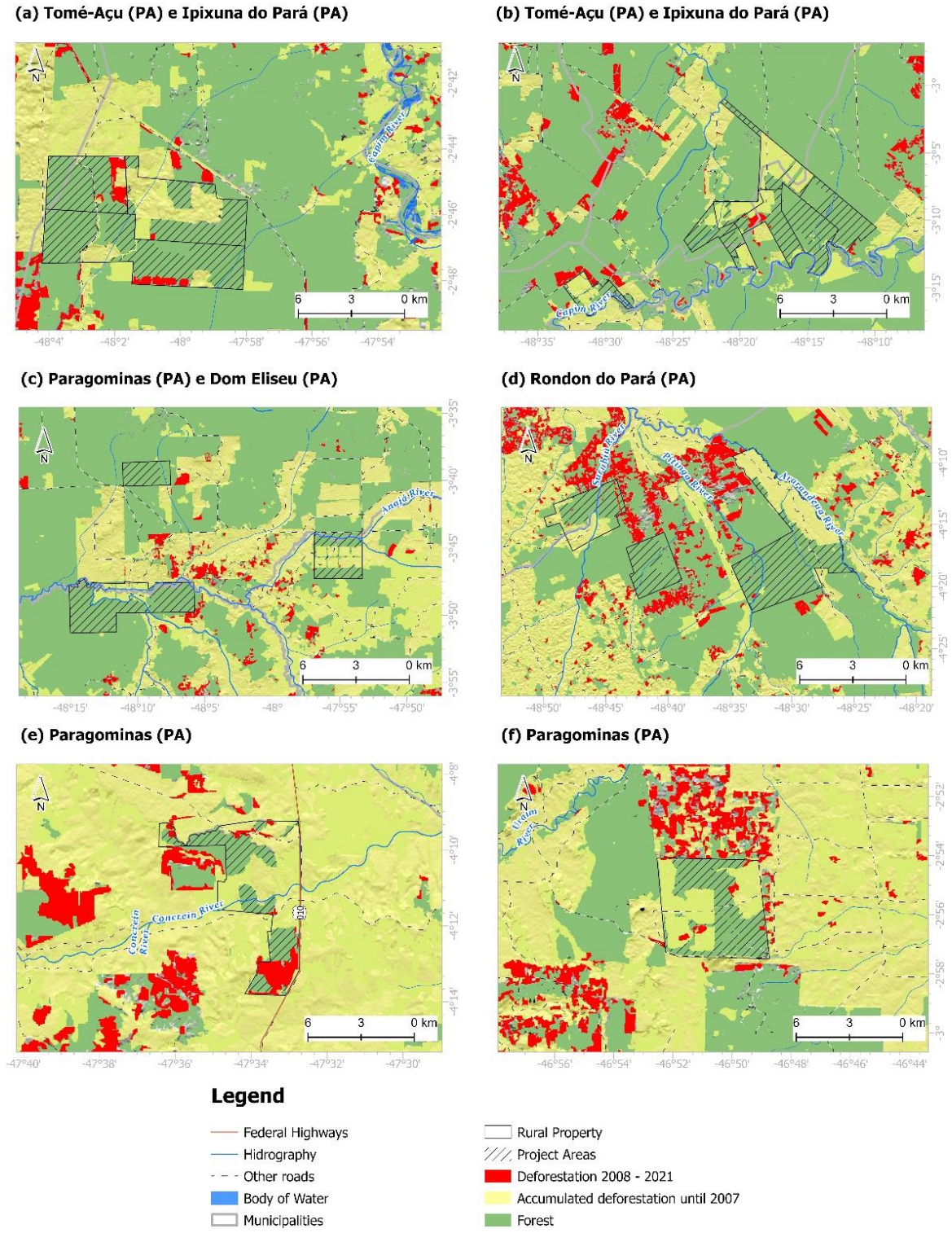


Figure 13 – Property's location and project spatial boundaries.

Considering the scope described, any eligible private property within the project zone may be included in the project at a future verification.

About the social recognition zone, in our first approach we based mapping and identification of communities located at influence zone on a public and available database and on an internal decision to recognize as project zone a radius of 10 km from the project areas to define which communities were more relevant to visit in first place. Based on this office decision, we visited some communities to verify if they really are in the project zone and to start the engagement process. The Figure 14, shows the groups of communities identified in the project area buffer and the communities visited.

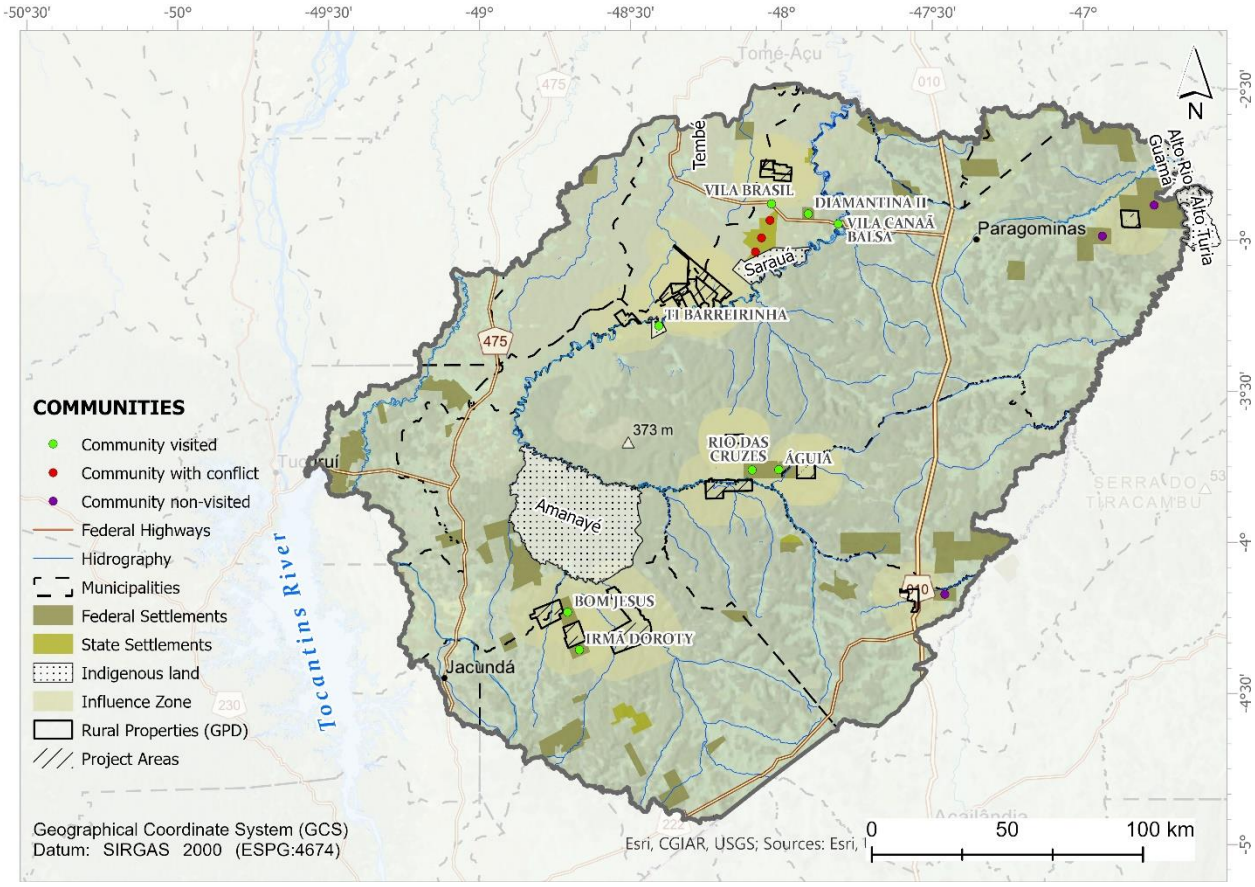


Figure 14 *– Location of the communities identified in a10km buffer of the Cauaxi REDD+ project area.*

2.1.8 Stakeholder Identification (G1.5)

The stakeholder identification process represents the first stages of a social engagement protocol executed by BRC. The other three stages represent participatory workshops for project design and participatory monitoring and dissemination of monitoring results, respectively, as shown on Figure 15.

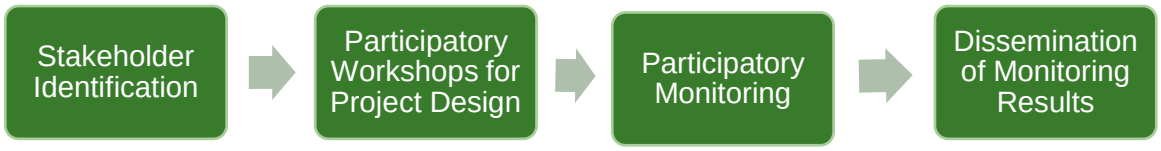


Figure 15 – Social Engagement Protocol

The identification process started with the identification of government agencies and regional environmental entities, also with the identification of non-government organizations, research institutes, after mapping community leaders and community associations, conservation areas, settlements, and organizations or groups with similar interests in the outcome of the project activities.

The stakeholder identification aims to understand the way of life, experiences, territorialization and the history of the communities within the project areas. During this process we use secondary information from IBGE GIS database, land collection of INCRA (National Institute of Colonization and Agrarian Reform), database of ITERPA (Institute of Lands of Pará) and FUNAI (National Foundation of Indigenous Peoples).

This was a primary information for field research, after that with spatial and proximity criteria for select, with some communities were made direct contact, using semi-structured questionnaires, photographic records, and observations. Then, after the diagnosis and field incursions was established the selection of priory community groups for the project's activities.

It was evaluated the demographic aspects to allow the characterization of families based on gender, age, number of children, and number of people per household. The social indicators addressed consist of assessing the level of education, health, residence condition, source of water supply, basic sanitation, and electricity. Indicators of economic activity include income-generating activities, average family income, and government benefits received by families. Cultural aspects are related to the religion and beliefs of local communities.

The information collected regarding production and extractive activities aims to understand the consumption profile and identify any surplus commercialization. It was also evaluate problems experienced by the local community, existence of land conflicts or disputes over natural resources, environmental problems, existence of areas of customary use and high conservation value areas.

For more details, visit section 2.3.

2.1.9 Stakeholder Descriptions (G1.6. G1.13)

As presented above, at Figure 9, were identified different community groups from rural clusters to villages, rural settlements (townships), and indigenous lands. The Table 8 presents a list of community groups identified and visited at the project zone considering the proximity of the rural properties grouped at the initial scope of activities. Other relevant stakeholders are of political nature, representatives of public power who can positively impact traditional communities in the project area through the implementation of public policies.

Table 8 – Stakeholders identified and their relationship with the project zone.

STAKEHOLDERS	MUNICIPALITY	TYPE OF ORGANIZATION	SPHERE	ASSOCIATED BODY	RELEVANCE TO THE PROJECT	RELATIONASHIP WITH THE PROJECT TERRITORY
Beneficiaries of settlements Bom Jesus. Urutum and Jerusalém	Rondon do Pará	Public Policy – Settlement Project	Federal	INCRA – National institute of land	Zone of influence	There is no use of natural resources in the Project area
Beneficiaries of settlements PA Irmã Dorothy	Rondon do Pará	Public Policy – Settlement Project	Federal	INCRA – National institute of land	Zone of influence	There is no use of natural resources in the Project area
Beneficiaries of settlements PA Águia	Ulianópolis	Public Policy – Settlement Project	Federal	INCRA – National institute of land	Zone of influence	There is no use of natural resources in the Project area
Beneficiaries of settlements PA Rio das Cruzes	Paragominas	Public Policy – Settlement Project	Federal	INCRA– National institute of land	Zone of influence	There is no use of natural resources in the Project area
Residents of Bom Jesus Township	Ipixuna do Pará	Public Policy – Settlement Project	State	Iterpa -State institute of land	Zone of influence	There is no use of natural resources in the Project area
Beneficiaries of settlements PA Diamantina II	Ipixuna do Pará	Public Policy – Settlement Project	Federal	Incra – National institute of land	Zone of influence	There is no use of natural resources in the Project area
Residents of Vila Canaã	Ipixuna do Pará	Township	Municipal	City hall	Zone of influence	There is no use of natural resources in the Project area
Residents of Vila Nova	Tomé Açu	Township	Municipal	City hall	Zone of influence	There is no use of natural resources in the Project area
Residents of Vila Brasil	Paragominas	Worker's village	Private	Brasil Sawmill Company	Zone of influence	There is no use of natural resources in the Project area

STAKEHOLDERS	MUNICIPALITY	TYPE OF ORGANIZATION	SPHERE	ASSOCIATED BODY	RELEVANCE TO THE PROJECT	RELATIONASHIP WITH THE PROJECT TERRITORY
Beneficiaries of TI Barreirinha	Paragominas	Public Policy – Indigenous land	Federal	Funai – National Indian Foundation	Zone of influence	There is no use of natural resources in the Project area
APRUJ – Rural producers association of PAs Bom Jesus, Ururtum and Jerusalém Region	Rondon do Pará	Social organization – Private association	Local	Does not apply	Zone of influence	Represents rural worker's residing in the project's zone of influence
AMDCanaã – Residents association of Canaã's township	Ipixuna do Pará	Social organization – Private association	Local	Does not apply	Zone of influence	Represents residents in the project's zone of influence
AMOVINO – Residents association of Vila Nova	Tomé Açu	Social organization – Private association	Local	Does not apply	Zone of influence	Represents residents in the project's zone of influence
Colony association of fisherman of Canaã's village - Z71	Ipixuna do Pará	Social organization – Private association	Local	Does not apply	Zone of influence	Represents fishers residing in the project's zone of influence
ATTRCD – Colony association of rural workers of Diamantina II	Ipixuna do Pará	Social organization – Private association	Local	Does not apply	Zone of influence	Represents rural worker's residing in the project's zone of influence

The interests of all the identified groups were discussed in participatory workshops developed during the social engagement second stage. The

Table 9 shows details on the rights, interest, and overall relevance to the project for the selected affected communities' groups.

Table 9 – Rights, interest, and overall relevance to the project for the selected affected communities' groups.

Stakeholders	Rights, Interest and Overall Relevance to the Project	UTM_X	UTM_Y
APRUJ – Associação dos Produtores Rurais	Association of the union of settlements PA Bom Jesus, PA Urutum and PA Jerusalem of Rondon do Pará has approximately 95 members, covering around 200 families assisted	-4,24	-48,72
Settlements of Bom Jesus	Located in Rondon do Pará, is a settlement project created in 2003, neighbor of part of the project's properties. Have approximately 46 families, living there.	-4,24	-48,72
Settlements of Irmã Dorothy	Located in Rondon do Pará, is a settlement project created in 2003, neighbor of part of the project's properties. Have approximately 59 families, living there.	-4,35	-48,67
Settlements of Águia (Bonito River at KM 60 and Rio Azul 100 Alqueires communities)	Located in Ulianópolis, is a settlement project created in 1997, neighbor of part of the project's properties. Have approximately 141 families, living there.	-3,76	-47,99
PA Rio das Cruzes	Located in Paragominas, is a settlement project created in 2003, neighbor of part of the project's properties. Have approximately 67 families, living there.	-3,46	-48,6
Vila Brasil	Worker's township at Serraria Brasil, located around the project areas, has about 50 families.	-2,88	-48,03
TI Barreirinha	Land belonging to the original Tupi Guarani peoples, from the Amanaye group, located between properties that make up the grouped conservation project. It has about two thousand hectares and an approximate population of 40 families.	-3,17	-48,24

2.1.10 Sectoral Scope and Project Type

The GPD is part of the Agriculture, Forestry and Other Land Use (AFOLU) sectoral scope 14 and consists in a Reduced Emissions from Deforestation and Degradation (REDD) project, under the category of Avoiding Unplanned Deforestation (AUD). This document refers to the grouped project description with initial 20 project activity instances (PAI#).

2.1.11 Project Activities and Theory of Change (G1.8)

BRC defined the project activities jointly with the communities, based on the results of the socio-economic diagnosis and public meetings. The activities described below represent a range of possible activities, and any changes that may be necessary will be presented and approved by the beneficiaries of them.

The activities' relevance to the project objectives depends on the PAI. The outputs described represent verifiable targets for the first ten years of the project, considering their current scope and may vary over time, with the inclusion of new PAIs.

The Outputs (short term) describe a period from one to up to 3 years. The Outcomes (medium term) describe the next 5 years of project lifecycle. The Impacts (long term) period describes the last years of the 10-year period. The Table 10 – Theory of change presents the activities description, Outputs, Outcomes, Impacts and the relevance to project's objectives.

Table 10 – Theory of change

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (Short term)	**Outcomes (medium term)**	**Impacts (Long term)**	
Fostering good fire management and firefighting practices to communities to prevent the spread of wildfires in the project area.	4 annual trainings/exercises executed 05 firefighting equipment sets delivered.	Reduction of forest fires.	Wildfire GHG Emission Reduction / Training.	Very high. Fire is traditionally used in the Amazon as an instrument for suppressing regenerating vegetation or clearing lands of forests for pastures and agriculture. Climatic anomalies such as El Nino alter the air currents in the Brazilian Northern region, making the forest drier and more flammable. In these years, the risk of burning developing into wildfires increases and must be mitigated. In Brazil, in drier years, GHG emissions caused by forest fires can exceed 1 G tCO2e (Aragão et al., 2018), which is equivalent to half of the national emission profile, considering all sectors of our economy. The creation of fire brigades would make a fundamental contribution to wildfires impacts mitigation. This activity, however, will be treated on a voluntary basis.

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (Short term)	**Outcomes (medium term)**	**Impacts (Long term)**	
Signing of long-term conservation agreements with landowners in Amazonia Legal.	03 conservation agreement already signed.	Maintenance of 57,291.44 ha of forest cover.	GHG emission reductions / Training.	Very high. The average GHG emission caused by land use change in Brazil is approximately 1 Gt CO2e, representing half of the national emission profile. Deforestation in the Amazon biome in Brazil surpassed 11,000 km2 in 2021 and shows an increasing trend. Training in forest inventory will contribute not only to the project's carbon stock estimates, but also for community members professional training, thus contributing to their employment and household income.
Forest surveillance: deforestation. forest degradation and burn scars monitoring.	57,291.44 ha of forests annually monitored.			
Carbon pools (TIER3)	128 inventory plots installed, representing 25,6 ha. 02 trainings related with forest inventory.	Carbon Stocks in different reservoirs to be known.		
Leakage management	10 monitoring reports + advocacy initiatives with landowners performed.	Reduction of GHG emission due to deforestation displacement.		

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (Short term)	**Outcomes (medium term)**	**Impacts (Long term)**	
Sustainable Forest Management	02 training in forest management, reduced impact logging and work safety, with a focus on FSC certification, carried out. Promote with the landowners in the first 03 years of the project activities: 02 sustainable forest management plans conform to the FSC standard. 02 safety equipment sets delivered.	FSC certified forests.	Improved Land Management / Training.	High. According to Walker et al. (2019), more than 20% of aboveground carbon stocks in the Amazon biome in Brazil were lost to forest degradation events between 2004 and 2016. According to data from INPE, the National Institute for Space Research in Brazil, 2,850 Km2 of forests were degraded in 2021 because of conventional forest exploitation.

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (Short term)	**Outcomes (medium term)**	**Impacts (Long term)**	
Capacity building / training related to Technical Assistance and Rural Extension (ATER): ecological pasture / voisin method; good practices for extracting chestnuts, good agricultural practices (subsistence agriculture), among others.	10 capacitation related to ATER.	Improvement in the production of the main products in the project zone by the communities.	Training / Well-being / GHG emission reductions.	High. According to the initial socio-economic diagnoses, communities in the project area, work with subsistence agriculture and use fire to manage their plantations. Thus, training in these areas would promote positive impacts on their well-being, in addition to bringing positive impacts to the climate. Actions related to sustainable agriculture or improvement in productive capacity can promote the reduction of deforestation and increase family income. Likewise, the creation of associations or cooperatives can organize local production, increasing family income.
Capacity building / training focused on encouraging collective work in the community. promoting the project to local associations.	4 trainings related in the collaborative economy and entrepreneurship.	Development of associative and collaborative actions to strengthen the collective work.		
Promotion of improvements in water quality and access to water.	30 water potability analysis. 30 water filter distribution.	Improvement in the water potability and access to water		

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (Short term)	**Outcomes (medium term)**	**Impacts (Long term)**	
Building / Renovation / equipment of schools located in reference region.	01 school renovated and 01 school built.	Improvement in basic education conditions and education quality.	Education / Well-being / Biodiversity.	Very high. The initial socioeconomic diagnosis indicated poor teaching quality. The percentage of illiteracy or functional illiteracy is high. Schools need repairs and better resources. There is only one teacher to teach all subjects. Classrooms are made up of students in different grades.
	02 schools equipped with TV, Printer, and computer for better resources and distance learning.			
Lectures	10 lectures about environment, forests, environmental services, biodiversity, environmental conservation, sustainable forest management, climate change, carbon cycle, environmental legislation, labor legislation, associations, among others.			

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (Short term)	**Outcomes (medium term)**	**Impacts (Long term)**	
Fostering and support for solid waste management and recycling.	5 lectures to promote solid waste separation, recycling (reduction. reuse. recycle) and composting. 01 Construction of a suitable site for depositing and storing recyclable waste. 10 removals of recyclable waste.	Improvements in solid waste management, less soil contamination.	Education / Health / Well-being.	Very high. The initial socioeconomic diagnosis indicated the garbage is either burned or simply thrown away in an open gully, which can cause contamination of soil and water sources. Good practices can involve better waste management, better understanding about garbage implications,
Hiring community staff for temporary work	According to the need of the project	Improvement in household income.	Employment / Livelihood.	High. The project will create temporary works opportunities, training in different topics and generate complementary income in a place where options are limited and there are few prospects.

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (Short term)	**Outcomes (medium term)**	**Impacts (Long term)**	
Biodiversity conservation	- 02 fauna (mammals, birds, reptiles, and amphibians) monitoring performed (rainy and dry season) - Elaboration of 2 monitoring reports focusing on endemic and game species	- Maintenance of species monitoring campaigns - Establishment of partnership with research institutes and universities	- Promotion of species conservation through the maintenance of forest habitats and avoidance of hunt pressure	Very high. The project area is in HCV area, with the occurrence of rare, threatened, and endemic species and connected to a landscape with ecosystem functions of global relevance. The primary fauna monitoring results revealed the occurrence of 223 species of birds, 16 species of reptiles, 26 amphibian species and 22 mammal species. A total of 40 species are endemic to the region and 20 are considered under threat of extinction (Near Threatened, Vulnerable, Endangered or Critically Endangered) by IUCN Red List

2.1.12 Sustainable Development

The following project will contribute to achieving national Sustainable Development Goals (SDG) priorities, as shown below. One of the keys to sustainable development consists of integration of all the 17 principles, and carbon projects can permeate practically over them all.

Considering the CCB Standards' objective of the integration between best-practice and multiple-benefit approaches into carbon projects project design and implementation, indirectly, all of 17 sustainable development goals should be worked together, despite the focus of each activity and each sub-objective of the goals.

The following infographic shows the project effect power on each principle. The size of icon represents the impact of project, and it was divided into three categories, considering the level of project actuation on each of them as: direct action, direct consequence, or indirect consequence, as shown on Figure 16.

Figure 16 – Infographic scale of the project effect power on Sustainable Development Goals.

The Figure 17 shows how Cauaxi REDD+ Grouped Project will contribute to achieving national SDG priorities, according to the intensity of the contribution.

Figure 17 – Project effect power on all Sustainable Development Goals SDGs

The Cauaxi REDD+ Grouped Project aims to be a **climate action** by structuring a climate solution, keeping carbon stocks on forest, resulting of forest preservation. Thus, it can help the goal acting on a sub-target that seeks to reduce greenhouse gases emissions. The project will cooperate to this target by avoidance of 5,292,891 tons of equivalent CO2 emission on atmosphere.

It can promote improvements on **life on land** as well through helping the Brazilian government to achieve the sub-target of progressing in sustainable forest management and protecting the forest coverage. In this sense the project aims to monitor the land and its vegetal coverage by continuum Remote Sensing technologies, that includes high temperature alerts and other alarms, automatically triggering and alerting on real time the project team. Furthermore, through monitoring fauna campaigns the project will help the sub-target of conservation and sustainable use of biodiversity. In this sense, from short to long term, it is planned 2 fauna's monitoring campaigns comprising mammals, birds, reptiles, and amphibians during rainy and dry seasons, it is planned to keep species' monitoring campaigns and to establish of partnership for goals with research institutes and universities. The first monitoring results revealed high relevance of local biodiversity, evinced by the observation of 223 birds' species, 16 reptiles' species, 26 amphibian species and 22 mammal species. A total of 40 species are endemic to the region and 20 are considered under threat of extinction.

On the necessary targets of **no poverty** and **zero hunger** the Cauaxi REDD+ Project can assist it through improving access to basic services as health and education, and over developing population skills on food production with workshops of good agricultural practices.

The **Innovation and Infrastructure** issues will be one of the goals of the project by creating conditions of digital inclusion and connectivity on communities of the project zone, what can indirectly help the improvement of the quality of education and the citizenship. Thus, it will assist the government on some of the sub-targets of SDG. To reaffirm how we intend to do it, will be installed internet and Wi-Fi spots in the project zone, by two school buildings, restoration and provide them with multimedia setups, TV, printer, computer, and a library.

About the SDG goal of **Responsible Consumption and Production**, the project will be an auxiliary tool to achieve it, through planned lectures on the schools' facilities about environment, forests, environmental services, biodiversity, environmental conservation, and mainly by lectures to promote solid waste separation and recycling and others, as shown before.

Once a project brings resources and other social improvements, the community members will, indirectly improve their self-esteem, positively affecting **good health and well-being**. It will help the Brazilian government to the SDG sub-target of prevent the abuse of drugs and other substances which can weaken people and families.

The project believes that the value created from it also brings **decent work and economic growth** for the communities involved. For example, it is planned to be constructed 20 new bathrooms, 10 water pumps installation, 20 recyclable waste removals installation and one storage for recyclable waste. The masons and the garbage men that will be contracted to do it will be members of the communities, which will be another project tool to achieve sub-targets of the SDG goals, through the decreasing of the workers proportion on informal jobs.

As it can be seen, the Cauaxi REDD+ Project will be an auxiliary tool to the Brazilian government achieve all the SDG goals till 2030, but as shown most of them will be through indirect impact, mainly because the targets are huge and challenging to be made by a single project.

2.1.13 Implementation Schedule (G1.9)

The Implementation Schedule are shown on following Table 11, and it shows key dates and milestones in the project's development and implementation, introductory meeting dates, start and end dates for each project activity, start and end dates for the GHG accounting period, monitoring schedule, verification schedule, and past activities.

Table 11 – Implementation Schedule

Date	Milestone(s) in the project's development and implementation
May, 02nd, 2022	Agreement signature between BRCarbon and Floraplac Industrial LTDA and Rio Concrem Industrial LTDA.
May, 03rd, 2022	Visit to the State Regional Centre of Environmental Regularization in Paragominas (SEMA/PA); Visit to the Social Assistance Municipality Secretary – SEMAS; Visit to the Science, Technology and Environmental Municipal Secretary.
May, 04th, 2022	Visit to the Vale do Acará Agricultural Association (AAVA); Visit to the Tomé-Açu Environmental Municipal Secretary.
May 05th, 2022	Visit to the State Agency of Agricultural Defense (ADEPARA) of Dom Eliseu; Meeting with the Rondon do Pará Rural Workers Syndicate.
May 30th, 2022	Agreement signature between BRCarbon and Mr. Gilson Antonio Moreira Machado.
May 11th to June 2nd, 2022	Forest Inventory of above-ground biomass, in Brazilian Amazon GPD APD Carbon Project areas, Paragominas-PA region. Total of 16 transects, 128 plots, (20 x 60 m) distributed throughout the municipalities of Paragominas, Ipixuna do Pará, Rondon do Pará.
June 4th to 16th, 2022	First stage of social engagement to Socioeconomic surveys and diagnoses. Locations PA Águia, PA Bom Jesus, PA Irmã Dorothy, TI Barreirinha. PA - settlement project, TI - Indigenous land.
June 27th to July 11th, 2022	Fauna Survey on properties Capinzal I, Ribeiro Rondon, D'graus (I, II and VI) and Floresta I.
July 29th to August 06th, 2022	Soil Organic Carbon and Litter field collections on properties Capinzal I, Ribeiro Rondon, D'graus (I, II and VI) and Floresta I. Total of 128 Sample Units (permanent plots of 20x60m) distributed throughout the municipalities of Paragominas, Ipixuna do Pará, Rondon do Pará.
August 3rd, 2022	Implementation of social diagnostic diagnosed activities by social survey, in the **Bom Jesus community**. of good practices and management of agricultural activities. Field day with rural extension of good practices and management of agricultural activities.
August 10th, 2022	Implementation of social diagnostic diagnosed activities by social survey, in the **Irmã Dorothy community**. Field day with rural extension of good practices and management of agricultural activities.
August 17th, 2022	Agreement signature between BRCarbon and Mr. Adão Ribeiro Soares.
August 17th, 2022	Implementation of social diagnostic diagnosed activities by social survey, in the **PA Águia** and **Rio das Cruzes communities**. Field day with rural extension of good practices and management of agricultural activities.
August 21st, 2022	Implementation of social diagnostic diagnosed activities by social survey, in the **PA Diamantina** communities. Field day with rural extension of good practices and management of agricultural activities.

Date	Milestone(s) in the project's development and implementation
November 11th, 2022	Implementation of social diagnostic diagnosed activities by social survey, in the **Vila Brasil communities**. Installation of an artesian well, to improve the quality and accessibility of fresh water in the community.
November 18th, 2022	Construction of an artesian well in the community Vila Brasil, Paragominas.
December 30th, 2022	Submission of the draft VCS PD in the VERRA registry system.
January 12th, 2023	On-site meeting with the education secretary (Mrs. Kelly Cristina) and team to discuss the works in the P.A Bom Jesus' and Irmã Dorathy's school.
January 26th, 2023	Jeová Samah Community's visit (Nossa Senhora do Perpétuo Socorro, Novo Jordão) to inform the main project stakeholders about the validation process and others.
January 28th, 2023	São Bento Community's visit (São Jorge, Menino Deus, Deus Proverá, Aparecida) to inform the main project stakeholders about the validation process and others.
January 30th, 2023	São Benedito Community's visit (Santa Rosa, Nossa Senhora do Livramento, Monte das Oliveiras, São Tomé e Santo Ezequiel Moreno) to inform the main project stakeholders about the validation process and others.
February 1st, 2023	São Miguel Community's visit (Betel, Nova Jerusalém) to inform the main project stakeholders about the validation process and others.
February, 2023	BRC's staff team visit to inform the main project stakeholders about the validation process and to provide a copy of the project description summary.
February 28th, 2023	Public comment period in VERRA registry.
May 1st, 2023	VVB validation site visit.
June, 2023	School construction in PA Irmã Dorothy (settlement project) and restructuration of PA Bom Jesus' school (settlement project).
July, 2023	Participatory monitoring, disclosure of monitoring results, disclosure of audit date and audit process. Lectures on climate change, carbon cycle, importance of forests and ecosystem services.
From May to October, 2023	Monitoring report preparation (first vintage 2022-2023).
February 2024	Project Verification.
During project	The implementation of project activities and the deforestation. forest degradation and burn scars monitoring will happen annually. Biodiversity. social parameters monitoring. and verification events will be happening with a minimum frequency of five years.

2.1.14 Project Start Date

The GPD project has different timeframes as it is described below (Table 12). It has one timeframe for each landowner, respecting the agreement's signature dates.

The agreement with *Floraplac Industrial LTDA* and *Rio Concrem Industrial LTDA* was signed on May 2nd, 2022, and it includes PAIs from 01 to 14.

The agreement with *Mr. Gilson Antonio Moreira Machado* was signed on May 30th, 2022, and it includes PAIs from 15 to 17.

The agreement with *Mr. Adão Ribeiro Soares* was signed on August 17th, 2022, and it includes PAIs from 18 to 21.

These milestones represent the beginning of the protection plan and the date on which activities that led to the generation of GHG emission reductions were implemented.

Table 12 – Project Start Date for each property.

PAI# number	Property name	Project Start Date	Property Owner
PAI#01	Fazenda Capinzal II	05/02/2022	Floraplac Industrial LTDA & Rio Concrem Industrial LTDA
PAI#02	Fazenda Capinzal I		
PAI#03	Fazenda Concrem I		
PAI#04	Fazenda D'Graus I		
PAI#05	Fazenda D'Graus II		
PAI#06	Fazenda D'Graus V		
PAI#07	Fazenda Yollanda		
PAI#08	Fazenda Paraná		
PAI#09	Fazenda D'Graus III		
PAI#10	Fazenda D'Graus IV		
PAI#11	Fazenda D'Graus VII		
PAI#12	Fazenda Nova Esperança		
PAI#13	Fazenda D'Graus VI		
PAI#14	Fazenda São Domingos		
PAI#15	Fazenda Floresta Nubia	05/30/2022	Mr. Gilson Antônio Moreira Machado
PAI#16	Fazenda Várzea Alegre		
PAI#17	Fazenda Floresta I		
PAI#18	Fazenda Cajueiro	08/17/2022	Mr. Adão Ribeiro Soares
PAI#19	Fazenda Ribeiro - Ipixuna		
PAI#20	Fazenda União I		

Project Crediting Period (GHG accounting period): The GPD will generate GHG emission reductions eligible for issuance as VCUs for up to 100 years. This approach is considered due to the project group character that allows the inclusion of new PAIs in the project scope over the project lifetime.

PAIs #1-20 will generate GHG emission reductions eligible for issuance as VCUs for 30 years, that is, compost of three baseline periods. The project starts crediting period, so, which is the same as the project start date.

Project Lifetime: A legal agreement (Appendix II) was signed with the landowner to continue the management practices that will lead to the project area conservation for at least 30 years, thus, the project activity instances lifetime is 30 years. So, the reduction in the GHG emissions, biodiversity and community well-being resulted by the project activities will be monitored along the PAI longevity (30yrs).

2.1.15 Benefits Assessment and Crediting Period (G1.9)

The GPD project has different timeframes as it is described below:

Project start date: The GPD started on 02nd May 2022 with the signature of the first long-term conservation agreement with PAIs# 1-14 landowner. This milestone represents the beginning of the protection plan and the date on which activities that led to the generation of GHG emission reductions were implemented.

Project Crediting Period (GHG accounting period): The GPD will generate GHG emission reductions eligible for issuance as VCUs for 100 years. 02nd May 2022 and ends on 02nd May 2121. This approach is considered due to the project group character that allows the inclusion of new PAIs in the project scope over the project lifetime. PAIs #1-20 will generate GHG emission reductions eligible for issuance as VCUs for 30 years.

Project Lifetime: A legal agreement (Appendix II) was signed with the landowner to continue the management practices that will lead to the project area conservation for at least 30 years, thus, the project activity instances lifetime is 30 years. So, the reduction in the GHG emissions, biodiversity and community well-being resulted by the project activities will be monitored along the PAI longevity (30yrs).

New PAIs will have different crediting period starting dates, based on the deforestation permits issued by the responsible environmental agencies in each state.

2.1.16 Differences in Assessment/Project Crediting Periods (G1.9)

The GPD start date is when the activities that led to the generation of GHG emission reductions of the first five project activity instances (PAIs) took place. Thus, each new PAI will have its own start date.

The project crediting period is when GHG emission reductions by the project activity instances are eligible for issuance as VCUs and will typically match the first baseline period. If necessary, we will renew

baseline in each PAI in 10 years to ensure that changes on the project's baseline scenario and/or regulatory surplus are taken into consideration throughout the lifetime of the project.

The 'project lifetime' is defined as the period when we implement the project activities. The project lifetime starts when a given activity instance starts to generate climate, community or biodiversity impacts and will have a longevity of 30 years as stated in the contract signed between the landowner and BRC.

2.1.17 Estimated GHG Emission Reductions or Removals

The following Table 13 shows the GHG Emission Reductions estimation for the next 10 years (from 2022 to 2031).

Table 13 – Green House Gases emission reductions estimates.

Year	Estimated GHG emission reductions (tCO_2e)
2022	922,795
2023	626,543
2024	674,509
2025	441,098
2026	572,429
2027	470,191
2028	340,223
2029	504,664
2030	355,736
2031	384,703
Total estimated ERs	5,292,891
Total number of crediting years	10
Average annual ERs	**529,289**

The information shown above was calculated by mathematical model. that are presented on this document.

2.1.18 Risks to the Project (G1.10)

This section identifies likely natural and human-induced risks to the expected climate, community, and biodiversity benefits during the project lifetime. It shows the outline measures needed and designed to mitigate these risks. The risk material can be found on Appendix III.

The Table 14 shows the project risks table.

Table 14 – Project Risks Table

Risk	Risk level	Risk impact	Potential impact of risk on climate, community and/or biodiversity benefits	Actions needed and designed to mitigate the risk
Unavoidable unplanned deforestation. (Human-induced)	Low	High	The communities around the project area promote deforestation to expand pastures or new plantations. This is most often a reduced magnitude and low impact activities, however, over time, such activities can harm the expected benefits to the climate.	Constant presence on project areas; Remote and Field Monitoring; Placing of sings; Social activities.
Wildfires. (Human-induced)	Moderate	High	The traditional communities in the project area use fire as an instrument for landscape management. This fire can strike the forest, especially in drier years, and undermine the project's climate benefits	Volunteer firefighting brigade creation and training; Social activities with firefighting and forest fire content; Acquisition of firefighting equipment; Fire Monitoring (Remote and Field)
Wildfires. (Natural)	Moderate	High	In the dry season, and mostly on drier years, some cleaning activities by fire or other kind of ignitions can strike the forest and run out of control	
Political (Human-induced)	Low	High	Specific groups of stakeholders can mobilize against carrying out project activities following their own agendas, which can compromise the project's benefits to communities.	Constant social engagement activities
Predatory hunting and overfishing. (Human-induced)	Moderate	High	Hunting and fishing are cultural and fundamental aspects of the livelihoods of the traditional communities residing in the project area. These activities are assumed as traditional and of low impacts. On the other hand, these activities are carried out in a disorganized manner, without any kind of monitoring or control, which can harm the project's biodiversity objectives.	Installation of conservation project location signs and hiring of heritage guards/tours
Extreme droughts (Natural)	High	High	Climatic anomalies such as El-Nino could change the air currents over the Amazon biome, making the forest drier and more flammable, which could compromise the project's climate and biodiversity objectives. Under ongoing global warming, the frequency of severe droughts such as in 2005 and 2010 is projected to increase strongly, up to the point where these droughts may become the new climate normal in the second half of this century.	Promote of sustainable project activities such as agroforestry systems which are productive system resilient of climate changes.

2.1.19 Benefit Permanence (G1.11)

The project proponent (BRC) takes legal steps to ensure that the climate, community, and biodiversity benefits will be maintained beyond the project lifetime.

Each Project Instance has a legal agreement (Appendix II) that was signed with the landowner to continue the management practices that will lead to the project area conservation for at least 30 years and guarantee the permanence of the carbon stocks in the post project scenario and, as well, the community and biodiversity benefits. Legal agreements has the section 4.2, entitled “Landowner responsibilities” that dispose the following: “(ii) Ensure the maintenance of areas and the legal protection necessary to ensure the permanence of carbon stocks in the post-project scenario. In other words, to maintain the integrity of the area object of the Carbon Credit Project, where no land use change of the rural property is allowed;”

The GPD GHG accounting period is 100 years. Any PAI lifetime can be extended to 100 years.

2.1.20 Financial Sustainability (G1.12)

BRC operates with its own capital and will fund all activities planned under the GPD. The actual and projected revenues from GHG emissions reductions and the projected cashflow are considered as commercially sensitive information.

Detailed financial information about the project can be shared with relevant stakeholders upon signing a non-disclosure agreement.

2.1.21 Grouped Projects

This project is designed as a Grouped Project, under a set of eligibility criteria for the new PAIs inclusion, that are described in the section below.

The project scope expansion is allowed by new project activity instances (PAIs) inclusion after its validation, which occurs on each verification event.

According to the VCS v4.1, grouped projects shall meet the following:

“3.5.8: Grouped projects shall have one or more clearly defined geographic areas within which project activity instances may be developed”.

The Grouped Project assumes only one wide geographic area called the Paragominas region, located in the Amazon “Deforestation Arch”, as shown in section 2.1.7. It has 51,380.43 Km² and covers 7 municipalities.

The project activity instances might encompass any private properties legally constituted, with forest cover on protected areas by the federal law. In other words, the Grouped Project can include any private properties that have forest remnants on Legal Reserve or on APPs. The Grouped Project considers all forest types located in the reference region.

"3.5.9: Determination of baseline scenario and demonstration of additionality are based upon the initial project activity instances. The initial project activity instances are those that are included in the project description at validation and shall include all project activity instances currently implemented on the issue date of the project description".

Regarding baseline and additionality, it is assumed that all private properties in the grouped project geographic area (baseline reference region) are subject to the same legal framework and similar deforestation agents and drivers as those identified for the project's initial PAIs. All landowners within the Legal Amazon have the right to convert up to 20% of the forest area (or 65% in the case of Cerrado) in their private properties for economic purposes. In the other hand, the Legal Reserve (RL), that represents 80% of the property (or 65% in the case of Cerrado), and the permanent preservation area (river banksides, slopes higher than 45°, etc.) are protected by law against deforestation. Notwithstanding, the business as usual in the private properties encompassed by the Grouped Project reference region, does not comply with the law, where the common practices is forest logging and suppression, without any legal permit, followed by livestock, and soybean plantation. However, specific assessment on baseline scenario and additionality will be done for each new activity instance included in the project scope after the grouped project registration, to revalidate the initial assumptions.

"3.5.10: As with non-grouped projects, grouped projects may incorporate multiple project activities. Where a grouped project includes multiple project activities, the project description shall designate which project activities may occur in each geographic area".

The only project activity considered in the project design in all project activity instances is avoiding unplanned deforestation (AUD).

To avoid unplanned deforestation, BRC will sign long-term conservation agreements with landowners. Complementary activities related to the reduction of unplanned deforestation, leakage mitigation, social and biodiversity related activities and monitoring activities are described in section 1.1, 2.1.1, 2.1.11 and 2.1.13.

"3.5.11: The baseline scenario for a project activity shall be determined for each designated geographic area, in accordance with the methodology applied to the project".

Only one wide geographic area is considered for this grouped project, once the baseline scenario for the avoided unplanned deforestation activity is the same and all private properties within the municipalities encompassed by the grouped project and are all subjected to the same regulatory framework. Please refer to sections 3.1.4.

"3.5.12: The additionality of the initial project activity instances shall be demonstrated for each designated geographic area, in accordance with the methodology applied to the project".

Only one geographic area is considered for this grouped project, as presented in section 2.1.7. Thus, the additionality approach for avoided unplanned deforestation activity is the same for all private properties

encompassed by the grouped project once they are subjected to similar drivers and agents of illegal deforestation. For additional information, please refer to sections 3.1.5.

"3.5.13: Where factors relevant to the determination of the baseline scenario or demonstration of additionality require assessment across a given area, the area shall be, at a minimum, the grouped project geographic area. Examples of such factors include, inter alia, common practice; laws, statutes, regulatory frameworks, or policies relevant to demonstration of regulatory surplus; determination of regional grid emission factors; and historical deforestation and degradation rates".

The relevant factors for the baseline scenario determination and demonstration of additionality of a given project activity instance are the same for the entire geographic area. Any legally constituted private properties within the reference region adopted for this grouped project (please refer to section 2.1.1), with forest remnants of Legal Reserve and Permanent Preservation Area are subject to some level of deforestation threat, thus is eligible for this grouped project.

"3.5.14: Where a capacity limit applies to a project activity included in the project, no project activity instance shall exceed such limit. Further, no single cluster of project activity instances shall exceed the capacity limit".

Not applicable. There is no capacity limit applicable to the project activity type (AUD) considered in the grouped project, since the BRC team will be present in the Reference Zone and can add as many human resources as necessary to fill the area.

2.1.21.1.1 Eligibility Criteria for Grouped Projects (G1.14)

"3.5.15: Grouped projects shall include one or more sets of eligibility criteria for the inclusion of new project activity instances. At least one set of eligibility criteria for the inclusion of new project activity instances shall be provided for each combination of project activity and geographic area specified in the project description. A set of eligibility criteria shall ensure that new project activity instances":

Meet the applicability conditions set out in the methodology applied to the project: All PAIs under this Grouped Project must meet the applicability conditions set out in the methodology VM0015 v3.0. Regarding the 20 initial project activity instances, the applicability conditions are met as demonstrated:

- The initial PAIs have no areas registered under the CDM or under any other GHG program.
- All lands included in the initial PAIs are qualified as native primary forest, according to the Brazilian forest definition.
- Baseline deforestation and forest degradation in the project area fall within the category "unplanned deforestation/degradation".
- Leakage avoidance activities in the initial PAIs do not include agricultural lands that are flooded to increase production, neither livestock production through use of feed-lots and/or manure lagoons.

- The baseline scenario for all the PAIs applied under this GPD are based in the illegal conversion of forest lands to non-forest lands, according to the regional land use common practice.

Use the technologies or measures specified in the project description: sections 2.1.11 and 3.3 define the technologies and measures available. The GHG emissions reductions will be caused by the signing of long-term forest conservation agreements with landowners in all PAIs. Complementary activities related to the reduction of unplanned deforestation, leakage mitigation, social and biodiversity related activities and monitoring activities are also described in section 2.1.11 and 3.3.

Apply the technologies or measures in the same manner as specified in the project description: The currently and future PAIs must apply the same technologies and measures specified in this document. Small adjustments area allowed to accommodate PAI specificities. Any adjustment will be reported, described, and must not overestimate the project climate benefits.

Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area: The grouped project assumes the Reference Region for baseline projection (please refer to section 3.1.4) as the unique geographic area, taking into consideration that all private properties within this biome are subject to the same legal framework. New PAIs must follow the same baseline approach described in the section 3.1.4

Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area: Considering that the grouped project refers to avoidance unplanned deforestation (AUD) in areas where the forest suppression is not permitted by law, all the subsequent project activity instances submitted under this GPD, must follow the same additionality approach presented in section 3.1.5 for PAIs #1-20. It means that the plausible baseline scenarios will not differ from the three scenarios identified in the additionality analysis, as follow:

1. Forest cover maintenance in Legal Reserve and Permanent Preservation Area, i.e.: through conservation activities resulting from incentives other than the REDD project.

2. Legal deforestation for pasture (cattle raising) and agriculture.;

3. Illegal deforestation for pasture (cattle raising) and agriculture purposes or simply for land grabbing and real estate speculation.

2.1.21.1.2 Scalability Limits for the Grouped Projects (G1.15)

According to section 3.6.9 of the VCS V4.4:

“Where a capacity limit applies to a project activity included in the project, no project activity instance shall exceed such limit. Further, no single cluster of project activity instances shall exceed the capacity limit”, BRC technical team didn’t identified capacity limit applicable to the project.

There is no capacity limit applicable to the project activity type (AUD) considered in the grouped project, since the BRC team will be permanently present on Reference Zone and can add as many human resources as necessary to meet the project activity demands. It is worth noting that BRC is establishing a local office at Paragominas municipality, that can improve local engagement, create jobs, and provide faster responses to the project needs.

2.1.21.1.3 Risk Mitigation Approach for Grouped Projects (G1.15)

Not applicable. The project cannot be expanded beyond its scalability limit. The climate, community and biodiversity benefits risk mitigation measures identified in this document are applicable to all currently and future PAIs.

2.2 Without-project Land Use Scenario and Additionality

Baseline scenario was set according to VM0015 v1.1. This module provides a stepwise approach for estimating GHG emissions related to unplanned deforestation.

GPD additionality was assessed according to VT0001 v3.0. This tool was adapted from the CDM "Tool for the Demonstration and Assessment of Additionality in A/R CDM Project Activities" (Version 02) and provides a stepwise approach to demonstrate additionality in VCS AFOLU projects. The following sections present the results of each step.

2.2.1 Land Use Scenarios without the Project (G2.1)

Considering that the baseline scenario is the same as the conditions existing prior to the project initiation, and in line with the CCB/VCS PD template, there is no need to repeat the description of the scenarios, for detailed information regarding the conditions existing prior to the project initiation, please refer to Section 3.1.4 (Baseline Scenario).

2.2.2 Most-Likely Scenario Justification (G2.1)

Considering that the baseline scenario is the same as the conditions existing prior to the project initiation, and in line with the CCB/VCS PD template, there is no need to repeat the description of the scenarios, for detailed information regarding the conditions existing prior to the project initiation, please refer to Section 3.1.4 (Baseline Scenario).

2.2.3 Community and Biodiversity Additionality (G2.2)

In the absence of the project, the scenario would be characterized by native forest degradation and deforestation. These activities are directly responsible for biodiversity habitat loss and one of the main drivers of species extinction. Considering the project initial scope, the project activity implementation will avoid the

deforestation of 57,291.44 ha throughout its lifetime, thus directly contributing to the maintenance of the forest cover, the usable area of habitats and the species diversity in the project zone. Although the Brazilian law states that all private properties located in the Legal Amazon should preserve 80% of its native forest, the business as usual in the private properties encompassed by the Grouped Project reference region, does not comply with the law and the common practices are forest logging and suppression, without any legal permit, followed by livestock, and soybean plantation.

The activities of fauna assessment and monitoring would not have been carried out in the without project scenario since it is not required by law. Moreover, these activities are highly costly since they are carried out by fauna specialists in places of difficult access. These activities will bring important information about species population and endangered species distribution.

In case of social change, the project will help the communities, through the strengthen of local associations and cooperatives, and even the municipal, state, and federal administrations on its issues such as improvement of schools' physical condition, thus it indirectly impacts on education quality and on its global index, among others possible changes as health services. Furthermore, through the project activities - mainly through the varies courses previewed - that will be implemented on the communities which will have the chance to develop new opportunities of jobs based on new productivity chains.

2.2.4 Benefits to be used as Offsets (G2.2)

Not applicable. No distinct climate, community and biodiversity benefits are intended to be used as an offset, rather than the VCUs generated by the project.

2.3 Stakeholder Engagement

The first stage focused on socio-economic and cultural surveys and diagnoses. In this first phase, we shared a project draft with communities and other stakeholders, providing general and specific types of activities that could be developed by the project to support discussions among community representatives and as a preparation for the second round of interaction. In this first step, we discussed the project's potential benefits, costs, and risks with the communities.

The second stage was conducted in the form of participatory workshops on the design of project activities and focused on building and obtaining free, prior, and informed consent from communities within or affected by the project. From these workshops we defined the project's social activities, monitoring parameters and mechanisms for participation and benefit-sharing. In addition, we also considered potential negative impacts and possible mitigation measures and mechanisms for ongoing communication and grievance redress procedures

were defined. In these workshops, we discussed topics such as HCVs and created an exclusive space for woman to interact.

We carried out the third stage in the form of social monitoring based on the previously defined monitoring plan. The fourth stage, we carried out the dissemination of monitoring results, the procedure for participating in the CCB's public comment period, the project validation/verification process, and the role of the auditor.

2.3.1 Stakeholder Access to Project Documents (G3.1)

All project documentation, including project description and monitoring reports will become available through the BRC and Verra websites, social media divulgation and during public meetings. The printed version distributed to communities and stakeholder will contain a general description of physical and social parameters, as well other relevant aspects during the project lifetime.

2.3.2 Dissemination of Summary Project Documents (G3.1)

A printed version of the CCB GPD summary in Portuguese will be actively disseminated to all stakeholder groups previous from the schedule meetings, but also during the public meetings copies will be available to any part interested in the project.

In February 2023, the BRC staff team will inform to all the stakeholders and provide a copy of the project description summary, also the BRC team will inform the same stakeholders about the audit team site visit.

2.3.3 Informational Meetings with Stakeholders (G3.1)

The informational meetings started in May 2022 and were caried out by BRC staff that visited representatives of public and private local stakeholders to conduct a formal presentation of BRC and the carbon project.

Visits were publicized on BRC and stakeholder's social media (Appendix I - Stakeholder Engagement). The initial engagement was carried out in the municipalities of Paragominas, Ipixuna do Pará, Tomé-Açú, Dom Eliseu and Rondon do Pará.

The complete list of meetings is described below. For more information about the meetings please refer to Appendix I.

- May 03rd 2022 – Visit in the Environmental Municipal Secretary of Paragominas (SEMMA – Secretaria Municipal de Meio Ambiente). Meeting between BRC staff and Mr. Roberto Carlos Gambin (Environmental Municipal Secretary of Paragominas);

- May 03rd 2022 – Visit to the State Regional Centre of Environmental Regularization of Paragominas (Núcleo Regional de Regularidade Ambiental de Paragominas). State Regional Centre attends the follow municipalities: Capim River basin – Abel Figueiredo | Aurora do Pará | Bujaru | Capitão Poço | Concórdia do Pará | Dom Eliseu | Garrafão do Norte | Ipixuna do Pará | Irituia | Mãe do Rio | Nova Esperança do Piriá | Ourém

| Paragominas | Rondon do Pará | Tomé-Açu e Ulianópolis. Meeting between BRC staff and Ms. Luana Alves (coordinator) and Ms. Luana (analyst).

- May 03rd 2022 – Visit to the Social Assistance Municipality Secretary (SEMAS – Secretaria Municipal de Assistência Social de Paragominas). Meeting with Ms. Amanda Alves Oliveira Purger (Social Assistance Municipal Secretary);

- May 03rd 2022 – Visit to the Environmental, Science, and Technology Municipal Secretary (Secretaria Municipal de Meio Ambiente, Ciência e Tecnologia de Ipixuna do Pará). Meeting between BRC staff and Luanda Thalita de Brito Silva (Environmental Municipal Secretary);

- May 04th 2022 – Visit to the Vale do Acará Agricultural Association of Tomé-Açu (AAVA - Associação Agropecuária do Vale do Acará). Metting between BRC staff, Bruno Machado (owner of instances PAI# 15 to 17), Mr. Manoel Antônio de Lima (Association President), Mr. João Cláudio de Lima Nivaldo (fiscal council director) and Mr. Ataíde de Moura (fiscal council director);

- May 04th 2022 – Visit to the Environmental Municipal Secretary of Tomé-Açu (Secretaria Municipal de Meio Ambiente de Tomé-Açú. Meeting between BRC staff, Bruno Machado (owner of instances PAI# 15 to 17) and Mr. Cosmo Ferreira do Amaral (Environmental Municipal Secretary);

- May 05th 2022 – Visit to the State Agency of Agricultural Defense of Dom Eliseu (ADEPARA - Agência Estadual de Defesa Agropecuária do Pará). Meeting between BRC staff and Mr. Gersilon Silva da Gama (Mayor of Dom Eliseu), Mr. Maikon Mantelli (Environmental Secretary of Dom Eliseu), Ms. Mônica Cristina Peloso Aguiar (Economic Development, Minning, Industry Commercial and Tourism Municipal Secretary of Dom Eliseu), Mr. Genilson Freitas Cavalcanti (Economic Secretary of Dom Eliseu) and members of the Dom Eliseu Rural Workers Syndicate, Mr. Tarcizio Burin (President), Ms. Laura Priore (Vice-President) and Mr. Guilherme Araújo.

- May 05th 2022 – Meeting with Rondon do Pará Rural Workers Syndicate (Sindicato de Trabalhadores Rurais de Rondon do Pará). Meeting with Mr. João Malcher (president), Ms. Cristina de Barros Malcher, e a laywer Ms. Maria Eduarda de Barros Malcher.

2.3.4 Community Costs. Risks. and Benefits (G3.2)

In our project, we designed the activities in a participatory manner with the local communities, in which the principal social diagnosis and monitoring tool used in the project instances is the Participatory Rural Appraisal. On this way, all relevant project information will always be informed in advance, followed by printed versions of documentation sent to each communities' leaders and local social organizations family encompassed by the project. The participatory design of the project activities enables the process to be flexible and dynamic, enabling the instance to be updated whenever the communities come up with new demands that the project can support.

In section 2.1.8, we expressed the project activities and benefits we will implement during the project's lifetime. All project activity costs oversee BRC. We have the strategy to promote forest conservation based on the financial flows from the carbon market, so the communities and families do not assume any financial risk or

expenses, nor any compulsory change in their way of life. The forest conservation activities will not interfere with the communities since they do not use the project area. There are no risks to the identified stakeholders or ownership rights associated with the project. Instead, we designed the project in compliance with CCB requirements to have positive net impacts on communities.

2.3.5 Information to Stakeholders on Validation and Verification Process (G3.3)

Our communication involves different ways, including presence and online meetings, Social Media communication, WhatsApp messages, oral seminars, schematic drawings, didactic videos, and printed materials. The communications goals are to present the project in a simple and didact manner and answer any related doubts. During the meetings, we have previously informed all stakeholders about the periodic verification procedures, and since the verification schedule is established, we communicate with the communities and stakeholders.

In February 2023 it is planned to the BRC staff team to visit and inform the main project stakeholders about the validation process and to provide a copy of the project description summary.

2.3.6 Site Visit Information and Opportunities to Communicate with Auditor (G3.3)

We will communicate with the stakeholders (e.g., community leaders) before verification activities by phone contact, WhatsApp messages, e-mail, and, when necessary, by presential visiting or radio.

BRC have a permanent team in the Belem and Paragominas region to deal with all logistic verification processes. So, we will be responsible for the logistics and displacement necessary for the smooth running of the audit, allowing the validation/verification bodies access to community representatives at their discretion.

2.3.7 Stakeholder Consultations (G3.4)

The stakeholder consultation process took place during the participatory workshops to design the project. In these events, we invited community members to speak freely about their problems and concerns, considering how the project could help. At the end of each event, we created a list of potential project activities.

Therefore, the activities described here reflect the demands of the communities influenced by the project. For other stakeholders, such as public government (municipality and state), we based the consultations on communication by e-mail, official letters, and meetings. We registered all evidence in the project database.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

We based the continued communication and consultation on presential and digital meetings. All community leaders have frequent internet access and enable effective and continuous contact with our team through WhatsApp, e-mail, and virtual meetings.

We plan to carry out annual public meetings to report the results of participatory monitoring of the implementation of project activities. During these events, communities will have new chances to influence the project design and its performance during the subsequent monitoring period, which aligns with adaptive management.

2.3.9 Stakeholder Consultation Channels (G3.5)

We develop a social engagement protocol to ensure that all consultations and participatory processes are undertaken directly with communities and other stakeholders. So far, the direct consultation and involvement of communities in participatory approaches can be evidenced in this document by photographic records.

2.3.10 Stakeholder Participation in Decision-Making and Implementation (G3.6)

We ensured stakeholder participation in decision-making by the BRC social engagement protocol, which provides the execution of participatory workshops for the project's design. During these workshops, we reserve an entire space for women's participation (without men). We are a team with more than ten years of experience in developing carbon projects, which gives them the necessary skills to conduct public meetings with appropriate language. We produced and distributed an illustrated book to help them understand the nature and scope of the carbon project, among other relevant aspects. So far, we have demonstrated the effectiveness of the

participation mechanisms by describing the project activities, which reflect the demands presented by the community, Figure 18.

Figure 18 – Local coordinator and BRC social team at Barreirinha Indigenous Land.

2.3.11 Anti-Discrimination Assurance (G3.7)

Our staff is responsible for designing and implementing all the project activities following the local community's approval. All BRC directors and company partners respect all relevant laws related to anti-discrimination assurance, which is enforceable by the company's social statute (**Erro! Fonte de referência não encontrada.**) and the BRC Ethic Conduct Code (**Erro! Fonte de referência não encontrada.**).

The landowners have signed a conservation agreement that clearly states that both parties must follow all the applicable laws regarding project implementation, management, and their commitment to no forms of discrimination, including gender, race, religion, sexual orientation, or other habits.

2.3.12 Feedback and Grievance Redress Procedure (G3.8)

At BRC, we understand that people's engagement, needs, and well-being are essential for maintaining the project in the long term. Therefore, we maintain direct communication with stakeholders and the community through calls and messages, allowing communication, feedback, and complaints at any time. Every year, we

held at least one presential meeting with all communities. In these meetings, we gather input on activities already carried out and demands for maintaining or carrying out new activities. In these meetings, we also apply questionnaires to measure our activities' effectiveness objectively.

Our process for receiving, hearing, responding to, and attempting to resolve grievances is established and delineated in three stages:

Amicably negotiation: we will listen to grievances from communities, and other relevant stakeholders, analyze them, and provide an oral or written response within one week via e-mail and/or WhatsApp or by presential meetings.

Mediation by a neutral party: If we cannot solve a complaint amicably through clarification or redress, the dispute will be referred to mediation by an independent third party. This third party may vary depending on the type of dispute. If there is a land dispute, we may refer the matter to the state or federal land government agency. If the conflict occurs between communities, it may be mediated by the BRC or community association representatives.

Arbitration: If the third party cannot mediate the ongoing dispute, the ongoing dispute will be judged in the district of Piracicaba or the local district.

2.3.13 Accessibility of the Feedback and Grievance Redress Procedure (G3.8)

All project documentation about our presential social meetings and questionaries including grievance and redress will be available on the project registration website through the PD and Monitoring Reports to any stakeholder interested in additional project information.

2.3.14 Worker Training (G3.9)

Three types of processes were implemented to provide orientation and training during the first monitoring period:

• Formation of the local team to support forest inventory

• Technical Assistance and Rural Extension (ATER) related to sustainable livestock

• Environmental education related to carbon cycle, climate change, the importance of forests and their different ecological functions

2.3.15 Community Employment Opportunities (G3.10)

The project designed aims to transform the reality of lack of opportunities in the local communities by creating new labor opportunities. Some of them will be related to the activities of the project itself, such as temporary workers in positions as cooks, masons, forest guides, boatmen among other functions. But the main source of new opportunities will be related to the creation and development of productivity chains as demanded

by communities in participatory activities and social diagnosis. Therefore, these opportunities will follow the needs of each kind of productivity chain developed.

In this sense, the trainings previewed to be provided will be important to improve the quality of these services, what will help the communities members to develop new skills that will be useful to then not only to work for the project, but to work for themselves and for other employers.

Furthermore, the project seeks to help these population to have a better labor situation, through giving them opportunities to understand and access to the Brazilian labor rights based on courses and partnerships with public institutions as labor ministry and Pará's labor state secretary. So, the project proponent is committed to inform in an appropriate way (adapted language and instruments) the workers about their rights and duties in accord to the Brazilian labor law.

Another point that needs to be highlighted is the law and moral obligation of avoid any kind of discrimination such as gender, age, religiosity, ethnicity among other kinds. The BRC is committed not just to avoid this problem in the project activities, but to conscious the people about it as a social issue. Therefore, the project has as a political guide to contract and give courses to all kinds of people aiming to decrease discrimination and improve wellbeing.

2.3.16 Relevant Laws and Regulations Related to Worker's Rights (G3.11)

The Project proponent is committed to meet all applicable Brazilian laws and regulations applicable to worker rights. Furthermore, have informed all workers about their rights, before hiring as its described in the Brazilians Labors Laws.

The following is a list of Brazil's relevant laws and regulations applicable to worker's rights:

The Brazilian Constitution, Chapter II – Social Rights, Articles 7- 11 which addressed: I) Minimum wage, ii) Normal working hours, iii) Guidance on vacation and weekly leave iv) Guidance on maternity and paternity leave v) Recognition of collective bargaining vi) Prohibition of discrimination. In addition to the Constitution, there are two additional decrees related to Brazilian labor laws.

Labor Federal Law (Consolidate of Working Laws (CLT): DECREE-LAW number 5.452, from May 1st of 1943). This decree gives more clarification on the subjects: i) Hourly, daily, weekly, and monthly work hours, ii) Employment of minors and women, iii) Establishes a minimum wage, iv) Worker safety and safe working environments, v) Defines penalties for employer's non-compliance, vi) Establishes a judicial work-related process for addressing all worker related issues. FEDERAL LAW Nº 5,889, June 8th of 1973 (Establishes Regular Norms for Rural Workers). This is a complementary law to the 1943 decree, once prior to 1973, rural workers did not have the same rights as urban workers. In 1973, this law was established to specify the equality between urban and rural workers, along with compensation for overtime.

Federal Law n.° 8.080, of 19th September 1990 that provides for the conditions for the promotion, protection and recovery of health, the organization and operation of the corresponding services and other provisions. It

includes the workers and their health on Public Health System. The Health Ministry (MS) Ordinance number 3.908, of 30th October 1998 also establishes procedures to guide and implement actions and services for workers' health in the Unified Health System (SUS).

Complementary Law 123/2006 of December 14, 2006. Establishes the National Statute of Microenterprise and Small Business; change devices of the Laws in 8,212 and 8,213, both dated July 24, 1991, of the Consolidation of Labor Laws - CLT, approved by Decree-Law no. 5,452, of 1st of May 1943, of Law no. 10189, of February 14th of 2001, of the Complementary Law in the 63, of January 11, 1990; and revokes the Laws in the 9,317 of the 5th of December 1996, and 9841 of October 5, 1999. Art. 3 For the purposes of this Complementary Law, are considered micro-enterprises or companies small business company, simple society, the individual company of limited liability and the entrepreneur who refers to art. 966 of the Law in 10,406 of the 10th of January 2002 (Civil Code), duly registered in the Registry of Merchant Companies or in the Civil Registry of Legal Entities.

2.3.17 Occupational Safety Assessment (G3.12)

During the execution of the project, a series of measures and actions aimed at the health and safety of the worker is necessary. It is also necessary to understand the risk involved in the activities carried out. On it's context, during the job, diary activities will be proposed, such the Safety, Environment and Health Diary Dialogue (DDSMS), that will be promoted to inform workers about their rights and about their obligations as individual and as a team.

Training on disease and accident prevention is planned for workers linked to the project, along with clarifications and general education and conduct actions that minimize accidents and harm to workers' health. Appropriate care for emergency situations will be proposed, with the establishment of local resources for health care and removal of victims in any accidents.

Actions aimed at minimizing the risk to workers' health will involve the promotion of adequate conditions to preserve the health and safety of all workers.

The risk analysis to the workers safety, that could be impacted due to the project activities, was based in the proposed jobs opportunity. Each employment opportunity will have a unique assessment to reflect the particularities of the job. The use of Personal Protective Equipment (PPE) to be used by different professionals will be widely encouraged and doubts about this aspect will be resolved whenever they occur.

- Field guide ("mateiros"): The project proponent will promote the use of individual protection equipment (boots, helmet, leggings, glasses and gloves) necessary to the field activities.
- Boat pilot ("voadeiras" and/or "rabetas"): The project proponent will promote the use of life jackets in the boats for all project staff and collaborators, including the pilot.
- Accommodation services: No risk was identified.
- Mason services: The project proponent will promote the use of the individual protection equipment (boots, helmet, gloves, etc) necessary to the mason activities.

- Cooking/kitchen services: No risk was identified.
- Project proponent focal point: The project proponent will promote the use of the individual protection equipment (boots, helmet, leggings, glasses and gloves) in the field works, according to each activity characteristics.
- Forest inventory team: The project proponent will promote the use of the individual protection equipment (boots, helmet, leggings, glasses and gloves) necessary to this kind of field activities.

2.4 Management Capacity

2.4.1 Project Governance Structures (G4.1)

The Cauaxi REDD+ Grouped Project have three types of governance structures, such as shown below on Figure 19.

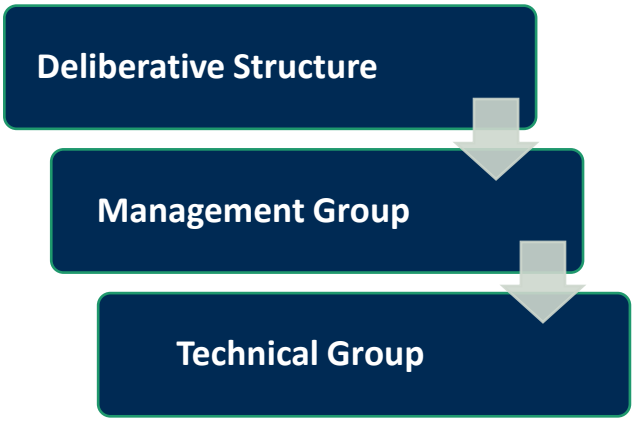


Figure 19 – Governance Structure for Cauaxi REDD+ Grouped Project project

The Deliberative Structure bunch contains the BRC, represented by Mr. Eng. Bruno Melo da Matta and partners, as project's proponent. It also contemplates the landowners, here represented by two companies' persons Floraplac Industrial LTDA, Rio Concrem Industrial LTDA, and by two private persons Mr. Gilson Antônio Moreira Machado and Mr. Adão Ribeiro Soares. This bunch are responsible for project decision taking.

The Management Group contains the BRC team and are that responsible for receiving prior Deliberative Group decisions, designing actions, planning and guiding the team and Technical Group on developing and project accomplishing process.

The Technical Group contains the BRC team, contractors and might around communities representant, who are responsible for project activities execution such as field monitoring and visits, studies, training, and reporting.

Describe the project's governance structures, and roles and responsibilities of all entities involved in project design and implementation.

For grouped projects, identify any new entities included in the project since the last CCB validation or verification.

2.4.2 Required Technical Skills (G4.2)

The BRC staff team has more than ten years of experience in AFOLU carbon project, including, methodological tools, community engagement, biodiversity assessment, carbon measurement, field activities, monitoring and project management. The BRC team is described below:

Eng. Beatriz Silvestre: Forest Engineering from the College of Agriculture "Luiz de Queiroz" - ESALQ/USP. Has experience in geoprocessing and spatial image analysis with focus on feasibility analysis for carbon projects.

MSc. Bruna P. Azevedo: Bachelor in Biological Science and master's in science at the University of São Paulo (USP), with an emphasis in Forest Resources and Conservation of Natural Ecosystems. She has expertise in the manipulation and analysis of ecological data, and experience in planning, developing, and executing biodiversity monitoring and conservation projects.

MSc. Eng. Bruno M. Matta: Environmental Engineer, Master in Biodiversity Conservation and Sustainable Development by the School of Environmental Conservation and Sustainability (ESCAS/IPÊ), with research related to the development of a deforestation baseline using the VM0015 methodology. He has experience in valuing Environmental Services and using tools and mechanisms to support environmental management and planning. He has strong expertise in Geoprocessing, Remote Sensing and Geographic Information Systems, experience in the development, validation, and verification of AFOLU projects. He has extensive knowledge of the certification process, especially for forest carbon standards (VCS and CCBS). He has already worked in different Brazilian biomes: Amazon, Caatinga, Cerrado and Atlantic Forest, in public, private and third sector institutions, always on issues related to environmental services, with an emphasis on forest carbon.

Ph.D. Eng. Danilo Roberti Alves de Almeida: Forest management, conservation, and restoration researcher with more than 55 previewed publications. He is a specialist in the use of remote sensing and drones for forest monitoring. Academic background: post-doctoral at the São Paulo (Brazil), University of Florida (USA), and Bangor University (UK); Ph.D. Forest Resources, University of São Paulo; M.Sc. Tropical Forest, National Institute of Amazonian Research; B.S. Forest engineer, Federal University of Viçosa.

Eng. David Escaquete: Forestry Engineer graduated from the State University of São Paulo (UNESP). David has 19 years of experience working in the forestry sector. He has technical expertise in the areas of strategic planning, business management, forest management, certification, production chains, monitoring and analysis of social and environmental impact, among others. David is CEO of BRFlor, commercial director of Genome A - Bio Tech, product development and certification strategy manager at Go Health Foods - GHF and member of the FSC Ecosystem Services standards and certification committees. Over nearly two decades of work, he has coordinated projects, led initiatives and provided services to a number of governments, universities, civil society organizations, traditional Amazon communities and companies such as the State Governments of Acre, Pará and Mato Grosso , ESALQ/USP, UNEMAT, IMAFLORA, WWF, IFT, GIZ, GITEC, IPAM, USAID, the Paiter-Surui (indigenous from the Sete de Setembro Indigenous Land/RO), Coomflona (extractive from the Tapajós/PA Flona), Alto Trombetas (quilombolas of PA), CONSPRA (Extractivists of Resex Verde par

Semper/PA), Cooperfloresta (rubbers of the Chico Mendes Settlement/AC, Amazonbai (Ribeirinhos of the Archipelago do Bailique/AP), Asproc (Ribeirinhos of Medio Juruá/AM) , Suzano, Bluetimber, Samise, Agrocortex, Mil Madeiras, Cemal, Pataua, Klabin, Veracel, CMPC Melhoramentos and Arauco.

MSc. Eng. Diego C. Serrano: Forestry Engineer graduated from the Superior School of Agriculture "Luiz de Queiroz" - ESALQ / USP (2003). Master in Energy Systems Planning in forest residues and solid biofuels from UNICAMP (2007). His skills include coordination, preparation and auditing of PDD's/PD's in scopes 1, 4, 13 and 14. He was technical coordinator of the European Union program for strengthening the productive chain of rural cooperatives in Mozambique (2005). He acted as a consultant on Extractive Reserves in the Amazon under UNDP programs (2004). He was a guest researcher at the National Biofuels Pole (2006). In the private sector, he served as technical coordinator of carbon, biodiversity and forest projects for Ecológica Assessoria (2007) and as technical manager of the carbon, forest and biofuels programs for CantorCO2e, where he was technically responsible for more than seventy carbon projects under the CDM and voluntary markets, including eight LULUCF PDs (2008-2009). From 2009 to 2014 he worked as lead auditor by Bureau Veritas Certification (BVQI) on carbon projects (CDM, VCS and emission inventories) where he audited more than sixty projects, 44 of them CDM. He has a lead auditor training in ISO 14001: 2004. In 2009 he founded C3-Forest, Environment & Energy, a company that provides consultancy in carbon, forest (LULUCF and AFOLU) and solid biofuel projects. From 2014 to 2019 Diego also audited VCS AFOLU projects by IMAFLORA and Earthood.

Eng. Gabriela Aguiar: Forestry Engineer graduated from the Superior School of Agriculture “Luiz de Queiroz” (ESALQ/USP), works in communication and stakeholder experience. She has experience in the areas of projects, quality, customer relations, human resources, environment and environmental education. In recent years, she has experienced the sustainability area through socio-environmental communication and the articulation of impact strategies.

MSc. Eng. Heberton Barros: Bachelor's Degree in Forestry Engineering from the Federal University of Espírito Santo (UFES) and master’s degree in Tropical Forest Sciences by the National Institute of Amazonian Research (INPA) with an emphasis on Human Support Capacity in Amazon Agro-ecosystems. Since 2009 he has been working as a researcher in NGOs such as IDESAM and recently (2014) he has been working as a researcher associated with research groups at the CNPQ (INPA), where he develops activities related to Earth observation, analysis and territorial planning in the Amazon using tools for geographic information systems and remote sensing. Its performance involves the analysis of human occupation of the Amazon territory; land use changes; prospecting for carbon projects via REDD+; elaboration, implementation, and monitoring of REDD+ projects and conservation projects. Develops forest ecology studies focused on the structure of forests, quantification of carbon stocks and carbon emissions from deforestation and forest degradation. Finally, it supported the formulation and articulation of strategic public policies to promote sustainable development in the Amazon region, at municipal and state levels. He is a member of the CNPQ research group: Environmental Services, Human Support Capacity and Impacts of Deforestation, led by INPA under the Coordination of the PhD. Phillip Martin Fearnside, where he develops research on the interaction of climate - human being - forests,

with research focused on forest fires and exploitation of natural resources in indigenous territories in southern Amazonia, expansion of agricultural frontiers and territorial management in the arc of deforestation.

Eng. Isabella Francischeti: Forest Engineering from the College of Agriculture "Luiz de Queiroz" - ESALQ/USP. With experience in restoration projects in the Atlantic Forest and Cerrado, as well as management and stewardship of natural protected areas. Works with geoprocessing and spatial image analysis with focus on feasibility analysis for carbon projects.

Eng. Léo Eiti Haneda: Forest Engineering from the College of Agriculture "Luiz de Queiroz" - ESALQ/USP. He is a specialist in remote sensing and data science for monitoring forest conservation and forest restoration. He has experience with data collection and analysis using multispectral images and Lidar data from satellite and UAV's for forest monitoring and management.

Geographer Ph.D. Lucas Santarosa: Graduated in Geography from the Faculty of Science, Technology, and Education (FCTE) of São Paulo State University (2014), a master's degree in Agronomy from the Faculty of Agricultural Sciences (FCA) of São Paulo State University (2016), and a Ph.D. in Geosciences and Environment from the Institute of Geosciences and Exact Sciences (IGCE) from São Paulo State University (2020). Geoscientist specialist in Geoprocessing and Remote Sensing works mainly on the following topics: spatial and temporal analysis (forecasting, machine learning, and geostatistics) of hydrological data and land use land cover, hydrodynamics of watersheds, aquifer recharge, isotopic hydrology, and soil physics.

Eng. **Plinio Ruschi**: Environmental Engineer graduated from the University Paulista "Julio de Mesquita Filho" – UNESP works in the project management and technical areas. He has experience in Environmental Assessment Reports, monitoring campaigns for flora, fauna, ground and surface water, noise, effluent, and air pollution, also in geoprocessing, remote sensing, and project management.

MSc. Eng. Renan A. Kamimura: Forestry engineer graduated from the Federal University of Lavras (UFLA) and post-graduated at the Master's level in Tropical Forest Sciences by the National Institute of Amazonian Research (INPA). He has over ten years of professional experience in the Amazon biome, especially in the areas of monitoring vegetation cover both using remote sensing and through field collection in a forest inventory. He had the opportunity to integrate several field expeditions to collect primary data in the Amazon, in indigenous lands; protected areas and rural settlements. He has worked on several projects for Sustainable Forest Management (MFS) and Reduction of Emissions from Deforestation and Forest Degradation (REDD+) in the scope of the voluntary forest carbon market as a developer and independent auditor.

MSc. Sociologist Marcelo da Silveira Rodrigues: Social scientist graduated from the Federal University of Juiz de Fora (UFJF) and post-graduated at master's level in Sociology by Federal University of Amazonas (UFAM). He has over ten years of professional experience in social and educational works, mainly in Amazon region, with a various type of publics and realities as riverside communities, traditional and indigenous people and urban sites. Furthermore, he has experience in development and application of socioeconomic diagnostics and participatory process.

Ph.D. Eng. Silvio Henrique Menezes Gomes: Bachelor in Forest engineering from Federal University of Sergipe and post-graduated at doctoral degree in Forest Management and Modeling by University of São Paulo (ESALQ). He has experienced in forest biometrics and advanced modeling to measure forest volume and biomass. Actually, he has applied and developed analytic methodologies for carbon stocks quality protocols in tropical forests, for field forest inventory data, remote sensing and drone-lidar systems. He has over seven years in development of computational programming tasks in forestry data and recently on focus in biomass estimation with derived lidar metrics. In addition, he has worked in management of planted and natural forests, always to solve forest modeling and inventory issues.

Wallisson Maciel: Business Manager graduated from Uema – Universidade Estadual do Maranhão's State University (UEMA) and Environmental Expert and Auditor graduating at UNINTER (Pará). He has experience in auditing, monitoring campaigns for flora, fauna, socioeconomics diagnostics, participative diagnostics and coordination of carbon projects.

Eng. Yohana Cunha de Mello: Forestry engineer graduated from the University of São Paulo, she works in the field of landscape ecology, monitoring, certification, and risk analysis. She has practice in the use of geoprocessing, analysis and data integration tools, conducts various professional activities involving feasibility studies and monitoring of value chains. She had the opportunity to work in different territories and projects aimed at strengthening community forest management and socio-biodiversity products. In her graduation work she studied the development of methodologies for identifying areas of high conservation value (HCV) and currently participates as a trainee in verification audits of carbon projects (REDD+).

Document key technical skills required to implement the project successfully, including community engagement, biodiversity assessment and carbon measurement and monitoring skills.

2.4.3 Management Team Experience (G4.2)

BRC technical staff is headed exclusively by professionals with more than 10 years of experience in elaboration, implementation, monitoring and certification of forest carbon projects. In addition, BRC, operates with more than 30 professionals and technics that cover Project Management, Biology, Engineering, and Communication areas.

Nowadays BRC is project proponent of another REDD+ project registered in VERRA with ID 2551. Also, BRC is partner of the A/R carbon projects of EMAS (ID 738) and Pratigi (ID 1317), assuming all the technical responsibility regarding all carbon aspects related with the project.

2.4.4 Project Management Partnerships/Team Development (G4.2)

As described in the previous section, the BRC's staff has all the necessary expertise and know how to undertake this grouped AUD project, including primary data collection, elaboration, implementation, and monitoring of the project activities.

According to the necessity local contractors, involving communities around the project areas, can be invited to be part of project development.

2.4.5 Financial Health of Implementing Organization(s) (G4.3)

BRC's financials are commercial sensitive information and can be shared with any relevant stakeholder upon a signature of a non-disclosure agreement.

2.4.6 Avoidance of Corruption and Other Unethical Behavior (G4.3)

The BRC directors are not involved in any form of corruption, which is enforceable by the company's social statue and by BR's Ethics and Conduct Code.

Any kind of involvement, direct or indirectly, in bribery, embezzlement, fraud, favoritism, cronyism, nepotism, extortion, and collusion are discouraged and disliked by Conduct Code and are punishable by expulsion or other measurements.

2.4.7 Commercially Sensitive Information (*Rules* 3.5.13 – 3.5.14)

It is to be considered as commercially sensitive information any trade, financial, commercial, scientific, technical, or other information, whose disclosure could reasonably be expected to result in a material financial loss or gain, compromising the contractual terms, deals or other negotiations stated by the project proponent.

It is also a sensitive information any information relates or internal policy decisions, financial, commercial, scientific, technical that the public disclosure could reasonably be expected to undermine or negatively affect the development and/or implementation of any project activity.

Information related to project social activity, the determination of the baseline scenario, demonstration of additionality, and estimation and monitoring of GHG emission reductions (including operational and capital expenditures) are not considered to be commercially sensitive and are provided in the public versions of the project documents.

2.5 Legal Status and Property Rights

2.5.1 Statutory and Customary Property Rights (G5.1)

The BRC REED+ AUD Paragominas is about **20 properties** owned by four private or companies' persons.

As shown before, the project will be developed on 14 Floraplac's Industrial LTDA & Rio Concrem's Industrial LTDA properties, from **PAI#01** to **PAI#14**; on three Mr. Gilson's properties, from **PAI#15** to **PAI#17**; and on four Mr. Adão's properties, from **PAI#18** to **PAI#20**.

BRC has conducted a rigorous land tenure due diligence with the legal staff team and all the proprieties meets the internal requirements and the VCS and CCB standards regarding to proof the rights of the carbon credits.

It's important to highlight that exists an internal check list that requires to the landowner a total of fifteen documents and each propriety that are part of a robust internal Due Diligence regarding the land tenure and carbon rights. It has a specific legal report according to the juridic feasibility, that are available on BRC's database. The documents received by BRC from the properties and both juridic and physical persons are shown on Annex I (**Erro! Fonte de referência não encontrada.**).

2.5.2 Recognition of Property Rights (G5.1)

This section will present the Property Rights for each project's property. The land document and registry of the properties are presented on Annex II – Property Documents.

2.5.2.1 Property – Fazenda Capinzal II – PAI#01

This property is located on Ulianópolis do Pará Municipality and has 4,197.30 ha. The Fazenda Capinzal II has its registration under number 4.304, page 2446, 2-N book, from "Cartório de Registro de Imóveis (CRI) da Comarca de Tomé-Açú" (notary's office).

2.5.2.2 Property – Fazenda Capinzal I – PAI#02

This property is owned by FLORAPLAC INDUSTRIAL LTDA and by RIO CONCREM INDUSTRIAL. As shown before, are located on Dom Eliseu Municipality and has 8,622.61 ha.

The Fazenda Capinzal I is registered under cartulary number 3.077, 2-L book, page 047 from "Registro Geral da Comarca de Paragominas" (notary's office). It was the result of junction of two other properties. The Juridic Feasibility Report considers that this property is suitable for carbon projects.

2.5.2.3 Property – Fazenda Cocrem I – PAI#03

This property is owned by Mr. Vitório Sufredini, Mr. Adriano Dagnoluzzo, Mr. Silvano Dagnoluzzo and Mr. Silvio Dagnoluzzo. As shown before, are located on Dom Eliseu Municipality and has 2,523.06 ha.

The Fazenda Cocrem I is registered under cartulary number 195, 2-A book, from "Cartório de Registro de Imóveis (CRI) da Comarca de Paragominas" (notary's office). It was the result of junction of two other properties.

2.5.2.4 Property – Fazenda D'Graus I – PAI#04

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Ipixuna do Pará Municipality and has 4,369.37 ha.

The Fazenda D'Graus I has its Certificate of full content under registration number 3.426, page 126, 2-K book, page 047 from "Cartório de Registro de Imóveis (CRI) da Comarca de Tomé-Açú" (notary's office).

2.5.2.5 Property – Fazenda D'Graus II – PAI#05

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Ipixuna do Pará Municipality and has 4,226.62 ha. The Fazenda D'Graus II is registered under cartulary number 3.423, page 123, 2-K book, under the "Cartório de Registro de Imóveis (CRI) da Comarca de Tomé-Açú" (notary's office), and under cartulary numbers 9.344, page 187, 2-AG book, and 7.933, page 141, 3-K book both under the "Cartório de Registro de Imóveis (CRI) da Comarca de São Miguel do Guamá" (notary's office).

2.5.2.6 Property – Fazenda D'Graus V – PAI#06

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Ipixuna do Pará Municipality and has 2,485.29 ha. The Fazenda D'Graus V has its registration under number 3.571, book 2 from "Cartório de Registro de Imóveis (CRI) da Comarca de Tomé-Açú" (notary's office).

2.5.2.7 Property – Fazenda Yollanda – PAI#07

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Ipixuna do Pará Municipality and has 724.019 ha. The Fazenda Yollanda has its registration under 6.554, sheet 020, 2-U book from "Cartório de Registro de Imóveis (CRI) de São Domingos do Capim" (notary's office).

2.5.2.8 Property – Fazenda Paraná – PAI#08

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Paragominas Municipality and has 3,917.10 ha. The Fazenda Paraná has its registration under number 1.193, page 293, 2-D book, from "Cartório de Registro de Imóveis (CRI) da Comarca de Paragominas" (notary's office).

2.5.2.9 Property – Fazenda D'Graus III – PAI#09

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Tomé-Açú Municipality and has 3,640.33 ha.

The Fazenda D'Graus III is registered under cartulary number 3.424, 2-K book, page 124 from "Cartório de Registro de Imóveis (CRI) da Comarca de Tomé-Açú" (notary's office).

2.5.2.10 Property – Fazenda D'Graus IV – PAI#10

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Tomé-Açú Municipality and has 4,182.01 ha. The Fazenda D'Graus Iv is registered under cartulary number 3.425, 2-K book, page 125 from "Cartório de Registro de Imóveis (CRI) da Comarca de Tomé-Açú" (notary's office).

2.5.2.11 Property – Fazenda D'Graus VII – PAI#11

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Tomé-Açú Municipality and has 1,483.98 ha. The Fazenda D'Graus VII is registered under cartulary number 6.270, 2-Z book, from "Cartório de Registro de Imóveis (CRI) da Comarca de Tomé-Açú" (notary's office). The Juridic Feasibility Report considers that this property is suitable for carbon projects.

2.5.2.12 Property – Fazenda Nova Esperança – PAI#12

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Tomé-Açú Municipality and has 1,816.66 ha. The Fazenda Nova Esperança is registered on certificate number 67 from Para's land institute of April 06th of 2010.

2.5.2.13 Property – Fazenda D'Graus VI – PAI#13

This property is owned by Floraplac Industrial Ltda. As shown before, are located on Tomé-Açú Municipality and has 738.90 ha.

2.5.2.14 Property: Fazenda São Domingos – PAI#14

This property is owned by Mr. Adriano D´Agnoluzzo and Mr. Silvano D´Agnoluzzo. As shown before, are located on Paragominas Municipality and has 2.178 ha.

The Fazenda São Domingos is registered under cartulary number 5.272, 2-E book, card 12 from "Registro Geral da Comarca de Paragominas" (notary's office).

The analyzed records rebuild the succession chain from when land was Para's government property to actual property owners.

In addition to the presented documents, the interested party has present certificate number 082, issued In 2019 by the ITERPA, attesting to the authenticity of definitive land sale title No. 46 (from Para's government to

first private owner). According to the legal analyses, it is understood that the Fazenda São Domingos is able to be part of a carbon project, considering the documentary evidence regarding the property's land regularity.

2.5.2.15 Property – Fazenda Floresta Núbia – PAI#15

This property is owned by Mr. Gilson Antônio Moreira Machado and it's result of junction of two other properties. As shown before, is located on Ipixuna do Pará Municipality and has 2,993.48 ha.

The first property, Fazenda Floresta, is registered under cartulary number 11.685, 2-A book, page 151 from "Cartório de Registro de Imóveis de São Miguel do Guamá" (notary's office).

2.5.2.16 Property – Fazenda Várzea Alegre – PAI#16

This property is owned by Mr. Gilson Antônio Moreira Machado. As shown before, are located on Ipixuna do Pará Municipality and has 2,173.96 ha.

The Fazenda Várzea Alegre is registered under cartulary number 13.327, page 101, 2-U book, and under cartulary number 12.153, page 024, 2-AQ book, both under the "Cartório de Registro de Imóveis (CRI) da Comarca de São Miguel do Guamá" (notary's office).

2.5.2.17 Property – Fazenda Floresta I – PAI#17

This property is owned by Mr. Gilson Antônio Morerta Machado. As shown before, are located on Ipixuna do Pará Municipality and has 1,392.75 ha. The Fazenda Floresta I is registered under number 13,316, book 2-AU, page 88 of August 20th, 2014, on "1º Ofício de São Miguel do Guamá" (notary's office).

2.5.2.18 Property – Fazenda Cajueiro – PAI#18

This property is owned by Mr. Adão Ribeiro Soares. As shown before, are located on Rondon do Pará Municipality and has 18,941.85 ha. The Fazenda Cajueiro is registered on certificate number 08939 from Para's land institute, book 01, page 003, of March, 26th of 2003.

2.5.2.19 Property – Fazenda Ribeiro – PAI#19

This property is owned by Mr. Adão Ribeiro Soares. As shown before, are located on Rondon do Pará Municipality and has 5,061.30 ha.

2.5.2.20 Property – Fazenda União I – PAI#20

This property is owned by Mr. Adão Ribeiro Soares. As shown before, are located on Rondon do Pará Municipality and has 6,910.81 ha.

2.5.3 Free, Prior and Informed Consent (G5.2)

Since the Cauaxi REDD+ Grouped Project are occurring on private lands and without any kind of conflicts, the only necessary consent is made by the landowner through the signature of the conservation agreement with BRC, so the protocol of the Free, Prior and Inform Consent is not necessary in this specific situation. The project will not encroach uninvited on community property or government property.

2.5.4 Property Rights Protection (G5.3)

The project activities have not resulted in people relocation, which can be demonstrated in this document by the project activities description, and through direct observations in the field and through interviews with landowners and community members.

The project is idealized and designed to respect the traditional communities' areas of use, as evidenced by the project area boundaries, which exclude pasture areas and adjacent forests, expanding the project benefits beyond the project boundaries involving communities located in the project zone area.

2.5.5 Illegal Activity Identification (G5.4)

The pressure for illegal deforestation is widely observed and commonly carried out in rural properties located in the Amazon "Deforestation Arch" and in the deforestation expansion fronts. In this way, conservation activities need to avoid both planned and illegal deforestation.

Illegal activities that might affect the project's impacts consist of hunting, logging, and mining activities.

The carbon stocks permanence threats and risks identifying process has occurred throughout the initial analyses in a GIS environment. The property and PAIs area dynamics of land use were identified through monitoring data sources, such as PRODES, DETER, MAPBIOMAS and remote sensing data (Landsat images, Sentinel, Google Earth).

After the desk analysis, any potential illegal activities occurring within the project areas were identified in the field and registered. A mitigation plan for the illegal activities found is on the run and encompasses environmental education, training, promotion of sustainable activities for income generation, monitoring and supervision by the competent authorities.

Therefore, short, medium, and long-term strategies are defined to address the risk to the carbon stocks from illegal (unplanned) activities, in a way to guarantee the benefits to the climate, community and biodiversity over the lifetime of the project.

2.5.6 Ongoing Disputes (G5.5)

Since the Cauaxi REDD+ Grouped Project is occurring on private and conflict-free property, there is no observed unresolved conflicts or disputes over rights to lands, territories, and resources.

The project's team didn't find any disputes that had been resolved during the last twenty years where such records exist, or at least during the last ten years in the project area.

The only conflict identified by the staff team is in the project zone and is related with the indigenous rights. The Amanayé population has the rights of an indigenous area called as Sarauá, these rights are recognized by a Federal Decree from 2011, but the indigenous were forced to leave their territory by settlers that established a rural community called as Balalaica.

It is necessary to highlight that Balalaica use to be the name of a former farm headquarters' and because of this history three of the state settlement projects (PEAS Vila Renascer, PAES Vila Bom Jesus, PAES Vila Nova Esperança) around it are traditional called by the locals as PA Balalaica, and PA is the letters which means settlement project. Which creates some confuse to understand the all the region frame, furthermore the conflicts itself were an obstacle to our team to make a properly research on the area and collect more data.

The project will not encroach uninvited on community property or government property.

2.5.7 National and Local Laws (G5.6)

The Project proponent is committed to meet all applicable Brazilian laws and applicable regulations. On this sense, BRC follow consultant lawyers to observe local laws and applicable regulations.

The following laws, statutes or regulatory frameworks are the most relevant to the project activities. The presentation order will follow the governance level, from National laws to municipality laws and other regulatory frameworks, and also follow chronology.

2.5.7.1 Federal legal instruments

Decree-Law number 5,452, from May 1st, 1943 – that approves the Consolidation of Labor Laws.

Federal Law number 5,197, from 1967 – that regulates fauna protection and provides other provisions.

Federal Law number 6,938, from 1981 – that provides for the National Environmental Policy, its purposes and mechanisms of formulation and application, and other provisions, creates the SISNAMA (The National Environmental System) and the CONAMA council (The National Environmental Council).

Federal Constitution of Brazil Federative Republic, from 1988 – that provides all legal basis for other legal disposition on country.

The National Environmental Council / Federal Environmental Ministry resolution number 237, from 2017 – that provides for environmental licensing.

Federal Law number 6,905, from 1998 – that provides for criminal and administrative sanctions derived from the environment's harmful conduct and activities, and other provisions.

Federal Law number 9,985, from 2000 – that regulates Federal Constitution's art. 225, § 1, items I, II, III and VII, and institutes the National System of Nature Conservation Units (SNUC) and makes other provisions.

Federal Law number 12,651, from 2012, is the major forest law in Brazil – that establishes general norms with the central foundation of the protection and sustainable use of forests and other forms of native vegetation in harmony with economic development.

2.5.7.2 Pará's State legal instruments

Following the government attribution's sphere, **Pará's State legal instruments** are shown below.

Ordinary Law number 5,887, from 1995 – that provides for the Pará's State Environmental Policy and other provisions.

Area Permanent - APP of rural properties, within the scope of State of Pará, and makes other provisions.

Ordinary Law number 7,398, from 2010 – that provides for the Ecological-Economic Zoning (ZEE) of the East Zone and *Calha Norte* of the State of Pará.

Decree number 2,099 of 2010 – that provides for the maintenance, restoration, conduction of natural regeneration, compensation and composition of the Legal Reserve area of rural properties in the State of Pará and other provisions.

Normative Instruction number 06, from May 19th, 2011 – that define land use conversion procedures through authorization of Forest Suppression in the real estate and rural properties in the Legal Amazon, according to the specifications detailed below and Attachments.

Normative Instruction number 02, from July, 06th 2015 – that Provides for Authorization for Vegetation Suppression - ASV, within the scope of environmental licensing processes of the Secretary of State for the Environment and Sustainability of Pará - SEMAS/PA and gives other arrangements.

Normative Instruction number 08, from October 28th, 2015 – that defines administrative procedures for the carrying out cleaning and authorization of deletion, the be carried out in areas of secondary vegetation in an early stage of regeneration, located outside Legal Reserve and Preservation **Normative Instruction number 05, from May 3rd, 2019** – SEMAS – that provides for technical procedures for elaboration, presentation, execution and evaluation Technical Sustainable Forest Management Plan (PMFS) in native forests explored or not and their forms of succession in the State of Pará and gives other arrangements.

Ordinary Law number 8,878, of 2019 – that provides for the land regularization of rural and non-rural occupations in public lands in the state of Pará, revokes Law No. 7.289, of July 24, 2009, and Decree-Law No. 57, dated August 22, 1969.

Decree No. 1,190, of 2020 – that regulates State Law No. 8,878, of July 8, 2019, to provide for land regularization in rural areas, and other measures.

Ordinary Law number 9,048, of 2020 – that establishes the State Policy on Climate Change of Pará (PEMC/PA), and other measures.

COEMA resolution number 162 of 2021 – that establishes the activities of local environmental impact, for the purposes of environmental licensing, under the competence of the Municipalities within the State of Pará, and other measures.

SEMAS/Pará Decree number 2,744, of 2022 – that provides for the Integrated Action Program for Sustainable Territories (PTS).

SEMAS/Pará Decree number 2,750, of 2022 – provides for the guidelines and procedures for preparing the State Plan for the Recovery of Native Vegetation in the State of Pará (PRVN) and creates the Working Group for the preparation of the State Plan for the Recovery of Native Vegetation in the State of Pará (GT-PRVN).

Following the government attribution's sphere, the **municipality's laws** are shown below, according to each municipality.

2.5.7.3 Paragominas Municipality

Law number 644/07, from 2007 – that Institutes the Municipality Environmental Policy and other provisions.

Law number 765/11, from 2011 – that Institutes the Municipal Environmental Code (CAM), containing the Policy and the Municipal System of Paragominas.

2.5.7.4 Rondon do Pará

Law number 421/2002, from 2002 – that provides for the Policy for the Protection, Control, Conservation, and Environment Recovery and gives other provisions.

2.5.7.5 Dom Eliseu

Law number 444, from 2017 – SEMMA – that Provides for the Reform of the Administrative Structure of the Municipality of Dom Eliseu, and other measures.

2.5.7.6 Goianésia do Pará

Municipal Ordinary Law number 233, from 2009 – that provides for the Municipal Environmental Policy and the improvement of the quality of life in the Municipality of Goianésia do Pará.

2.5.7.7 Ulianópolis

Law number 311, from 2011 – SEMMA/ Ulianópolis – Pará – That provides for the municipal environmental policy, the fund, and the municipal council for the environment, all of the municipality of Ulianópolis and makes other arrangements.

2.5.7.8 Ipixuna do Pará

Law number 370, from 2020 – SEMMA/ Ipixuna do Pará – Pará – That establishing the new municipal environmental policy of Ipixuna do Pará and other provisions.

2.5.7.9 Tomé-Açu

Complementary Law number 11, from 2006 – that establishes the Master Plan for Sustainable Development of the Municipality of Tomé-Açu, establishes the guidelines and norms for the physical-territorial and urban organization and takes other measures.

2.5.8 Approvals (G5.7)

The Grouped Project is a project to develop and implement conservation activities to avoid unplanned deforestation (AUD). The project zone as it was described in previous sections it is Paragominas Region, on Pará's State and covers 7 municipalities.

On federal scope, there are a technical note from the Environment Ministry (MMA)[16] recognizing the role of REDD+ projects in the voluntary market, through the Secretariat of the Amazon and Environmental Services and the Department of Forest Conservation and Environmental Services. In this official document that has guidelines about the Federal Government Initiative Forest Plus (Floresta+) refers to the voluntary market in this way: "*Considering all the mitigation potential of the land use change sector and forests in Brazil, this context presents a valuable opportunity to attract large investments in projects that act directly in the territory, providing environmental monitoring, surveillance and environmental protection services in areas, transforming the local reality and promoting the conservation and recovery of large-scale native vegetation, an essential contribution to reducing illegal deforestation, supporting sustainable development and ensuring long-term conservation of Brazilian forests*".

So as the Grouped Project meets all requirements of the technical note described above, the AUD Grouped Project is perfectly in line with the host country conservation strategy. In a state scale, the BRC is strengthening

[16] Technical Note nº 353/2021-MMA – at https://www.gov.br/mma/pt-br/assuntos/servicosambientais/florestamais/copy_of_FlorestamaiscarbonoNotatcnica.pdf/@@download/file/copy_of_FlorestamaiscarbonoNotatcnica.pdf

the communication between the Pará's Environment State Agency and with the Pará State Lands Agency (ITERPA).

Also, in a municipality scale, the BRC is strengthening the communication with different governmental agencies, as shown on section 2.3, can be observed in 7 Municipality by presential meetings (Appendix I) about project activities that are being developed in the territory.

It's important to highlight that the grouped project is structured in the voluntary carbon market in private areas, where the project activities implementation approval depends exclusively of the landowners' approvals. It means that it is not necessary to obtain any national, state, or municipal approval to start its activities.

Notwithstanding, BRC adopts a straightforward approach to inform and invite the executive power agencies, to join the initiative and contributes, inside its attributions, to strength the positive project impacts to the communities and environment.

2.5.9 Project Ownership (G5.8)

According to the VCS definitions, Cauaxi REDD+ Grouped Project ownership is defined by item 6, section 3.6.1 of the VCS standard v.4.0, as follows:

"An enforceable and irrevocable agreement with the holder of the statutory, property or contractual right in the land, vegetation or conservational or management process that generates GHG emission reductions or removals which vests project ownership in the project proponent."

As shown before, the project ownership is held by the land ownership documents and by the agreements between BRC and these landowners, as presented on Appendix II.

2.5.10 Management of Double Counting Risk (G5.9)

The double counting is avoided once the Cauaxi REDD+ Grouped Project will be registered in the VERRA registry system using the VCS and CCB standards, where the VCUs sales are traceable, registered, and retired.

Thus, this grouped project is perfectly in line with the Brazilian Environment Ministry (MMA) understanding about AFOLU private projects, that in the case of this grouped project will be registered in VERRA's registration system to avoid double counting in the voluntary market.

So far, Article 6 of the Paris agreement that provides for market mechanisms between the parties has not been regulated. In this context, neither the federal government in Brazil, nor the nine states of "Legal Amazon", considering the state of Pará where instances are located, have engaged in GHG programs focused on offsetting GHG emissions. Thus, financial resources received by the federal government, such as donations from the Norwegian government to the Amazon fund did not constitute double counting.

2.5.11 Emissions Trading Programs and Other Binding Limits

Not applicable. The Cauaxi REDD+ Grouped Project will be registered on VCS/CCB Verra's system.

2.5.12 Other Forms of Environmental Credit

This project has not received another form of GHG-related environmental credit or renewable energy certificates.

2.5.13 Participation under Other GHG Programs

This project isn't seeking registration under other GHG programs, aside from VCS and CCB. The project proponent is not interested in issuing another GHG related environmental credit. To date, the project has not sought or received another form of GHG-related environmental credit.

2.5.14 Projects Rejected by Other GHG Programs

Not applicable. This project has never been submitted (and will not be submitted) to analysis by any GHG programs.

2.5.15 Double Counting (G5.9)

As shown on 2.5.10 - Management of Double Counting Risk (G5.9), the double counting is avoided once the Cauaxi REDD+ Grouped Project will be registered in the VERRA registry system using the VCS and CCB standards, where the VCUs sales are traceable, registered, and retired.

3 CLIMATE

3.1 Application of Methodology

3.1.1 Title and Reference of Methodology

The project is based on the following methodology and tools.

VCS Methodology VM0015 – Methodology for Avoided Unplanned Deforestation, version 1.1, 3 December 2012

VCS VT0001 – Tool for the Demonstration and Assessment of Additionality in VCS AFOLU Project Activities, version 3.1, February 2012

Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects – Part 1 – Core Guidance for Project Proponents, September 2011

AFOLU Non-Permanence Risk Tool, version 3, 19 October 2016.

3.1.2 Applicability of Methodology

According to the applicability conditions stated in VM0015 v.1.1. the methodology has no geographic restrictions and is applicable globally under the following conditions:

a) Baseline activities may include planned or unplanned logging for timber. fuel-wood collection. charcoal production. agricultural and grazing activities if the category is unplanned deforestation according to the most recent VCS AFOLU requirements.

Cauaxi REDD+ Grouped Project baseline scenario encompasses unplanned deforestation for cattle and agriculture purposes. as well as timber and fuelwood.

b) Project activities may include one or a combination of the eligible categories defined in the description of the scope of the methodology (table 1 and figure 2 of the VM0015).

According to table 1 of the VM0015. the project activities fit in scenario “D” as follow (Figure 20):

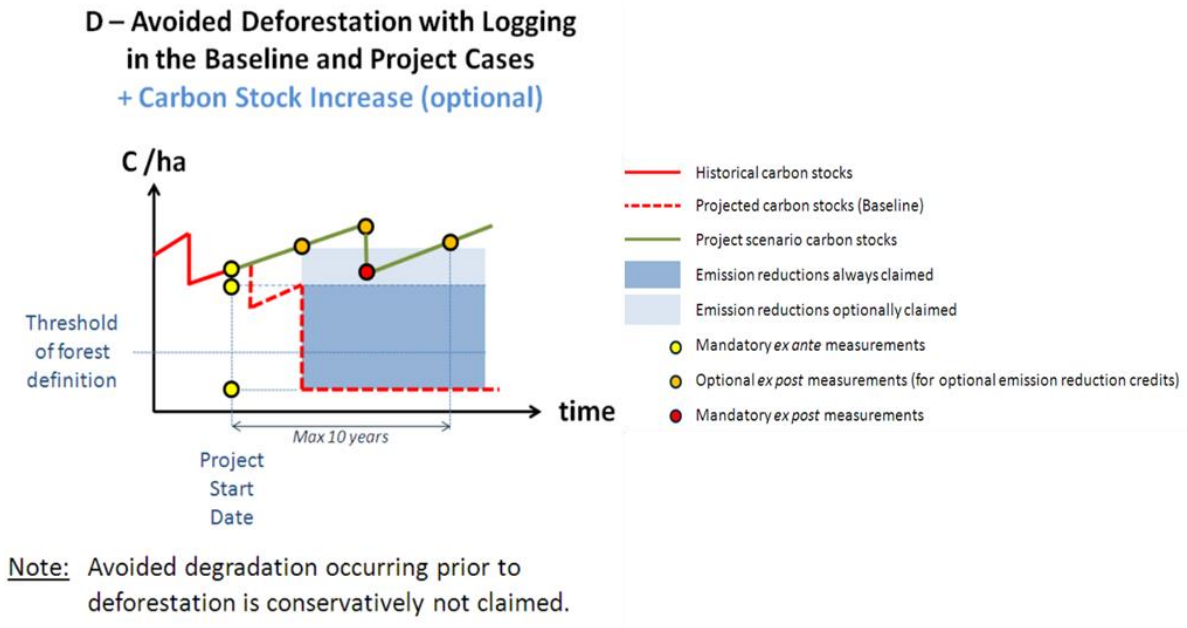


Figure 20 – Project category according to the applied methodology.

c) The project area can include different types of forest, such as, but not limited to, old growth forest, degraded forest, secondary forests, planted forests and agro-forestry systems meeting the definition of "forest".

The first project activities instances area encompasses two types of forest, as shown on section 2.1.5.1, the monsoon climate is also occasionally known as humid tropical climate, tropical monsoon, and trade wind climate. According to Alvarez (2013), this climate is the most representative climate of the country, has average monthly temperatures above 18°C in all months of the year and is considered an intermediate climate type between types Af (equatorial climate) and Aw (tropical savanna climate). In essence, the monsoon climate tends to have more rainfall than the tropical savanna climate or less pronounced dry seasons. Furthermore, a characteristic of these climates tends to have less variation in temperatures leading to low annual temperature range.

Types of vegetation:

- Dense Ombrophilous Forest – 94,1% of the area
- Secondary vegetation – 5,9% of the area

d) At project commencement, the project area shall include only land qualifying as "forest" for a minimum of 10 years prior to the project start date.

For baseline modelling and climate benefits (VCUs) it is considered land categorized as "forest" for a minimum of 10 years prior to the project start date. For more information refer to section 2.4, below.

e) The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) if they do not grow on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm. If the project area includes a forested wetlands growing on peat (e.g., peat swamp forests), this methodology is not applicable.

The project does not include peat forest in its baseline, nor in the project activities, only the Ombrophilous Dense Alluvial Forest, that is a floodplain forests.

According to the applicability conditions stated in the VT0001 v.3, the tool is applicable under the following conditions:

I) AFOLU activities the same or like the proposed project activity on the land within the proposed project boundary performed with or without being registered as the VCS AFOLU project shall not lead to violation of any applicable law even if the law is not enforced.

The project activities are based in conservation of the Legal Reserve[17] that include monitoring against forest degradation and deforestation, promote training and capacitation focus in sustainable activities in the communities in the project zone. Neither of these activities will lead to violation of any applicable law.

II) The use of this tool to determine additionality requires the baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario. Project proponent(s) proposing new baseline methodologies shall ensure consistency between the determination of a baseline scenario and the determination of additionality of a project activity.

The Cauaxi REDD+ Grouped Project made use of the approved VCS Methodology VM0015, - Methodology for Avoided Unplanned Deforestation, version 1.1. This methodology includes all the steps to define the most plausible baseline scenario.

3.1.3 Project Boundary

The Project Boundary are shown on following

[17] Law 12.651/2012 available at https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm

Table 15Table 15 and Table 16.

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Table 15 – GHG sources of Cauaxi REDD+ Gouped Project

Source		Gas	Included?	Justification/Explanation
Baseline	Biomass Burning	CO_2	No	Counted as carbon stock change
		CH_4	Yes	Fire is used as an instrument for converting the forest to pasture or other land used in the baseline scenario. In the process of legal forest suppression, commercial wood is extracted, and the remaining woody material is felled and burned on site. CH4 is expected to be emitted due to woody biomass burning in the baseline scenario.
		N_2O	Yes	According to VM0015, section 1.4, only when it's significant.
	Livestock emissions	CO_2	No	Not a significant source
		CH_4	No	Conservatively excluded
		N_2O	No	Conservatively excluded
Project	Biomass Burning	CO_2	No	Counted as carbon stock change
		CH_4	Yes	Fire is used as an instrument for converting the forest to pasture or other land used in the baseline scenario. In the process of legal forest suppression, commercial wood is extracted, and the remaining woody material is felled and burned on site. If a fire occurs in the project scenario the CH4 will be accounted for as project emissions.
		N_2O	Yes	According to VM0015, section 1.4, only when it's significant.
	Livestock emissions	CO_2	No	Not a significant source
		CH_4	No	Conservatively excluded
		N_2O	No	Conservatively excluded
	Harvest Wood Products	CO2	No	According to VM0015 it is reasonable to assume that the project activity, including when harvest activities are planned (such as logging for timber, fuel-wood collection, and charcoal production), produces less emissions of GHG than the baseline activities implemented prior and after deforestation on the deforested lands.

Table 16 – Carbon pools considered in the Cauaxi REDD+ Grouped Project

Carbon Pool		Included?	Justification/Explanation
Above ground	Tree	Yes	Main source of project emissions, through deforestation. Carbon stock changes in this pool are always significant
	Non tree	Yes	Inclusion is optional in the case where stocks are not greater in the baseline than in the project scenario. Part of the forest types in the project area are characterized by the occurrence of bamboo, vines, and shrubs. The inclusion is a conservative project approach and doesn't impact in over estimation of the GHG baseline emissions.
Below Ground	Tree	Yes	Inclusion is recommended per VM0015, section 1.3. Carbon stocks are significant in this pool in tropical forests, representing 10-30% of the aboveground tree woody biomass (Nogueira et al., 2008).
	Non tree	Yes	Inclusion is recommended per VM0015, section 1.3. Carbon stocks are significant in this pool in tropical forests, part of the forest types in the project area are characterized by the occurrence of bamboo, vines, and shrubs.
Dead Wood		Yes	Inclusion is optional per VM0015. section 1.3
Litter		Yes	Inclusion is optional per VM0015. section 1.3
Soil Organic Carbon		Yes	Inclusion is optional per VM0015. section 1.3
Harvested Wood Products		Yes	According to VM0015. section 1.3 to be included when is significant

The following Figure 21 is intended to demonstrate project boundaries, physical locations of various management activities. For that, it aggregates different points previously presented, such as communities, leakage areas, field transect used by the biodiversity and forest inventory teams, location of lodging and finally the project core areas limits, where are the forest conservation and maintenance. These locations show the set of relevant points, where the various project implementation measures have been taking place.

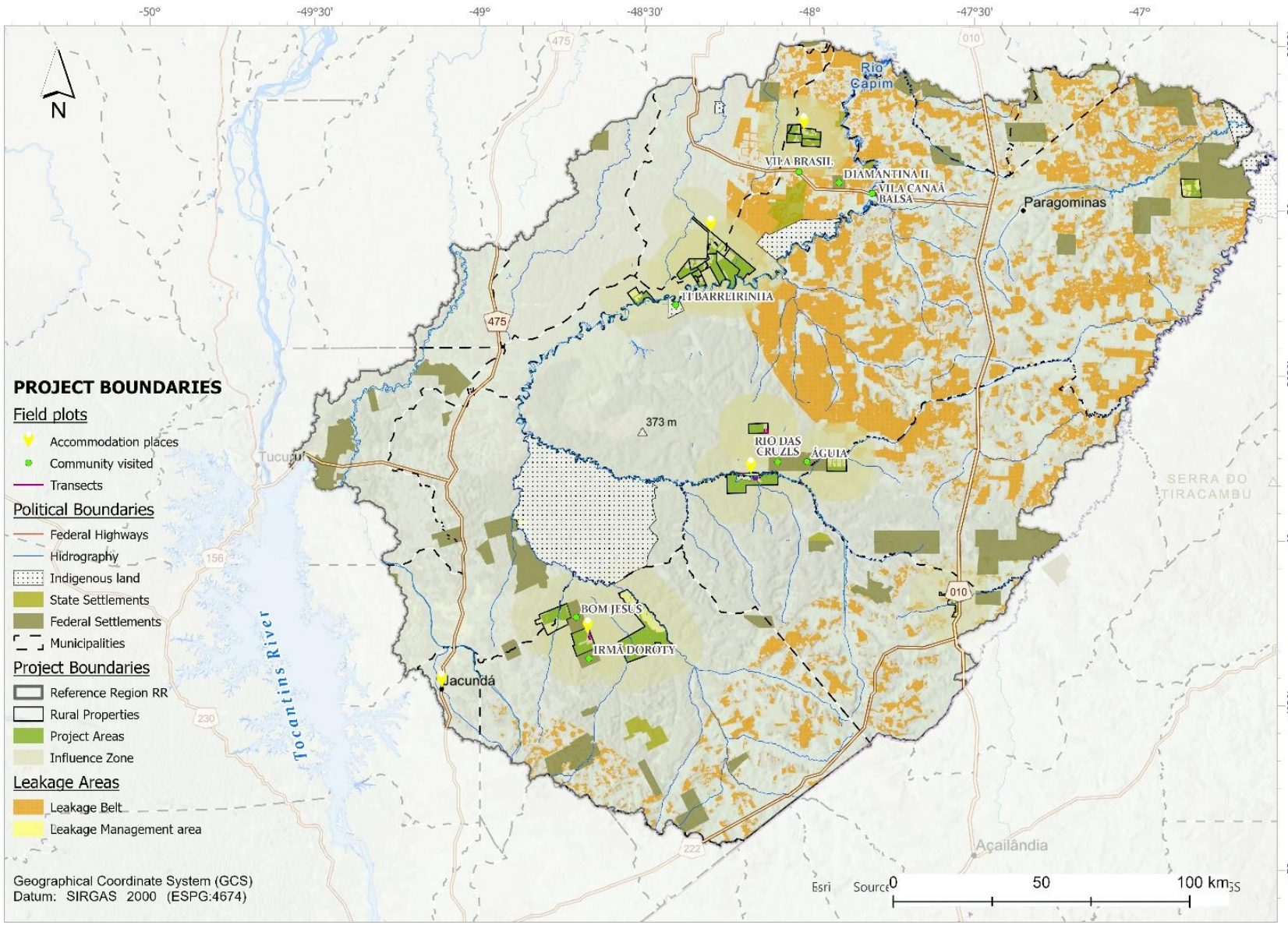

Figure 21 – Map of the project boundary.

3.1.4 Baseline Scenario

It was followed the VM0015 to establish the Cauaxi REDD GP baseline scenario. Following the methodological approach, this analysis is divided in 4 steps.

3.1.4.1 Definition of boundaries

3.1.4.1.1 Spatial boundaries

3.1.4.1.1.1 Reference region

To define the reference region the municipality areas and watershed limits were used. Through this configuration, the project brings together the social, economic, and environmental complexity of the region in terms of presenting (a) deforestation agents and drivers; (b) landscape configurations and ecological conditions; and (c) socio-economic and cultural conditions.

To define the project area, federal, state, and local roads were considered. As well as the presence of settlements and other drivers. Public areas intended for indigenous reserves and conservation units were excluded from the final area of the reference region. Section two contains all the details on these elements. A total area of 5,109,576.79 ha was defined by combining this information, 89 times the total project area. The reference region includes the project areas with 90% correspondence with vegetation classes, elevation, slope, and rainfall (Table 17).

3.1.4.1.1.2 Project area

The definition of project areas is based on legal principles stipulated by the Brazilian forest code. All areas correspond to the surplus vegetation legally established as a legal reserve (RL) verified from monitoring data carried out by the federal government. Federal and state laws support between 50% and 80% of the RL on the properties chosen for the project. Landscape and ecological elements in these areas correspond to the specifications of the methodology (VM00015),

Table 17 shows the correspondence between the project areas and the reference region.

Table 17 – Similarity analysis of the reference region (RR) and project area (PA).

Landscape configuration and ecological conditions: area in hectares and percentage				
Forest types	***RR***		***PA***	
Anthropic	1.790.045	35,0%		
Dense Ombrophilous Forest (Ds, Db, Da)	3.074.063	60,1%	53,850	94.1%
Open Ombrophilous Forest (As, Ab)	77.431	1,5%		
Secondary Vegetation (Vs)	168.039	3,3%	3,348	5.9%
Others	8.949	0,2%		
Total	**5.118.526,96**	**100%**	**57,197.99**	**100%**

Elevation		***RR***	***PA***	
< 50	214.168	4,2%	1,276	2.2%
50 – 100	1.766.423	34,5%	22,845	39.9%
100 – 150	1.447.468	28,3%	19,088	33.4%
150 – 200	982.782	19,2%	12,560	22.0%
200 – 250	392.333	7,7%	1,370	2.4%
250 – 300	211.554	4,1%	58	0.1%
300 – 350	96.432	1,9%		0.0%
350 – 400	7.367	0,1%		0.0%
Total	**5.118.526,96**	**100%**	**57,197.99**	**100%**
Rainfall	***RR***		***PA***	
Am – Tropical	3.362.272	65,7%	36,182	63.3%
Aw – Tropical	1.592.080	31,1%	21,016	36.7%
Af – Tropical	164.175	3,2%		
Total	**5.118.526,96**	**100%**	**57,197.99**	**100%**
Slope	***RR***		***PA***	
Plan	1.961.736	38,3%	20,223	35.4%
Smooth Wavy	2.148.723	42,0%	23,762	41.5%
Wavy	563.395	11,0%	7,753	13.6%
Strong wavy	338.090	6,6%	4,575	8.0%
Mountanious	106.254	2,1%	885	1.5%
Steep	329	0,0%		0.0%
Total	**5.118.526,96**	**100%**	**57,197.99**	**100%**

3.1.4.1.1.3 Leakage belt

The geographic delimitation of the Leakage Belt (LB) used Option I – Opportunity Cost Analysis, described in Step 1, Section 1.1.3 of VM0015. After local interviews with producers and local actors of the regional agricultural production chain, it was evidenced in economic viability of implementation livestock and agriculture projects (soybean) inside the Reference Region (RR). Furthermore, the RR is in the Arc of Deforestation, an extremely consolidated region for such agricultural and livestock activities, as the terrestrial transport infrastructure facilitates the movement and reduces the cost of production, respectively. In this context, it is clearly shown that economic forces of agricultural and livestock production drive regional deforestation.

The first step was delimited a radius of 100 kilometers from the four main meat consumption centers (slaughterhouses) in the RR and surroundings located in the municipalities of Paragominas (PA), Marabá (PA), Imperatriz (MA) and Açailândia (MA) mapped by the cartographic database of IMAZON GEO (ImazonGeo). Second step, within this radius, the largest continuous fragments of the forest class mapped by PRODES data were selected. Thus, geographically delimiting the LB, which comprises a total area of 875,568.32 hectares. Figure 22 highlights the spatial delimitation of the LB.

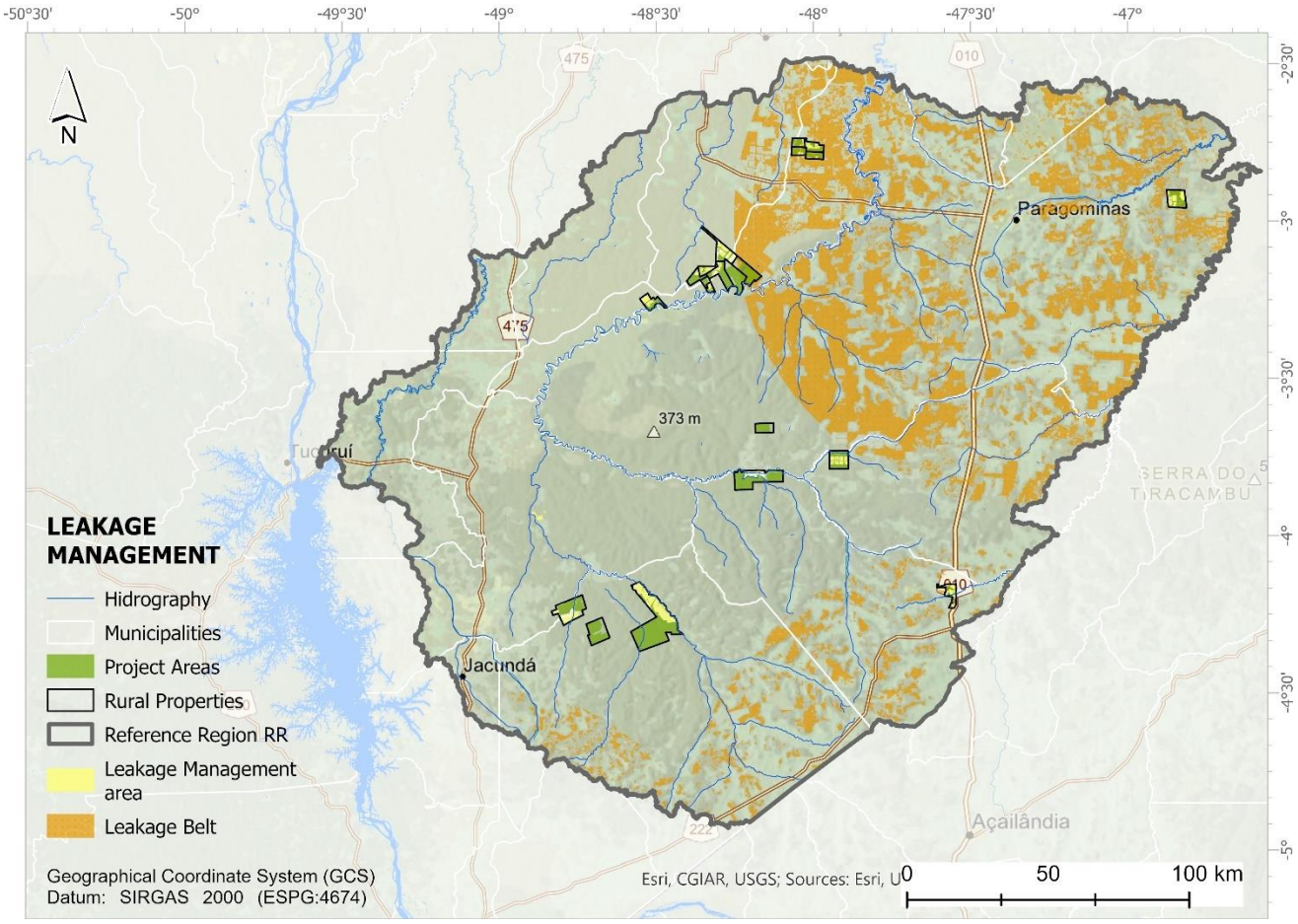

Figure 22 – Spatial explicit boundaries of Leakage Belt and Leakage Management Areas. Reference Region and Project Areas – PAI#s.

3.1.4.1.1.4 Leakage management areas

For the spatial delimitation of the Leakage Management Areas (LMA), the requirements suggested by section 1.1.4 of VM0015 were used. Thus, selecting all areas destined for the agriculture and livestock land use in the private properties of project. The total area of the LMA is 25,139.0 hectares. Such areas will be the focus of the project in order to reduce the risk of leakage and displacement of deforestation activities. These areas are outside the Project Area and areas without forest cover mapped by PRODES data. In addition, these areas will receive special attention from the project proponents, improving agricultural and livestock production practices and compliance with good environmental regularization practices and implementation of the current forest code. Figure 22 spatially illustrates the Project's LMA.

3.1.4.1.1.5 Forest

To assess the Forest Coverage Benchmarks and confirm the existence of the forest 10 years before the start of the project in the selected areas were used Landsat 8 images (OLI sensor, Operational Terra Imager) from 2013 and images from Sentinel 2 (MSI sensor, Multispectral Instrument). All methodological

details are presented in the document entitled "*Image acquisition, processing, and classification procedure for defining project areas*" presented in Appendix VI (GIS). This document details the data sources and pre-processing, data classification and post-processing, and classification accuracy assessment, the metadata shows the folders with each category of data.

In summary, the images are selected and downloaded; at the same time, atmospheric correction and level conversion are performed. Following download, images were reprojected, bands were stacked, project areas were clipped, and samples were selected. The classification is performed by a Machine Learning algorithm (Random Forest) with tested accuracy. Finally, the classification results are visually validated with high-resolution images and adjusted. Afterwards, the project areas classification was incorporated into PRODES (see Step 2) to produce detailed information for modeling.

3.1.4.1.2 Temporal boundaries

3.1.4.1.2.1 Starting date and end date of the historical reference period

The historical reference period used for the model calibration is from 2017 until 2019, while for the model validation, the year of 2021 was used.

3.1.4.1.2.2 Starting date of the project crediting period of the AUD project activity.

The VCS project crediting period starts on 02nd May 2022 and ends on 01st May 2122, in a total of 100 years, the maximum granted by the VCS standard v.4.3.

As the project start date is based on the date that the conservation agreement was signed between the landowner and BRC, how it was presented on Section 2.1.14 - Project Start Date.

PAIs #1-20 will generate GHG emission reductions eligible for issuance as VCUs for 30 years. A legal agreement (Appendix II) was signed with the landowner to continue the management practices that will lead to the project area conservation for at least 30 years, thus, the project activity instances longevity is 30 years. New PAIs will have different crediting period starting dates, based on the conservation agreements signed by the landowner.

3.1.4.1.2.3 Starting date and end date of the first fixed baseline period

The fixed baseline period starts on 02nd May 2022 and ends on 31st December 2031, in a total of 10 years as stated in the VM0015.

3.1.4.2 Analysis of historical land-use and land-cover change

3.1.4.2.1 Collection of appropriate data sources

To define land-use and land-cover change analysis, data were provided by the Brazilian Amazon Forest Monitoring Program by Satellite (PRODES). All PRODES data are distributed free of charge through

the TerraBrasilis portal (http://terrabrasilis.dpi.inpe.br/downloads/), a web platform developed by INPE for access, consultation, analysis, and dissemination of geographic data generated by the monitoring projects of the native vegetation of the institute.

PRODES uses images generated by the NASA/USGS Landsat series satellites. These images are characterized by spatial resolution in the range of 30 meters and at least 3 spectral bands. Therefore, the data used to analyze changes in land use and land cover during the historical reference period within the reference region and project area were the years 2017, 2019, and 2021.

Table 18 shows the image data used for forest and non-forest classification layers of each year mentioned.

Table 18 – Data sources used by PRODES/INPE.

Vector (Satellite or Airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene or Point identifier	
		Spatial	Spectral	(km²)	(DD/MM/YY)	Path / Latitude	Row / Longitude
Satellite	LANDSAT 8/OLI	30 x 30	0.450 - 2.29 µm	10.037.31	31/07/2017	222	62
				6.734.25	15/07/2017	222	63
				2.1210.2	06/07/2017	223	62
				24.273.14	06/07/2017	223	63
				2.434.17	29/07/2017	224	62
				2.033.78	29/07/2017	224	63
				10.037.31	05/10/2019	222	62
				10.037.31	05/09/2019	222	62
				6.734.25	10/09/2019	222	63
				21.210.2	09/08/2019	223	62
				21.210.2	20/07/2019	223	62
				24.273.14	09/08/2019	223	63
				24.273.14	13/08/2019	223	63
				24.34.17	20/08/2019	224	62
				20.33.78	20/08/2019	224	63
				10.037.31	26/07/2021	222	62
				10.037.31	14/10/2021	222	62
				6.734.25	26/07/2021	222	63
				2.1210.2	02/08/2021	223	62
				2.4273.14	02/08/2021	223	63
				2.4273.14	03/08/2021	223	63
				2.4273.14	26/07/2021	223	63
				2.434.17	24/07/2021	224	62
				2.033.78	24/07/2021	224	63

3.1.4.2.2 Definition of classes of land-use and land-cover

Forest and Non-Forest were the only classes used to describe land use and land cover (LU/LC). Based on Landsat images, whose characteristics were discussed previously, PRODES defines deforestation polygons as regions with a total area greater than 6.25 ha. The Non-Forest class corresponds to areas of deforestation detected by PRODES, the complete removal of forest cover in a short period of time. In this process, the forest cover is completely removed and replaced by other covers and uses (agricultural, pasture, urban, hydroelectric, etc.), or it can even be abandoned and enter a regeneration process. Deforestation can be seen as a single process, which starts with the forest intact and ends with the conversion of the original forest to another land cover. When we consider deforestation as a single process, it is necessary to include not only the extremes of this process, which are more obvious and easier to identify but also the forest degradation gradient produced over the course of the deforestation process, which can occur slowly over time, due to the continuous logging and successive occurrences of forest fire. Table 19 presents the list of all land use and land cover classes and uses.

Table 19 – List of all land use and land cover classes existing at the project start date within the reference region

Class identifier		Trend in carbon stock	Presence in	Baseline activity			Description
IDcl	Name			LG	FW	CP	
1	Forest	Constant	RR, PA, LK	Yes	Yes	Yes	Remaining forest
2	No Forest	Constant	RR, PA, LK	No	No	No	Deforestation areas to cattle ranching and agriculture

3.1.4.2.3 Definition of categories of land-use and land-cover change

Change categories within the project area and leakage belt that could occur during the project crediting period are presented in the change matrix (Table 20 and Table 21).

Table 20 – Potential land-use and land-cover change matrix

ID_{cl}		Name	Initial LU/LC Class	
			Forest	Non Forest
			I1	I2
Final LU/LC class	F1	Forest	Forest/Forest	Non Forest/Forest
	F2	Non Forest	Forest/Non Forest	Non Forest/Non Forest

Table 21 – List of land-use and land-cover change categories

ID_{cl}	Name	Trend in Carbon Stock	Present in	Activity in case of baseline		
				LG	FW	CP
I1/F1	Forest	Constant	RR, PA, LK.	Yes	Yes	Yes
I2/F1	Forest	Increase	RR, LK, PA	Yes	Yes	Yes
I1/F2	Non-Forest	Decrease	RR, LK, PA	Yes	Yes	Yes
I2/F2	Non-Forest	Constant	RR, LK, PA	Yes	Yes	Yes

3.1.4.2.4 Analysis of historical land-use and land-cover change

3.1.4.2.4.1 Pre-processing

The images used are of the Landsat class, that is, they have a spatial resolution of around 30 meters, a revisit rate of around 15 – 20 days. The images are available from their providers already orthorectified, with geometric system correction refined using control points and digital terrain elevation models. With this

level of correction, the images are ready to be used. Images are taken in such a way as to highlight deforestation areas.

The PRODES use as reference the calendar year of deforestation refers to the period from August 1st of one year to July 31st of the following year. It is assumed that most deforestation occurs during the dry season. The date of the dry season for that location was established for each image based on climatological parameters. Unobserved areas due to cloud cover must be considered when calculating the estimated increment for each image. In cases of high cloud coverage, images from multiple satellites (or dates) can be used.

3.1.4.2.4.2 Interpretation and classification

The PRODES methodology uses an incremental map, which hides the areas that have been deforested in previous years by using an exclusion mask. Only parts of the image from the reference year containing primary forest are used during the interpretation. This mask prevents the possibility of old deforestation being mapped again. The exclusion mask also includes areas where there is no natural occurrence of forests. Additionally, deforestation increments through photo interpretation by specialists to identify the pattern of change from forest cover to clear cutting based on the three main elements observable in the images: tonality, texture, and context.

3.1.4.2.4.3 Post-processing

PRODES data are distributed in a matrix format with the presentation of all classes defined by PRODES: annual deforestation (accumulated up to 2007 and annual from 2008), inconsistencies in the classification of deforestation, cloud cover, water bodies, and naturally occurring areas. not forested. In the GIS environment, we reclassified these classes to obtain forest and non-forest class maps for the years 2017, 2019, and 2021, as previously described. All this information is also organized in vector data in shapefile format.

3.1.4.2.4.4 Map accuracy assessment

To verify the accuracy of the classification from PRODES, random points were generated for each year of interest classification. With a total of 150 points for each year, the accuracy check was performed with a confusion matrix on Landsat images and visual verification of the class about the imaged reality. Table 22 presents the summary of the accuracy found for each of the classes and the global analysis.

Table 22 – Results of the accuracy assessment of the land use data used in the reference period.

	2017	2019	2021
Forest	0.906	0.925	0.852
Non-Forest	0.959	0.940	0.927
Global	0.940	0.933	0.900

3.1.4.2.4.5 Preparation of a methodology Appedix to the PD

See the GIS methodology in the project description Appendix VI – SIG.

3.1.4.3 Analysis of agents, drivers and underlying causes of deforestation and their likely future development

3.1.4.3.1.1 Identification of agents of deforestation

The main signs of human pressure on forest areas are deforestation, forest degradation, hot spots, and the opening of roads. The results of the PRODES historical database in the reference region show a total deforested area of 30,179.62 km² (58,73% of the reference region) accumulated until 2021. The current length of the road network in the reference region is approximately 5,588 kilometers, of which 5,391 kilometers (96.5%) are unofficial roads and only 197 kilometers (3.5%) correspond to official roads (BR-010, PA- 123 and PA-256). Base in the PRODES database Paragominas municipality is the 4th position in the Deforestation Pará state ranking.

The main economic sectors (livestock and agriculture) in the reference region currently demand around 1,9 million hectares to maintain the production levels of 2021 (Mapbiomas), divided mainly in pasture with 72,8% and soy with 14,4% of the total agricultural areas. One important aspect to highlight is that during the reference period the cattle herd (SIDRA/IBGE data) has increased in all 6 municipalities part of the reference region, the mayor increase was identified in Dom Eliseu with 51% more animals in 2021 comparing with 2017.

The others temporally croplands (without considering the soy) are estimate that covers 5,7% of reference region agricultural area, which almost represents the area of Federal and State Projects Settlements (PAs) with 5,5% of the reference region, and the main activity is temporally agriculture and livestock.

The perception of the forest as a stock of resources of economic value only began to form in Paragominas and region in the 1980s, in view of the reduction in the generous incentives given to livestock and the decline in the fertility of large areas of pasture. From that decade onwards, the exploitation of native wood was presented as an alternative for generating income and financing livestock (Veríssimo et al., 1996; Mattos and Uhl, 1996).

In the early 1970s, only timber species with high commercial value were exploited, generating little impact on the forest structure. However, in the 1980s, a set of factors contributed to the consolidation of the timber sector in Paragominas, among which the following stand out: (i) the significant reduction in the supply of wood in southern Brazil; (ii) the establishment of a transport and communication system in the Amazon capable of supporting the timber industry; and (iii) the availability of labor from the Northeast (Veríssimo et al. 1996; Uhl and Almeida, 1996). In the early 1990s there were 137 sawmills in Paragominas

exploring and sawing native wood, which corresponded to 15% of wood production in the Amazon (Veríssimo et al., 1996).

Today due the remaining accessibility of logging activity, the forests of reference region are under strong pressure from logging and charcoal. It is possible to project a scenario on the accessibility levels of the local timber sector based on the analysis of the economic viability of the timber activity in the 21.200,80 km² of remaining forest in reference region. This analysis considers the location of the main wood processing centers, transport and processing costs, existing wood species and their market values.

Thus, it is important to emphasize that the main agents of deforestation found in the reference region are linked to livestock and logging activities and that they are not found within the private project areas. In a broader analysis, covering Mato Grosso, Rondônia and Pará, it should be included (i) soy production (Silva Junior & Lima, 2018), (ii) mining (both legal and illegal) (Souza et al., 2018), (iii) big dams (Souza Jr et al., 2019).

Also, cattle ranching and soy farming accounts for some 82% of the deforestation in the Amazon (GREENPEACE, 2008). This correlation pattern between deforestation and cattle activity is also observed in most regions of Amazon Forest frontier, especially in the reference region. Besides the fact that cattle ranching is highly profitable, unsustainable ranching causes huge environmental impact with low social return (Azevedo-Ramos & Moutinho, 2018), mostly due to low-productivity pasture management (Hansen et al., 2019; Silva et al., 2018). The ranchers thus seek new areas for pasture, increasing pressure on pristine forests and raising deforestation (Silva et al., 2018).

Within the project's area and its reference region, there are three main deforestation agents: (a) Ranching activities, (b) illegal timber extraction and (c) land grab, both large and small scales. In a small-scale pattern is it possible to find other potential agents, such as small farmers that normally uses areas in "pousio" to make agriculture for their own subsistence, planting, p.e. cassava or other temporally cultures. It's a common practice that both deforestation agents act in the same area but in different periods of time, usually the degradation process starts with the illegal and unsustainable logging of the areas, after the degraded areas are deforested in small patches less than 6,25ha to avoid be identified in the monitoring deforestation systems until the moment that they get connected and appears in the monitoring systems.

So, mainly the illegal deforestation dynamic in the region occurs in two ways: 1. is conducted by external agents of the proprieties when is financially prohibitive to the landowner to implement conservation activities to protect all the forest areas inside of the legal reserve. The propriety low governance in the forest areas generated in most of cases situations of illegal invasions, logging, and deforestation in private areas, in some situations ending in the land grab. Other common practice is the small deforestation (normally smaller than 6,25ha to avoid be mapped in the PRODES monitoring system) made by the landowner (when the land grab logic is not applied) to increase the productive areas of the propriety, especially, in a situation which the surveillance has not been enforced as it occurred in the last 5 years (historical reference period) in the reference region Table 23.

Table 23 – Summary of the main deforestation agent in the reference region.

Name of the deforestation agent	Illegal ranching activities, timber extraction and land grab
Brief description of the main social, economic, cultural and other relevant features	In the 1960s and 1970s, the opening of highways, colonization projects, tax incentives and other government efforts to integrate the Amazon region with the rest of the country attracted large population groups to the Brazilian Amazon. This migration accelerated the population growth of many municipalities in the North region, especially those located along the newly created highways, as was the case of Paragominas, located on the margins of the Belém-Brasília highway (BR-010). The dynamics of deforestation in this region have historical roots due to the promotion of colonization that occurred during the dictatorship. At this time the federal government supported the occupation of land by settlers who after the opening of forest areas received the title of the area. Thus, the current context of deforestation in the reference region originates from the creation of the BR-010; The dynamics of deforestation is now updated since the weakness in the public surveillance and forest monitoring which has been contributing to occur the action of the three main agents (logger, land grabber and rancher) that in most situations the same stakeholder assumes the role of the three agents of deforestation. For example, by extracting timber from illegal areas and with revenue from illegal logging, the farmer invests in grazing and buying cattle. After the degradation of the pasture, with low productivity the rancher looks for new areas to maintain the deforestation dynamics.
Brief assessment of the most likely development of the population size	In the continuity of the baseline and the common practice of land use and occupation it is expected that in areas where the opportunity cost, especially of the livestock economic activity, an increase in forest pressure will be attractive due to the joint action of the three agents. deforestation in the reference region and, consequently, an increase in population size. In other regions with lower transition potential, but with a likelihood of change, where the dynamics of deforestation stem from the motivation of land speculation and land grabbing, an increase in population size is not expected.
Statistics on historical deforestation attributable	According to the Mapbiomas data all the land use after the deforestation in the reference region is the pasture. So, all the deforestation that occurred in the reference period in the reference region can be attributable to the deforestation dynamics of the three main deforestation agents, as it was described above.

3.1.4.3.1.2 Identification of deforestation drivers

See Table 24, below, where the factor maps identified as deforestation drivers and were used in the land use change model are described according to the VM0015 requirements.

Table 24 – Identification of deforestation drivers

Deforestation driver	Evidence that the identified variables have been a driver for deforestation during the historical reference period	Driver variables will impact on each agent group's decision to deforest.	Likely future development
Distance of the accumulated deforestation in 2019	The reason for choosing this variable is the characteristic of deforestation in the region known as border deforestation (the reference region is located in the "arc of deforestation"). In these locations, forest cover in the vicinity of an agricultural / urban landscape matrix has a higher opportunity cost for conservation than in isolated and / or hard to reach regions. Thus, productive areas tend to increase, following the logic of "*puxadinho*" over conserved areas.	Illegal timber and Cattle ranching	The distance from deforestation is one of the main variables in the deforestation arc, it aggregates different vectors, as it is the transition from the forest class to the non-forest class. For example, the deforestation that occurs due to the opening of a road / branch leads to the phenomenon of the "fish bone" that is nothing more than the distance from the deforestation that occurred around a variable explaining the change in land use, which makes forest areas close to the road / branch with the greatest potential for transition to a non-forest class. Another example, common in the reference region, is related to the opening of the "puxadinhos" of unproductive pasture areas, since the degradation of pastures by the region's rudimentary livestock activity and low technical qualification makes extensive livestock farming a common practice, which results in a low average density of cattle per hectare of 0.5 heads. So, when there is a greater demand from the consumer market for meat, the rancher opens new areas to expand the herd and meet market demand; soon opening livestock areas in the forest areas on the edge of degraded pastures. Thus, it is to be expected that the distance from deforestation will be an important deforestation driver in the reference region, displacing the agents mentioned above in the northern direction of the state.
Distance of roads	Roads are known and consolidated deforestation vectors on a global scale and are responsible for deforestation in "fishbone" format.	Illegal timber and Cattle ranching	According to the VM0015, section 3.2, the most likely future development is not applied to spatial variables, such slope, elevation etc.

Deforestation driver	Evidence that the identified variables have been a driver for deforestation during the historical reference period	Driver variables will impact on each agent group's decision to deforest.	Likely future development
Distance of the rivers	This variable was chosen because the areas close to the watercourses are areas most used for various agricultural activities. Mainly for the easy accessibility to the resource and also for being in the riparian zone where are more fertile soils, with high presence of organic material. They are also a common means of transport in the Amazon region, facilitating the flow of illegal timber products and access to remote regions.	Illegal timber	According to the VM0015, section 3.2, the most likely future development is not applied to spatial variables, such slope, elevation etc.
Distance of communities	Locations with clustering of people, with little infrastructure and poor access to public policy, find themselves in a state of neglect by public governance, especially with regard to environmental command / control. Forested areas have a great vulnerability around the localities that demand wood (energy, construction and commercialization), which initially selectively extract, then cut and burn for the implantation of low productivity and low value pastures. aggregate.	Cattle ranching	According to the VM0015, section 3.2, the most likely future development is not applied to spatial variables, such slope, elevation etc.

3.1.4.3.1.3 Identification of underlying causes of deforestation

The deforestation agents and the event related underlying causes identified for this project are presented on following Table 25.

Table 25 – The deforestation agents and the event related underlying causes.

Underlying causes of deforestation	Briefly description	Likely future development	Project measures
Land uses policies and their enforcement	According to official data (INPE/PRODES), in 2008, Paragominas had 874 thousand hectares of deforested area (clear cutting and degradation), equivalent to 45% of its total area. Due to its history of deforestation, Paragominas was included in the list of the 36 largest deforesters in the Amazon biome, prepared by the Ministry of the Environment (MMA) in January/2008. The municipalities included in the list were considered priority areas for combating illegal deforestation, which is why they were the targets of a series of government measures, among which the following stand out: (i) requirement to re-register 80% of rural properties with an area greater than four fiscal modules (that is, over 280 hectares in Paragominas); (ii) access to credit conditional on proof of land and environmental regularity, that is, presentation of the CCIR, proof of CAR and/or LAR in effect; and (iii) Operation "Arco de Fogo" (April/2008), which consisted of a task force of inspection, involving the Federal Police, IBAMA, the National Force and the State Secretariat for the Environment of Pará. Despite the efforts that contributed to the deforestation reduction in the Paragominas region, in the last 5 years (reference period) all the reference region has been facing in the advance of deforestation. This situation has become more evident since the last federal administration, through the weakening of inspection bodies, lack of punishment for environmental crimes and a significant reduction in immediate actions to combat and control of illegal activities in the region.	The weakening of environmental management, as discussed in the previous sections, at different levels from the promotion of sustainable activities, environmental regularization, supervision and command and control actions have medium and long-term impact on combating deforestation. Thus, it is expected that even in the scenario of changing environmental management especially in the strengthening of actions to Prevent and Combat Deforestation, effectively the fall in the upward curve of deforestation rates will happen in an interval of 2-4 years. It's important to highlight that the actions to stop illegal deforestation in Brazil is linked with NDCs goals to 2030.	The project aims to promote a valuation of environmental assets, contributing to the decarbonization of society and, thus, initiating a transition to a low-carbon economy. In this scenario, the project encourages the environmental conservation of forest fragments, both in the area and in the project zone. The project aims to promote a value of environmental assets, contributing to a decarbonization pathway of the society and thus initiating a transition to a low carbon economy. In this scenario, the project promotes the environmental conservation of forest fragments, both in the project area and in the project zone. It is worth mentioning that in parallel BRC (PP) is involved in different spaces of discussion, networks, and initiatives. These advocacy efforts aim to contribute, especially, with the adjustment and improvement of public policies, among them stand out: Climate Observatory, Forest Code Observatory and also in the REDD Alliance Network.

Underlying causes of deforestation	Briefly description	Likely future development	Project measures
Population pressure	Population growth is always a cause of deforestation on different scales, from macro/international issues, where an agricultural commodity, in which Brazil has a prominent place in trade relations, begins to have a growing consumer demand for some economic power where the population increase. This scenario indirectly influences the opportunity cost of land, which leads to areas with low opportunity cost (forest areas) presenting a demand for conversion to a productive use. In addition to the macro aspect, you can also mention the population growth that occurred in the reference region over the last 10 years. According to IBGE data, the population in the 7 municipalities has been presenting an average annual linear growth, with Ulianópolis leading in population growth with an average annual increase of 3.19% in its population; Rondon do Pará, on the other hand, was the municipality with the smallest increase with 1.15% per year in its population in the last 10 years. This population growth is reflected in the increase in deforestation rates in the reference region, with Ulianópolis presenting the highest deforestation rate in the reference period (Figure 23). This is mainly due to rural areas where family growth occurs without adequate birth control, because of low HDI values in these locations. This family increase generates demand for new productive areas so that new families can have open areas to develop some agricultural activity.	The tendency is for increased pressure on forest ecosystems due to population growth, bearing in mind that the municipalities that are part of the reference region have low demographic density values, the municipality with the lowest value is Goianésia do Pará (5.93) and the highest is Ipixuna do Pará (12.88), see information in Table 6. Other information that corroborates to this scenario is the historic population growth data. In this scenario of potential population growth, especially in rural areas close to forest areas, where they are isolated places with low access to basic public services about birth control, thus with the increase and growth of the population. Added to this scenario is the absence of rural extension and technical assistance, which results in open areas with low productivity. Therefore, with the increase in population and unproductive open areas, the Forest in the reference region is under pressure from this deforestation agent	The project will promote different technical assistance and rural extension activities in the project zone, these actions will aim to train rural producers in the management of productive areas, aiming at recovery and increased productivity, with this it is expected that the pressure on forest areas will decrease.

Underlying causes of deforestation	Briefly description	Likely future development	Project measures
Ukraine war and other conflicts	The economic consequences of the War extend over the globalized world, even reaching countries far from the disputed territory, such as Brazil, for example, inflation in the prices of oil, natural gas, fertilizers, inputs, commodities such as wheat, corn, among others. The rise in prices in a short time is reflected in the cost of living for people who don't even know where Ukraine is. Russia and Ukraine – called the 'breadbasket of Europe' – are important producers of food and agricultural inputs. The war between the two countries compromises agricultural production and exports, with consequences for global food security. Both countries play an important role in the export of grains – wheat and corn, for example -, which are the basis of world food. According to the latest report on the FAO global food market, between 2017 and 2020, Russia and Ukraine accounted respectively for 10.97% and 11.49% of cereal exports and 22.56% and 10.29% of wheat exports. Ukraine also has an important share in the maize market and is responsible for 15.7% of exports between 2017 and 2020.	The war between Ukraine and Russia had several impacts on the global agribusiness production chain. Among them, the shock in the supply chain and in the cost of food has become a worrying factor for Brazilian producers. The effects of this conflict extend both to the area of plant production, as well as to the animal production sector. This occurs since a large part of the costs for feeding poultry, cattle and pigs comes from the consumption of grains, such as bran and corn. Another impact of the conflict on agribusiness was the valuation of Brazilian products due to the international blockade of products from Russia, especially soy and corn. With the closing of the Russian market, there was a significant increase in Brazilian commodities, which generated an increase in demand for areas for agriculture. With the demand for areas for grains, pasture areas end up being converted to agricultural areas where profitability per hectare is significantly higher than pasture. Consequently, pastures put pressure on forest areas with greater potential for transition.	The project will promote different technical assistance and rural extension activities in the project zone, these actions will aim to train rural producers in the management of productive areas, aiming at recovery and increased productivity, with this it is expected that the pressure on forest areas will decrease.

3.1.4.3.1.4 Analysis of chain of events leading to deforestation

The dynamics of deforestation is a complex and multifaceted phenomenon which is dependent on a series of agents and vectors, which are driven by aspects: social, cultural, and economic (micro and macro). The intensification of land use conversion activities in the reference region in the 1970s has as its main time frame the construction of the BR-010 (Belém-Brasília) after the establishment of this route connecting the Paraense Amazon with the capital of Brazil, a series of villages and towns began to settle in the region bordering the federal highway, these villages later gave rise to cities.

The establishment of cities, in turn, boosted migration to the region, increasing its demographic density and the demand for products and new productive areas. It is essential to mention that the pressure on environmental assets in the region originated in the 1970s, through logging activities focused on the exploitation of commercial species of high economic value. However, with the high demand for wood in the southeastern region of Brazil in the 1980s, combined with the construction of BR-010, which became the route for wood transporting from the reference region to other regions of the country, the logging of high environmental impact has become common local practice. In the 1990s, for example, according to Verissímo et al (1996), the Paragominas region produced 15% of the total wood in the Brazilian Amazon.

Therefore, the implementation of road infrastructure works can be related as an incentive for the migration of a significant number of populations to the region, enhancing the exploitation of wood as the main economic activity, initiating the cycle and the process of forest degradation. In some situations, forest exploitation occurred concomitantly with the conversion of land, mainly for livestock activity, including financing the implementation of pasture with resources obtained through illegal logging.

In 2008, however, Paragominas was included in the list of the 36 municipalities that most deforested in the Amazon, based on this inclusion, the municipality was the focus of actions to reduce local deforestation rates. Based on the actions implemented under the Green Municipality Program and with the Arco-de-fogo Operation, deforestation rates showed a decline until 2015.

In the reference period analyzed by the Cauaxi REDD Grouped Project (2017-2021), a reversal of the situation of decline in local deforestation was noted, the municipalities in the reference region showed an increase in local deforestation rates (Figure 23). This situation has become a reality in the Brazilian Legal Amazon because of the weakening of environmental management, the loosening of environmental inspection and monitoring and the total suspension of command-and-control actions promoted by the federal administration of (2018-2021). Despite the change that occurred in 2022 the impacts of mistakes made in recent years lasted for a significant period.

It is worth mentioning that in many cases, anthropic disturbances under the carbon cycle in the forest ecosystem, occur repeatedly over a period, causing a great impact on the forest structure and biodiversity of the place. Predatory logging, together with frequent droughts, forest fires and an increasingly significant forest edge effect, ends up contributing to an increase in forest susceptibility to land use conversion.

The disturbances have a series of causes linked by different agents and vectors of deforestation, from: the demand for wood, expansion of agriculture and livestock, the offer of agricultural credit without environmental conditions and the establishment of roads and cities. These agents/vectors act motivated by market demand for agricultural products, lack of governance and corruption, population growth and migration.

3.1.4.3.1.5 Conclusion

Thus, today, due to the historical location of wood extraction, together with the entire logistics and productive chain installed, the forest areas are under intense pressure, mainly for charcoal and wood, associate with the demand to new pasture areas that has been pushed to the forest cause of the grains demand.

Added to this scenario, it is also important to mention that the increase in the world demand for grains (Table 25) has made the agricultural activity with the highest opportunity cost, generating a greater demand for productive areas with this objective. Soybean, among other grains, ends up occupying pasture areas which in turn advance into already degraded border areas and with greater susceptibility to land conversion.

With this, it is expected that the baseline scenario established based on the dynamics of deforestation that occurred over the reference period will continue in the coming years and, only, the sum of efficient actions and strategies in the control, combat, monitoring deforestation, allied to the promotion of actions to value environmental assets and bioeconomy products and the promotion of sustainable activities, will succeed in reversing this scenario of increased deforestation rates in the reference region.

So, based in the steps previously performed it is possible to conclude that the most-likely future deforestation trend is continue increasing in the next years until the joint actions to avoid the deforestation can get to the objectives to decline the deforestation rates in the legal Amazon. Also, it´s important to highlight that the relationship between the agents' groups, deforestation drivers, underlying causes and historical levels of deforestation was verified and as it was explained the main causes of the deforestation dynamics.

3.1.4.4 Projection of future deforestation

3.1.4.4.1 Projection of the quantity of future deforestation

3.1.4.4.1.1 Selection of the baseline approach

The baseline approach selected to project the future deforestation of the project was the letter "c" (step 4.1.1 of the VM0015), the modelling approach. The deforestation rates measured in the reference period in the municipalities that are part of the reference region and encompass all the 20 first project activity instances, reveal a clear trend and this trend is an increasing of the deforestation rate, as is it possible to see in Figure 23, below. Also, conclusive evidence emerged from the analysis of agents and drivers (step

3) explaining the different historical deforestation rates and there is at least one explanatory variable can be used to project the deforestation rate. So, according to the VM0015 the approach “C” was selected to project the future deforestation.

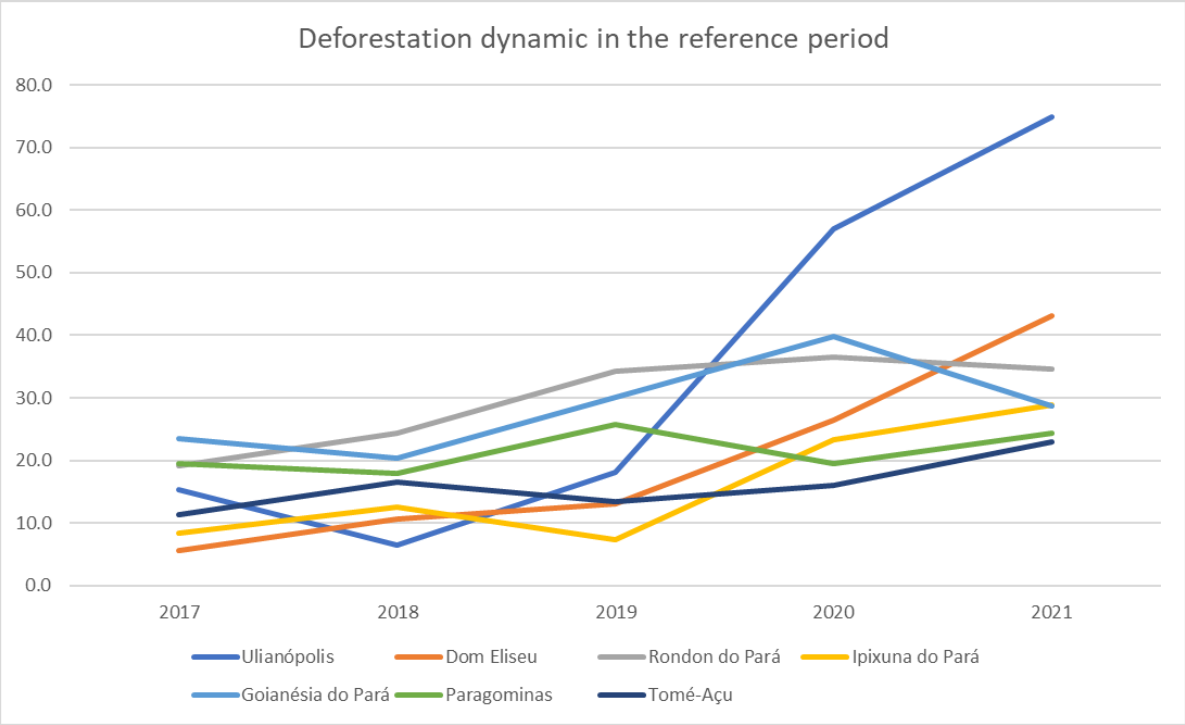

Figure 23 – Annual Deforestation (km²) in the reference period in the reference region

3.1.4.4.1.2 Quantitative projection of future deforestation

Approach “c”: Modeling

Land use changes can be modeled empirically by relating historical changes to their explanatory variables (vectors) so that it is possible to extract a set of rules that can be extrapolated to the future (SANGERMANO et al. 2012).

According to MATTA (2015), the most common methods for extracting these relationships are neural networks (PIJANOWSKI et al. 2002), logistic regression (PONTIUS & SCHNEIDER 2001) and evidence weights (SOARES-FILHO et al. 2006).

AMUCHASTEGUI and FORREST (2013) evaluated six different tools with potential for modeling land use changes: LCM, GEOMOD, DYNAMIC EGO, MAXENT / ZONATION, CLUE and InVEST. The study concluded that the best land use modeling tool is LCM and is considered a successful project.

MATTA (2015) pointed out in his study that within the scope of REDD + projects validated to the VCS standard, the Land Change Modeler (LCM) was used in three projects in Brazil and one project in Peru, in

Cordilheira Azul National Park (CIMA, 2012). It is worth mentioning another study that used MLP to simulate the impact of major works, such as the Belo Monte Hydroelectric Deforestation Risk (IMAZON, 2011).

For this reason, the tool chosen for the baseline analysis of the Cauaxi REDD+ project was the Land Change Modeler, LCM module (EASTMAN, 2009), present in the IDRISI 16.0 Taiga Edition software.

Algorithm used: Neural Networks

Artificial neural networks are important tools that use a computational learning approach to quantify and model complex behaviors and patterns. Among them, Multi-Layer Perception (MLP) stands out as the most used neural network. MLP consists of one input data (the explanatory variables) and one output data (the modeled transitions) and one or more hidden data. Each hidden data has a node (or neuron) that is connected by weights to the input and output data. (PIJANOWSKI et al. 2002).

HU AND WENG (2009) pointed out that neural networks have been widely used due to their advantages over other statistical methods, such as: it does not need to assume assumptions for input data; It is robust in noisy environments and assimilates complex patterns. Although there are several robust neural network models, the MLP neural network is the most used, according to the authors.

Weights in a neural network are determined using a training algorithm that randomly selects the initial weights and then compares the calculated output data with the expected observation value. The difference between the calculated and expected values in all observations is summarized using the mean of squared errors. After all observations are analyzed by the neural network, the weights are modified so that the total error is distributed across the various nodes of the network. This process of looking forward and backward to propagate the inaccuracy is repeated until the error assumes its lowest value. (PIJANOWSKI et al. 2002).

In the analysis of the deforestation dynamics of the Cauaxi REDD+ Project Reference Region, the input data (factor maps) of the neural network model were all analyzed, even though there is a possibility of correlation and redundancy of information between them. As SANGERMANO, et al. (2012) demonstrated that MLP is nonparametric and allows to associate complex relationships regardless of the presence or absence of multicollinearity or inclusion of insignificant variables.

Location analysis of future deforestation within reference region is required to determine the annual areas of deforestation within the project area and leakage belt. Once location analysis was completed, the portion of annual areas of baseline deforestation within the project area and leakage belt was determined using GIS software (from Table 26 to Table 28).

Table 26 – Annual areas of baseline deforestation in the reference region (RR).

Year	Project Year	Stratum *Dense Forest* in the reference region		Stratum *second growth forest* in the reference region		Stratum *open forest* in the reference region		Total	
		Annual *ABSLRR* (ha)	Cummulative ABSLRR (ha)	Annual ABSLRR (ha)	Cummulative ABSLRR (ha)	Annual ABSLRR (ha)	Cummulative ABSLRR (ha)	Annual ABSLRR (ha)	Cummulative ABSLRR (ha)
2022	1	171.873,61	171.873,61	8.134,52	8.134,52	4.488,46	4.488,46	184.496,58	184.496,58
2023	2	86.962,40	258.836,00	3.710,34	11.844,86	2.660,54	7.149,00	93.333,28	277.829,87
2024	3	90.708,41	349.544,41	3.055,04	14.899,90	2.672,50	9.821,50	96.435,95	374.265,82
2025	4	56.264,58	405.809,00	1.493,36	16.393,26	1.581,49	11.402,99	59.339,43	433.605,25
2026	5	76.671,68	482.480,67	1.716,13	18.109,39	2.025,79	13.428,78	80.413,59	514.018,84
2027	6	58.675,42	541.156,09	1.043,57	19.152,96	1.511,13	14.939,91	61.230,11	575.248,95
2028	7	39.589,21	580.745,30	592,38	19.745,33	934,77	15.874,68	41.116,36	616.365,31
2029	8	59.887,79	640.633,09	775,39	20.520,73	1.420,28	17.294,96	62.083,47	678.448,78
2030	9	40.271,37	680.904,46	437,28	20.958,01	835,93	18.130,89	41.544,58	719.993,36
2031	10	40.389,23	721.293,69	387,81	21.345,82	913,51	19.044,40	41.690,56	761.683,91
TOTAL		**721.293,69**		**21.345,82**		**19.044,40**		**761.683,91**	

Table 27 – Annual areas of baseline deforestation in the project area (PA).

Year	Project Year	Stratum Dense Forest in the Project Area		Stratum second growth forest in the Project Area		Total	
		Annual *ABSLPA* (ha)	Stratum Dense Forest in the total project area	Annual ABSLPA (ha)	Cummulative ABSLPA (ha)	Annual ABSLPA (ha)	Cummulative ABSLPA (ha)
2022	1	1.743,61	1.743,61	1.193,22	1.193,22	2.936,83	2.936,83
2023	2	1.171,06	2.914,67	599,40	1.792,62	1.770,46	4.707,29
2024	3	1.331,55	4.246,22	407,66	2.200,28	1.739,21	6.446,49
2025	4	899,73	5.145,94	184,06	2.384,34	1.083,79	7.530,28
2026	5	1.257,68	6.403,63	206,07	2.590,41	1.463,75	8.994,03
2027	6	1.047,73	7.451,36	126,70	2.717,10	1.174,43	10.168,47
2028	7	738,11	8.189,47	69,09	2.786,19	807,19	10.975,66
2029	8	1.183,94	9.373,41	86,02	2.872,21	1.269,96	12.245,62
2030	9	812,80	10.186,20	49,46	2.921,68	862,26	13.107,88
2031	10	890,82	11.077,02	40,92	2.962,59	931,73	14.039,61
TOTAL		**11.077,02**		**2.962,59**		**14.039,61**	

Table 28 – Annual areas of baseline deforestation in the leakage belt (LB).

Year	Project year	Stratum *Dense Forest* in the leakage belt		Stratum *second growth forest* in the Leakage Belt		Stratum *open forest* in the Leakage Belt		Total	
		Annual *ABSLLB* (ha)	Cummulative ABSLLB (ha)	Annual ABSLLK (ha)	Cummulative ABSLLK (ha)	Annual ABSLLK (ha)	Cummulative ABSLLK (ha)	Annual ABSLLK (ha)	Cummulative ABSLLK (ha)
2022	1	77.397,81	77.397,81	5.301,83	5.301,83	2.660,70	2.660,70	85.360,34	85.360,34
2023	2	39.795,63	117.193,44	2.469,74	7.771,57	1.497,91	4.158,61	43.763,28	129.123,62
2024	3	42.508,71	159.702,15	2.160,83	9.932,40	1.532,17	5.690,78	46.201,71	175.325,33
2025	4	26.204,36	185.906,51	1.077,38	11.009,78	905,24	6.596,02	28.186,98	203.512,31
2026	5	36.165,39	222.071,90	1.260,51	12.270,29	1.147,66	7.743,68	38.573,55	242.085,87
2027	6	27.274,89	249.346,78	769,36	13.039,65	865,40	8.609,08	28.909,64	270.995,51
2028	7	18.620,03	267.966,82	436,83	13.476,48	541,69	9.150,77	19.598,56	290.594,06
2029	8	27.791,11	295.757,93	577,45	14.053,93	829,42	9.980,19	29.197,98	319.792,05
2030	9	19.097,67	314.855,60	331,82	14.385,75	491,48	10.471,67	19.920,96	339.713,01
2031	10	18.401,59	333.257,19	296,52	14.682,26	534,19	11.005,85	19.232,30	358.945,31
TOTAL		**333.257,19**		**14.682,26**		**11.005,85**		**358.945,31**	

3.1.4.4.2 Projection of the location of future deforestation

3.1.4.4.2.1 Preparation of factor maps

All factor maps that were generated are presented below, see (Table 29), it obtained all the spatial data related to each of the 4 variables analyzed, and it created digital maps representing the Spatial Features of each variable. The LCM requires producing Distance Maps from the mapped features (e.g., distance to roads or distance to already deforested lands) and this data was created using the Empirical approach which is suggested by the VM0015 (section 4.2.1).

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Table 29 – Factor maps selected to the model selected for the baseline scenario.

Factor Map		Source	Variables represent		Meaning of the categories or pixel value		Other Maps and Variables used to create factor map		Algorithm or Equation used	Comments
ID	File Name		Unit	Description	Range	Meaning	ID	File Name		
1	**dist_deforest_2019.rst**	The cartographic base used was generated with the 2019 data from the PRODES INPE Amazon Monitoring System.	degrees	Distance of the accumulated deforestation in 2009	**0 - 1.01**	Values close to **0** are closer to the deforestation.	1A	Prodes2019_RR.shp	The classes accumulated deforestation forests and hydrography in shapefile format were selected in the ArcGIS 10.7 software. This land cover file was imported into Idrisi Taiga software. Subsequently, the file was converted from vector format to na image, a Boolean file of the deforestation class 2018 was created, and its Euclidean distance was calculated.	The reason for choosing this variable is the characteristic of deforestation (the reference region is located in the "arc of deforestation"). In these locations, forest cover in the vicinity of na agricultural / urban landscape matrix has a higher opportunity cost for conservation than in isolated an/ or hard to reach regions. Thus, productive areas tend to increase, following the logic of "puxadinho" over conserved areas.
2	**dist_estradas1img.rst**	The cartographic base used was provided by IMAZON, and refers to the systematic mapping of branches, secondary and primary roads in a 1:50,000 scale.	degrees	Distance of main and secondary roads	**0 - 1.02**	Values close to **0** are closer to main roads.	2A	estradas_amazonas_imazon.shp	The data was clipped to the reference region using Arcgis 10.7 software. The information was imported into the Idrisi. Taiga software and converted to raster, then the Euclidean road distances within the reference region were calculated.	Roads are known and consolidated deforestation vectors on a global scale and are responsible for deforestation in "fishbone" format.
3	**dist_rios.rst**	The cartographic base used was generated with the hydrographic data of State System of Hydric Resource Information of the Pará (SEIRH) on a scale of 1:250,000.	degrees	Distance of the rivers	**0 - 1.01**	Values close to **0** are closer to the deforestation.	3A	Rios_SEIRH_AUD_RR_Final.shp	The spatial information of the hydrography was grouped at cut to the study area using Argis 10.7 software. The information was imported into the Idrisi Taiga software, where such vectors were converted to matrix format and the Euclidean hydrographic distances within the RR were calculated.	This variable was chosen because the areas close to the watercourses are areas most used for various agricultural activities. Mainly for the easy accessibility to the resource and also for being in the riparian zone where are more fertile soils, with high presence of organic material. They are also a common means of transport in the Amazon region, facilitating the flow of illegal timber products and access to remote regions.
4	**dist_comunidade_img2.rst**	The cartographic base used was generated based on IBGE (2010) spatial information in 1:25,000 scale.	degrees	Distance of communities	**0 - 1.01**	Values close to **0** are closer to the deforestation.	4A	Comunidades_IBGE2010_Ncidades_28112021.shp	It was clipped to the reference region using Arcgis 10.7 software. The communities with the reference region were calculated.	Locations with clustering of people, with little infrastructure and poor access to public policy find themselves in a state of neglect by public governance, especially with regard to environmental command/ control. Forested areas have a great vulnerability around the locations that demand wood (energy, construction and commercialization), with initial selectively extract, then cut and burn for the implantation of low productivity and low value pastures aggregate.

3.1.4.4.2.2 Preparation of deforestation risk maps

The preparation of all risk maps follows the Figure 24, this flowchart illustrates how the deforestation risk maps were generated and for evaluate the model and the factor maps (Table 29) That best explains the dynamics of deforestation. The sensitivity analysis “Jacknife” was used, the approach selected was the same used by SANGERMANO, et al. (2012) and MATTA (2015),

In the analysis two classes are created: “ROC with only” and “ROC without”. “ROC with only” indicates that in the 2021 transition potential map, modelled with 2017 and 2019 data, only one focus explanatory variable was used, see Table 30 below. “ROC without” means that all other explanatory variables were used, except the focus variable was excluded from the analysis. So, nine different deforestation risk maps were produced to determine the most accurate model, comparing the transition potential maps modelled to 2021 with the actual deforestation that happened from 2017-2021 (see the details in the project Appendix VII – Carbon Pools Measures).

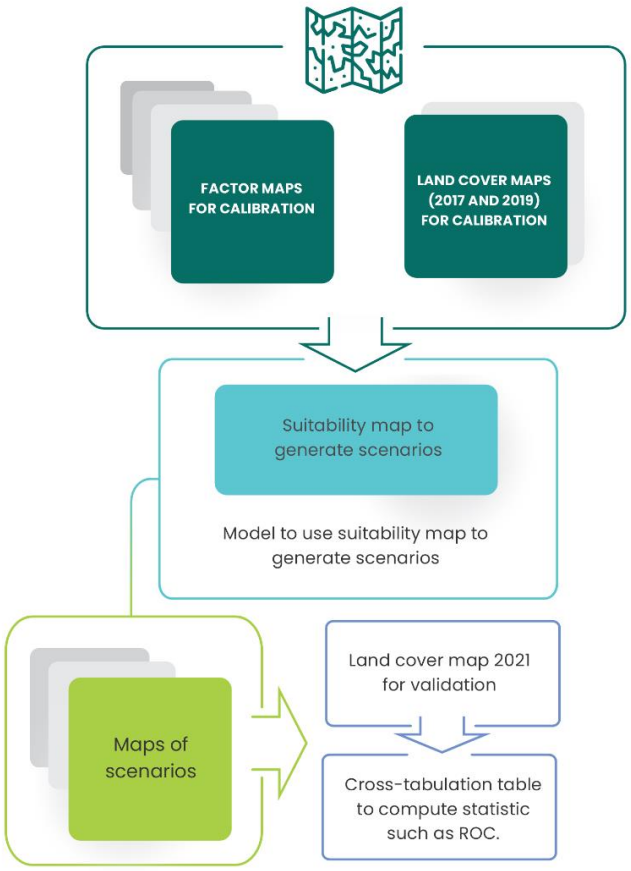


Figure 24 – Flow-chart diagram illustrating how the Risk Map was generated.

ROC is the Relative Operating Characteristic, a method widely used to evaluate the accuracy of a model in predicting the occurrence locations of a class by comparing a susceptibility (transition potential) image or risk map that depicts the likely occurrence locations of the class, with a Boolean image (values of 0 - non-existence and 1 - existence) showing where the class really exists.

In the operation using the ROC was adopted as amplitude threshold the standard value equal to 10 (PONTIUS and SCHNEIDER, 2001). According to SANGERMANO, et al. (2012), variables that usefully contribute to the model will have a high ROC value when used separately ("ROC with only"). Variables that contribute unique information will have a lower ROC value when excluded from the model ("ROC without").

For each susceptibility value within the adopted threshold, points called false and true positives are generated (CLARK LABS, 2009). A real positive is a pixel that is categorized as a change in the actual scenario (in the case of 2019-2021) and in the modeled susceptibility scenario. A false positive is a pixel categorized as not changing in the real scenario, but as changing in the modeled scenario. These points are then connected in a computational environment creating a curve whose area (Area Under the Curve - AUC) represents the value of the ROC (dimensionless) statistic. The modeling software, IDRISI Taiga, calculated the area over the curve using the trapezoidal rule of differential and integral calculus.

Table 30 – Jacknife analysis of the factor maps using the ROC to calibrate and validate the model used to establish the baseline scenario.

Calibration 2017 x 2019; confirmation 2021			
ID	**Driver**	**"ROC with only"**	**"ROC without"**
1	Distance from rivers	0.893	0.925
2	*Distance from communities*	0.882	0.925
3	*Distance from 2019 deforestation*	0.925	0.904
4	*Distance from roads*	0.850	0.925

The Figure 25 to Figure 28 presents the Deforestation Vectors maps, calculated for the project.

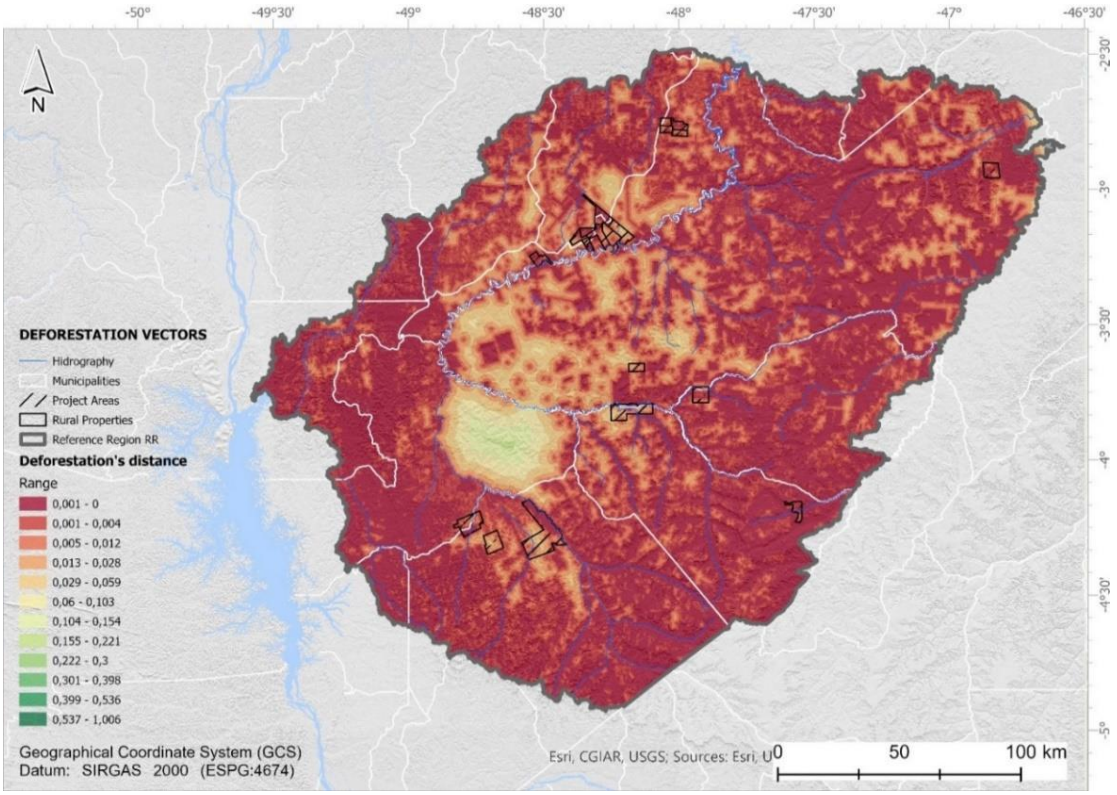


Figure 25 – Deforestation vectors map 1: distance from deforestation

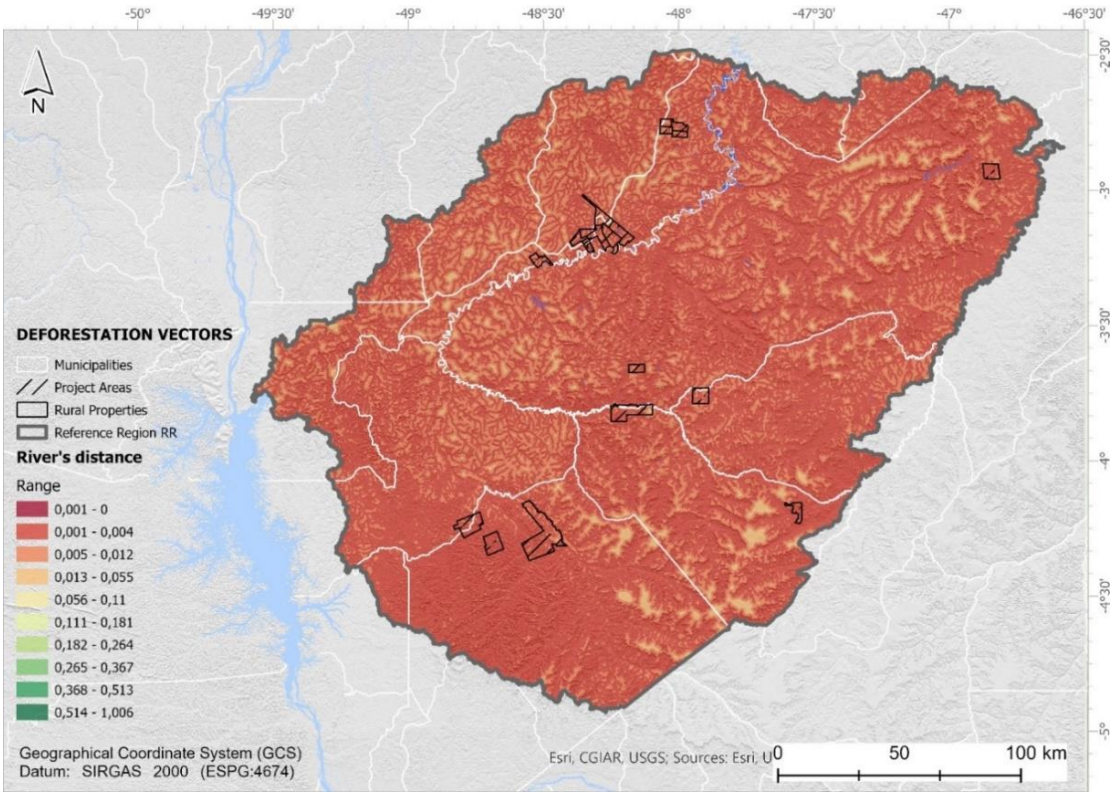


Figure 26 – Deforestation vector map 2: distance from rivers

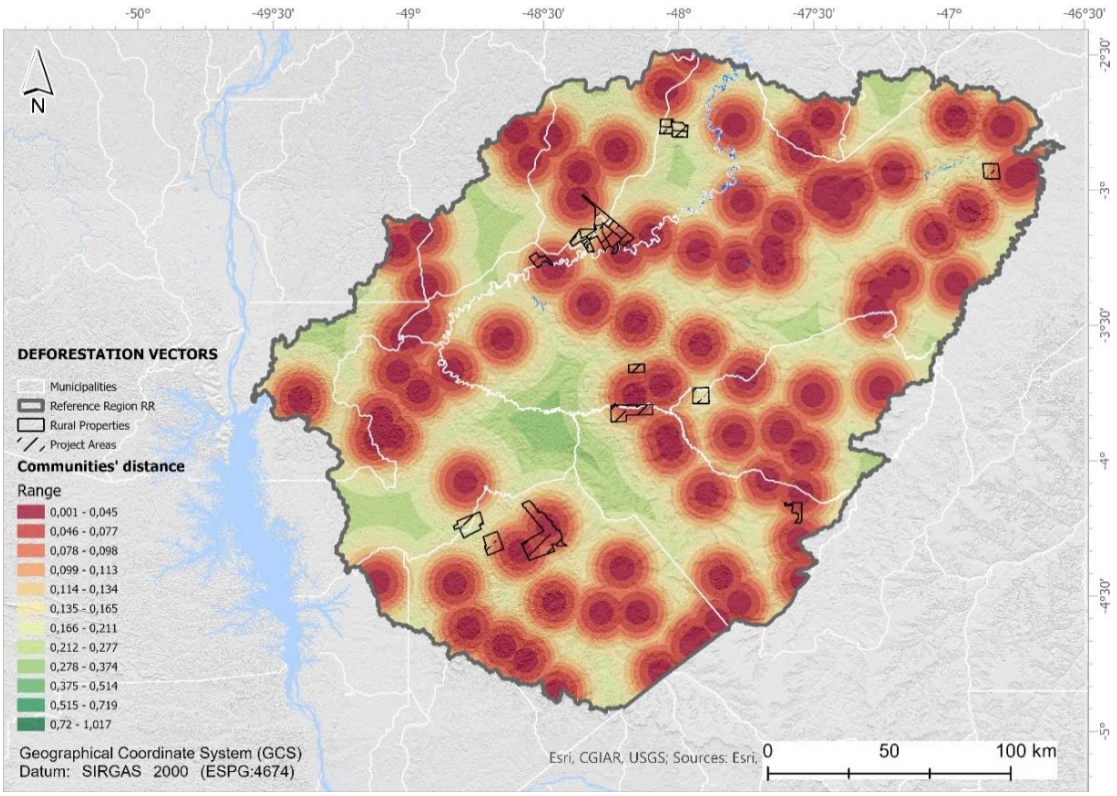


Figure 27 – Deforestation vectors map 3: distance from communities.

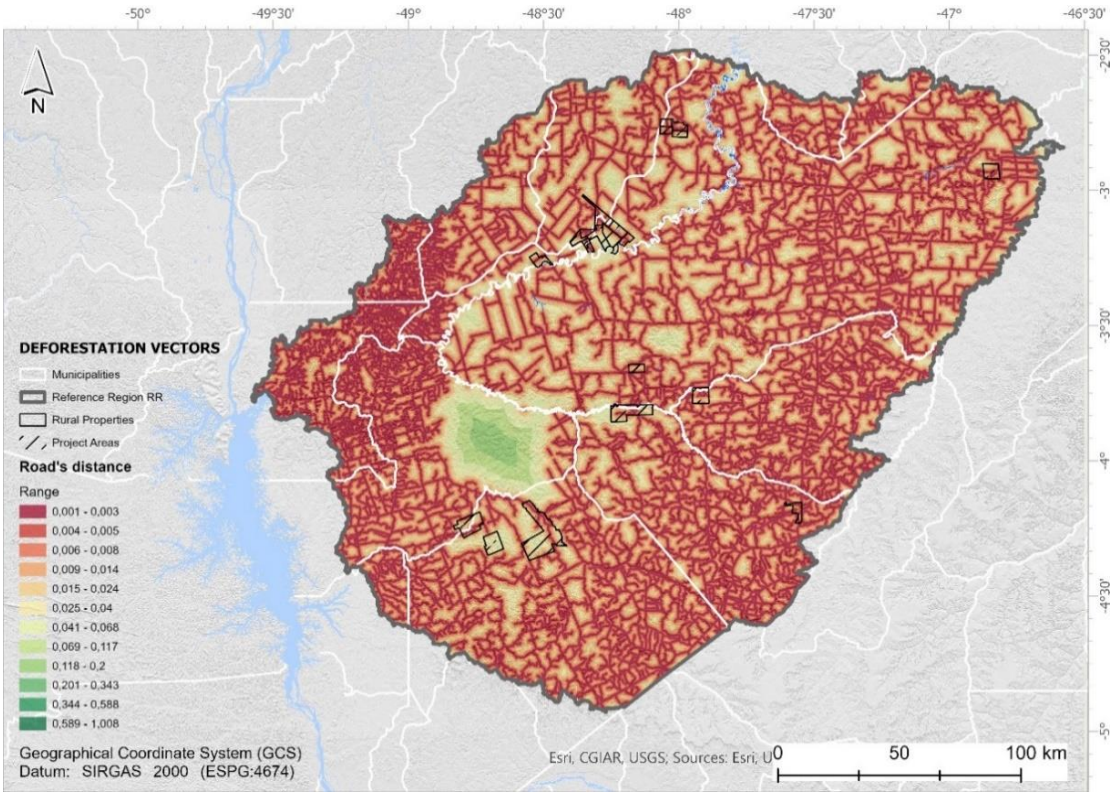


Figure 28 – Deforestation vectors map 4: distance from roads.

3.1.4.4.2.3 Selection of the most accurate deforestation risk map

To evaluate the accuracy of the model it was necessary to compare the map obtained through the prediction with real data (Figure 29 e Figure 30). For this analysis we compared the land use maps estimated / modeled map for 2021 with the actual map observed in 2021 (confirmation period).

The model prediction results were analyzed in two ways. Firstly, a total of 9 different combinations of variables were simulated in MLP for 2021 (land use change models, with the calibration period between 2017 and 2019). The soft prediction output data, vulnerability map, generated for each of the twelve models was compared with the actual deforestation map (forest class changes to deforestation class) from the same period of the models; through ROC Statistics.

The factor map that is the distance from the accumulated deforestation with a value of 0,925 (see Table 30 above). This variable represents the main characteristic of deforestation in the region, known as border deforestation (the reference region is in the “arc of deforestation”). In these locations, forest cover in the vicinity of an agricultural/urban landscape matrix has a higher opportunity cost for conservation than in isolated and/or hard to reach regions. Thus, productive areas tend to increase, following the logic of *"puxadinho"* over conserved areas that are mainly under edge effect and with high deforestation susceptibility. Also, the other factor maps were included in the selected model, even if doesn´t change the

ROC value but contributes significantly to the quantity and location of the deforestation, comparing the projected land use and the real land use, especially because the second test described below (histogram test) showed better distribution when all the factors' maps are together. So, the deforestation risk map with the best fit according to the ROC statistic value was the model used with 0,925.

The ROC obtained to the Cauaxi reference region is a value that can be comparable with other studies, for example the values obtained by PONTIUS and SCHNEIDER (2001). In this study, in a land cover change model validated with the ROC method it was obtained two different values of ROC according with the model used, in the logistic regression produced a ROC of 0,65 and in the Multi-criteria Evaluation (MCE) produced a suitability map with a ROC of 0,70.

The model that obtained the highest value for the ROC statistics was evaluated in another test. Through the generation of two histograms: one with the vulnerability values within the areas that showed real change (Table 29) and the other with the vulnerability values within the areas that did not (persistence) (Table 30). According to SANGERMANO et al. (2012), a perfect model presents vulnerability values equal to one in all areas that showed change and vulnerability values equal to 0 in areas that did not change.

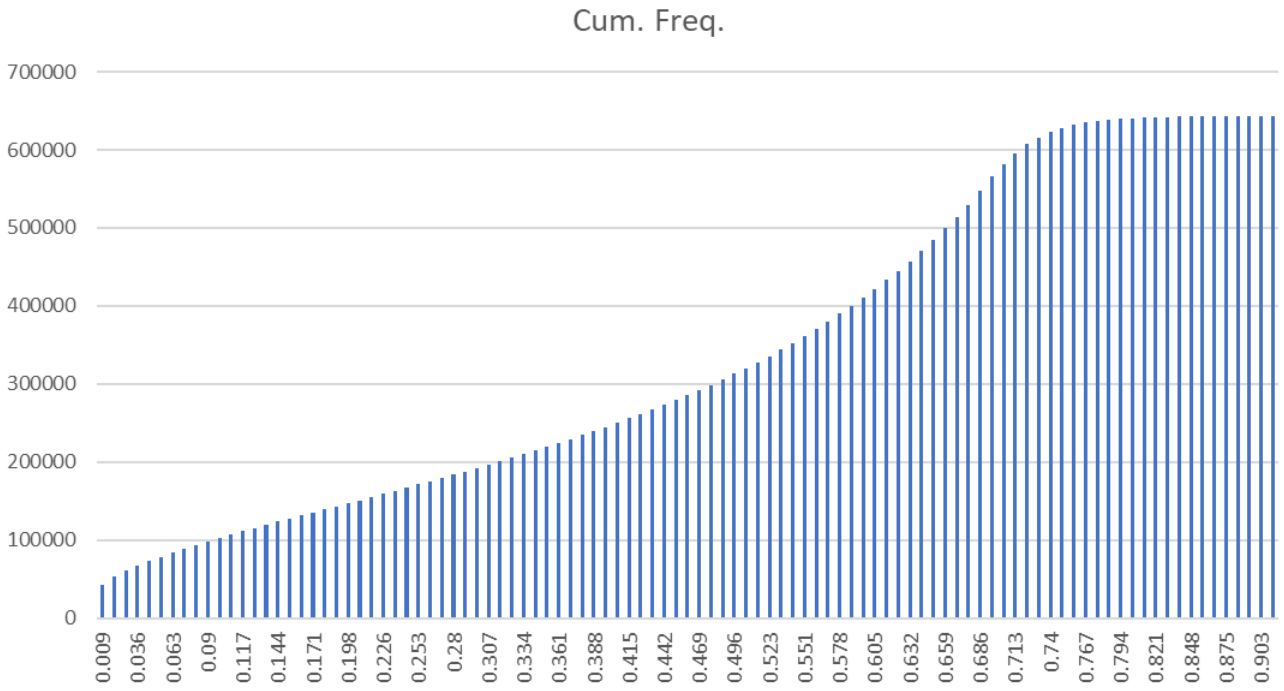


Figure 29 – Histogram of the frequency of vulnerability values (deforestation risk) in the period 2019-2021 in relation to the frequency of areas (pixels) that was deforested in the same period analyzed.

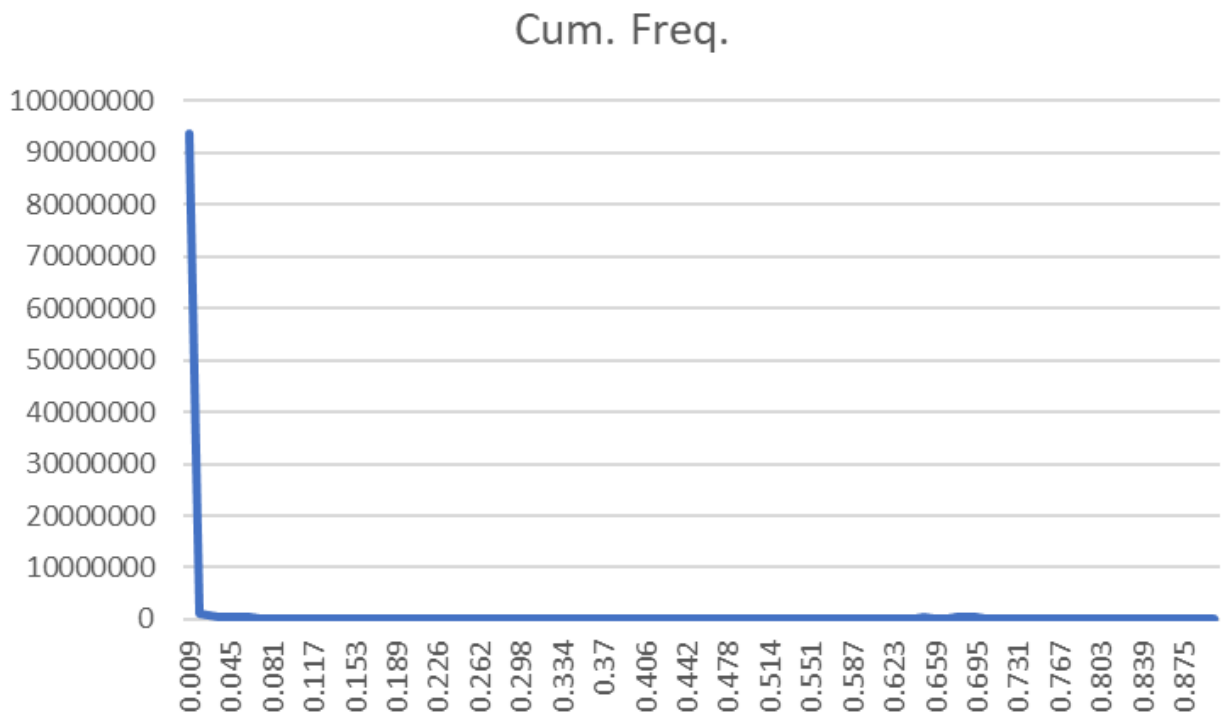


Figure 30 – Histogram of the frequency of vulnerability values (deforestation risk) in the period 2019-2021 in relation to the frequency of areas (pixels) that persisted in the same period analyzed.

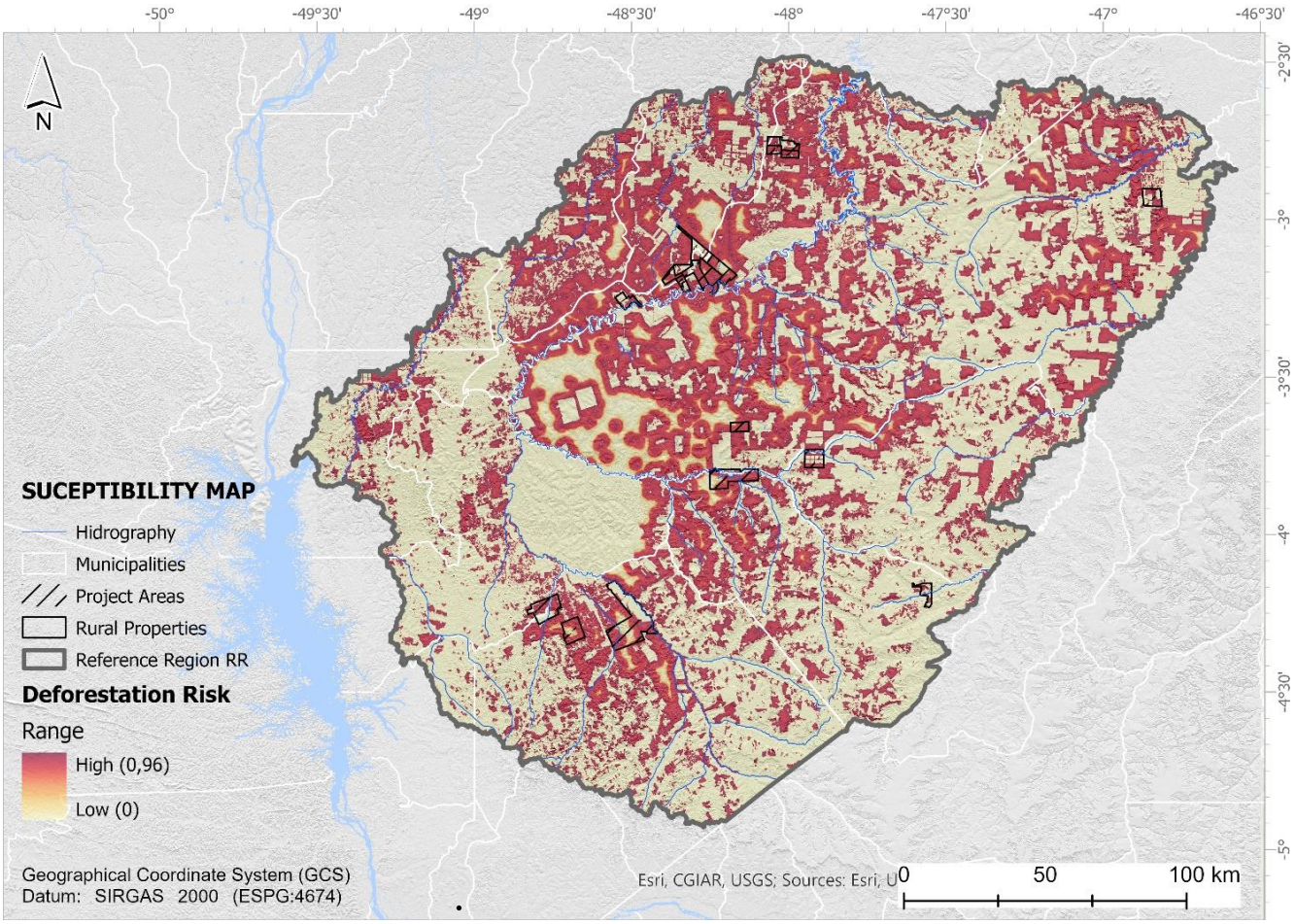


Figure 31 – Susceptibility of deforestation risk map.

4.2.4 Mapping of the locations of future deforestation

Change predictions were estimated and mapped using Markov Chains. According to MATTA (2015) apud BACA (2002), Markov chains are a system modeling formalization that describes the whole system as a stochastic process. Thus, the system is characterized by its states and the way in which they alternate. Markov's processes are based on the premise that there is a dependence between an event and its previous one.

The first order Markovian Chain model depends only on its present state and on the possibilities of transition (SOARES FILHO, 2015). The transition probabilities do not change over time, which characterizes it as a stationary process (LIU, 2006).

According to MATTA (2015), LCM output data related to change prediction are: the estimated land use map for a specific time period, containing the same classes as the hard prediction data (Figure 32). In addition to the estimated land use map, the soft prediction map is also generated, which is a continuous Boolean map with values ranging from 0 to 1.

As the focus of the analysis is the transition between the Forest and Deforestation classes, the vulnerability map is equivalent to the transition potential map developed by neural networks (Figure 31).

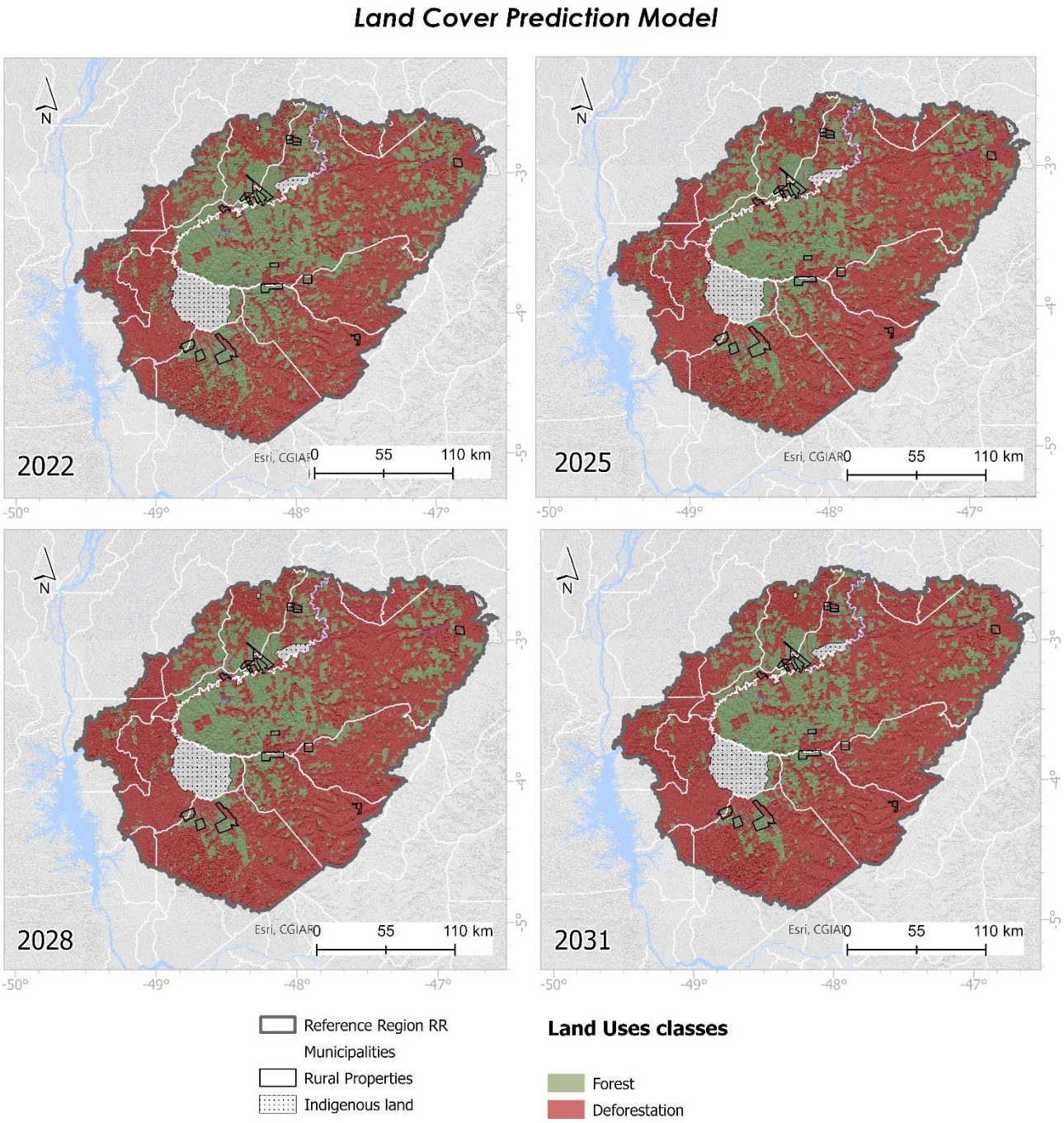


Figure 32 – Land Cover prediction Model (2022-2027)

3.1.5 Additionality

According to the VM0015: “Additionality of the proposed AUD project activity must be demonstrated using either the most recent VCS-approved VT0001Tool for the Demonstration and Assessment of Additionality in VCS AFOLU Project Activities.”

Based on that, the following four steps were assessed:

a) STEP 1. Identification of alternative land use scenarios to the AFOLU project activity.

b) STEP 2. Investment analysis to determine that the proposed project activity is not the most economically or financially attractive of the identified land use scenarios; or

c) STEP 3. Barrier's analysis; and

d) STEP 4. Common practice analysis.

3.1.5.1 STEP 1. Identification of alternative land use scenarios to the AFOLU project activity

Sub-step 1a. Identify credible alternative land use scenarios to the proposed VCS AFOLU project activity:

Based in the economic and political trends and regional business as usual, three credible alternative land use scenarios were identified for the project area, as follow:

1. Forest cover maintenance, i.e.: through conservation activities resulting from incentives other than the REDD project.
2. Legal deforestation for pasture (cattle raising) and agriculture.
3. Illegal deforestation for pasture (cattle raising) and agriculture purposes or simply for land grabbing and real estate speculation.

The three land use scenarios identified above occur in the municipalities encompassed by the grouped project, the same is observed for the surrounding municipalities. In addition, they are also credible and in line with historical land uses, practices, and economic trends in the region. For additional information regarding project region historic land use dynamic, please refer to section 5.1.4 “baseline scenario”.

Sub-step 1b. Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations.

According to this section, the following step must be applied:

Demonstrate that all land use scenarios identified in sub-step 1a follow all mandatory applicable legal and regulatory requirements.

Considering the project activities will be developed in the Legal Reserve of private properties, only scenario 1 is in accordance with current laws and regulations. Despite the common practice of deforestation for cattle and agriculture purposes in the region, once the project covers the Legal Reserve portion of the properties, deforestation permits is not a legal option, thus scenario 2 is not a credible scenario and must be excluded from the analysis.

On the other hand, most of the deforestation observed in the region is illegal, thus scenario 3 is credible and very much in line with the common land use practice observed in the region. Therefore, the uncontrolled land occupation by land-grabbers and independent producers, followed by illegal deforestation, even not being in line with the mandatory applicable legislation and regulations, is a credible scenario. This assumption is based in the land use "business as usual" (BAU) for the municipality of Dom Eliseu, Rondon do Pará, Paragominas, Tomé-Açu, Ipixuna do Pará, Ulianópolis and Goianésia do Pará. It's worth noting that this land use pattern is observed in the surrounding municipalities, as well, encompassing the entire Southeast of Pará, where applicable mandatory legal or regulatory requirements are systematically not enforced and non-compliance with those requirements is widespread.[18]

According to a broad study carried out by IMAZON (2013), the Brazilian government does not have control over the land in a great part of the Amazon territory. The research indicated that 158 million hectares (32% of the territory) would be supposedly private areas without verification or validation by the official government institution. According to a survey carried out by the MapBiomas Alert Platform, around 98% of the deforestation registered in Brazil in 2020 had signs of irregularity, either because the deforestation was carried out without legal authorization or because it occurred in protected areas, such as conservation units, indigenous lands or Permanent Preservation Areas (APPs). The lack of inspection is also a fundamental factor for the common practice of deforestation: a study published in the journal Environmental Research Letters shows that only 1.3% of the 115,688 deforestation alerts in the Amazon published by the MapBiomas Alerts platform between 2019 and 2020 was subject to inspection and resulted in embargoes or infraction notices by IBAMA (Coelho-Junior *et al*, 2022). This represents 6.1% of the total deforested area detected. And Pará was the state with the most deforestation alerts validated by the platform.

Based in the above mentioned, only Scenarios 1 and 3 are plausible alternative land use to the VCS AFOLU project activity, where scenario 1 is deemed plausible, once forest conservation of Legal Reserve follows all mandatory legislation and regulations, while scenario 3 is deemed plausible considering the widespread BAU of non-enforcement and non-compliance with the land use legislation and regulations. It's worth mentioning that incompliance with environmental laws and legal requirements for land use is common in the Amazon and can be found in many relevant articles and studies about the region. Please refer to project **Erro! Fonte de referência não encontrada.** - **Erro! Fonte de referência não encontrada.** and **Erro! Fonte de referência não encontrada.**.

18 https://mapbiomas.org/dados-sobre-fiscalizacao-mostram-que-impunidade-ainda-predomina-no-combate-ao-desmatamento

Sub-step 1c. Selection of the baseline scenario:

The historical trends of land use and land occupation in the Amazon, indicate that deforestation would be the most likely scenario for the forest land within the project's boundary. According to the Brazilian National Space Agency (INPE)[19], so far, around 729,000 km² have already been deforested in the Amazon biome, which corresponds to 17% of that biome. Of this total, 300,000 Km² were deforested in the last 20 years. In addition, models for predicting deforestation in the short term (one to three years ahead in time), based on deforestation rates that reached the highest levels observed in the last decade, show that Pará is the state with the largest area under deforestation risk for 2023: 4,504 km², which corresponds to 29.37% of all threatened territory in the Amazon. These data are from PrevisIA[20], a platform that uses artificial intelligence to indicate areas at risk of deforestation in the Brazilian Amazon and which, in 2022, showed an accuracy of almost 80% in predicting deforestation. In a BAU scenario, the tool predicts a loss of over 11,805 km² of native forest in 2023.

The PrevisIA platform makes it possible to visualize a heat map that illustrates the probability of forest destruction in the deforestation season that begins in August and ends in July of the following year. In the figure below (Figure 33) we present the map generated by the platform and highlight the region where the project areas are located, all within the areas at risk of deforestation in the short term.

19 http://www.inpe.br/faq/index.php?pai=6

20 PrevisIA was created in partnership with the Amazon Institute of Man and Environment (Imazon), Microsoft, and Fundo vale. The tool analyzes a set of variables to indicate the areas at most significant risk of deforestation in the amazon biome.

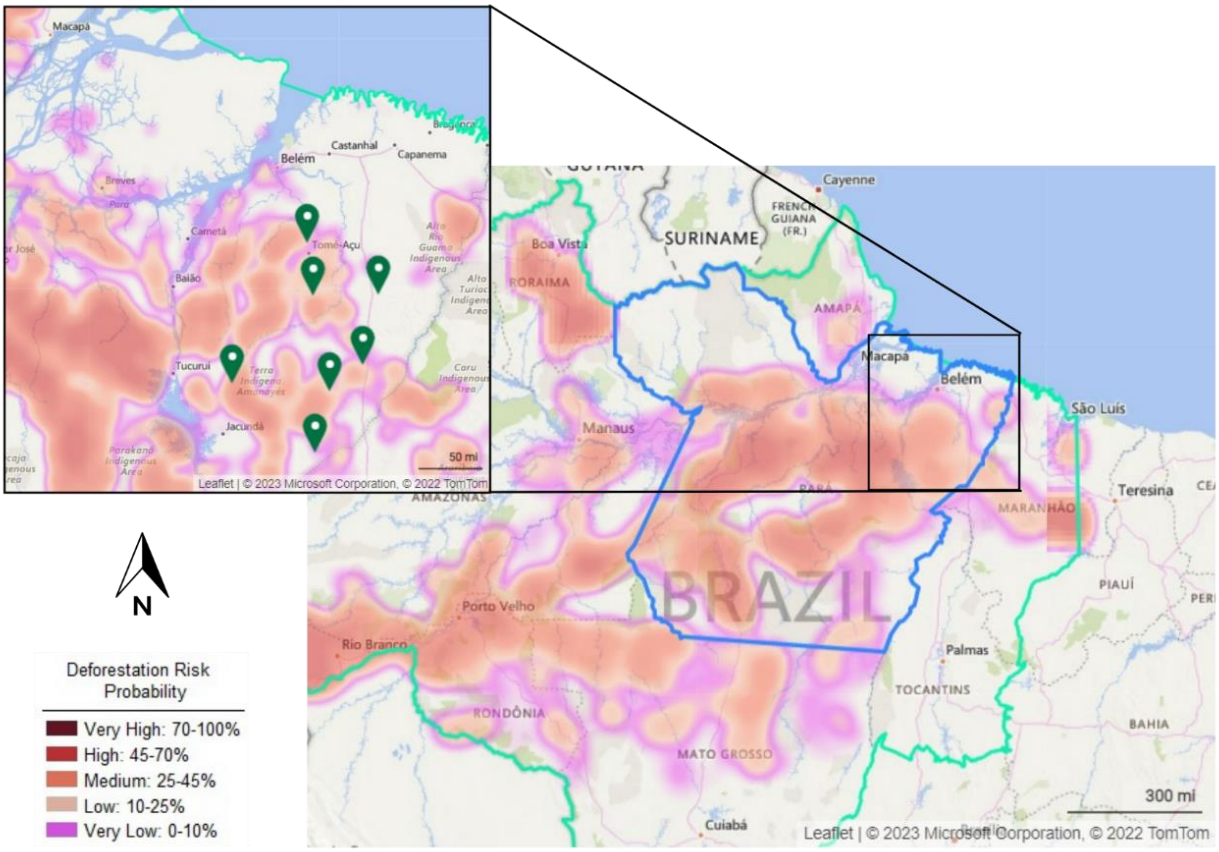


Figure 33 – Probability of projected deforestation risk for the Brazilian Amazon, with emphasis on the municipalities where the project areas are located, according to projections on the PrevisIA platform.

Data from the Deforestation Alert System from Imazon, reveals that Pará state remains with the highest deforestation rate among the nine states of the Amazon region (Northern region). From August 2021 to July 2022, 3,858 km² of forests in Pará were cut down, which represents 36% of the total devastated in the Amazon (10,781 km²). Analyzing the Table 31 below that presents the deforested area in the seven municipalities that make up the project, we observe that the municipality of Ulianópolis has the lowest forest cover among the seven municipalities (27.71%) and, not by chance, it also has the highest rate of deforestation, as the accumulated deforestation until 2021 (72.19%), as well as the highest rate of increase in deforestation from 2020 to 2021 (1.47%).

According to the most recent data, after one decade of drop in the deforestation rates in Amazon biome, it was observed a shifting in this trend from 2016 on, where the annual deforested area and fire outbreaks have shown a significant increasing (Figure 34). This new trend has become more evident between 2019 until 2022, where the deforestation and fire events have boosted up by changes in the Brazilian government environmental policy, after election in 2018. The government that acted during this period showed very little commitment to the environmental agenda and a strong alignment with cattle

ranchers, miners, and agribusiness. In addition, the president, as well as the Minister of the Environment at the time, promoted severe cuts in the budget of IBAMA, the main institution in charge of inspecting and controlling environmental crimes. Please refer to project **Erro! Fonte de referência não encontrada.** - **Erro! Fonte de referência não encontrada.**.

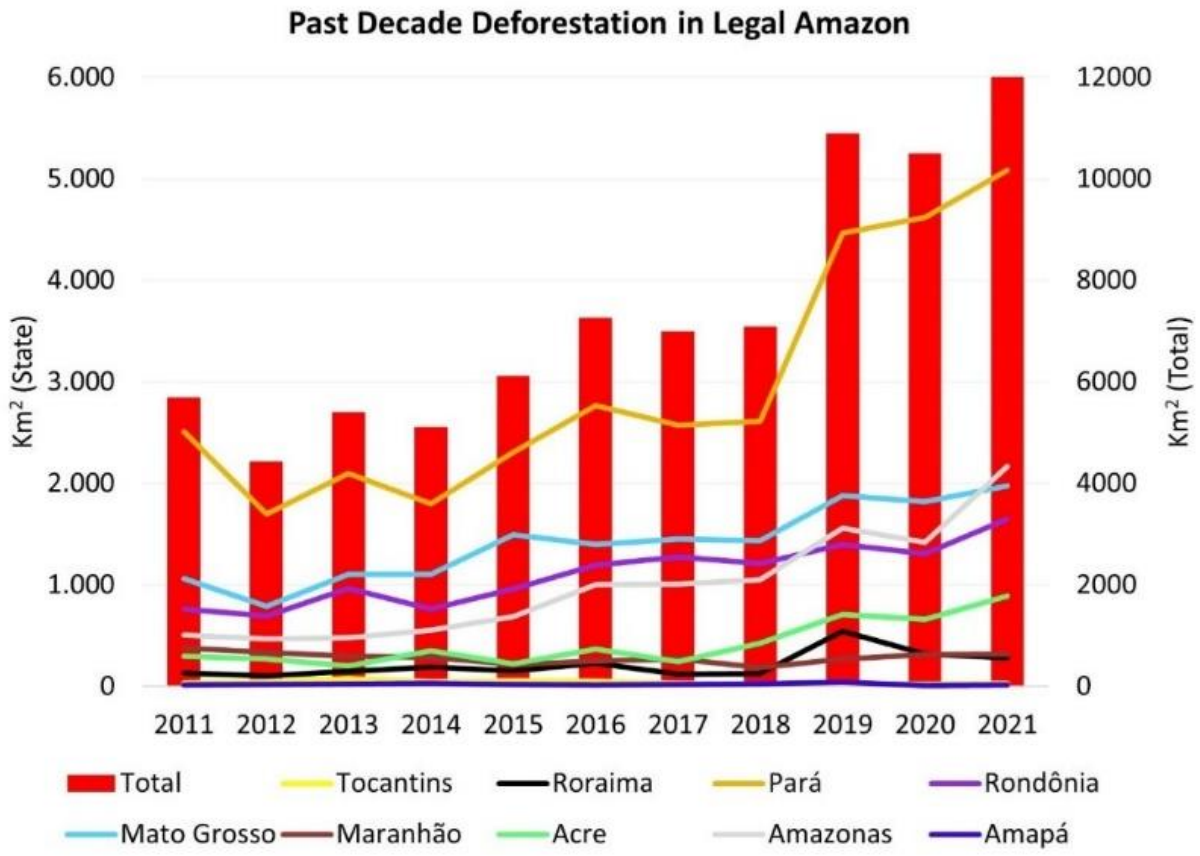


Figure 34 – Annual deforested area for Amazon biome from 2008 until 2021 - km² (INPE).

The annual deforestation report in Brazil, released in July 2022 by Mapbiomas Alerta, the state with the largest deforested area detected in 2021 was Pará – loss of 402,492 ha, which represents 24.3% of the total deforested in the country. In the period from 1985 to 2020, of the total deforested, 99% was converted to agricultural use, reveals a survey carried out by MapBiomas. According to the survey, of the total area of vegetation lost, 38 million hectares (86.3%) were turned into pasture, while 6 million hectares (13.6%) were used in agriculture, with soy being the main crop. When considering the accumulated in the period, Pará tops the list of states with the greatest reduction in forest areas, with a loss of 15.4 million hectares between 1985 and 2020. This correlation pattern between deforestation and cattle activity is also observed in most regions of Amazon Forest frontier. Therefore, the most likely scenario for the project area, in the absence of the project activities, is option 3 (Illegal deforestation for cattle raising and agriculture purposes or simply for land grabbing and real estate speculation). Even considering several applicable laws that

mandate forest conservation, the current political and economic context, as mentioned above, suggests a systematic lack of enforcement of applicable laws and regulations.

Table 31 – Accumulated deforestation, deforestation increment and forest cover by municipality.

Municipalities	Area (km²)	Accumulated deforestation until 2021 (Km²)	Increment of Deforestation last two years (km²)	Forest cover 2021 (Km²)
Paragominas (PA)	19,465.00	8,869.0 (45.56%)	31.6 (0.16%)	9,293.0 (47.74%)
Rondon do Pará (PA)	8,286.00	5,703.4 (68.83%)	35.1 (0.42%)	2,502.1 (30.20%)
Ulianópolis (PA)	5,122.00	3,697.7 (72.19%)	75.5 (1.47%)	1,419.4 (27.71%)
Dom Eliseu (PA)	5,296.00	3,583.3 (67.66%)	43.6 (0.82%)	1,535.3 (28.99%)
Goianésia do Pará (PA)	7,048.00	4,006.9 (56.85%)	29.1 (0.41%)	2,543.8 (36.09%)
Tomé-Açu (PA)	5,169.00	3,060.6 (59.21%)	23.1 (0.45%)	2,076.3 (40.17%)
Ipixuna do Pará (PA)	5,245.00	2,847.1 (54.28%)	29.8 (0.57%)	2,327.2 (44.37%)

The histograms presented below illustrate the dynamics of historical data on accumulated deforestation versus cattle herd for the 7 project municipalities: Paragominas, Rondon do Pará, Goianésia do Pará, Ulianópolis, Dom Eliseu, Tomé-Açu and Ipixuna do Pará. Highlight for the municipality of Ulianópolis, today considered the main financial center of the state of Pará when it comes to agribusiness, where the largest cattle producers in the region are located. The municipality contributes with the largest agro GDP in southeastern Pará and is the first in the deforestation ranking, having surpassed the mark of 250 km² deforested in 2021. The municipalities of Ipixuna do Pará and Tomé Açu maintained a more balanced dynamic between the deforestation rate and the increase in livestock.

Figure 35 – Deforestation (Km²) and Head of Cattle in the seven Municipalities of the Project (IBGE).

3.1.5.2 STEP 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method.

Considering that the VCS AFOLU grouped project generates no financial or economic benefits other than VCS related income, the VT0001 v.3 states that the simple cost analysis (Option I) must be used.

Sub-step 2b. – Option I. Apply simple cost analysis.

Considering that project activity cannot be associated to financial revenues, the simple cost analysis (option I) was chosen.

Despite the economic potential of non-timber forest products, landowners in the region do not make use of this potential for several reasons. The most important is the regional economic model, strongly based on livestock and agribusiness, and the lack of a structured market that guarantees flow and good prices. In addition, the lack of research for the use and processing methods still demands a lot of work. Rare are the no-timber forest products in large quantities and generate considerable values, such as açaí and Brazil nuts, which together in 2021 generated almost R$6,5 million reais in the main municipalities of the project's micro-region (IBGE, 2021). In general, very little is known about the forest´s potential for food, medicine, fiber, oils and extracts. Despite the enormous known variety of species with non-timber economic potential, the lack of investment in research, mapping of individuals, storage and processing techniques, logistical restrictions and technical assistance, added to a still incipient consumer market, means that many species of flora, with the possibility of generating alternative income for families, is not commercially exploited. On the other hand, logging, charcoal and livestock activities end up consolidating themselves as the main activities associated to deforestation, since all 3 have a well-consolidated market and technological packages. In the case of livestock activity, in addition to the widespread culture and structured market with good liquidity, it also has a series of incentives and financing lines. Thus, in the scenario with the project, where activities are implemented to reduce illegal deforestation and promote the maintenance of Legal Reserve areas, is not plausible to be associated with any source of income, other than that arising from the sale of reduced emissions credits (VCU).

Finally, when we analyze the only products from extractivism that have any relevance in the project region, the açaí and Brazil nut, it is worth mentioning that even in a scenario without a project, the Brazil nut trees and açaí trees will remain in the pasture.

3.1.5.3 STEP 3. Barrier analysis

As stated in the VT0001, barrier analysis may be performed instead of or as an extension of investment analysis. If this step is used, determine whether the proposed project activity faces barriers that:

a) Prevent the implementation of this type of proposed project activity without the revenue from the sale of GHG credits; and

b) Do not prevent the implementation of at least one of the alternative land use scenarios. Use the following sub-steps:

Sub-step 3a. Identify barriers that would prevent the implementation of the type of proposed project activity.

The following barriers were identified, as those able to prevent the project activities in a scenario without any kind of PES mechanism, as carbon credits (VCUs). If not alone, at least in conjunction, these barriers can prevent the implementation of the project activities.

Institutional barriers.

This refers to the risks related to changes in government policies or laws, as well as the weakening of enforcement of forest and land-use-related legislation. Despite the legal restriction on deforestation in RL and APP areas. In practice, this restriction depends on law enforcement, which in some political contexts ends up not happening, on the contrary, in recent years there has been a movement to dismantle the inspection apparatus motivated by political actors at different levels, including the federal executive branch, as presented in **Erro! Fonte de referência não encontrada.**.

Technological barriers.

Absence of facilities to convert, store and add value to production, in other words, this barrier refers to the lack of equipment and infrastructure for NTFP processing, as laboratories, bio factories, fruit dryers, warehouses, freezers, etc.

Barriers related to local tradition.

Despite some local people keeping some ethnobotanical knowledge, most communities face significant technical assistance restriction and do not practice most of this knowledge, that could lead to an income generation based in NTFP. In addition, this knowledge has not been taught to new generations in a systematic way.

Barriers due to social conditions and land-use practices.

This is assumed as a potential barrier, once the illegal practices assumed as the baseline scenario (illegal logging and illegal deforestation, followed by cattle raising, as well as crimes related to land disputes and land grabbing) are associated with a quick return, in addition of being widespread in the region. This, associated with the low-income profile of most population, ends up boosting the pressure over the forest remnants.

Barriers relating to markets, transport, and storage.

Firstly, the distance from project activities and undeveloped roads and infrastructure that incur large transport costs to the final customer[21], eroding the competitiveness and profitability of timber and non-timber products in the project area. And then, absence of facilities to convert, store and add value to production.

For documented evidence regarding the above-mentioned barriers, see the references in **Erro! Fonte de referência não encontrada.**.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternative land use scenarios (except the proposed project activity)

Institutional barriers

Although there are institutional restrictions (laws and inspection agencies) for opening new areas of forest for livestock activities, the field reality does not reflect this constraint. The systematic lack of resources, personnel and infrastructure, associated with corruption involving public servants, landowners, political, land grabbers and ranchers (please refer to **Erro! Fonte de referência não encontrada.**, lead to a scenario of little effectiveness of the command-and-control apparatus against deforestation, so that, institutional barriers, although they exist in theory, in practice they are unable to curb illegal deforestation for livestock occupation and grabbing purposes.

Technological barriers

The PP were not able to identify any technological barrier that could prevent the livestock activity in the project region, in the contrary, this activity, as this is conducted in the region, does not require much technological resources.

Barriers due to local ecological conditions

Livestock activity is very flexible and not affected by local ecological conditions. Only severe droughts are supposed to disturb the activity, but considering the high precipitation index in the region, it does not figure a barrier for the baseline activity.

Barriers related to local tradition.

The PP were not able to identify any local tradition barrier that could prevent livestock activity in the project region. Cattle raising activity is very common and widespread in the region, furthermore the cattle raising works as a high liquidity savings for locals.

Barriers due to social conditions and land-use practices

[21] Considering that most of the NFTP produced in the Project has its final costumer in big cities out of the Northern region. (e.g.: vegetal oils, cocoa, nuts and açaí)

The PP where not able to identify any social conditions or land-use practices barrier that could prevent the livestock or agriculture activity in the project region, once the cattle rising and agriculture activity is common and widespread in the region.

Barriers relating to markets, transport and storage

The livestock activity has good liquidity and despite market prices fluctuation, does not face real market restriction. Herd transportation and storage can be a problem due to the road's conditions. However, this does not figure a real restriction once the herd can be commercialized to local slaughterhouses and be transported by road in the dry season.

3.1.5.4 STEP 4. Common practice analysis

According to step 4, the project proponent must provide an analysis to which extent similar activities to the one proposed as the VCS AFOLU project activity have been implemented previously or are currently underway.

Similar activities are defined as that which are of similar scale, take place in a comparable environment, inter alia, with respect to the regulatory framework and are undertaken in the relevant geographical area, subject to further guidance by the underlying methodology. Other registered VCS AFOLU project activities shall not be included in this analysis.

Considering the above-mentioned criteria of "similar scale", "comparable environment" and "regulatory framework", a survey was carried out of all rural properties with a size between 1 and 200 fiscal modules in the reference region (19 municipalities) using the database of data made available by the SIGEF (Brazilian Land Planning System) and it was possible to detect that only 7.5% (116 properties) of rural properties comply with the Brazilian Forestry Legislation in terms of forest area greater than 80% of the property area. Of the 1545 rural properties surveyed, only 334 (21.6%) have forest cover greater than or equal to 50% of the property area (**Erro! Fonte de referência não encontrada.**). In other words, it is concluded that 92.5% of rural properties in the reference region do not meet this legal requirement, assuming that the proposed VCS AFOLU project activity is not the baseline and therefore additional scenario.

3.1.6 Methodology Deviations

Not applied. It wasn't made any methodology deviation to develop the Project Description.

3.2 Quantification of GHG Emission Reductions and Removals

3.2.1 Baseline Emissions

The procedures to quantify the baseline emissions are in accordance with the VM0015. In step 5 of the methodology, baseline activity data for forest to non-forest change was established (see baseline scenario, section 3.1.4).

This section presents the expected changes in carbon stocks by reservoir in the baseline scenario. Initial stocks are obtained by direct measurement in the project areas in the Paragominas region, through forest inventories, while stocks in the post-deforestation categories are taken from peer reviewed literature.

This section is based on step 6 of the VM0015, and the goal of this step is to estimate the baseline carbon stock changes and the baseline non-CO2 emissions from forest fires used to clear forests.

The estimation of the average carbon stocks was made for each LU/LC class. The Cauaxi REDD+ Grouped project collect in the field all the data necessary to estimate the carbon stocks in all the pools within the forest class considered in the project boundaries, all the procedures are based in Standard Operation Procedures and the detailed results can be obtained in the same forestry inventory report (see project Appendix VII – Carbon Pools Measures).

3.2.1.1 Initial Class – Ombrophilous dense forest

3.2.1.1.1 Aboveground Tree Biomass

Table 32 – Baseline carbon stock change in aboveground tree biomass (t CO2-e ha-1).

Stratum (i)	$C_{AB\_tree,bsl,i}$	$C_{AB\_tree,post,i}$	$\Delta C_{AB\_tree,i}$
D	543.76	0.1	543.66
Ap	306.48	0.1	306.38

Forest carbon stock in aboveground tree biomass (CAB_tree,bsl,i) is estimated through field measurements in sample fixed area plots employing representative random sampling per strata, following VM0015 requirements. Post-deforestation carbon stock in aboveground tree biomass (CAB_tree,post,i) is taken from peer reviewed literature (Silva Neto et al., 2012). For more information about the sampling design, allometric equations adopted and associated SOPs, see project Appendix VII – Carbon Pools Measures.

3.2.1.1.2 Belowground Tree Biomass

Forest carbon stock in belowground tree biomass (CBB_tree,bsl,i) is calculated through root-to-shoot ratios taken from peer reviewed literature (Silva et al., 2008). Post-deforestation carbon stock in belowground tree biomass (CBB_tree,post,i) is taken from peer reviewed literature (Silva Neto et al., 2012).

Table 33 – Baseline carbon stock change in belowground tree biomass (t CO2-e ha-1).

Stratum (i)	$C_{BB\_tree,bsl,i}$	$C_{BB\_tree,post,i}$	$\Delta C_{BB\_tree,i}$
D	168.57	0.02	168.55
Ap	95.01	0.02	94,99

3.2.1.1.3 Aboveground Non-Tree Biomass

Forest carbon stock in aboveground non-tree biomass (CAB_non-tree,bsl,i) is estimated according to peer reviewed literature (Nogueira et al., 2008). Palms and vines are considered to represent 1.9% and 3.4% of the aboveground tree biomass in dense tropical forests, respectively, and 8.6% and 10.7% of the aboveground tree biomass in open tropical forests, respectively. Post deforestation carbon stock in aboveground tree biomass (CAB_non-tree,post,i) is taken from peer reviewed literature (Silva Neto et al., 2012).

Table 34 – Baseline carbon stock change in aboveground non-tree biomass (t CO2-e ha-1)

Stratum (i)	$C_{AB\_non-tree,bsl,i}$	$C_{AB\_non-tree,post,i}$	$\Delta C_{AB\_non-tree,i}$
D	28.82	15	13.82
Ap	16.24	15	1.24

3.2.1.1.4 Belowground Non-Tree Biomass

Forest carbon stock in belowground non-tree biomass (CBB_tree,bsl,i) is calculated through root-to-shoot ratios taken from peer reviewed literature (IPCC 2006, VM0015). Post deforestation carbon stock in belowground tree biomass (CBB_non-tree,post,i) is taken from peer reviewed literature (Silva Neto et al., 2012).

Table 35 – Baseline carbon stock change in belowground non-tree biomass (t CO2-e ha-1).

Stratum (i)	$C_{BB\_non-tree,bsl,i}$	$C_{BB\_non-tree,post,i}$	$\Delta C_{BB\_non-tree,i}$
D	5.76	3	2.76
Ap	3.25	3	0.25

3.2.1.1.5 Deadwood

Forest carbon stock in dead wood (CDW,bsl,i) is estimated based on field measurements of fixed area plots, considering standing dead trees and lying dead wood, according to VM0015 criteria. Post-deforestation carbon stock in deadwood (CDW,post,i) is set as zero as the project area is expected to be systematically burned every year in the baseline scenario. For more information about the sampling design, allometric equations adopted and associated SOPs, refer to project Appendix VII – Carbon Pools Measures.

Table 36 – Baseline carbon stock change in deadwood (t CO2-e ha-1).

Stratum (i)	$C_{DW,bsl,i}$	$C_{DW,post,i}$	$\Delta C_{DW,i}$
D	39.03	-	39.03
Ap	31.74	-	31.74

3.2.1.1.6 Litter

Forest carbon stock in litter (CLI,bsl,i) is estimated based on field measurements of fixed area plots, according to VM0015 criteria. Post-deforestation carbon stock in litter (CLI,post,) is set as zero as the project area is expected to be systematically burned every year in the baseline scenario. For more information about the sampling design, allometric equations adopted and associated SOPs, see project Appendix VII – Carbon Pools Measures.

3.2.1.1.7 SOC

Forest carbon stock in soil organic carbon (CSOC,bsl,i) is estimated based on field measurements of fixed area plots, according to VM0015 criteria. Post-deforestation carbon stock in soil organic carbon (CSOC,PD-BSL,i,) is assumed to be the long-term average stocks on the land following deforestation, and calculated based on land-use factors according to VM0015 v1.0 criteria. For more information about the sampling design, allometric equations adopted and associated SOPs, see project Appendix VII – Carbon Pools Measures.

3.2.1.1.8 Wood Products

Not applicable.

3.2.1.2 Post-deforestation Class – Pasture

Carbon stock in pasture is estimated based on parameters from a peer reviewed international paper, in which applied the same proposal methodology of VM0015 – appendix 3: “Estimation of carbon stocks in soil organic carbon pool (Csoccl)” field data measurements in Paragominas region. Post-deforestation carbon stock from land-use changes to pasture is assumed to be the long-term average stocks in a period

of deforestation. For more information, detailed methodology, parameter tables and total sampling used in database, see project Appendix VII – Carbon Pools Measures.

3.2.2 Baseline carbon stock change in the project area

All the methodological approach to calculate this step is according with VM0015 section 6.1.3, since the Soil Organic Carbon pool was selected in the project boundary the calculation method used was the number two. The baseline carbon stock change in the project area are presented from Table 37 to Table 44.

Table 37 – Baseline carbon stock change in the above-ground biomass in the project area

Project year t	Activity data per category x Carbon stock change factor for above-ground biomass in the project area		Total baseline carbon stock change in the project area		Activity data per category x Carbon stock change factor for above-ground biomass in the project area		Total baseline carbon stock change in the project area	
	IDct = 1		annual	Cumulative	*IDct* = 2		annual	Cumulative
	$ABSLPA_{ct.t}$	$\Delta Cab_{ct.t}$	$\Delta CabBSLPA_t$	$\Delta CabBSLPA$	$ABSLPA_{ct.t}$	$\Delta Cab_{ct.t}$	$\Delta CabBSLPA_t$	$\Delta CabBSLPA$
	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2022	1,743.6	524.8	915,043	915,043	1,193.2	287.5	343,073	343,073
2023	1,171.1	524.8	614,568	1,529,611	599.4	287.5	172,339	515,412
2024	1,331.5	524.8	698,792	2,228,402	407.7	287.5	117,210	632,622
2025	899.7	524.8	472,175	2,700,577	184.1	287.5	52,921	685,543
2026	1,257.7	524.8	660,030	3,360,607	206.1	287.5	59,249	744,792
2027	1,047.7	524.8	549,848	3,910,454	126.7	287.5	36,428	781,220
2028	738.1	524.8	387,358	4,297,812	69.1	287.5	19,864	801,084
2029	1,183.9	524.8	621,327	4,919,139	86.0	287.5	24,733	825,817
2030	812.8	524.8	426,554	5,345,693	49.5	287.5	14,222	840,038
2031	890.8	524.8	467,499	5,813,191	40.9	287.5	11,764	851,802

Table 38 – Baseline carbon stock change in the below-ground biomass in the project area

Project year t	Activity data per category x Carbon stock change factor for below-ground biomass in the project area		Total baseline carbon stock change in the project area		Activity data per category x Carbon stock change factor for below-ground biomass in the project area		Total baseline carbon stock change in the project area	
	IDct = 1		annual	Cumulative	*IDct* = 2		annual	Cumulative
	$ABSLPA_{ct,t}$	$\Delta Cbb_{ct,t}$	$\Delta CbbBSLPA_t$	$\Delta CbbBSLPA$	$ABSLPA_{ct,t}$	$\Delta Cbb_{ct,t}$	$\Delta CbbBSLPA_t$	$\Delta CbbBSLPA$
	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2022	1,743.6	84.3	147,054	147,054	1,193.2	10.8	12,866	12,866
2023	1,171.1	84.3	98,766	245,820	599.4	10.8	6,463	19,329
2024	1,331.5	84.3	112,301	358,121	407.7	10.8	4,396	23,725
2025	899.7	84.3	75,882	434,003	184.1	10.8	1,985	25,709
2026	1,257.7	84.3	106,072	540,074	206.1	10.8	2,222	27,931
2027	1,047.7	84.3	88,365	628,439	126.7	10.8	1,366	29,297
2028	738.1	84.3	62,251	690,690	69.1	10.8	745	30,042
2029	1,183.9	84.3	99,852	790,542	86.0	10.8	928	30,970
2030	812.8	84.3	68,550	859,092	49.5	10.8	533	31,503
2031	890.8	84.3	75,131	934,223	40.9	10.8	441	31,944

Table 39 – Baseline carbon stock change in the above-ground non tree biomass in the project area

Project year t	Activity data per category x Carbon stock change factor for above-ground non tree biomass in the project area		Total baseline carbon stock change in the project area		Activity data per category x Carbon stock change factor for above-ground non tree biomass in the project area		Total baseline carbon stock change in the project area	
	IDct = 1		annual	Cumulative	*IDct* = 2		annual	Cumulative
	ABSLP Act,t	ΔCabnon tree_ct,t	ΔCab,nontree, BSLPAt	ΔCab_nontree_ BSLPA	ABSLP Act,t	ΔCabnon tree_ct,t	ΔCab,nont ree,BSLPA t	ΔCab_nontree_BS LPA
	ha	tCO2-e ha-1	tCO2-e	tCO2-e	ha	tCO2-e ha-1	tCO2-e	tCO2-e
2022	1,743.6	28.8	50,250	50,250	1,193.2	16.2	19,382	19,382
2023	1,171.1	28.8	83,999	134,248	599.4	16.2	51,662	71,044
2024	1,331.5	28.8	122,373	256,621	407.7	16.2	63,410	134,454
2025	899.7	28.8	98,053	354,673	184.1	16.2	34,327	168,781
2026	1,257.7	28.8	100,549	455,222	206.1	16.2	22,992	191,773
2027	1,047.7	28.8	92,370	547,592	126.7	16.2	14,895	206,668
2028	738.1	28.8	87,712	635,304	69.1	16.2	11,581	218,249
2029	1,183.9	28.8	85,587	720,891	86.0	16.2	8,121	226,370
2030	812.8	28.8	78,816	799,707	49.5	16.2	5,896	232,266
2031	890.8	28.8	83,217	882,924	40.9	16.2	5,084	237,349

Table 40 – Baseline carbon stock change in the below-ground non tree biomass in the project area

Project year t	Activity data per category x Carbon stock change factor for below-ground non tree biomass in the project area		Total baseline carbon stock change in the project area		Activity data per category x Carbon stock change factor for below-ground non tree biomass in the project area		Total baseline carbon stock change in the project area	
	IDct = 1		annual	Cumulative	*IDct* = 2		annual	Cumulative
	ABSLPAct,t	ΔCbb_nontree_ct,t	ΔCbb,nontree,BSLPAt	ΔCbb,nontree,BSLPA	ABSLPAct,t	ΔCbb_nontree_ct,t	ΔCbb,nontree,BSLPAt	ΔCbb,nontree,BSLPA
	ha	tCO2-e ha-1	tCO2-e	tCO2-e	ha	tCO2-e ha-1	tCO2-e	tCO2-e
2022	1,743.6	5.8	10,050	10,050	1,193.2	3.2	3,876	3,876
2023	1,171.1	5.8	6,750	16,800	599.4	3.2	1,947	5,824
2024	1,331.5	5.8	7,675	24,475	407.7	3.2	1,324	7,148
2025	899.7	5.8	5,186	29,660	184.1	3.2	598	7,746
2026	1,257.7	5.8	7,249	36,910	206.1	3.2	669	8,415
2027	1,047.7	5.8	6,039	42,948	126.7	3.2	412	8,827
2028	738.1	5.8	4,254	47,203	69.1	3.2	224	9,051
2029	1,183.9	5.8	6,824	54,027	86.0	3.2	279	9,331
2030	812.8	5.8	4,685	58,712	49.5	3.2	161	9,492
2031	890.8	5.8	5,135	63,846	40.9	3.2	133	9,625

Table 41 – Baseline carbon stock change in the Litter in the project area

Project year t	Activity data per category x Carbon stock change factor for litter in the project area		Total baseline carbon stock change in the project area		Activity data per category x Carbon stock change factor for litter in the project area		Total baseline carbon stock change in the project area	
	IDct = 1		annual	Cumulative	*IDct* = 2		annual	Cumulative
	ABSLPAct,t	ΔCLict,t	ΔCliBSLPAt	ΔCliBSLPA	ABSLPAct,t	ΔCLict,t	ΔCliBSLPAt	ΔCliBSLPA
	ha	tCO2-e ha-1	tCO2-e	tCO2-e	ha	tCO2-e ha-1	tCO2-e	tCO2-e
2022	1,743.6	22.29	38,872	38,872	1,193.2	12.57	14,994	14,994
2023	1,171.1	22.29	26,108	64,980	599.4	12.57	7,532	22,526
2024	1,331.5	22.29	29,686	94,666	407.7	12.57	5,123	27,648
2025	899.7	22.29	20,059	114,724	184.1	12.57	2,313	29,961
2026	1,257.7	22.29	28,039	142,763	206.1	12.57	2,589	32,550
2027	1,047.7	22.29	23,358	166,122	126.7	12.57	1,592	34,142
2028	738.1	22.29	16,455	182,577	69.1	12.57	868	35,010
2029	1,183.9	22.29	26,395	208,972	86.0	12.57	1,081	36,091
2030	812.8	22.29	18,121	227,092	49.5	12.57	622	36,713
2031	890.8	22.29	19,860	246,952	40.9	12.57	514	37,227

Table 42 – Baseline carbon stock change in the Soil Organic Carbon in the project area

Project Year t	Activity data per category x Carbon stock change factor for SOC in the project area		Total baseline carbon stock change in the project area		Activity data per category x Carbon stock change factor for SOC in the project area		Total baseline carbon stock change in the project area	
	IDct = 1		annual	Cumulative	*IDct* = 2		annual	Cumulative
	ABSLPAct,t	ΔCLict,t	ΔCliBSLPAt	ΔCliBSLPA	ABSLPAct,t	ΔCLict,t	ΔCliBSLPAt	ΔCliBSLPA
	ha	tCO2-e ha-1	tCO2-e	tCO2-e	ha	tCO2-e ha-1	tCO2-e	tCO2-e
2022	1,743.6	1.84	3,212	3,212	1,193.2	29.71	35,449	35,449
2023	1,171.1	1.84	2,157	5,369	599.4	29.71	17,807	53,256
2024	1,331.5	1.84	2,453	7,822	407.7	29.71	12,111	65,367
2025	899.7	1.84	1,657	9,479	184.1	29.71	5,468	70,836
2026	1,257.7	1.84	2,317	11,796	206.1	29.71	6,122	76,958
2027	1,047.7	1.84	1,930	13,726	126.7	29.71	3,764	80,722
2028	738.1	1.84	1,360	15,086	69.1	29.71	2,052	82,774
2029	1,183.9	1.84	2,181	17,267	86.0	29.71	2,556	85,330
2030	812.8	1.84	1,497	18,764	49.5	29.71	1,469	86,799
2031	890.8	1.84	1,641	20,405	40.9	29.71	1,216	88,015

Table 43 – Baseline carbon stock change in the Dead Wood in the project area

Project Year t	Activity data per category x Carbon stock change factor for dead wood biomass in the project area		Total baseline carbon stock change in the project area		Activity data per category x Carbon stock change factor for dead wood biomass in the project area		Total baseline carbon stock change in the project area	
	IDct = 1		annual	Cumulative	*IDct* = 2		annual	Cumulative
	DWSLPAct,t	ΔCdw,ct,t	ΔCdwBSLPAt	ΔCdwBSLPA	DWSLPAct,t	ΔCdw,ct,t	ΔCdwBSLPAt	ΔCdwBSLPA
	ha	tCO2-e ha-1	tCO2-e	tCO2-e	ha	tCO2-e ha-1	tCO2-e	tCO2-e
2022	1,743.6	30.19	52,632	52,632	1,193.2	22.90	27,319	27,319
2023	1,171.1	30.19	35,349	87,981	599.4	22.90	13,724	41,043
2024	1,331.5	30.19	40,193	128,174	407.7	22.90	9,334	50,376
2025	899.7	30.19	27,159	155,333	184.1	22.90	4,214	54,591
2026	1,257.7	30.19	37,964	193,297	206.1	22.90	4,718	59,309
2027	1,047.7	30.19	31,626	224,923	126.7	22.90	2,901	62,209
2028	738.1	30.19	22,280	247,203	69.1	22.90	1,582	63,791
2029	1,183.9	30.19	35,738	282,941	86.0	22.90	1,970	65,761
2030	812.8	30.19	24,535	307,476	49.5	22.90	1,132	66,893
2031	890.8	30.19	26,890	334,366	40.9	22.90	937	67,830

Table 44 – Baseline carbon stock changes in all carbon pools included in the project boundary.

Project year	Baseline carbon stock changes	
	annual	cumulative
	$\Delta CBSLPA_t$	$\Delta CBSLPA$
	tCO_2-e	tCO_2-e
2022	1,674,071.96	1,674,071.96
2023	1,139,169.92	2,813,241.88
2024	1,226,379.57	4,039,621.46
2025	801,995.91	4,841,617.37
2026	1,040,780.04	5,882,397.41
2027	854,892.87	6,737,290.28
2028	618,586.84	7,355,877.13
2029	917,570.67	8,273,447.79
2030	646,792.15	8,920,239.95
2031	699,459.96	9,619,699.90

3.2.2.1 Baseline non-CO2 emissions from forest fires

We calculated the non-CO2 emissions using the methodology described in section 6 of VM0015. More details can be found in Appendix VII – Carbon Pools Measures (Section “non-CO2 emissions from forest fires”). Below we present Tables 45 and 46 related to non-CO2 emissions.

Table 45 – Total baseline non-CO2 emissions from forest fire in the project area (Table 24 of VM0015).

	Emissions of non-CO2 gasses from baseline forest fires				Total baseline non-CO2 emissions from forest fire in the project area	
	ID icl = 1		ID icl = 2			
Project Year t	ABSLPA icl,t	EBBBSLtot icl	ABSLPA icl,t	EBBBSLtot icl	Annual EBBBSLPAt	Cumulatiuve EBBBSLPA
	ha	CO2e ha-1	ha	CO2e ha-1	tCO2e	tCO2e
1	1743,611255	4021,41	1193,22	11,85	2936,83	2936,83
2	1171,057914	2700,89	599,39961	5,95	1770,46	4707,29
3	1331,546086	3071,04	407,65945	4,05	1739,21	6446,49
4	899,7277935	2075,10	184,06069	1,83	1083,79	7530,28
5	1257,684764	2900,69	206,06808	2,05	1463,75	8994,03
6	1047,733301	2416,46	126,69774	1,26	1174,43	10168,47
7	738,108844	1702,35	69,085989	0,69	807,19	10975,66
8	1183,936785	2730,60	86,02279	0,85	1269,96	12245,62
9	812,7969247	1874,61	49,463218	0,49	862,26	13107,88
10	890,8178904	2054,56	40,915499	0,41	931,73	14039,61

Table 46 – Parameters used to calculate non-CO2 emissions from forest fires (Table 23 of VM0015).

Initial Forest Class		Parameters																
IDcl	Name	% Fburnt icl	tCO2e ha-1 Cab	tCO2e ha-1 Cdw	tCO2e ha-1 Cl	% Pburnt ab, icl	% Pburnt dw, icl	% Pburnt l, icl	% CE ab, icl	% CE dw, icl	% CE l, icl	tCO2e ha-1 ECO2-ab	tCO2e ha-1 ECO2-dw	tCO2e ha-1 ECO2-l	tCO2e ha-1 EBBCO2-tot	tCO2e ha-1 EBBN2O icl	tCO2e ha-1 EBBCH4 icl	tCO2e ha-1 EBBtot icl
1	Dense Forest	13,56%	572,58	39,03	22,29	52,3%	39,7%	99,7%	50%	50%	50%	20,290532	1,052	1,507	22,85	0,213	2,094	2,306
2	Second growth forest	13,56%	322,72	31,74	12,57	52,3%	39,7%	99,7%	50%	50%	50%	11,436432	0,855	0,85	13,14	0,01	0	0,01

3.2.3 Project Emissions

According to the VM0015, future carbon stock changes and non-CO2 emissions from forest fires under the project scenario must be estimated *ex-ante* to assist in guiding the optimal implementation of emission reduction measures and to allow reasonable projections of revenue to be made. In this regard, two approaches are listed in the methodology:

- Planned activities within the project area.
- Unplanned deforestation that cannot be avoided.

3.2.3.1 Ex ante estimation of actual carbon stock changes due to planned activities

As per this section of methodology, certain areas of forest within the project area might be subject to project activities that will change the carbon stocks of these areas compared to the baseline, like:

- Planned deforestation to build project infrastructure,
- Planned degradation by timber logging, fuel-wood collection, etc.
- Forest protection, which will lead to carbon sequestration in forest areas that at project start are below their carbon stock potential.

In addition, the methodology states that, if the project activity generates a significant decrease in carbon stocks during the fixed baseline period, the carbon stock change must be estimated *ex ante* and measured *ex post*. If the decrease is not significant, it must not be accounted for, and *ex-post* monitoring will not be required.

Despite the environmental law allowing the use of wood for house construction, canoes, or other self-supply wood necessity, none of these activities are supposed to exceed, in a project scenario, the demand that would occur under the baseline scenario. In fact, considering that the REDD+ project brings governance to a project area, it's expected that all the logging to supply the above-mentioned demand, that would occur with or without the implementation of the REDD project, in a project scenario, must happen in a sustainable basis according to the law requirements. This assumption is based in the fact that, if the landowner does not receive the resources from the VCU´s commercialization, most of the environmental monitoring and projects of sustainable income generation in the project zone, that are part of the REDD project, would not be implemented, resulting in more degradation for logging and deforestation for cattle rising and commercial agriculture.

Considering the scenario mentioned above, the BRC understands that the project activity will not generate more deforestation or degradation, and thus GHG emission, if compared to the baseline scenario. Also, REDD+ project does not consider any kind of forest disturbance to build infrastructure, thus the project emission due to planned activities within the project area does not need to be estimated *ex ante,* nor measured *ex post.*

In addition, the Cauaxi REDD+ project has opted to does not account or monitor the carbon change in forest that was in a disturbed condition prior to the project start date, (with the potential to remove carbon during the regeneration process), following a conservative approach.

3.2.3.2 *Ex ante estimation of carbon stock changes due to unavoidable unplanned deforestation within the project area*

According to the VM0015, to allow *ex ante* projections to be made, the project proponent shall make a conservative assumption about the effectiveness of the proposed project activities and estimate an Effectiveness Index (*EI*) between 0 (no effectiveness) and 1 (maximum effectiveness). The estimated value of *EI* is used to multiply the baseline projections by the factor (1 - *EI*) and the result shall be considered the *ex-ante* estimated emissions from unplanned deforestation in the project case.

$$\Delta CUDdPA_t = \Delta CBSL_t * (1 - EI)$$

Where:

ΔCUDdPAt	Total *ex-ante* actual carbon stock change due to avoided unplanned deforestation at year *t* in the project area; tCO2-e
ΔCBSLt	Total baseline carbon stock change at year *t* in the project area; tCO2-e
EI	*Ex ante* estimated Effectiveness Index; % **(70%)**
t	1, 2, 3 … *T,* a year of the proposed project crediting period; dimensionless

The project proponent believes that under the REDD project governance it will be possible to reduce in 70% the deforestation in the project area compared to the baseline scenario, therefore the *ex-ante* Effectiveness Index (*EI*) adopted for the first baseline period is 0.7.

Table 47 – Ex ante estimated net carbon stock change in the project area under the project scenario

Project year	Total carbon stock decrease due to planned logging activities		Total carbon stock increase due to planned logging activities		Total carbon stock decrease due to unavoided unplanned deforestation		Total carbon stock change in the project case	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CPLdPA_t$	$\Delta CPLdPA$	$\Delta CPLiPA_t$	$\Delta CPLiPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$
	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	0	0	0	502.222	502.222	502.222	502.222
2023	0	0	0	0	341.751	843.973	341.751	843.973
2024	0	0	0	0	367.914	1.211.886	367.914	1.211.886
2025	0	0	0	0	240.599	1.452.485	240.599	1.452.485
2026	0	0	0	0	312.234	1.764.719	312.234	1.764.719
2027	0	0	0	0	256.468	2.021.187	256.468	2.021.187
2028	0	0	0	0	185.576	2.206.763	185.576	2.206.763
2029	0	0	0	0	275.271	2.482.034	275.271	2.482.034
2030	0	0	0	0	194.038	2.676.072	194.038	2.676.072
2031	0	0	0	0	209.838	2.885.910	209.838	2.885.910

3.2.4 Leakage

According to the VM0015, two sources of leakage are considered in this methodology and must be addressed:

- Decrease in carbon stocks and increase in GHG emissions associated with leakage prevention measures.
- Decrease in carbon stocks and increase in GHG emissions associated with activity displacement leakage.

In the first case, the BRCs commits to invest part of the annual budget generated through the sales of VCU in mitigation measures to guarantee that the offsite carbon stocks will not decrease. Such investments will reinforce a holistic approach and strategy, e.g., rural technical assistance, leadership capacity-building, social empowerment, education etc. Focusing on supporting leakage management areas through the intensification of sustainable territorial management and monitoring illegal practices (logging, grazing, land grabbing and mining) in the leakage belt.

The second source of leakage considered by the methodology refers to activities that cause deforestation within the project area in the baseline scenario and could be displaced outside the project boundary due to the implementation of the AUD project activity. VM0015 states that if carbon stocks in the leakage belt area decrease more during project implementation than projected in the baseline case, this will be an indication that leakage due to displacement of baseline activities has occurred.

Notwithstanding, it is not expected that the implementation of project activities will generate any offsite decreases in carbon stocks. In fact, the project implementation is expected to additionally reduce deforestation outside the project boundaries, as compared to the baseline scenario. For this reason, it was assumed that the implementation of the Cauaxi REDD+ Project will not result in negative leakage, but rather a "positive leakage" since there it's also expected to have a reduction in deforestation rates outside of the project area.

According to VM0015, section 8.2, for the leakage ex-ante calculation, if deforestation agents do not participate in leakage prevention activities and project activities, the Displacement Factor shall be 100%. Where leakage prevention activities are implemented, the factor shall be equal to the proportion of the baseline agents estimated to be given the opportunity to participate in leakage prevention activities and project activities.

The project foresees that 50% of the potential leakage agents are contemplated, or will be given the opportunity, to participate in the leak mitigation activities, as per the initiative developed in the leakage management areas, therefore the "Displacement Leakage Factor" (DLF) assumed for ex-ante leakage calculations is 0.5.

Table 48 – Ex ante estimated leakage due to activity displacement

Year	Total ex ante estimated decrease in carbon stocks due to displaced deforestation		Total ex ante estimated increase in GHG emissions due to displaced forest fires	
	annual	cumulative	annual	cumulative
	∆CADLKt	∆CADLK	EADLKt	EADLK
	tCO2-e	tCO2-e	tCO2-e	tCO2-e
2022	251,111	251,111	0	0
2023	170,875	421,986	0	0
2024	183,957	605,943	0	0
2025	120,299	726,243	0	0
2026	156,117	882,360	0	0
2027	128,234	1,010,594	0	0
2028	92,788	1,103,382	0	0
2029	137,636	1,241,017	0	0
2030	97,019	1,338,036	0	0
2031	104,919	1,442,955	0	0

3.2.5 Net GHG Emission Reductions and Removals

According to the VM0015 v1.1 net anthropogenic GHG emission reduction of the proposed AUD project activity is calculated as follows:

$$\Delta REDD_t = (\Delta CBSLPA_t + EBBBSLPA_t) - (\Delta CPSPA_t + EBBPSPA_t) - (\Delta CLK_t + ELK_t)$$

Where:

∆REDDt	*Ex ante* estimated net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year *t*; tCO2e
∆CBSLPAt	Sum of baseline carbon stock changes in the project area at year *t*; tCO2e
Note:	The absolute values of $CBSLPA_t$ shall be used in equation 19.

EBBBSLPAt	Sum of baseline emissions from biomass burning in the project area at year *t*; tCO_2e
∆CPSPAt	Sum of *ex ante* estimated actual carbon stock changes in the project area at year *t*; tCO_2e
Note:	If $CPSPA_t$ represents a net increase in carbon stocks, a negative sign before the absolute value of $CPSPA_t$ shall be used. If $CPSPA_t$ represents a net decrease, the positive sign shall be used

EBBPSPA	Sum of (*ex-ante* estimated) actual emissions from biomass burning in the project area at year *t*; tCO_2e
CLKt	Sum of *ex ante* estimated leakage net carbon stock changes at year *t*; tCO_2e
Note:	If the cumulative sum of CLK_t within a fixed baseline period is > *0,* CLK_t shall be set to zero.

***ELK*$_t$**	Sum of *ex ante* estimated leakage emissions at year *t*; tCO_2e 1, 2, 3 … *T,* a year of the proposed project crediting period; dimensionless

The project emission reduction is calculated based in the baseline land use change model and biomass carbon stock per hectare. For additional information, please refer section 3.4 and 4.1, above. For project emission, please refer to section 4.2. for information regarding leakage emission and leakage management please refer to section 4.3.

Table 49 – Ex ante estimated net anthropogenic GHG emission reductions

Year	Estimated baseline emissions (tCO_2e)	Estimated project emissions (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions (tCO_2e)
2022	1,677,009	503,103	251,111	922,795
2023	1,140,940	343,521	170,875	626,543
2024	1,228,119	369,653	183,957	674,509
2025	803,080	241,683	120,299	441,098
2026	1,042,244	313,698	156,117	572,429
2027	856,067	257,642	128,234	470,191
2028	619,394	186,383	92,788	340,223
2029	918,841	276,541	137,636	504,664
2030	647,654	194,900	97,019	355,736
2031	700,392	210,770	104,919	384,703
Total	9,633,740	2,897,894	1,442,955	**5,292,891**
Average	963,374	289,789	144,295	**529,289**

Table 50 – Ex ante Voluntary Carbon Units (VCUt)

Project year	Ex ante net anthropogenic GHG emission reductions		Ex ante VCUs tradable		Ex ante buffer credits	
	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta REDD_t$	$\Delta REDD$	VCU_t	VCU	VBC_t	VBC
	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	922,795	922,795	830,516	830,516	92,280	92,280
2023	626,543	1,549,339	563,889	1,394,405	62,654	154,934
2024	674,509	2,223,848	607,058	2,001,463	67,451	222,385
2025	441,098	2,664,945	396,988	2,398,451	44,110	266,495
2026	572,429	3,237,374	515,186	2,913,637	57,243	323,737
2027	470,191	3,707,565	423,172	3,336,809	47,019	370,757
2028	340,223	4,047,788	306,200	3,643,009	34,022	404,779
2029	504,664	4,552,452	454,197	4,097,207	50,466	455,245
2030	355,736	4,908,188	320,162	4,417,369	35,574	490,819
2031	384,703	5,292,891	346,233	4,763,602	38,470	529,289

3.3 Monitoring

3.3.1 Data and Parameters Available at Validation

Data / Parameter	ABSLRRi.t
Data unit	ha
Description	Annual area of baseline deforestation in stratum i within the reference region at a year t; ha yr-1
Source of data	Land Use Change Model
Value applied	See Table 26 , section 3.1.4
Justification of choice of data or description of measurement methods and procedures applied	This parameter was estimated using the Land Change Modeler (LCM), the model was calibrated using the land use map of 2017 and 2019 and, in the validation, process was used the 2021 year. See more details in section 3.1.4
Purpose of data	Determination of baseline scenario
Comments	Not applicable

Data / Parameter	ABSLPAi.t
Data unit	ha
Description	Annual area of baseline deforestation in stratum i within the project area at a year t; ha yr-1
Source of data	Land Use Change Model
Value applied	See Table 27, section 3.1.4
Justification of choice of data or description of measurement methods and procedures applied	This parameter was estimated using the Land Change Modeler (LCM), the model was calibrated using the land use map of 2017 and 2019 and, in the validation, process was used the 2021 year. See more details in section 3.1.4
Purpose of data	Determination of baseline scenario
Comments	Not applicable

Data / Parameter	ABSLLKi.t
Data unit	ha
Description	Annual area of baseline deforestation in stratum i within the leakage belt at a year t; ha yr-1
Source of data	Land Use Change Model
Value applied	See Table 28, section 3.1.4
Justification of choice of data or description of measurement methods and procedures applied	This parameter was estimated using the Land Change Modeler (LCM). the model was calibrated using the land use map of 2017 and 2019 and. in the validation. process was used the 2021 year. See more details in section 3.1.4
Purpose of data	Determination of baseline scenario
Comments	Not applicable

Data / Parameter	Cabt,icl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the above-ground tree biomass carbon pool of initial forest class icl;
Source of data	Forest inventory with field data and direct measurement. The value is estimated using sample fixed area plots and regional allometric equation for tree components. For more information, please refer to project forestry inventory Appendix VII – Carbon Pools Measures.
Value applied	See Table 32, section 3.2.1
Justification of choice of data or description of measurement methods and procedures applied	Forest inventory was performed near the project area. For more information, please refer to project Appendix VII – Carbon Pools Measures.
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cabt,icl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the above-ground non-tree biomass carbon pool of initial forest class icl;
Source of data	Estimated based on carbon stock in aboveground biomass in trees in Cabt,icl and previously published data (Nogueira et al., 2008)
Value applied	See Table 34, section 3.2.1
Justification of choice of data or description of measurement methods and procedures applied	Values applied represents the percentage of the carbon stock in aboveground non-tree biomass found by Nogueira et al. (2008) for the same forest types in the same region.
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cbbt,icl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the below-ground tree biomass carbon pool of initial forest class icl;
Source of data	Estimated based on carbon stock in above-ground biomass in trees in Cabt,icl and previously root-shoot ratio published by Nogueira et al., 2008. Dense Forests = 0.31
Value applied	See Table 33, section 3.2.1
Justification of choice of data or description of measurement methods and procedures applied	Eco-region-specific root to shoot ratio is used to improve accuracy.
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cbbnt,icl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the below-ground non-tree biomass carbon pool of initial forest class icl;
Source of data	Estimated based on carbon stock in above-ground biomass in trees in Cabt,icl and previously root-shoot ratio published by IPCC (2006)
Value applied	See Table 35, section 3.2.1
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cdw,icl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the dead wood carbon pool of initial forest class icl;
Source of data	Forest inventory with field data and direct measurement. For more information. please refer to forestry inventory project Appendix VII – Carbon Pools Measures.
Value applied	See Table 36, section 3.2.1
Justification of choice of data or description of measurement methods and procedures applied	Forest inventory was performed near the project area. For more information, please refer to project Appendix VII – Carbon Pools Measures.
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cl.icl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the litter carbon pool of initial forest class icl;
Source of data	Local field data collected from each of the forest inventory sample plots
Value applied	Please refer to Section 3.2.1.1.6 – Litter
Justification of choice of data or description of measurement methods and procedures applied	Local data collected nearby the project area. For more information, please refer to project Appendix VII – Carbon Pools Measures.
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Csoc,icl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the soil organic carbon pool of initial forest class icl;
Source of data	Local field data collected from each of the forest inventory sample plots. For more information refer to project forestry inventory Appendix VII – Carbon Pools Measures.
Value applied	Please refer to Section 3.2.1.1.7 – SOC
Justification of choice of data or description of measurement methods and procedures applied	Local data collected nearby the project area. For more information. please refer to project Appendix VII – Carbon Pools Measures.
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cabt,fcl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the above-ground tree biomass carbon pool of post deforestation class fcl;
Source of data	Secondary data from peer-reviewed literature (Silva Neto et al., 2012).
Value applied	See the values applied in section 3.2.1.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cabnt,fcl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the above-ground non tree biomass carbon pool of post deforestation class fcl;
Source of data	Secondary data from peer-reviewed literature (Silva Neto et al., 2012).
Value applied	See Table 39 in Section 3.2.2.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cabnt,fcl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the below-ground tree biomass carbon pool of post deforestation class fcl;
Source of data	Secondary data from peer-reviewed literature (Silva Neto et al., 2012).
Value applied	See the values applied in section 3.2.2.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cbbnt,fcl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the below-ground non tree biomass carbon pool of post deforestation class fcl;
Source of data	Secondary data from peer-reviewed literature (Silva Neto et al., 2012).
Value applied	See Table 40 in section 3.2.2
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cdw,fcl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the dead wood carbon pool of post deforestation class fcl;
Source of data	-
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	In the post deforestation class this carbon pool does not exist.
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Cl,fcl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the litter carbon pool of post deforestation class fcl;
Source of data	-
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	In the post deforestation class this carbon pool does not exist
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	Csoc,fcl
Data unit	tCO2-e ha-1
Description	Average carbon stock per hectare in the soil organic carbon pool of post deforestation class fcl;
Source of data	Local field data collected from post-deforestation (pasture) areas within the project zone. For more information refer to project report soil collect.
Value applied	See Table 42, section 3.2.2
Justification of choice of data or description of measurement methods and procedures applied	Local data collected nearby the project area. For more information, please refer to Appendix VII – Carbon Pools Measures
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	CFTREE
Data unit	t C (t d.m.)-1
Description	Carbon fraction of tree biomass;
Source of data	Nogueira et al. 2008
Value applied	0.485
Justification of choice of data or description of measurement methods and procedures applied	Eco-region-specific carbon fraction is used to improve accuracy.
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	EBBtoticl,t
Data unit	tCO2-e ha-1
Description	Total GHG emission from biomass burning in forest class icl at year t;
Source of data	Calculated based on proportion of forest area burned during the historical reference period in the forest class icl;, Average carbon stock per hectare in the carbon pool p burnt in the forest class icl at year t; Average proportion of mass burnt in the carbon pool p in the forest class icl; Average combustion efficiency of the carbon pool p in the forest class icl; dimensionless. See equations 11, 12, 13 and 14 of the VM0015.
Value applied	See Table 46, section 3.2.2
Justification of choice of data or description of measurement methods and procedures applied	To estimate non-CO2 emissions from forest fires, it is necessary to estimate the average percentage of the deforested area in which fire was used, the average proportion of mass burnt in each carbon pool (Pburnt,p), and the average combustion efficiency of each pool (CEp). These average percentage values are estimated for each forest class (icl) and are assumed to remain the same in the future. The calculation is based on revised IPCC 1996 GL LULUCF and in the VM0015
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	EBBN2Oicl,t
Data unit	tCO2-e ha-1
Description	N2O emission from biomass burning in forest class icl at year t;
Source of data	Calculated based on proportion of forest area burned during the historical reference period in the forest class icl;, Average carbon stock per hectare in the carbon pool p burnt in the forest class icl at year t; Average proportion of mass burnt in the carbon pool p in the forest class icl; Average combustion efficiency of the carbon pool p in the forest class icl; Global Warming Potential for N2O (value = 265, Default factor from the latest IPCC Assessment Report), dimensionless. See equations 11, 12, 13 and 14 of the VM0015.
Value applied	See Table 46, section 3.2.2
Justification of choice of data or description of measurement methods and procedures applied	To estimate non-CO2 emissions from forest fires, it is necessary to estimate the average percentage of the deforested area in which fire was used, the average proportion of mass burnt in each carbon pool (Pburnt,p), and the average combustion efficiency of each pool (CEp). These average percentage values are estimated for each forest class (icl) and are assumed to remain the same in the future. The calculation is based on revised IPCC 1996 GL LULUCF and in the VM0015
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

Data / Parameter	EBBCH4icl,t
Data unit	tCO2-e ha-1
Description	CH4 emission from biomass burning in forest class icl at year t;
Source of data	Calculated based on proportion of forest area burned during the historical reference period in the forest class icl;, Average carbon stock per hectare in the carbon pool p burnt in the forest class icl at year t; Average proportion of mass burnt in the carbon pool p in the forest class icl; Average combustion efficiency of the carbon pool p in the forest class icl; Global Warming Potential for CH4 (value = 28, Default factor from the latest IPCC Assessment Report), dimensionless. See equations 11, 12, 13 and 14 of the VM0015.
Value applied	See Table 46, section 3.2.2
Justification of choice of data or description of measurement methods and procedures applied	To estimate non-CO2 emissions from forest fires, it is necessary to estimate the average percentage of the deforested area in which fire was used, the average proportion of mass burnt in each carbon pool (Pburnt,p), and the average combustion efficiency of each pool (CEp). These average percentage values are estimated for each forest class (icl) and are assumed to remain the same in the future. The calculation is based on revised IPCC 1996 GL LULUCF and in the VM0015
Purpose of data	Calculation of baseline emissions
Comments	Not applicable

3.3.2 Data and Parameters Monitored

Data / Parameter	APAi.t
Data unit	ha
Description	Annual area deforested in stratum i within the project area at a year t; ha yr-1
Source of data	PRODES - INPE
Value applied	Not applicable
Justification of choice of data or description of measurement methods and procedures applied	See
Purpose of data	Monitoring activity data of deforestation in project area
Comments	Not applicable

Data / Parameter	ALKi.t
Data unit	ha
Description	Annual area deforested in stratum i within the leakage belt at a year t; ha yr-1
Source of data	PRODES - INPE
Value applied	Not applicable
Justification of choice of data or description of measurement methods and procedures applied	
Purpose of data	Monitoring activity data of deforestation in leakage belt
Comments	Not applicable

The parameters that will be monitored over the lifetime of the project (when applicable) are detailed in section 5.3.1 and will be available for validation, as instructed in Appendix V of Methodology VM0015. The demand for monitoring the baseline parameters is conditioned to each baseline update period. As well as the monitoring of parameters directly related to the measurement of different carbon pools, which must be updated every 10 years. Parameters of activity data such as deforestation, forest degradation (ilegal logging and fires) and Sustainable Forest Management in Project Area, Leakage Belt and Reference Region shall be monitored and measured annually. Both parameters applicable to project monitoring will be measured and reported in project verification.

3.3.3 Monitoring Plan

The monitoring plan of the project will follow section Part 3 of the VM0015 methodology, which consists of two distinct tasks. We will describe it in two continuous monitoring activities following the aspects:

a) technical description of all subtasks

b) data collected and monitored

c) data collection procedures

d) quality control and assurance

e) data systematization and storage

f) responsibilities for each task among the parties involved.

Task 1) MONITORING OF CARBON STOCK CHANGES AND GHG EMISSIONS FOR PERIODICAL VERIFICATIONS

1.1 Monitoring of actual carbon stock changes and GHG emissions within the project area

1.1.1 Monitoring project implementation

a. This subtask evidence all actions and activities directly provided by the project at annual frequency. Specifically report the main objective of combating and reducing deforestation and forest degradation (removal of illegal wood, forest fires, use of wood for firewood and other uses) and Sustainable Forest Management in the Project Area and Leak Belt. A detailed description of the forest measurement of carbon pools measured in the project are available in Appendix VII – Carbon Pools Measures.

b. Such deforestation monitoring activities (ABSLPAi,t) and forest degradation apply remote sensing techniques to detect illegal deforestation and forest degradation activities. Several geospatial data bases that measure forest loss with different methodologies and sensors and different objectives will also be systematized. Monitoring systems will be used to detect illegal activities in near real-time (DETER, SAD, GLAD), and for annual measurement and national reporting of GHG emissions (PRODES). For the monitoring of carbon pools, the same parameters reported in the project validation, at a periodic interval of 10 years, will be remeasured. The data that will be monitored are: tree biomass (CAB, tree, icl/CBB, tree,icl) and non-arboreal above and below ground (CAB, non-tree,icl/CBB, non-tree,icl), dead tree biomass - dead wood standing and falling (CDW,icl), litter biomass (CL,icl) and organic soil carbon (CSoc,icl).

c. Geospatial information is made available openly and free on the web. It will be downloaded and systematization in a Geographic Information Systems environment (GIS) and are available in project Appendix VI – SIG methodology. In addition, actions and activities of project implementation will be evidenced through digital spatial data, satellite images, and other relevant documents (attendance list of meetings and training, receipts, vouchers and analog documents, photographic records, among others). A detailed description of the procedures for forest measurement and remeasurement of the project's carbon pools are available in the project Appendix VII – Carbon Pools Measures.

d. To control and guarantee the quality of spatial data of deforestation and forest degradation, we will validate with visual interpretation with experienced analyst of this monitoring systems using high spatial resolution (Planet) and temporal images (Sentinel 2A). Quality control and assurance in forest measurement of carbon pools are available in project

Appendix VII – Carbon Pools Measures, in the Section Standards Operating Procedures - SOP.

e. Digital documentary storage will be carried out in the cloud and on Hard Disks and analog documents at the company's headquarters, located in Piracicaba. The evidence will be widely available in any project verification action if access by the audit team is required. The systematization of this temporal database is the responsibility of BRC.

f. BRC is responsible for the implementation of all activities mentioned above.

1.1.2 Monitoring land use and land-cover change.

a. For the annual quantification of the land use change, "Forest to Non-Forest" will be used the PRODES monitoring system. Detailed information of this remote monitoring using orbital sensors is available at: METADATA PRODES - INPE (inpe.br) and PRODES - INPE (inpe.br) methodology. To quantify the change in land use from "Forest to Forest Decrease / Biomass Increment" DETER will be used. Detailed DETER information is available at: DETER - B (mma.gov.br) and Methodology DETER (inpe.br).

b. The main parameter measured will be the change of the use class "Forest" to other land uses, forest with biomass decrease (Degraded Forest and forest fires and use for agricultural purposes) and increase in biomass (natural regeneration) as suggested by Table 37 of VM 00015.

c. Cartographic information is made available openly and free of charge on the web. It will be downloaded and systematization in a Geographic Information Systems environment. In addition, actions and monitoring activities of the project will be evidenced through digital spatial data, satellite images and others.

d. To control and guarantee the quality of spatial data of land use change, we will validate with visual interpretation with experienced analyst of this monitoring systems used with high spatial resolution (Planet) and temporal images (Sentinel 2A).

e. Digital documentary storage will be carried out in the cloud and on Hard Disks and analog documents, at the company's headquarters, located in Piracicaba. The evidence will be widely available in any project verification action if access by the audit team is required.

f. BRC is responsible for implementation of all activities mentioned above.

1.1.3 Monitoring the change in carbon stocks and non-CO2 emissions from forest fires.

a. Using Sentinel 2A images will be quantified the area of forest fires within the Project Area. The dNBR index will be used for spatial evidence of spectral change and, respectively,

remote detection of burned areas. Such an automated process on the Google Earth Engine platform is however validated with visual interpretation and high-resolution spatial images by experienced remote sensing analyst. In this context, the area of fire, which has been reduced in the biomass stock due to fire, will be measured.

b. When significant, the biomass loss due to forest fires, will be monitored by burned area (AUFPAicl,t). Representing the change of the use class "Forest" to other land uses, forest with biomass decrease to forest fires, as suggested by Table 37 of VM 00015. Other parameters are monitored EBBtoticl,t/EBBN2Oicl,t/EBBCH4icl,t to quantify non-CO2 emissions.

c. Selection of cloudless Sentinel 2A images before and after fire event with NIR and SWIR bands to calculate the NBR (Normalized Burn Ratio) ex ante and ex post, and later calculates the difference for the index obtaining the Delta NBR index.

d. For control and quality assurance of spatial data of forest fires, BRC will validate with visual interpretation with experienced analyst of this monitoring systems used with high-spatial resolution (Planet) and temporal (Sentinel 2A) images.

e. Digital documentary storage will be carried out in the cloud and on Hard Disks and analog documents, at the company's headquarters, located in Piracicaba. The evidence will be widely available in any project verification action if access by the audit team is required.

f. BRC is responsible for the broad implementation of all activities mentioned above.

1.1.4 Monitoring the impacts of natural disturbances and other extreme events.

a. For quantification of forest cover loss due to natural disturbances and extreme events, when significant, DETER and subsequent visual validation with high-resolution images will be used. Deter's detailed information is available at: DETER - B (mma.gov.br) and Methodology DETER (inpe.br).

b. The main parameter that will be measured is ACPAicl,t. Representing the change of the use class "Forest" to other land uses due to extreme events. The change occurs for the forest class with biomass decreases and later increase in biomass, as suggested by Table 37 of VM 00015.

c. Cartographic information is made available openly and free of charge on the web. It will be downloaded and systematization in GIS. In addition, actions and monitoring activities of the project will be evidenced through digital spatial data, satellite images and others.

d. To control and guarantee the quality of spatial data of land use change, BRC will validate with visual interpretation with experienced analyst of this monitoring systems used with high spatial resolution (Planet) and temporal images (Sentinel 2A).

e. Digital documentary storage will be carried out in the cloud and on Hard Disks and analog documents, at the company's headquarters, located in Piracicaba. The evidence will be widely available in any project verification action if access by the audit team is required.

f. BRC is responsible for the broad implementation of all activities mentioned above.

1.2) Monitoring Leakage Belt

For monitoring the Leakage Belt, the same tasks and cartographic basis for monitoring the Project Area, described earlier in section 1.1, will be useful. As suggested by VM00015 Part 3 in section 1.2.1, 1.2.2 and 1.2.3. The ABSLLBi.t, the parameter for the geographic boundaries of the Leakage Belt, will be monitored.

1.3) Ex post net anthropogenic GHG emission reductions

With the achievement of steps 1.1 and 1.2 of Task 1 in Parthian 3 of VM00015, the reduction of greenhouse gas emissions will be calculated due to the reduction of deforestation and forest degradation within the Project Area and Leakage Belt. In this context, step 1.3 of Monitoring Task 1 will be completed. The parameters required to perform monitoring, collection and measurement procedures, quality control and assurance, systematization/storage of spatial data, and responsibility of these subtasks are described earlier in section 1.1 for Project Area, which are similar to Leakage Belt monitoring.

Task 2) REVISITING THE BASELINE PROJECTIONS FOR FUTURE FIXED BASELINE PERIOD

2.1) Update information on agents, drivers, and underlying causes of deforestation

a. After 10 years of the project, the project baseline will be updated, with the objective of portraying the potential changes in land use and their pressure on the loss of forest cover in the Reference Region. It will be necessary to fully revisit Step 3 of VM0015 and sub-items 3.1, 3.2, 3.3, 3.4 and 3.5. New deforestation agents and drivers will be mapped to determine a new baseline.

b) The data that will be collected and monitored are the same as those listed in Step 3 to determine the baseline. However, they will be updated if new vectors and deforestation agents working in the Reference Region are evaluated.

c) Local interviews and socioeconomic surveys will be conducted in the Reference Region and the region near of the Project Area to evaluate some new trend and dynamics of land use and change,

specifically new agents and vectors of forest cover losses. Monthly and annual monitoring will also be carried out with high spatial and temporal resolution images to assess the geography of deforestation and the dynamics of land use and change.

d) To control and guarantee the quality of spatial data of land use change, BRC will validate with visual interpretation with experienced analyst of this monitoring systems used with high spatial resolution (Planet) and temporal images (Sentinel 2A).

e) Digital documentary storage will be carried out in the cloud and on Hard Disks and analog documents, at the company's headquarters, located in Piracicaba. Both evidences will be widely available in any project verification action if access by the audit team is required.

f) BRC is responsible for the broad implementation of all activities mentioned above.

2.2) Adjustment of the land-use and land-cover change component of the baseline

2.2.1) Adjustment of the annual areas of baseline deforestation

a) Update of land use and change maps for the new reference period for baseline update. The maps used are the annual mapping of PRODES, for quantification in historical deforestation within Reference Region.

b) The data updated will be the historical land use changes - deforestation - in the Reference Region.

c) Cartographic information is made available openly and free of charge on the web. It will be downloaded and systematization in a Geographic Information Systems environment. In addition, actions and monitoring activities of the project will be evidenced through digital spatial data, satellite images and others.

d) To control and guarantee the quality of spatial data of land use change, BRC will validate with visual interpretation with experienced analyst of this monitoring systems used with high spatial resolution (Planet) and temporal images (Sentinel 2A).

e) Digital documentary storage will be carried out in the cloud and on Hard Disks and analog documents, at the company's headquarters, located in Piracicaba. Both evidences will be widely available in any project verification action if access by the audit team is required.

f) BRC is responsible for the broad implementation of all activities mentioned above.

2.2.2) Adjustment of the location of the projected baseline deforestation

a) Update of land use and change maps for the new reference period for baseline update. The maps will be the annual mapping of PRODES, to evidence spatial and geographical action of historical deforestation in the Reference Region.

b) The data updated will be the historical land use changes - deforestation - in the Reference Region.

c) Cartographic information is made available openly and free of charge on the web. It will be downloaded and systematization in a Geographic Information Systems environment. In addition, actions and monitoring activities of the project will be evidence of the s through digital spatial data, satellite images among others.

d) To control and guarantee the quality of spatial data of land use change, BRC will validate with visual interpretation with experienced analyst of this monitoring systems used with high spatial resolution (Planet) and temporal images (Sentinel 2A).

e) Digital documentary storage will be carried out in the cloud and on Hard Disks and analog documents, at the company's headquarters, located in Piracicaba. Both evidence will be widely available in any project verification action if access by the audit team is required.

f) BRC is responsible for the broad implementation of all activities mentioned above.

2.3) Adjustment of the carbon component of the baseline

a. As well as the update of the baseline, the project will update the stock of the carbon pools measured at a maximum periodicity of 10 years. Table 12 shows all the carbon pools measured and updated the stock with orientation in Appendix III of VM00015.

b. For the monitoring of carbon pools, the same parameters reported in the validation of the project, at a 10-year interval, will be remeasured. The data that will be monitored are: tree biomass (CAB, tree, icl / CBB, tree,icl) and non-arboreal above and below ground (CAB, non-tree,icl/ CBB, non-tree,icl), dead tree biomass - dead wood standing and falling (CDW,icl), litter biomass (CL,icl) and organic soil carbon (CSoc,icl).

c. Detailed description of the forest measurement of the carbon pools measured and that will be updated in the project are available in project Appendix VII – Carbon Pools Measures.

d. Quality control and assurance in forest measurement of carbon pools are available in Appendix VII – Carbon Pools Measures, in the Section Standards Operating Procedures - SOP.

e. Digital documentary storage will be carried out in the cloud and on Hard Disks and analog documents, at the company's headquarters, located in Piracicaba. Both evidence will be widely available in any project verification action if access by the audit team is required.

f. BRC is responsible for the broad implementation of all activities mentioned above.

3.3.4 Dissemination of Monitoring Plan and Results (CL4.2)

The Monitoring Plan will be fully responsible for the execution of BRC. Annually will be shared with the communities directly involved in the project and surrounding stakeholders the activities developed. All information used is open and widely reported by BRC and verifiable in external audit processes of project verifications.

4 COMMUNITY

4.1 Without-Project Community Scenario

4.1.1 Descriptions of Communities at Project Start (CM1.1)

As previously mentioned, the creation of communities present in the territory varies greatly. The community groups visited can be divided into 3 (three) categories: **Settlement Project**, **Townships,** and **Indigenous Territory**. They are located close to rural properties and project areas. Proximity which varies from the direct boundary between properties, passing through rivers that separate them, to areas that are distant because they have other properties between them.

The Settlements **Bom Jesus** and **Irmã Dorothy** are located at Rondon do Pará, the indigenous land **Barreirinha** is in Paragominas, **PA Rio das Cruzes** and **Aguia** Settlements are in the border of the municipalities of Paragominas and Dom Eliseu. Finally, **Vila Brasil**, **PA Diamantina** and **Balalaica** are in the Ipixuna do Pará municipality. A total of 76 questionnaires were applied, distributed according to the graph below, and equality was sought in relation to gender, as can be seen in the Table 51.

After mapping and identifying the main community groups around the project areas, the BRC social team carried out a first foray into the field, with the aim of starting the first stage of social engagement, based on the presentation of the company, the project and the application using semi-structured questionnaires and carrying out a socioeconomic diagnosis.

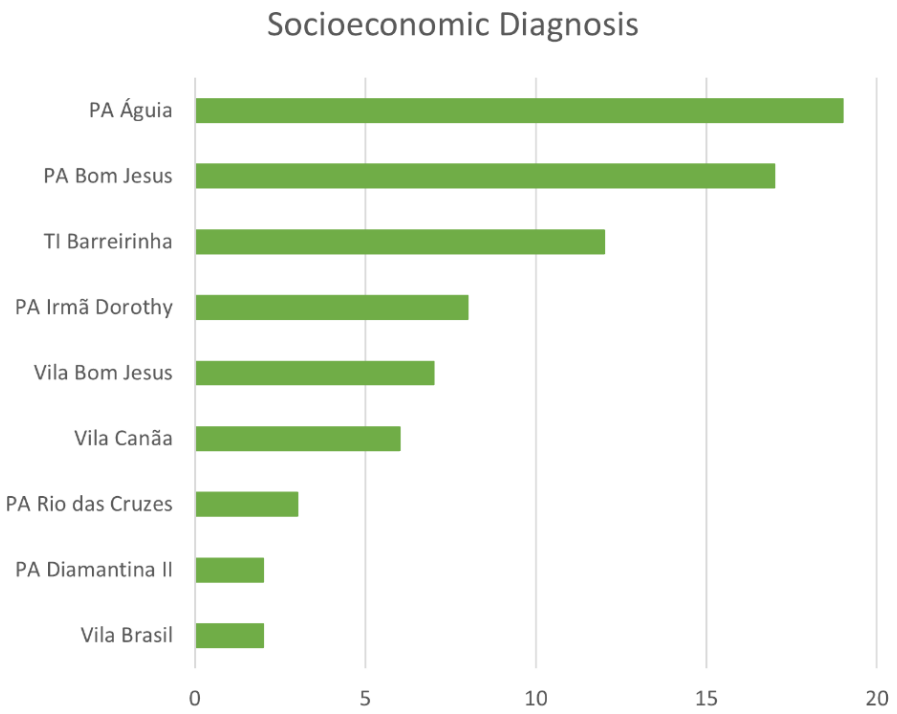


Figure 36 – Number of interviews carried out in the social diagnosis in each community group.

Table 51 – Scope of the first socioeconomic diagnosis around the project area.

	Gender	
Placement	♀	♂
PA Diamantina II	-	2
Vila Brasil	2	-
PA Rio das Cruzes	1	2
Vila Canãa	2	4
Balalaica	3	4
PA Irmã Dorothy	3	5
TI Barreirinha	10	2
PA Bom Jesus	5	12
PA Águia	11	8
Total Geral	**37**	**39**

Almost half of the people declared themselves as brown, followed by 25 people who did not declare color or race. If we consider people who declared themselves as black and multiracial people, we will reach a total of 41 people.

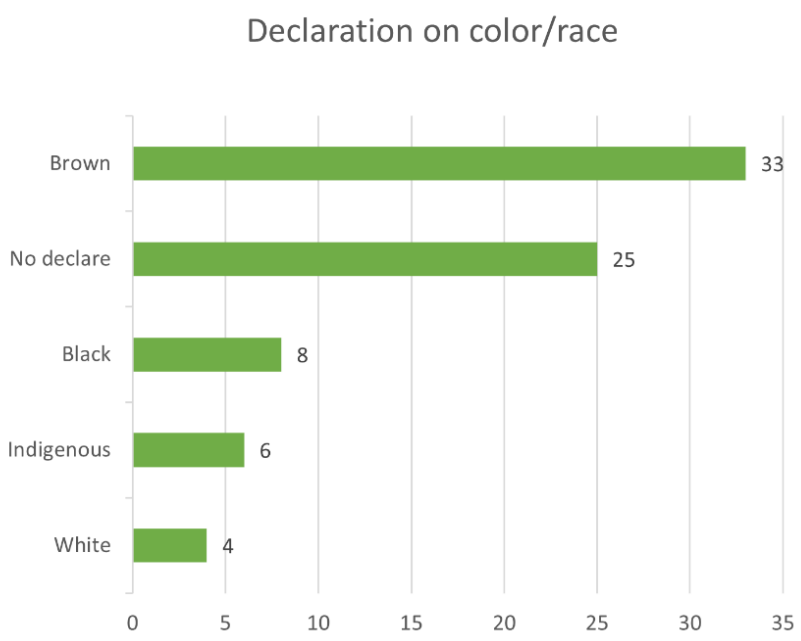


Figure 37 – Representative of declaration on race.

The most expressive religion was evangelical among the others, having not only devotees, but also physical structures in almost all communities visited. In all, 39 people declared themselves to be evangelical, with high incidence in the settlements. While the highest incidence of catholic is found in the townships and in the indigenous territory.

The age range of the interviewees has an average of 44 and 45 years, according to survey. As can be observed at Table 52 below, the level of education observed about the majority was illiterate and incomplete elementary school, with is aligned to the municipality rates present at section 2.1.6.

Table 52 – Education level of interviewed people

Territories / Education Level	PA Águia	Balalaica	PA Bom Jesus	PA Diamantina II	PA Irmã Dorothy	PA Rio das Cruzes	TI Barreirinha	Vila Brasil	Vila Canãa	Total Geral	
										N	%
Literate	1	-	1	-	1	-	-	-	1	4	5%
Without education	5	2	3	-	1	1	1	-	1	14	19%
Uncompleted fundamental	6	4	7	1	5	-	3	-	1	26	35%
Completed fundamental	2	1	2	1	-	1	1	-	-	8	11%
College incompleted	2	-	-	-	-	-	-	-	-	2	3%

Territories / Education Level	PA Águia	Balalaica	PA Bom Jesus	PA Diamantina II	PA Irmã Dorothy	PA Rio das Cruzes	TI Barreirinha	Vila Brasil	Vila Canãa	Total Geral	
										N	%
College completed	2	-	4	-	-	-	5	2	-	13	17%
Graduated	-	-	-	-	-	1	1	-	1	3	4%
College incompleted	1	-	-	-	-	-	1	-	2	4	5%
incomplete higher	-	-	-	-	1	-	-	-	-	1	1%
Total	**19**	**7**	**17**	**2**	**8**	**3**	**12**	**2**	**6**	**76**	

4.1.2 Interactions between Communities and Community Groups (CM1.1)

The interaction between communities and community groups identified in section 2.1.8 was successful. During the implementation of project activities three field trips were conducted to the selected communities, between May and June 2022.

In some communities it was possible to hold meetings with a significant quorum, where the details of the project were openly discussed, giving space for the community to deliberate together on its position regarding the project to generate carbon credits in the surrounding area in question. For all off them, BRC distributed didactic materials (**Erro! Fonte de referência não encontrada.**).

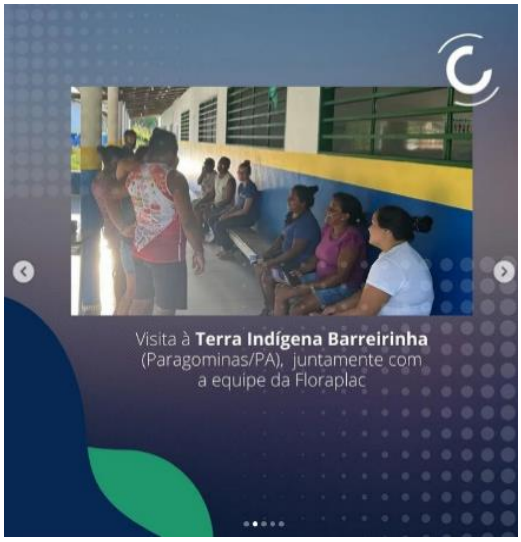
On these occasions, doubts were clarified and understanding of the membership was improved, as well as the identification of local priorities, a participatory and collaborative approach together with the community.

Figure 38 – Communication material: how communities can get involved in the carbon project.

The different family groups surveyed declared themselves to be family producers, farmers, and indigenous people. Most of the time, settlements and townships projects are organized through associations. With this, it was possible to obtain a heterogeneous community representation and with valuable information from strategic figures within the community. This approach was used, especially, in towns and locations with higher population concentration.

In addition to the questionnaires, another strategy was adopted to conduct semi-structured interviews with leaders or local figures of social relevance, as well as members of associations, employees linked to the area of health and education, local leaders, and political figures with a strong presence in the community.

These interviews managed, in general, to assist in the construction of a social portrait of the communities, since, when cross-referencing the interviews of the different stakeholders, it was possible to arrive at a social composition formed by different perspectives.



https://www.instagram.com/p/Cfecyc2Ak9z/?utm_source=ig_web_copy_link on July 1st. 2022.

Figure 39 – Publicization of initial engagement on BRC's social media.

Beyond the engagement steps described, some activities were also started to implement the benefits, such as collecting water samples, evaluating the school structure, holding workshops to improve pasture management and agricultural production. The material distributed at these meets can be found at **Erro! Fonte de referência não encontrada.**.

Figure 40 – Field Day – sustainable agricultural production practices at Irmã Dorothy Settlement.

4.1.3 High Conservation Values (CM1.2)

According to the assessment carried out in the field, based on interviews and participatory approach, the local communities did not recognize any high conservation values (HCVs) in the project area. The concept of HCV was approached with communities during the first and second stages of social engagement. At first, communities were encouraged to identify possible HCVs in face-to-face meetings held door-to-door. BRC understands that the concept of HCV is too abstract for communities and that a participatory field mapping may be carried out in the future occasions for an adequate demarcation of possible HCVs.

Having said that, BRC identified some potential HCVs in the project areas that are related to community livelihoods and traditional cultural identity. The *Capim* River was one of the resources mapped in the social engagement process as a site with high conservation value for the indigenous who lived at Barreirinha Indigenous land. The main channel, the river Capim, presents approximately 764,82 km long, considering from its mouth with the Guamá river, until the confluence with the basins of the Surubiju and Ararandua rivers (Lima, 2012).

Table 53 – Areas that are fundamental for the livelihoods of communities (HCV)

High Conservation Value	HCV 5 - sites and resources fundamental satisfying the necessities of local communities or indigenous people: the Capim River.
Qualifying Attribute	In addition to providing water and food for the indigenous community, it is culturally significant for the identity and is fundamental for subsistence, being a source of fishing and food for families, in addition to serving as a space for leisure and well-being for the community. Furthermore, the river is a traditional path, historically it is like a road for the population,
Focal Area	The project area is here defined as the focal area that needs to be managed to maintain or enhance this HCV because they are around Barreirinha's indigenous land to this end, the project will invest in actions related to forest conservation and monitoring.

The following pictures (Figure 41 and Figure 42) represents the Capim River, shooted on wet season, August 23th of 2022.

Figure 41 – Capim River on August 23th of 2022.

Figure 42 – Capim River on August 23th of 2022.

Another high conservation value indicated was the spaces with cultural and traditional importance for indigenous people. For example, the *rameira/ramada* is a space in the form of a bandstand covered with straw which works as a prayer space and other rituals.

Table 54 – Areas that are critical for the traditional cultural identity of communities (HCV).

High Conservation Value	HCV 6 - cultural sites of local importance
Qualifying Attribute	Areas, features, with cultural significance archaeological, or historical, and/or of cultural, ecological, economic, or religious/sacred critique of the traditional cultures of local communities or indigenous peoples, identified through engagement with indigenous people.
Focal Area	The rameira/ramada is located behind the Nossa Senhora Aparecida school, in the Barreirinha indigenous land.

The following picture (Figure 43) shows the rameira/ramada space.

Figure 43 – Ramiera/Ramada on Barreirinha indigenous land.

The Barreirinha indigenous land context in landscape is surrounded by consolidated areas and productive properties, being a conservation island. In addition to this territory having a strategic location, among the areas of the project, the positive impact on the communities and the surrounding biodiversity is of great importance to the project activities.

4.1.4 Without-Project Scenario: Community (CM1.3)

In the without-project land use scenario, what is expected is the keep of the conditions found during social baseline, where a low level of education, lack of access to health programs, lack of basic sanitation, lack of solid waste proper management and the maintenance of livestock production-based economy, can be observed. In general, the communities visited have very precarious conditions of well-being. Those located in locations farther from the municipality's administrative centers generally have roads that are difficult to move around, which makes access and possibilities for improvement even worse.

The main challenge mapped in the first stages of social engagement were related to well-being indicators, such as health, education, and water access. In Rondon do Pará, at the Irmã Dorothy and Bom Jesus settlements, issues of difficulty in accessing health care were raised, with the nearest basic care unit located 40 km away, in the seat of the municipality of Jacundá.

The school that serves the community does not have access to drinking water, electricity, wi-fi, bathroom and kitchen. There is no basic equipment to assist in the production of material for students. There is also no

adequate school transport to pick up and take students to school, which means that they have to go on foot, on horseback or by motorcycle.

Figure 44 – EMEF Urutum. estrutura de alvenaria.

Figure 45 – Place for preparing school meals at EMEF Urutum.

To improve their livelihoods and forest prevention and conservation, the necessity of training in agricultural sustainable practices and managing wildfires in all communities visited at this region was identified.

Furthermore, in the municipalities of Dom Eliseu, Ulianópolis and Ipixuna do Pará, the potential for strengthening cooperatives and associative activities in the territories was identified, with the aim of expanding sources of income and diversifying production with pulp, flour and honey in the settlements PA Aguia and Rio das Cruzes and in Barreirinha's Indigenous Land.

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CM2.1)

The anticipated impacts resulting from project activities under the with-project scenario can be found in this section. It is important to highlight that the BRC will bear all costs associated with the development, implementation, monitoring and certification of the project. No cost will be passed on the community's groups selected.

BRC is aware that to make any social improvement on the communities' reality it is necessary to involve its members and because of that we aim to strengthen the social engagement among the people, through social projects of integration.:

Community Group	**PA Bom Jesus**
Impact(s)	Educational access and improve local infrastructure in municipality school *Urutum*.
Type of Benefit/Cost/Risk	**Direct actual benefit**: preparation of letter and awareness-raising advocacy actions with municipal education department. **Direct predicted benefit:** renovation of spaces identified as priority in the municipal school of *Urutum*. which currently serves 22 students in multigrade grades. **Indirect predicted benefit**: improvement in the quality of teaching and education of local communities
Change in Well-being	Security's improvement to the scholar community, better conditions of educational development and increase access to region students

Community Group	**PA Irmã Dorothy**
Impact(s)	Educational access and a better school infrastructural condition at EF Comunidade Irmã Dorothy
Type of Benefit/Cost/Risk	**Direct actual benefit**: preparation of letter and awareness-raising advocacy actions with municipal education department. **Direct predicted benefit:** construction of a new school identified as priority to replace the present EF Comunidade Irmã Dorothy municipal school, which currently serves 41 students in multigrade grades, and is in inadequate infrastructural inappropriate condition for the educational process. **Indirect predicted benefit**: improvement in the quality of teaching and education of local communities
Change in Well-being	Better conditions of educational development and increase access to settlement students

Community Group	**Settlement projects (Irmã Dorothy, Bom Jesus, Aguia. Rio das Cruzes and Diamantina)**
Impact(s)	Sustainable Management practices
Type of Benefit/Cost/Risk	**Direct actual benefit**: Improve training. capacities. and education workshops on sustainable practices such pasture management and wildfires prevent. **Direct predicted benefit:** reduction of GHG emissions from forest degradation. adoption of soil management practices in pastures. reduction of the impact of fire on biodiversity and reduction of the impact on the health of communities by reducing the amount of smoke inhaled. Pasture productivity increase due the good practices. **Indirect predicted benefit**: A healthier forest which benefit population in general and the region faunistic reality
Change in Well-being	Improved land management. through actions aimed at improving forest management and animal production

Community Group	**Aguia Settlements, Barreirinha Indigenous Lands and Diamantina II Settlements.**
Impact(s)	Strengthen local production chains and increase the economic resilience of communities.
Type of Benefit/Cost/Risk	**Direct actual benefit**: Diagnosis Improve training. capacities. and education workshops on sustainable practices such pasture management and wildfires prevent. **Direct predicted benefit:** Elaboration of the business plan for potential production chains in the region. such as indigenous crafts. pulp and honey cultivation and strengthening of community social organizations. **Indirect predicted benefit:** Promote activities that add inclusive value chains and measures that strengthen the conservation of natural resources.
Change in Well-being	Training will increase the communities' skills and create job opportunities for interested parties. The trainings will also improve the social organization through the formation of associations and organize the production and improve the local economy with the commercialization of products of the communities. through the formation of cooperatives.

Community Group	**Brasil rural village**
Impact(s)	Improve water access, fostering and support for solid waste management and recycling.
Type of Benefit/Cost/Risk	**Direct actual benefit:** water potability analysis. Installation of water pumps. water tanks and hydraulic systems to supply homes and schools. **Direct predicted benefit:** Construction of one site. **Indirect predicted benefit**: improved health conditions
Change in Well-being	will improve access conditions to water and water quality. indirectly impacting the community health

4.2.2 Negative Community Impact Mitigation (CM2.2)

Like any project that works with people, the implementation of our project can change the internal relations between the community members, mainly because of the entrance of economic resources through the project interventions or because the interventions itself. In this sense there are risks of weakening the social fabric

As mentioned, there are always risks in the implementation of projects involving people, however REDD+ Cauaxi activities seek not to negatively impact the way of life, traditions or well-being of communities. The project will seek, with its activities, to increase the level of governance and dialogue with government bodies responsible for maintaining and improving basic rights.

In general, these negative impacts are not easy to predict, it becomes clear after it happens. In this sense the BRC will create strategies to mitigate it through communication tools with the communities' members and leaders, to adapt the course of activities when it seems necessary.

Therefore, it is necessary to highlight that the Cauaxi REDD+ conservation program aims to generate positive impacts for climate and the communities' groups mapped around project areas. Some strategies such as workshops, training, and advocacy with local secretaries, to improve health and educational standards, strengthen local associations, organizations, production chains (honey, pulp, and crafts), and the public politics access. And these strategies are important to create a relation of strong trust between the communities and the BRC team.

Further than that, the identified HCVs will be better understood by the application of social surveys and implementation of project activities in general. Within this strategy these areas which are fundamental for the livelihoods of communities will be better recognized and consequently more protected and improved by the additional conservation of forest cover promoted by the implementation of the project activities.

4.2.3 Net Positive Community Well-Being (CM2.3. GL1.4)

Considering the GPD initial scope, net well-being impacts of the project are potentially positive for all identified community groups. This can be demonstrated by comparing the social baseline (without project land

use scenario) with the project scenario considering the planned activities and the theory of change matrix. In this sense, BRC expects to cause changes in communities well-being, through digital inclusion, wildfires reduction, improvements in health and education, improvement in access to water and water quality, training, qualification and generation of employment and household income.

4.2.4 High Conservation Values Protected (CM2.4)

Considering GPD current scope, BRC has identified areas that are fundamental for the livelihoods of communities (project area itself) and areas that are critical for the traditional cultural identity of communities as HCVs. Additional measures related to forest protection. BRC does not recognize and/or perceive any negative impacts of the project on the identified HCVs, on the contrary, it sees its activities as a stronghold to protect the HCVs identified. But, as already mentioned above there are always risks on projects that involves people, so the BRC will be in constant contact with the people on the ground to change the project's course whenever necessary, not just to respect their customs and cultures, but also to reinforce their social engagement and confidence with our activities.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (CM3.1)

The other main stakeholder that Cauaxi REDD+ project recognizes is the public entities, especially the municipal ones, which are impacted by the project activities and constructions/reforms of public buildings. In principle, there are no negative impacts on its stakeholders, only positive ones, considering that the project activities will improve the public services and its infrastructural condition on the region of the project. However, it can cause some political issues that are not possible to predict by now, so it's necessary to wait for the consequences of our activities and then take actions to bypass it, if necessary.

4.3.2 Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

As argued above, in general, there are no negative impacts on other stakeholders expected. When necessary, the proponent and rural landowners will analyze, implement mitigation or adaptation measures for any negative impacts that may arise during the project.

4.3.3 Net Impacts on Other Stakeholders (CM3.3)

As the other main stakeholders in the project area are public entities, there is no room to negative impact them through the project. On the contrary, BRC sees the activities as a help to the public issues on the territory. Of course, if BRC perceives any issue in the way of misunderstood it will reorient the path of the actions.

4.4 Community Impact Monitoring

4.4.1 Community Monitoring Plan (CM4.1. CM4.2. GL1.4. GL2.2. GL2.3. GL2.5)

The community monitoring plan seeks to be an important tool to make the project not only a strategy to avoid deforestation and retain carbon on the soil, but also and, mainly, to improve the conditions of live and well-being of the population impacted by it. This is not a simple goal as it needs to be constantly agreed with the communities and its members. In this sense the project will be open to keep in constant contact with all the communities' leaders and its members in general to adapt strategies if necessary and requested. During the project period the BRC will be always open to receive suggestions, complaints, and praises to improve the activities and actions on the ground.

Among all the activities the project predicts to implant, there are some that are key to keep this relationship with the local population of the project zone in a productive and transparent manner. So, in this way the Cauaxi REED+ project will implant some structures to achieve this goal, for example providing courses of sustainable practices to land management, cattle ranching, familiar agriculture practices, among others which are interest of the population. Furthermore, the project will provide some training and conditions to achieve its goals, as fire brigade teams, environmental agents and others. More than that, this monitoring plan will keep an eye on the health and education conditions of the impacted population and the reality of gender issues to improve women's social conditions.

To achieve all these goals the activities implemented will be monitored through the social indicators described in the Table 55 below.

Table 55 – Social Indicators

Community, community group and other stakeholders	Aspect	Unity	Frequency	Indicator	Assessment (types of measurements and sampling methods)
Property employees + 9 territories, townships and villages mapped on project zone	Education improvements	Number of students	Annual	Change or maintenance of educational quality – increase access to school, better infrastructural conditions	Official public data; Internal surveys; Changes on infrastructural condition; Social perception through questionaries and interviews applied by BRC;
Property employees + 9 territories, townships and villages mapped on project zone	Health improvements	Number of people	Annual	Change or maintenance of social health condition - access to basic care, medicines, and treatments.	Official public data; Internal surveys; Changes on infrastructural condition; Social perception through questionaries and interviews applied by BRC.
Property employees + 9 territories,	Gender issues	Number of women	Annual	Change or maintenance on women condition –	Official public data; Internal surveys; Changes on infrastructural condition; Social

Community, community group and other stakeholders	Aspect	Unity	Frequency	Indicator	Assessment (types of measurements and sampling methods)
townships and villages mapped on project zone.				access to work and empowerment, participation on decision making	perception through questionaries and interviews applied by BRC.
Property employees + 9 territories, townships and villages mapped on project zone.	Sustainable issues	Number of people	Annual	Change or maintenance of environmental practices - people with adequate training on best practices of environmental challenges	Official public data; Internal surveys; Changes on infrastructural condition; Social perception through questionaries and interviews applied by BRC.
Property employees + 9 territories, townships and villages mapped on project zone.	Well-being	Number of people	Annual	change or maintenance of social aspects – improvement on quality of life (jobs, culture, free time, leisure)	Official public data; Internal surveys; Changes on infrastructural condition; Social perception through questionaries and interviews applied by BRC.
Property employees + 9 territories, townships and villages mapped on project zone.	Livelihoods	Number of people	Annual	Change or maintenance of livelihood's - the variability of types of production systems	Official public data; Internal surveys; Changes on infrastructural condition; Social perception through questionaries and interviews applied by BRC.

All activities will include the creation of a monitoring file to be controlled by the company's staff and accessible to the beneficiary population itself. This will allow its control and the possibility of adapting courses if necessary.

4.4.2 Monitoring Plan Dissemination (CM4.3)

The monitoring plan and monitoring results will be available on Verra's website, through the GPD and monitoring reports full documents. In addition, the activities implemented during the project lifetime and monitoring results will be discussed with local communities in public meetings aimed at this purpose, held during the third and fourth social engagement stages.

It will be delivered a document version to stakeholders and a version of the document will be available on BRC's office, both Piracicaba, SP and Paragominas, PA.

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (B1.1)

The Amazon is known worldwide for its records of biological diversity in numerous taxa, accompanied by a high degree of endemism associated with specific ecosystems found only in this portion of the planet. Covering more than 6 million km² in nine northern South American countries, the region is habitat of at least 40,000 plant species, 427 mammals, 1,294 birds, 378 reptiles, and 427 amphibians. Approximately 60% of the Amazon in located in Brazil, which corresponds to 49.5% of the entire national territory (IBGE, 2019). The high deforestation rates and land use change from forests to livestock and agricultural have led to severe loss of biodiversity. In addition to deforestation, which implies loss of habitat area, other important threats to biodiversity in the project zone are forest degradation caused by wildfires and illegal logging, forest fragmentation, predatory hunting, and climate change (Fearnside, 2005).

As described in Section 2.1.1, nine properties included in the present AUD project are also under validation and verification in another APD Grouped Project (Verra Project ID 2551). Therefore, these areas have already been through one fauna inventory, conducted during the dry season, and its results are a sample of what we expect to find in all 20 properties included in the present project. The second fauna inventory is scheduled to happen in February of 2023 during the rainy season.

The inventory included 4 faunistic groups (mammals, birds, reptiles, and amphibians) and took into consideration endemic and threatened species.

Table 56 summarizes the results found so far. The complete results of the fauna inventory, description of the field methodology, species lists, and photographic records are available in **Erro! Fonte de referência não encontrada.**. Some of the photographic records of the fauna in the project area are shown below (Figure 46 to Figure 51).

Table 56 – Biodiversity existing conditions in the project area.

	Mammals	Birds	Reptiles	Amphibian	Total
Total richness	22	223	16	26	287
Endemic species	6	19	4	11	40
Endangered species*	6	14	-	-	20

*Classified as Near Threatened. Vulnerable. Endangered or Critically Endangered according to IUCN Red List

It is worth emphasizing that 20 species found during the fauna inventory are classified at some level of extinction threat under the IUCN Red List, what means that these species are facing the risk of extinction in the wild and actions that promotes habitat conservation are fundamental to guarantee the survival of these species.

The bird species *Psophia obscura* and the mammals *Cebus kaapori* are two examples of critically endangered species threatened by habitat loss and hunt pressure.

Figure 46 – Ara chloropterus (Red-and-green Macaw). Photo: Paulo Affonso Fonseca Pires Neto.

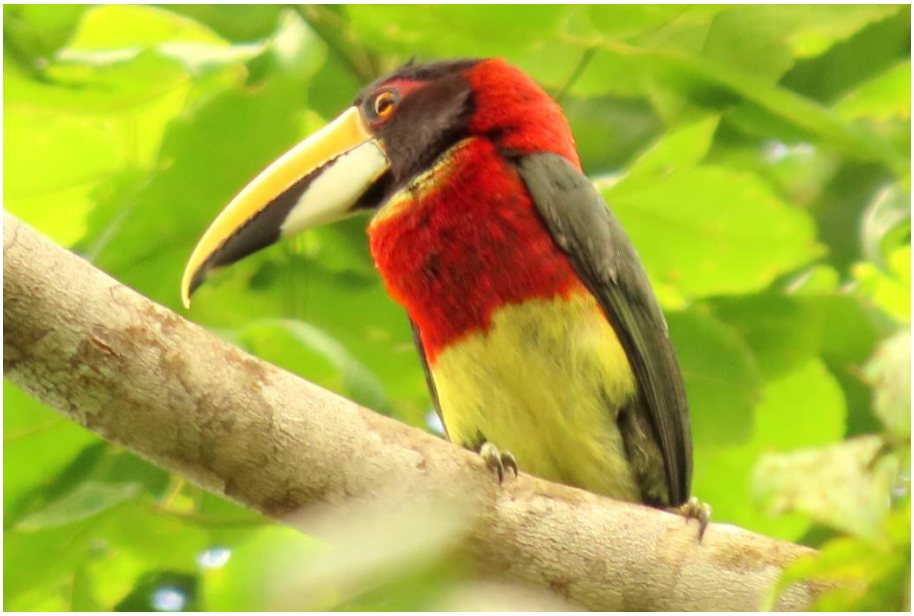


Figure 47 – Pteroglossus bitorquatus (Eastern Red-necked Araçari). Photo: Paulo Affonso Fonseca Pires Neto.

Figure 48 – Pithecopus hypochondrialis (Orange-legged Leaf Frog). Photo: Victor Augusto Fávaro.

Figure 49 – Corallus hortulanus (Garden Tree Boa). Photo: Victor Augusto Fávaro.

Figure 50 – Pantera onca. Photo: Jairo Alves Junior.

Figure 51 – Priodontes maximus (Giant Armadillo). Photo: Jairo Alves Junior.

5.1.2 High Conservation Values (B1.2)

The project zone has a global significant concentration of biodiversity values, such as threatened species and endemic species. The project zone also constitutes a globally significant landscape-level area where viable

populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance. The tables below (Table 57 to Table 59) describe the HCVs related to biodiversity identified in the project zone.

Table 57 – High Conservation Value identified in the project zone.

High Conservation Value	Global significant concentration of biodiversity values: endemic species
Qualifying Attribute	Studies indicate high rates of endemism among the biodiversity cataloged in the Amazon. It is estimated that 170 species of mammals, 263 types of birds and 620 species of amphibians and reptiles are endemic (Mittermeier et al. 2003).
Focal Area	The project area is in the Endemism Center of Belém (ECB), one of the regions most affected by deforestation in the Amazon. A total of 40 endemic animal species have been identified in the project area (**Erro! Fonte de referência não encontrada.**). The project will monitor biodiversity on an ongoing basis, focusing on endemic species.

Table 58 – High Conservation Value identified in the project zone.

High Conservation Value	Global significant concentration of biodiversity values: threatened or endangered species
Qualifying Attribute	According to IBGE data, there are 278 species of animals and plants at risk of extinction in the Brazilian Amazon.
Focal Area	A total of 20 species of birds and mammals under conservation threat have been identified within the project area (**Erro! Fonte de referência não encontrada.**). The project will monitor biodiversity on an ongoing basis focusing on the threatened species.

Table 59 – High Conservation Value identified in the project zone.

High Conservation Value	Global significant large landscape-level ecosystem
Qualifying Attribute	The project zone is in the Amazon Forest, the biggest tropical forest in the world that houses thousands of biodiversity species and provides different ecosystem services to humanity. It is estimated that the Amazon houses approximately 425 mammal species, 1300 bird species, 371 reptiles and 427 amphibians (Mittermeier et al., 2003).
Focal Area	The project zone represents the conservation of 57,291.44 ha of native forests located within the legal reserve that suffer highly illegal deforestation pressure. The conservation of the legal

	reserve will avoid habitat loss, fragmentation, and forest conversion, the main drivers of biodiversity loss in the Amazon.

5.1.3 Without-project Scenario: Biodiversity (B1.3)

In the without-project land use scenario deforestation, forest degradation caused by conventional logging and wildfires, fragmentation and mining can negatively affect biodiversity in the project zone. These are the recognized drivers for forest cover reduction in Amazonia Legal. The same drivers typically perceived in the project zone act in the project area. Habitat loss is the main cause of species extinction. In addition to habitat loss, biodiversity can be affected by predatory hunting.

5.2 Net Positive Biodiversity Impacts

5.2.1 Expected Biodiversity Changes (B2.1)

The with-project scenario in the project zone and over the project lifetime predicts only positive impacts to biodiversity. The conservation activities aim to promote habitat conservation and avoid predatory hunting. Table 60 shows expected biodiversity changes.

Table 60 – Expected biodiversity changes.

Biodiversity Element	Mammals, Birds, Reptiles and Amphibians
Estimated Change	Predicted positive indirect impact: maintenance of species richness and conservation
Justification of Change	The project activities will promote the maintenance of forest cover with the consequent maintenance of the useful habitat area for the species. In addition, the project will promote the continuous monitoring of different groups, with a focus on endangered, endemic, and game species. In this way, through the monitoring results, BRC will be able to intervene in the dynamics of the territory through environmental education actions, having in perspective an adaptive project management plan and to prevent the reduction in the diversity of species and local extinctions.

5.2.2 Mitigation Measures (B2.3)

Negative impacts on biodiversity are not expected due to project activities implementation neither within nor outside the project area. All project activities are designed to conserve the forest cover and avoid habitat loss within the project area. The threatened and endemic species identified (HCV) will be positively impacted by those activities.

5.2.3 Net Positive Biodiversity Impacts (B2.2. GL1.4)

Considering the project initial scope, the project activity implementation will avoid the deforestation of 57,291.44 ha throughout its lifetime, thus directly contributing to the maintenance of the forest cover, the usable area of habitats and the species diversity in the project zone. The project's anticipated net impacts on biodiversity in the project zone will be positive compared with conditions under the without-project land use scenario.

5.2.4 High Conservation Values Protected (B2.4)

The project activities do not foresee to negatively affect the HCVs related to biodiversity. The implementation of project activities will result in the direct conservation of forest cover in private areas in the project zone, thus contributing to the maintenance of habitats, species diversity, protection of threatened and endemic species and landscape integrity.

5.2.5 Species Used (B2.5)

The project activities do not foresee the introduction of plant or animal species of any kind.

5.2.6 Invasive Species (B2.5)

The project activities do not foresee the introduction of invasive species of any kind. Neither foresee the increase of any invasive species population as a result of project activities during its lifetime.

5.2.7 Impacts of Non-native Species (B2.6)

The project activities do not foresee the use of non-native species; therefore. no potential adverse effect is expected in the project zone.

5.2.8 GMO Exclusion (B2.7)

Project activities do not foresee the introduction of plant or animal species of any kind, including GMOs.

5.2.9 Inputs Justification (B2.8)

This is a conservation project and the implementation activities do not foresee the usage of inputs, such as fertilizers, chemicals pesticides and biological control agents.

5.2.10 Waste Products (B2.9)

No significant waste is expected to be generated by the project activities implementation.

5.3 Offsite Biodiversity Impacts

5.3.1 Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

This is a conservation project and no potential negative impacts on biodiversity outside of the project zone are expected due to project activities implementation.

5.3.2 Net Offsite Biodiversity Benefits (B3.3)

Not applicable. No negative impacts on biodiversity outside the project zone are expected. Thus, the net effect of the project on biodiversity is always positive.

5.4 Biodiversity Impact Monitoring

5.4.1 Biodiversity Monitoring Plan (B4.1. B4.2. GL1.4. GL3.4)

This section brings the biodiversity variables to be monitored, the sampling methods, the monitoring frequency and reporting to be used during the project implementation that are linked to the project's biodiversity goals. The minimal monitoring frequency for CCB Standard is five years, that is once in each monitoring cycle. The sampling will be carried out in both dry and rainy seasons.

The monitored area will comprise the natural forests located within the private properties of the project. The biodiversity variables and sampling methods are described in Table 61.

Table 61 – Biodiversity monitoring plan.

Activity description	Biodiversity Variables	Sampling Method	Project Goals
Mammal's monitoring	Species richness	Active search, camera traps	Biodiversity Conservation
	Threatened species	Threatened species sampled are identified through IUCN Red List	
	Endemic species	Endemic species sampled are identified through peer review literature	
	Game species	Games species sampled are identified through direct observation, peer review literature and community interviews.	
Bird's monitoring	Species richness	Active search	
	Threatened species	Threatened species sampled are identified through IUCN Red List.	
	Endemic species	Endemic species sampled are identified through peer review literature	
	Game species	Games species sampled are identified through direct observation, peer review literature and community interviews.	
Reptiles and Amphibians' monitoring	Species richness	Active search	
	Threatened species	Threatened species sampled are identified through IUCN Red List	
	Endemic species	Endemic species sampled are identified through peer review literature	
	Game species	Games species sampled are identified through direct observation, peer review literature and community interviews.	

Among mammals, there is a great diversity of habits and behavior patterns that require the application different methods to determine ecological parameters (Voss and Emmons, 1996). The active search and camera trap survey methods have been traditionally used in the study of medium and large mammals (Cullen Jr. et al., 2003).

The active search method consists of free surveys carried out by specialists walking through a constant speed on pre-existing irregular trails searching for animals (e.g., sighting or vocalizations) or their signs (e.g., footprints, tracks, feces, bones, etc.). The mammals survey will be carried out in two periods, the first starting with sunrise and extending until 1:00 pm, and the second starting after the hottest hours, around 15:00 hours, extending to the night period. All records were listed in field spreadsheet, and whenever possible, verified through photographic record.

The camera traps have application in biological, ecological, and behavioral studies, such as feeding behavior, habitat, activity patterns, species richness and population ecology (Trolliet et al., 2014; Caravaggi et al., 2017. Moreover, it is a practical, non-invasive method that requires little effort in the field, when compared to other methods. The location for the installation of the camera traps will be defined in the field, aiming the proximity with fauna trails or paths. The exact local of installation will be collected using a GPS. The traps will remain in operation throughout 24 hours and attractive baits will be used to enhance the records.

The bird surveys will also be carried out through active search and conducted in two periods, the first starting with sunrise extending until 1:00 pm and the second starting after the hottest hours in the afternoon, around 3:00 pm up to the night period. All visual and/or acoustic records that result in an undoubted identification of the species will be recorded. Visual identification will be performed using binoculars (Bushnell 10x42) and digital recorders (Sony PX240 and Roland R05). When necessary, the identification will be confirmed with identification guides.

The reptiles and amphibians survey will be conducted through the method of active search twice a day, in the morning period (5:00 am - 12:00 pm) and twilight/night (4:00 pm - 10:00 pm) to cover the period of greatest activity of amphibians and reptiles. The survey will focus on searching micro-habitats of amphibians and reptiles, such as litter, fallen trucks, rocks, aerial roots, holes in ground and trees, aquatic environments, termite mounds, temporary ponds, and others (Heyer et al., 1994).

All recorded species will be evaluated according to the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species to identify the species that are under extinction risk within the project area. The endemism of the recorded species will be identified through peer review literature. The identification of game species will also be made through literature review, direct observation, and community interviews.

5.4.1.1 Exceptional Biodiversity Benefits

- Qualifying conditions **GL3.1**.

The REDD+ Grouped Project intends to meet the Gold Level for exceptional biodiversity benefits by meeting the vulnerability criteria established in the Climate, Community & Biodiversity Standards: v3.1 (GL3.1.a). The existing biodiversity conditions (see section 5.1.1) demonstrated the presence of two Critically Endangered (CR) species (*Psophia obscura* and *Cebus kaapori*) and one Endangered (EN) species (*Pteroglossus bitorquatus*) within the project area. These species trigger the vulnerability criteria and classifies the project area as a Key Biodiversity Area (KBA) (Langhammer et al. 2007).

The *P. obscura* is a large-bodied (>1kg), terrestrial bird species, popularly known as black-winged trumpeter (jacamim-de-costas-escuras). The species is endemic to the Brazilian Amazon with occurrence restricted to Belem Center of Endemism, one of the oldest deforestation frontiers of the biome. The species distribution range goes from eastern Amazonia to east of Tocantins River in north-east Para and northwestern Mato Grosso (BirdLife International, 2018). The trumpeters are forest-interior specialists, and deforestation and forest fragmentation are the main threats to the species survival. Moreover, the large body characteristics and group-living behavior makes them very attractive for hunters (Carvalho et al., 2022).

C. kaapori is a primate popularly known as gracile or untufted capuchin monkey (Caiarara). The species is endemic to Para and Maranhão states of Brazil, and its distribution range also coincides with Belem Center of Endemism (Fialho et al., 2021). Its distribution range its quite small for an Amazonian primate and the fact that is restricted to one of the places with the highest human population and highest levels of deforestation makes this species one of the most endangered primates of the Brazilian Amazon (Oliveira et al., 2014). The biggest threats to *C. kaapori* survival are the land use change from forests to cattle ranches, soy plantations, construction of hydroelectric dams, hunting pressure and pet trade. The threats are so intense that the species has been listed on the top 25 most endangered primates (Mittermeier et al., 2012).

P. bitorquatus is a toucan species from the Ramphastidae family, commonly known as Eastern Red-necked Araçari (araçari-de-pescoço-vermelho). The *P. bitoquartus* inhabits tropical forests, galley forests and woodland savannas. The species is also endemic to Belem Center of Endemism and occurs between the east side of Tocantins River and Maranhão state (Aleixo et al., 2018). Although the species has already been registered on secondary forests, it seems to be much more dependent on a conserved forest matrix than other congeneric species (Lima et al., 2014; BirdLife International, 2016).

- Population trends **GL3.2**.

Is estimated that the population of *P. obscura* is decreasing, and recent studies performed within and nearby the project zone estimates population size of less than a couple of hundreds of individuals, distributed in two disjuncts groups (Lees et al., 2012; BirdLife International, 2018). One of the known groups is located within the project zone, in the municipality of Paragominas and the other group is located outside the project zone, in the

Gurupi Biological Reserve and contiguous Indigenous Land (Lees et al., 2012; BirdLife International, 2018; Carvalho et al., 2022). The species distribution range goes from eastern Amazonia to east of Tocantins River in north-east Para and northwestern Mato Grosso (Birdife International, 2018).

The population size of *Cebus kaapori* in the wild is not known, however, field observations and recent studies suggests low populations densities (Fialho et al., 2021). Studies performed nearby the project region in REBIO Gurupí, in Maranhão state, found populations of 0.25 groups/10 km (Buss et al. 2014). In Para state, the populations are estimated between 0.28 sightings/10 km (Pereira 2002) and 0.16-0.19 groups/10 km (Camargo 2008.

Although is considered a common species by some authors, *P. bitorquatus* presents very limited geographic range distribution that coincides with one the most deforested Amazon regions (BirdLife International, 2016). According to Amazonian deforestation models, this species is likely to lose 45.6-57.8% of its habitat within the next three generations what could profoundly impact the species survival (Soares-Filho et al. 2006, Bird et al. 2011).

- Measures needed to maintain or enhance the population status **GL3.3**

All trigger species found within the project area have small geographic range, are endemic to Belem Center of Endemism and suffer populations decline due to habitat loss caused by forest degradation and deforestation. In this scenario, the most important measure that will be taken by the project activities to maintain the survival of the trigger species is the conservation of the forest cover and avoidance of illegal deforestation within the project area. The project areas will act as biodiversity remnants in a landscape that is mostly dominated by grazing and agriculture.

- Indicators of population trends **GL3.4**

According to IUCN Red List, all trigger species (*Psophia obscura, Cebus kaapori and Pteroglossus bitorquatus*) are currently on a decreasing populational trend that is caused mostly due to habitat loss, for that reason, the protection of forest remnants is one the most effective measures for species conservation. In the IUCN Red List assessment *of P. bitorquatus* and *P. obscura* the authors highlight that the conservation actions should promote joint actions that aims to reduce carbon emissions and enhance biodiversity conservation (BirdLife International 2016; 2018).

5.4.2 Biodiversity Monitoring Plan Dissemination (B4.3)

The monitoring plan and monitoring results will be available on Verra's website, through the monitoring reports full documents. In addition, the monitoring results will be published in the project proponent social media and website. The monitoring plan and results will be communicated to the communities and stakeholders during public meetings and social engagement stages.

It will be delivered a document version to stakeholders and a version of the document will be available on BRC's office, both Piracicaba, SP and Paragominas, PA.

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