ITAÚBA REDD+ Project

By Carbonext

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Project Title	ITAÚBA REDD+ PROJECT
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Date of Issue	10-June-2022
Project Location	Marcelândia and Itaúba municipalities, State of Mato Grosso, Brazil
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Project Lifetime	14 December 2022 – 13 December 2051; 30-year lifetime
GHG Accounting Period	14 December 2022 – 13 December 2051; 30-year total period
History of CCB Status	-
Gold Level Criteria	Climate; Biodiversity.
Expected Verification Schedule	July, 2022

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1 SUMMARY OF PROJECT BENEFITS Unique Project Benefits

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) Expected Climate Benefits: The project aims to climate change mitigation by avoiding deforestation of 2,915 hectares in the Amazon Biome, through local Surveillance, remote satellite monitoring, and a system of deforestation alerts in the Project Area for early identification of illegal trespassing. The project will also enhance climate adaptation by creating a climate adaptation private fund to build local financial resilience in terms of responsiveness to climate related disasters and/or emergencies.	3
2) Expected Community Benefits: The project will have a positive impact on local communities, strengthening awareness and capacity building in activities related to the reduction of deforestation and activities aimed at the conservation of natural resources, such as environmental education activities, climate change adaptation, soil conservation, and sustainable agriculture practices. Overall, the project aims to empower local communities and promote the principles of forest valuation and natural resource use. The climate adaptation fund will bring social safety in terms of climate resilience.	4
3) Expected Biodiversity Benefits: The project guarantees constant monitoring of the forest integrity inside the Project Area and ensures the conservation of local habitats and biodiversity, which includes at least nine endangered species of fauna listed in the IUCN Red List and/or in the ICMBio Red Book. At least one endangered species will have its population trends monitored as an indicator of the effectiveness of its habitat conservation.	5

1.2 Standardized Benefit Metrics

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
GHG emission reductions or removals	Net estimated emission removals in the project area, measured against the without-project scenario	Not applicable	N/A
	Net estimated emission reductions in the project area, measured against the without-project scenario	859,641 tCO_2e	3.2.4
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	2,915 hectares	3.2.1
	For ARR[3] projects: Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario	Not applicable	N/A
Improved land management	Number of hectares of existing production forest land in which IFM[4] practices are expected to occur as a result of project activities, measured against the without-project scenario	Not applicable	N/A
	Number of hectares of non-forest land in which improved land management practices are expected to occur as a result of project activities, measured against the without-project scenario	Not applicable	N/A
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	3103	4.4.1
	Number of female community members who are expected to have improved skills and/or knowledge resulting from training as part of project activities	Not applicable	4.4.1

[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] Afforestation, reforestation and revegetation (ARR) - Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through the planting, sowing and/or human-assisted natural regeneration of woody vegetation (*VCS Program Definitions*)
[4] 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,[5] expressed as number of full-time employees[6]	2 - 4	4.4.1
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	Not applicable	4.4.1
Livelihoods	Total number of people expected to have improved livelihoods[7] or income generated as a result of project activities	65	4.4.1
	Number of women expected to have improved livelihoods or income generated as a result of project activities	Not applicable	4.4.1
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	Not applicable	4.4.1
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Not applicable	4.4.1
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	3168	4.4.1
	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	Not applicable	4.4.1
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	Not applicable	4.4.1

[5] 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.
[6] 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])
[7] 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
	activities, measured against the without-project scenario		
	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	No applicable	4.4.1
Well-being	Total number of community members whose well-being[8] is expected to improve as a result of project activities	3168	4.4.1
	Number of women whose well-being is expected to improve as a result of project activities	Not applicable	4.4.1
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation,[9] measured against the without-project scenario	15,352.90	5.4.1
	Expected number of globally Critically Endangered or Endangered species[10] benefiting from reduced threats as a result of project activities,[11] measured against the without-project scenario	8	5.5.2

[8] 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.
[9] 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
[10] Per IUCN's Red List of Threatened Species
[11] In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

2 GENERAL

2.1 Project Goals, Design and Long-Term Viability

2.1.1 Summary Description of the Project (G1.2)

The ITAÚBA REDD+ PROJECT aims at protecting forests in one of the regions having the highest deforestation trends in the Amazon Biome: the municipalities of Itaúba and Marcelândia. Both the municipalities are inside the “Arc of Deforestation” and since the colonization of the municipalities, besides the damage caused to natural ecosystems, several social conflicts have emerged from the dynamics of unsustainable land use, associated with the extensive deforestation and degradation activities. Throughout time, communities with livelihoods based on family-scale agriculture and forest resources were expulsed from the region and gave place to the large scale agricultural and pasture activities.

For the project period, the baseline scenario for the Project Area indicates that the historical patterns of change in land-use would be reproduced: extensive deforestation and systematic conversion from forest to soy crops and pasture areas for cattle ranching, far above the limits stablished by the Brazilian Forest Code. The project activities are designed to avoid the deforestation drivers that would realize the referred baseline in the without project scenario, with the long-term vision of restoring the relation of local communities of rural workers with the forest areas and contribute with the transition to socioeconomic scenario build on bioeconomy principles. With project activity approval, the proponents intend to improve the mechanisms of remote and *in loco* surveillance, as well as implement activities that will result in other climate, community, and biodiversity benefits.

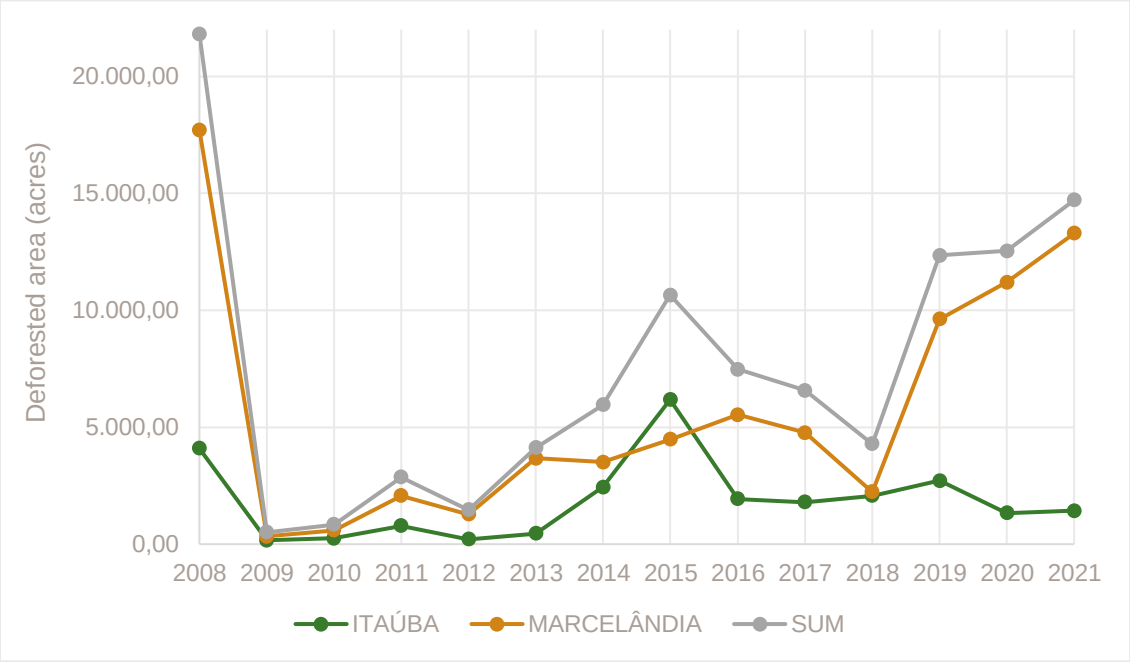

Figure 1: Annual increase of deforestation in the municipalities of Marcelândia and Itaúba. Source: [1]

The climate, community and biodiversity benefits of the project include but are not limited to:

- Avoided deforestation of 2,915 hectares of native Amazon Forest over 30 years, corresponding to an estimated net GHG emission reduction of 859,641 tCO_2e by the end of the project (annual average of 28,655 tCO_2e).
- Technical training and capacity building on forest management, fire brigades, occupational health, and safety in the local communities.
- Environmental education activities with the local communities.
- Monitoring of biodiversity and endangered species population trends inside the project area.

The ITAÚBA REDD+ PROJECT is contemplated in the sectoral scope of Agriculture, Forestry and Other Land Use (AFOLU) under the Reducing Emissions from Deforestation and Degradation (REDD) Unplanned Deforestation and Degradation (AUDD) category.

2.1.2 Project Scale

Project Scale	
Project	x
Large project	

2.1.3 Project Proponent (G1.1)

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2.1.4 Other Entities Involved in the Project

There is no other entity which is involved in this project.

2.1.5 Physical Parameters (G1.3)

As stated in section 2.1.1, the current project will be developed in two municipalities, Marcelândia and Itaúba, which belong to Mato Grosso state, in the central-western region of Brazil (Figure 2).

The main physical aspects (Geological units, soil, geomorphology, climate, hydrology, and types of vegetation) related to the municipalities are described below.

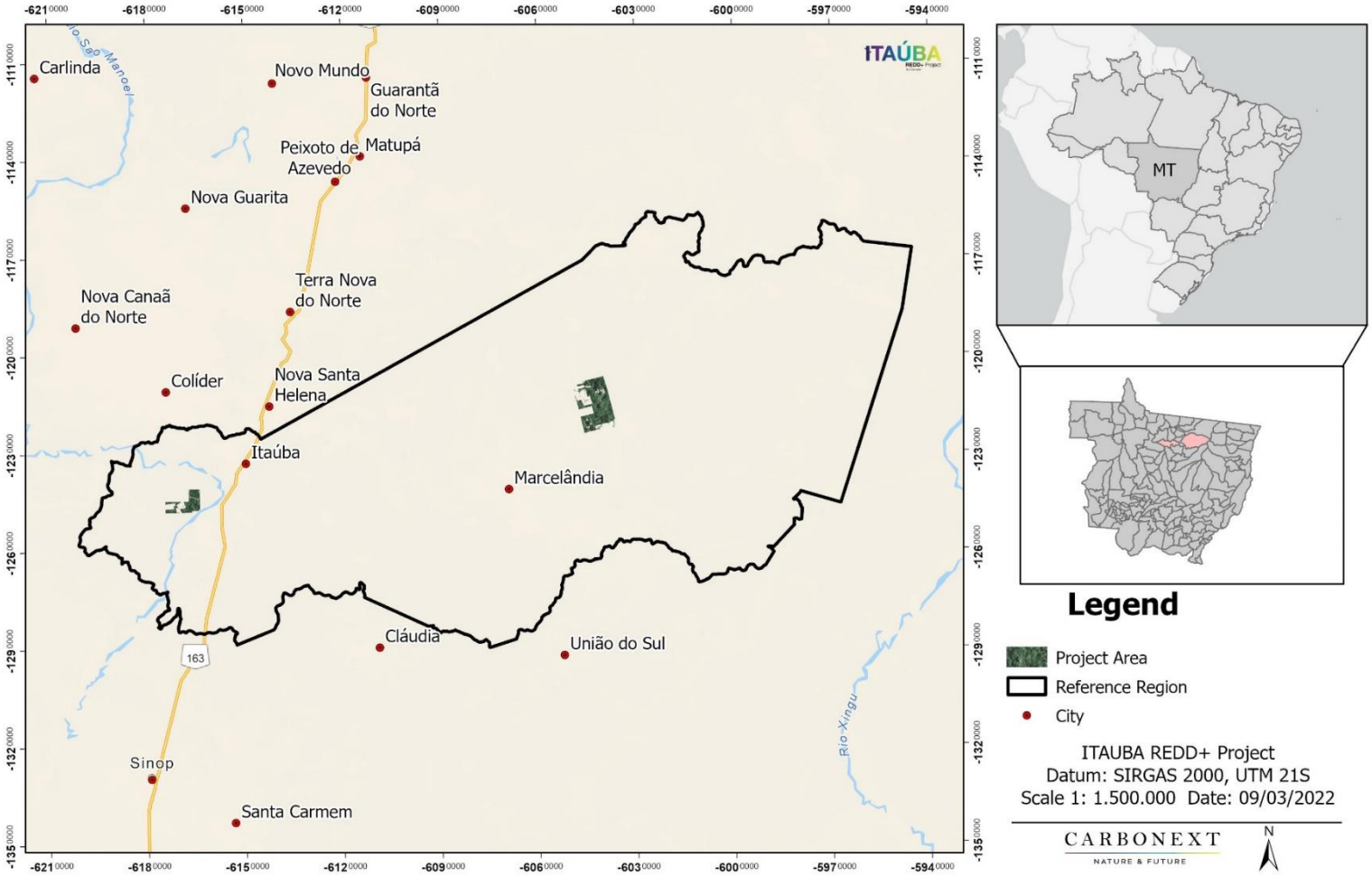


Figure 2: Project location within the regional division of the State of Mato Grosso. Source: Carbonext (2022)

2.1.5.1 Geological units

According to the Geological Survey of Brazil - CPRM, the main geological units in Marcelândia are the Ronuro Formation and the Colíder Group, both contributing 83% of the total (Table 1). The former one is a deposit of unconsolidated sediments, composed of sand, clay and fluvial gravel of the Cenozoic Era (5 million years ago). The Colíder Group, on the other hand, has its formation associated with the Juruena plutono-volcanic arc, whose main components are acidic rhyolitic vitrophyritic and microporphyritic lavas, rhyodacites and dacites, as well as intermediate andesitic, porphyritic lavas intercalated with pyroclastic and epiclastic deposits [2].

Table 1: Geological Units in Marcelândia. Source: CPRM, apud [2]

Geological Units	**Total area (ha)**	**%**
Ronuro Formation	695,449	56.59
Colíder Group	324,620	26.41
Alluvial deposits	87,765	7.14
Dardanelos Formation	63,095	5.13
Nhandu granite	33,692	2.74
Pleistocene Ferruginous detrital-lateritic coverage	24,347	1.98
Total	1,228,968	

The alluvial deposits have their formation associated with fluvial sedimentary deposits, whose main sediments have a sandy and clayey nature (most consolidated and semi-consolidated ones), associated also with gravels. Dardanelos Formation has a heterogeneous composition of sediments, ranging from medium to coarse sandstones, with traces of conglomerates, volcanic sub gray wacke and arkose. The Nhandu Granite is formed basically batholiths and granitic stocks, presenting in smaller proportion subvolcanic facies composed of fine granites to micro quartz, among other elements. Finally, the Pleistocene Detrital-Lateritic coverage is configured as a sediment deposit composed of yellowish sandy-clay sediments, generated by allochthonous and autochthonous processes, and can be totally pedogenized [2].

Regarding the municipality of Itaúba, the main substrate that predominates in the region is the Dardanelos Formation, described by [3]. This unit outcrops in the northeast quadrant, filling the Caiabis depression. The rocks of this formation are already in an advanced stage of weathering, developing sandy-silty soils, presenting thicknesses of 2 meters, forming a ferruginous lateritic layer. Due to the advanced weathering process, the relief is smooth, with wide interfluves, low density subdentric drainage, slightly rough texture, and gray coloration. Another aspect of this formation is found closer to the Atlântica district, where a fine-grained sandstone package of reddish/yellowish placement and planar-parallel stratification is identified, encompassed by a mangano-ferric layer [4].

Another formation is also identified that is presumed to be the result of reworking of sandstone rocks of the Dardanelos Formation, found in the direction of Serra Formosa. This unit presents conglomerate packages consisting of pebbles of Archean sandstones, quartz sandstones with a yellow clay matrix, overlain by packages of red clayey sediments [4].

2.1.5.2 Soil Groups

According to the survey conducted by the Economic-Ecological Zoning (SEPLAN, 1998 apud [2]), there are seven types of soil in Marcelândia (Table 2), with the predominance of Dark Red Latosol (64.29%) located throughout the eastern and southern portions of the municipality. These are deep mineral soils, resistant to surface erosion due to their high porosity and permeability. Its texture is considered clayey with chemical properties that limit agricultural activities, requiring corrective action for full utilization. However, this type of soils is indicated for cyclical farming in developed management systems. Allied to the flat relief and absence of gravel, stones, among other physical impediments, these soils favor the development for the most diverse agricultural cultures, without the need for intensive use of agricultural machinery [2].

Table 2: Soil Classes in Marcelândia. Source: SEPLAN (1998) apud [2].

Soil Classes	**Total area (ha)**	**(%)**
Dark Red Latosol	789,306	64.29
Red-Yellow podzolic Latosol	284,005	23.13
Gley low humic	62,760	5.11
Red-Yellow alic podzolic	53,521	4.36
Litholithic soils	33,916	2.76

Plinthosol	3,636	0.30
Dystrophic alluvial soil	621	0.05

Located in the northwestern portion of the municipality, the Red Yellow podzolic Latosol presents a large texture gradient within the latosol class, occurring both in flat and gently undulating reliefs, subject to erosion processes. For agricultural use, this type of soil also requires intervening practices, such as fertilization and liming [2].

The Gley low humic soil is formed by hydromorphic minerals, found mostly in permanently flooded environments, such as riverbanks. Regarding their textural aspect, they are usually grayish or bluish clay due to the presence of iron. The agricultural use of this type of soil is only possible after drainage processes and corrections of chemical element deficiencies, and can be used for pastures and sugar cane, among others agricultural crops [2].

Another mineral soil type is the Red Yellow alic podzolic, found in the northeastern portion of the municipality. These are non-hydromorphic soils, whose main use for agriculture is planted pasture, besides its usefulness for reforestation and preservation of flora and fauna [2].

The other soil classes identified present stony forms (Litholithic soils) and low natural fertility (Plinthosol) [2].

The pedological aspects of the municipality of Itaúba, unlike Marcelândia, presents only one type of soil, namely: Latosolic Dystrophic Concretionary Soil. They are poorly developed soils, with more than 50% gravel-sized ferruginous concretions, whose texture can vary from medium to clayey, with yellowish to reddish colors. This characteristic makes these soils unsuitable for cultivation, being possible only where the gravel found is very small in diameter [4].

2.1.5.3 Geomorphology

Four types of geomorphological classes are identified for Marcelândia, with the flattening system being the most predominant (92.92 %), see Table 3. The predominantly flat relief of this system is the result of a prolonged erosive process within stable tectonic and climatic conditions [5].

Table 3: Geomorphological classes in Marcelândia. Source:[2]*SEPLAN (1998) apud* [2]

Geomorphological classes	**Total Area (ha)**	**(%)**
Flattening system	1,143,397	93.1
Meandriform Alluvial Plain System	58,641	4.8
Hill and slope dissection system	20,638	1.7
Floodplain system	5,255	0.4
Total	1,227,931	

The Hill and slope dissection system are transitional regions between the flattening system in the northwest of Marcelândia, where erosive processes that form the hills and slopes are more recent event [2].

The Floodplain system has its genesis in the sedimentary deposits of smaller rivers. Associated to the fluvial genesis of larger rivers with low gradient, the Meandriform Alluvial Plain System has as its main characteristic the formation of concave margins, where the excavation process occurs and at the other end the sedimentation process (point bar). The formation of swamps with the presence of a lot of organic deposits is common, as well as the formation of temporary islands [2].

The description of the geomorphology of the municipality of Itaúba was based on the study "*Aspectos Geomorfológicos da Folha Sinop – MIR – 320 (SC.21-Z-D) – Memória técnica*" [4] and two geomorphological systems were observed, namely: Flattening System and the Fluvial Plain System.

The surface of the Flattening System presents reliefs formed on sandy sediments, with a standard hill shape with flattened tops and a sub-dendritic drainage network. A recurring process observed in this system is indiscriminate deforestation, which increase the velocity of laminar runoff, generating linear erosion fronts with the deepening of furrows and gullies. A consequence of this process is the multiplication of erosive and depositional events [4].

Above the 400m altitude, outcrops of Dardanelos Formation are common, formed by medium-sized hills supported by laterite sandstone blocks and reworked by colluvial processes. Another feature observed is

the occurrence of Dardanelos metarenites, with the formation of asymmetric hills in the Utiariti Formation [4]

The other system identified is the Fluvial Plain, which corresponds to fluvial terraces composed of sands, silts, and clays subject to gleization process with unconsolidated gravel deposits in small drainages. In this system the slope is less than 1% and the width of these plains and terraces are always less than 2500 meters [4].

2.1.5.4 Climate

The State of Mato Grosso has three main climate zones, which are: Equatorially hot and humid, with a defined dry season of the South-Amazon Depression; Sub-equatorially continental humid of the Parecis Plateau and the highly humid and dry Continental Tropical of the slaps, plateaus, and depressions. The municipalities of Marcelândia and Itaúba are in the Equatorially hot and humid zone and according to Köppen and Geiger the climate is classified as Aw [6].

The outstanding characteristic of this climate type is the daily temperature ranges, which can represent a variation between 10 and 12ºC, while the seasonal cycle range is no more than 2ºC. Maximum temperatures may reach 35º and minimum between 19.5 and 21 ºC. The medium annual precipitation index ranges from 2000 to 2500 mm, with a moderate dry season that occurs from June to September with an intensity of 200 to 250 of water deficiency (Figure 3). The rainy season is from October to April, with a water surplus of 100 to 1200 mm [6].

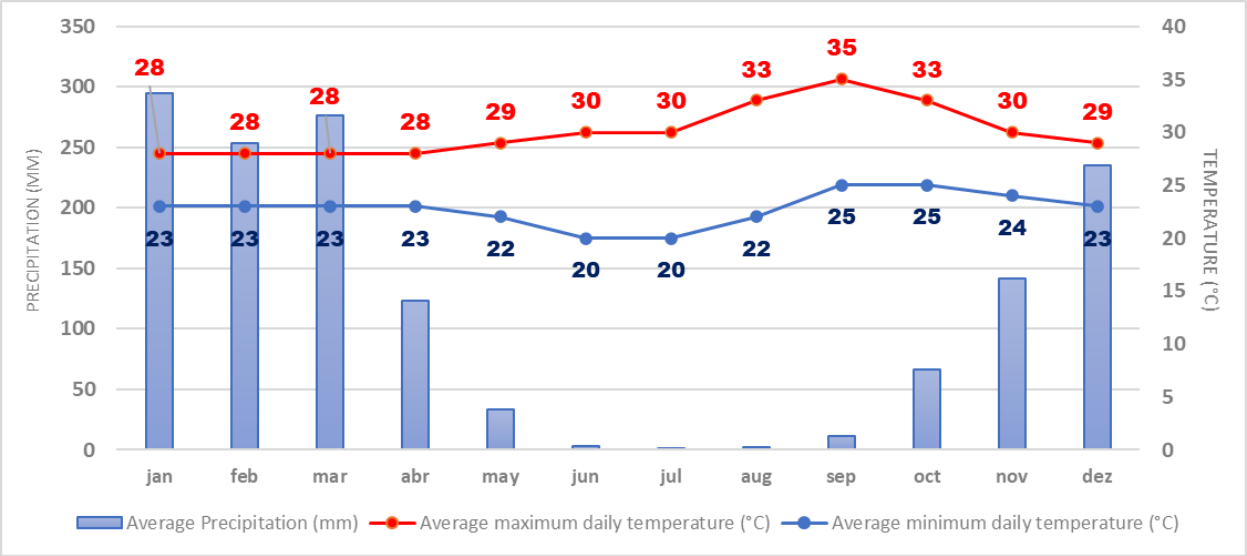


Figure 3: Marcelândia and Itaúba's Climate Diagram. Adapted from Meteoblue[12].

2.1.5.5 Hydric resources

The river networks in the state of Mato Grosso supply the three largest hydrographic basins in Brazil, namely: the Amazon basin, the Platina basin, and the Araguaia-Tocantins basin [7]. The municipality of Marcelândia is totally inserted in the Amazon basin (Figure 4), composing an extensive hydrographic network with almost 6,300 km in length of permanent, intermittent, and ephemeral rivers, favoring the diversity of natural landscapes – such as waterfalls – and a high biodiversity. Among its main rivers, we can identify the Manissauá-miçu (also called Manito) and the Peixoto de Azevedo river, both flowing into the Xingu River (Figure 4) [8]. The municipality is also covered by two aquifer domains, namely: Porous Domain and the Fractured Domain [6].

The Municipality of Itaúba, as well as Marcelândia, is fully inserted in the Amazon basin, with influence from the Mid Teles Pires and Manissauá-Miçu sub-basins (Figure 5), which together present annual outflows between 20,000 and 40,000 hm^3/year. The aquifers domain covering Marcelândia are also identified for Itaúba [6].

[12] It is worth noting that the Meteoblue weather diagrams are based on 30-year simulations of hourly weather models and are available for all places on Earth. They give good indications of typical weather patterns and expected conditions (temperature, precipitation, sunlight, and wind). The simulated weather data have a spatial resolution of about 30 km and may not reproduce all local weather effects, such as thunderstorms, local winds or tornadoes, and local differences as they occur in urban, mountainous, or coastal areas (www.meteoblue.com)

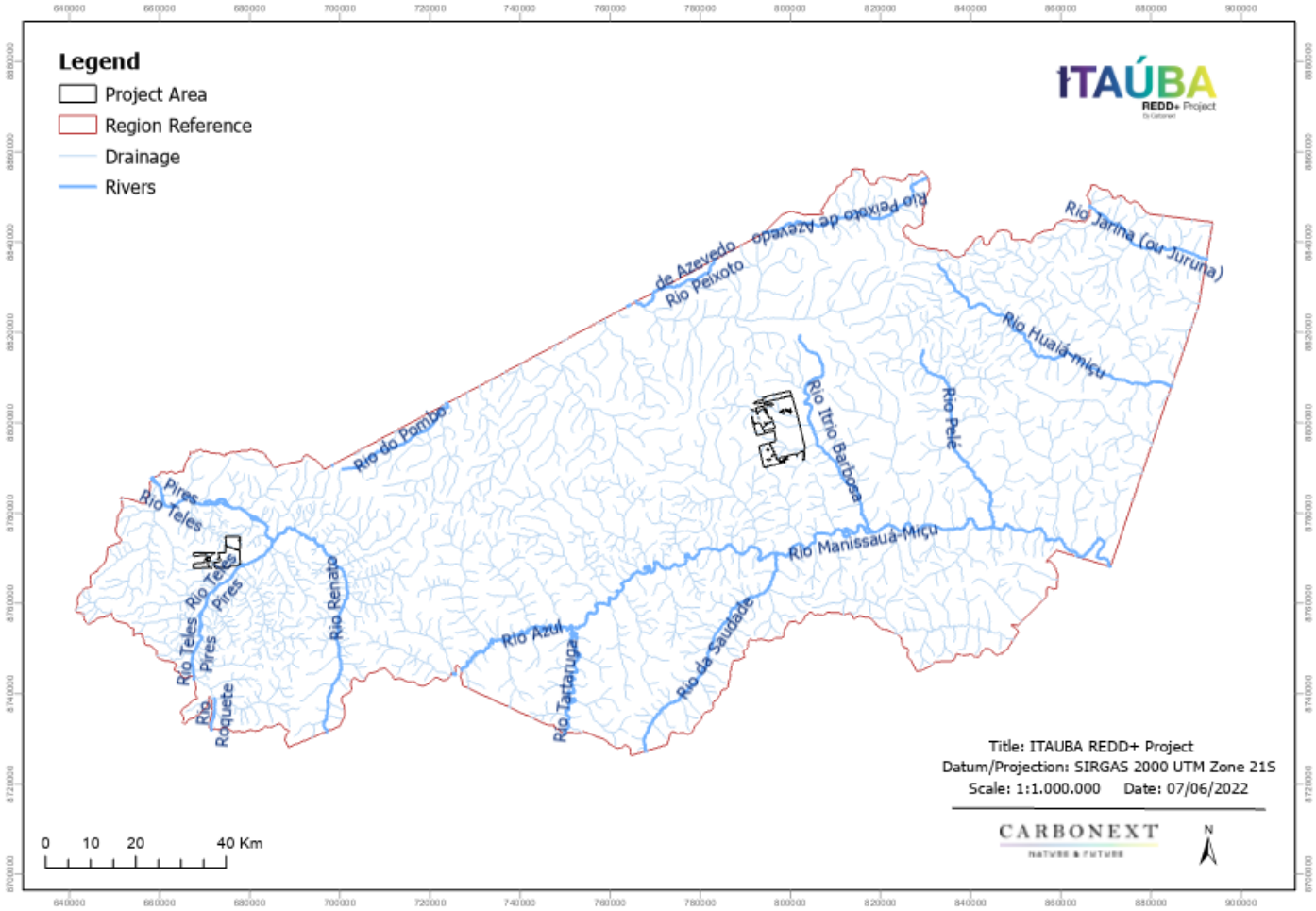


Figure 4: Hydrography in the reference region and project area. Source: Carbonext (2022)

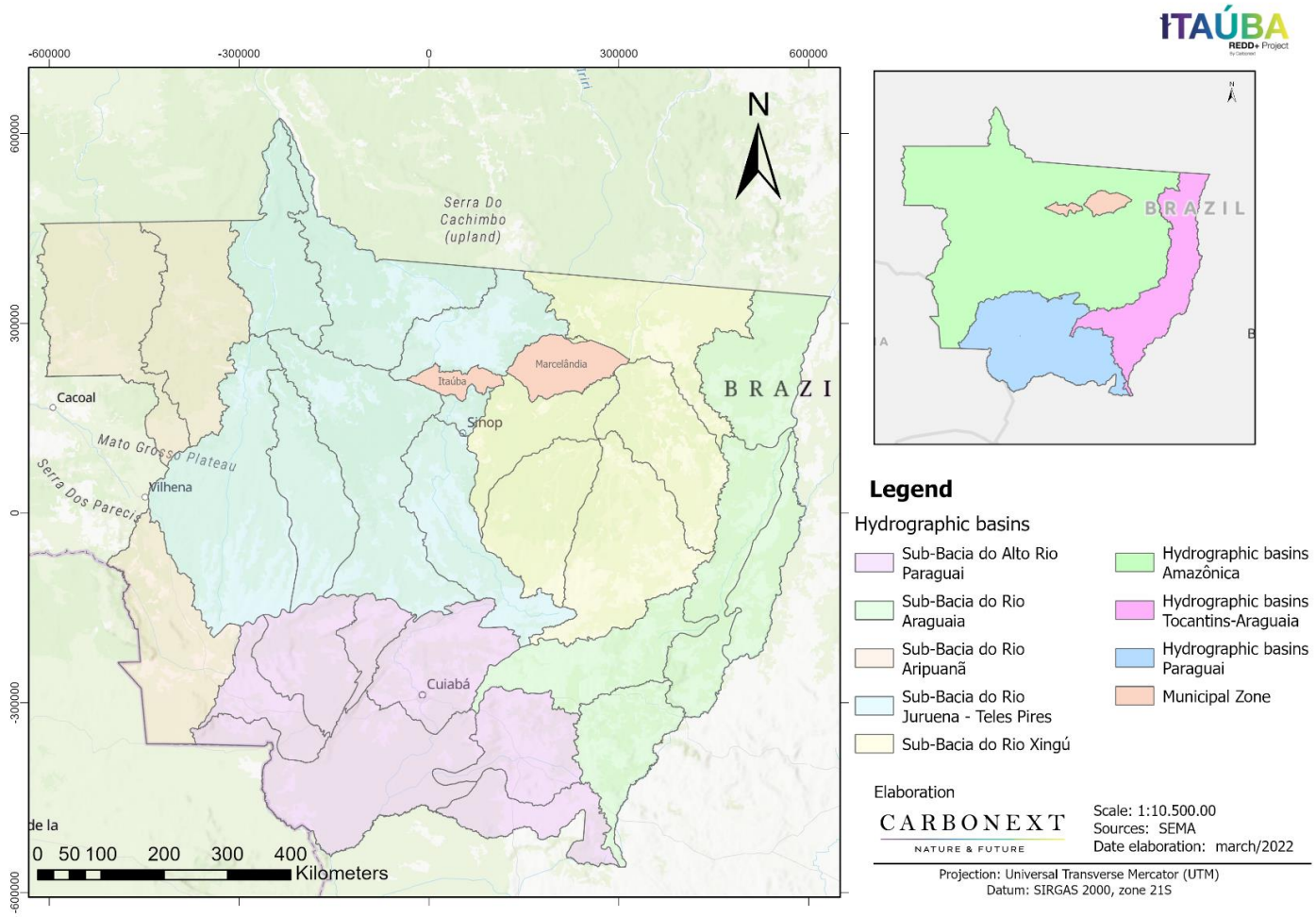


Figure 5: Hydrographic basins in the state of Mato Grosso. Source: Carbonext (2022)

2.1.5.6 Vegetation

The great availability of water resource allied to the great territorial extension gave the state of Mato Grosso a considerable variety of vegetations, comprising three of the five Brazilian biomes, namely: Amazon, Cerrado (type of Savannah) and Pantanal [9]. Both municipalities, Marcelândia and Itaúba, are inserted in the Amazon Biome, however, they have different predominant vegetation.

According to SEPLAN (1998) apud [2] the main vegetational formations of Marcelândia are the Ombrophylous Forest, on soils of the podzolic type; Seasonal Forest, present in dissected relief, forming enclaves; and Savannah Formations or Cerrados with wooded and forested physiognomies (*Cerradão* and *Cerrado Strictu Sensu*) (Figure 6). In 2012, IBGE [9] inserted a new classification for this region, indicating as Evergreen Seasonal Forest (*Floresta Estacional Sempre Verde*) the transition vegetation between the Ombrophylous Forest and the Seasonal Forest, which species are essentially Amazonian and varies between 49 to 66 species [10] .

The project area in Marcelândia is inserted in Evergreen Seasonal Forest. As there are no biomass data on this vegetation in the literature available, the biomass data from Lower Montane Semideciduous Forest (subgroup of Seasonal Forest) conservatively was used [11]. Itaúba, in another hand, is fully inserted in the Wooded Savana (Figure 6), which biomass data are available in the 3rd National Communication and the inventory of greenhouse gas emission [11].

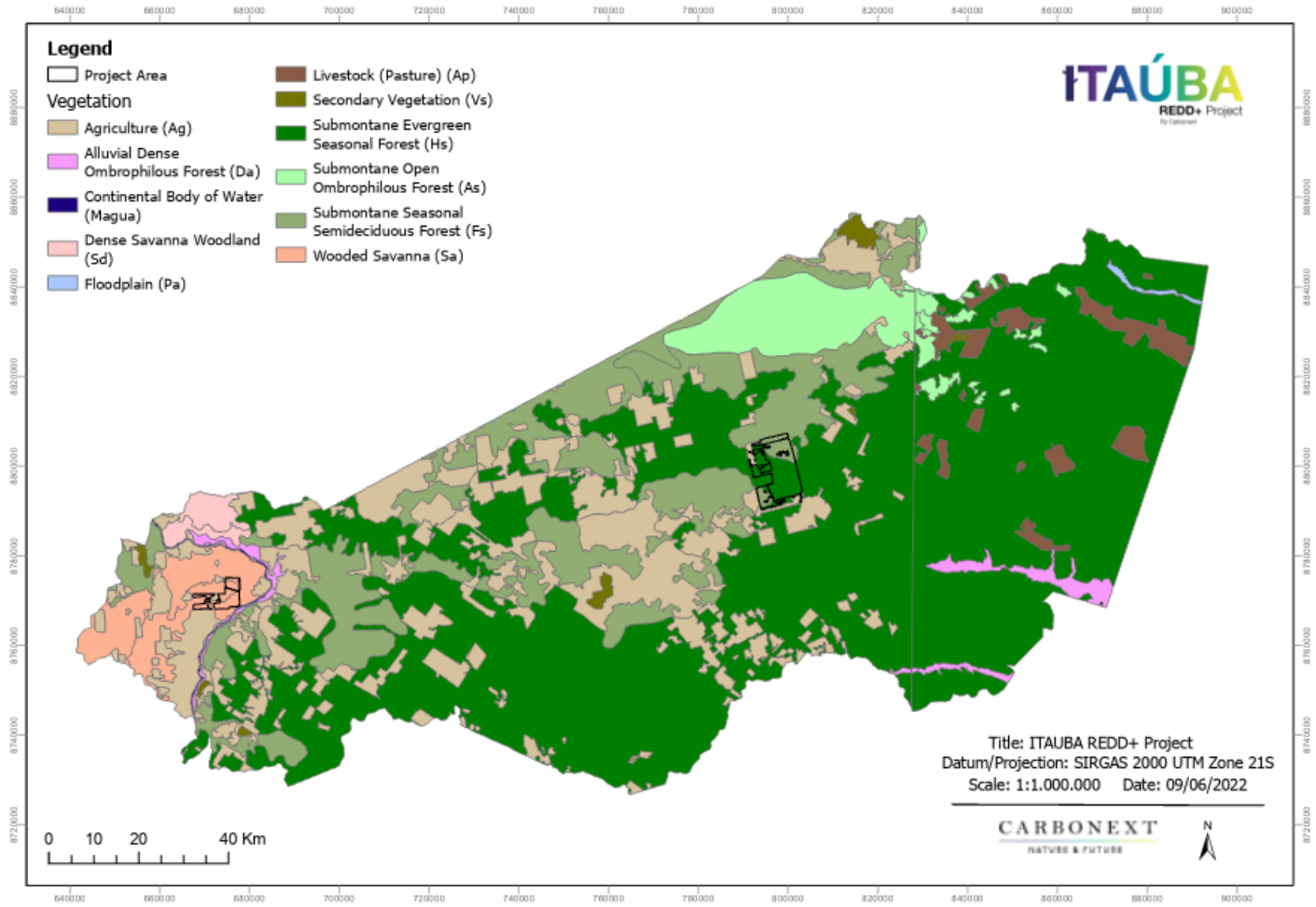


Figure 6: Vegetation types and Land Use in the reference region and project area. Source: Carbonext (2022)

The Seasonal Forest is conditioned by climatic seasonality, which varies between heavy summer rains followed by severe droughts. These conditions favor the dry soil and the presence of phanerophytes. The Lower Montane Semideciduous Forest, subgroup of Season Forest, is found in areas whose relief varies from rugged to flat in the northern part of the municipality (Rizzini *et al*., 1988 apud [6]). The composition of this forest includes the following species (Table 4):

Table 4: Floristic composition of the Seasonal Forest found in Marcelândia. Source: SEPLAN (1998) apud [2]

Species	**Local Name**
Zanthoxylum sp.	Mamica
Jaracatia sp.	Jacaratiá
Hymenaea courbaril	Jatobá
Pseudobombax sp.	Embiruçu
Tabebuia serratifolia	Ipê-amarelo
Guarea sp.	*
Croton balanostigma	Balsa-rana

The Dry Forest (*Cerradão)* is one of the four subgroups of the Cerrado [9], which occurs in the form of small enclaves covering dissected reliefs in tubular and hill forms in the Chapada do Cachimbo covered by quartz sands, as well as in tubular relief with lithotic soils in the Chapada de Dardanelos and quartz sands in the Planalto dos Parecis [2].

Structurally it is characterized by a woody grassy mat and the presence of trees (approximately 7 meters high) with twisted branches, thick bark, and large leaves. It is generally found on tubular or undulating and dissected reliefs, covered by sandstone deposits [2]. The characteristic species are (Table 5):

Table 5: Floristic composition of the Dry Forest found in Marcelândia. Source: SEPLAN (1998) apud [2]

Species	Local Name
Hymenaea stigonocarpa	Jatobá-do-cerrado
Tabebuia caraiba	Ipê-do-cerrado
Annona coriacea	araticum
Caryocar brasiliensis	pequizeiro
Hancornia speciosa	mangaba
Davilla elliptica	lixeirinha
Salvertia convallariaeodora	colher-de-arara
Curatella americana	lixeira
Kielmeyera sp.	Pau-santo
Qualea sp.	pau-terra
Byrsonima sp.	muricis

The Ombrophylous Forest is characterized by the presence of large trees with well-defined strata and conditioned to the humid tropical climate with no biologically dry period during the year, with well distributed precipitation and elevated temperatures. Within this class can be found the Open Montane Ombrophylous Forest, whose tree arrangement promotes the passage of light and the development of vines, palms, and bamboos, among other trees. Another class found is the Lower montane Ombrophylous Dense Forest occurring along the watercourses of the Quaternary plains. It is a formation whose plants have fast growth rate with smooth bark and tubular roots (SEPLAN, 1998 apud [2]). The composition of this forests includes the following species (Table 6 and Table 7).

Table 6: Floristic composition of the Lower montane Ombrophylous Dense Forest. Source: (SEPLAN, 1998 apud [2]*)*

Species	**Local Name**
Anacardium giganteum	Cajuaçú
Castilloa ulei	Caucho
Ceiba pentandra	Sumaúma
Parkia pendula	Angelim-de -saia
Hevea brasiliensis	Seringueira
Myroxilum peruiferum	Bálsamo
Manilkara uberi	Maçaranduba
Peltogyne densiflora	Pau-rôxo
Tabebuia serratifolia	Ipê-amarelo
***Virola* spp.**	Ucuuba

Table 7: Floristic composition of the Open Montane Ombrophylous Forest. Source:SEPLAN, 1998 apud [2] .

Species	**Local Name**
Bertholletia excelsa	Castanheira
Parkia pendula	Paricás or Angelim-de-saia
***Virola* sp.**	Ucuuba
***Cariniana* sp.**	Jequitibá
***Hymenaea* sp.**	Jatobá
Caryocar villosum	pequiá

***Iriatea* sp.**	Paxiúbas
Attalea maripa	Inajá
Euterpe precatoria	Palmito
***Oenocarpus* spp.**	Bacabas
Phenakospermum guianense	Sororoca
Euterpe oleracea	Palmeira açaí

The Wooded Savana has a floristic composition similar to that found in Dry Forest (*coriacea* and *crassifora)*, however, it presents dominant species that characterize environments that may or may not present an association with gallery forest, such as *megalophylla*. Its sparse physiognomy is defined by low trees and continuous grass (Figure 7), subject to annual burning [10].

Figure 7: Wooded Savana present in Itaúba - MT. Picture taken by Marcos Breno Marques

2.1.6 Social Parameters (G1.3)

2.1.6.1 Expansion Region

The expansion region defined for the project takes place at the north-central part of the state of Mato Grosso, approximately 700 kilometers from the capital of the state, the city of Cuiabá. According to the

Brazilian Institute of Geography and Statistics - IBGE [12], the state of Mato Grosso total area is 903,207.050 km^2 and the population estimate on July 1st, 2021, was 3,567,234 inhabitants. Mato Grosso is the 17th most populous state in Brazil and concentrates 1.7% of the Brazilian population. It has a population density of 3.9 inhabitants per square kilometer. There are a total of 141 towns and cities in the state of Mato Grosso, which are distributed in 12 Planning Regions. The Project Zone encompasses two of them: Marcelândia and Itaúba, both belonging to the Central North Planning Region, located in the Mato Grosso State's portion of the Legal Amazon deforestation arc zone and in the influence area of the roadway BR-163 (Cuiabá-Santarém).

The foundation of the municipalities of Marcelândia and Itaúba were both in the late XX century, during the military dictatorship in Brazil, a period when the widespread mindset was to explore the region extensively. Since then, the situation there is very similar to other municipalities in the north of the state, having suffered a fast and intense expansion in the occupation process, due to the disordinate development of the cattle raising, agricultural and wood exploration activities.

Figure 8: Poster produced and published by SUDAM, the Amazon Development Superintendence, in 1972, saying: "Drive your cattle to the greatest pasture of the world", referring to the Amazon [13].

2.1.6.2 Human Development Index

The Municipal Human Development Index (MHDI) is a measure composed of indicators of three dimensions of human development: longevity, education, and income. The index ranges from 0 to 1. The closer to 1, the greater the human development. The Brazilian MHDI follows the same three dimensions as the Global HDI, calculated by the United Nations Development Program - longevity, education, and income, but goes further: it adapts the global methodology to the Brazilian context and the availability of national indicators. Although they measure the same phenomena, the indicators considered in the MHDI are more suitable for evaluating the development of Brazilian municipalities. Thus, the MHDI - including its three components, MHDI Longevity, MHDI Education and MHDI Income - measured the status of municipalities in three important dimensions of human development during two decades of Brazilian history [14].

Table 8 indicates the MHDIs of Marcelândia and Itaúba and shows that the weakest component of both the municipalities is education, in comparison with the city of Cuiabá and a broader scenario of the state of Mato Grosso.

Table 8: Human development index [14]

	MHDI (2010)	Classification [very high – very low]	MHDI income	MHDI longevity	MHDI education
Marcelândia	0.701	high	0.700	0.813	0.604
Itaúba	0.690	medium	0.714	0.809	0.569
Cuiabá	0.785	high	0.800	0.834	0.726
Mato Grosso	0.725	high	0.821	0.635	0.725

2.1.6.3 Conservation areas and Indigenous territories

In a range of 200 kilometers from each one of the two portions of the Project Area, there are 9 areas that fit the legal Brazilian definitions of Conservation Units (CU) and Indigenous territories (IT), which are listed in the Table 9.

Table 9: Conservation Units (CU) and Indigenous Territories (IT). Source: Carbonext (2022)

Portion of the PA	Conservation Units and Indigenous territories	Distance (km)	CU/IT
PA Itaúba	1. Parque Batelão	101.05	IT
	2. Reserva Particular do Patrimônio Natural Cristalino III	165.30	CU
	3. Parque Estadual Cristalino	169.35	CU
	4. Parque do Xingu	66.96	IT
	5. TI Capoto/Jarina	93.59	IT

PA Marcelândia	6. TI Paraná	131.60	IT
	7. TI Gleba Iriri	121.76	IT
	8. TI Menkragnoti	147.76	IT
	9. TI Apiaka/Kayabi	193.56	IT

None of the listed areas are located inside the reference region, or closer than 20 kilometers from the Project Area, and they are not expected to influence or be influenced by the project activities in any aspects. However, there are 7 Priority Areas for Conservation (PAC) defined by the Brazilian ministry of the environment that intersect the 20 kilometers buffer from the two portions of the Project Area. The PAC are defined using computational models that geographically allocate the necessity of specific conservation efforts based on multiple criteria [15]. Each one of the areas is classified by its biological importance, the main prescribed actions, and the level of priority of these actions, according to the table below.

Table 10: PAC and its biological importance linked with actions applied for conservation. Source: Adapted from [15]

Register of the PAC	Biological Importance	Actions Priority Level	Main Prescribed Actions	
AMZ-529	High	Very High	13	Monitoring and Forest Management
AMZ-530	High	High	13	Monitoring and Forest Management
AMZ-531	Extremely High	Extremely High	13	Monitoring and Forest Management
AMZ-804	High	Very High	10	Recuperation of degraded areas
AMZ-807	Very High	Very High	10	Recuperation of degraded areas
AMZ-816	Extremely High	Extremely High	10	Recuperation of degraded areas
AMZ-089	High	Very High	1	Creation of Sustainable Use Conservation Units

2.1.6.4 Settlements and other local communities

In the same range of 200 kilometers from the Project Area, there are 7 settlements recognized by INCRA, the Brazilian federal autarchy that is responsible for the agrarian reform in the country, but none of them is expected to have any influence or be influenced by the project activities (Table 11).

Table 11: Settlements and other local communities located near the Project Area. Source: Carbonext (2022)

Municipality	Settlements	Distance
Itaúba	Gleba Cafezal	22 Km
	PA Veraneio	38 Km
	PDS 12 de Outubro	22.7 Km
	PA Wesley Manoel dos Santos	27 Km
	PDS KENO	37.9 Km
	PDS Terra Viver	48.7 Km
Marcelândia	PA Bonjaguá	33.6 Km

2.1.6.5 Municipality of Marcelândia

2.1.6.5.1 Population, age and gender

The population of the Municipality of Marcelândia was 10,107 inhabitants in 2021 according to the Brazilian Institute of Geography and Statistics estimates, with a projected population density of 0.82 inhabitants per square kilometer. The age pyramid of the municipality has an evident triangular shape, which is typical of developing countries (see Figure 9) and the population is characterized by having an equal sex ratio between males and females [16].

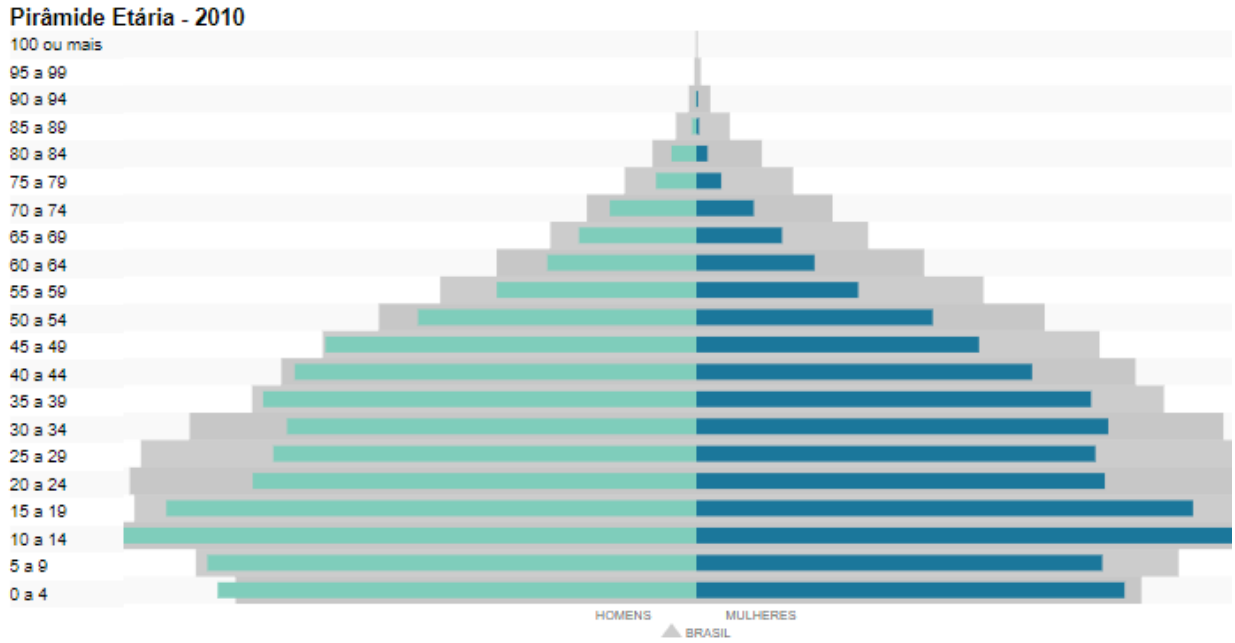


Figure 9: Age and gender structure of Marcelândia's population [16].

2.1.6.5.2 Health

The municipality has 7 healthcare facilities, including a public hospital (Hospital Maria Zélia), which is in the urban area of the municipality. The average infant mortality rate in the city is 10.58 per 1,000 live births [17]. Hospitalizations due to diarrhea are 6.2 per 1,000 inhabitants. Compared with all the municipalities in the state, it ranks 78 out of 141 and 11 out of 141, respectively. When compared to cities across Brazil, these positions are 2935 out of 5570 and 531 out of 5570, respectively. Only 2% of the residences count with appropriate sanitation systems[13] [16].

[13] Residences that are connected to general sanitation networks or are equipped with septic tanks are considered to have proper sanitation systems.

2.1.6.5.3 Education

The Municipality of Marcelândia has 10 elementary schools, with 120 professors and 1,867 students enrolled, and 4 secondary schools, with 56 professors and 588 students enrolled [18]. The Basic Education Development Index (IDEB) of the public schools of the municipality is 5.8 for the early years of the primary education and 4.8 for the last years [19], being higher than State of Mato Grosso and Brazilian national indexes. The schooling rate for people between 6 and 14 years old is 98.3%, but approximately 59% of the population did not complete the elementary school years [16].

2.1.6.5.4 Income

The average monthly salary in Marcelândia is 1.8 minimum wages[14] [20]. The proportion of formally employed persons in relation to the total population was 18.7%. In comparison with the scenario in Mato Grosso, Marcelândia is ranked 135th and 43rd, respectively, out of 141 municipalities, in these indexes. In comparison with cities across the country with the Brazilian scenario, it is ranked 3125th and 1574th out of 5570, respectively. Considering households with monthly income of up to half a minimum wage per person, 37.1% of the population were in these conditions, which ranked it in position 70 out of 141 among cities in the state and in position 3161 out of 5570 among cities in Brazil [20].

2.1.6.5.5 Land use and economic activities

Marcelândia is 160 kilometers away from Municipality of Sinop, the fourth most populous of the state and an important regional and national agribusiness hub. The economy of the municipality is mainly concentrated in agricultural, livestock and logging establishments and its GDP per capita was R$32,044.25 in 2019 [18].

The municipality has 57.75% of its territory designated for agricultural uses and these areas are divided into four segments: farming (8.26%%), pasture (27.88%), forest (54.37%) and agroforestry systems (6.52%). Most of the farming areas are covered by temporary crops and, in terms of participation in the municipality's GDP, the most expressive are soy (43.28%), corn (7.83%) and rice (4.27%). In the forestry segment, the most expressive activity is the extraction of round wood (2.90%), followed by charcoal and firewood, in smaller quantities. In the livestock segment, there are 160,000 heads of beef and dairy cattle

[14] The minimum wage per month in Brazil is R$1,212.00 since January 2022 (https://www12.senado.leg.br/noticias/materias/2022/01/03/passa-a-vigorar-salario-minimo-de-r-1.212#:~:text=Come%C3%A7ou%20a%20valer%20no%20s%C3%A1bado,assinada%20pelo%20presidente%20Jair%20Bolsonaro).

in the municipality, more than fifteen times the population of the city. There is also the creation of approximately 44,000 chicken heads and other animals in smaller numbers. Considering the forest areas located inside of agricultural establishments, 80.12% are natural areas under the regimes of permanent preservation or legal reserves [18]. The municipality also encompasses an indigenous area, the Xingu Indigenous Park, which occupies an important part of its territory.

2.1.6.5.6 Relevant historical conditions

Marcelândia was settled in the late 20th century by the company Colonizadora Maiká, whose owner was Sr. José Bianchini. Its name was attributed as a tribute to his son, Marcelo. The proximity to the river Manissauá Miçu (or Manito) – a tributary to the Xingu River - facilitated the access to the glebe where the town was founded and the natural abundance of the river and its surroundings – also explored by hunting and fishing - provided the resources that were needed by the first explorers. Many of the first inhabitants were settlers from the south of Brazil, that came to explore the land [18].

In 1982, Marcelândia was still legally defined as a district of the Municipality of Sinop, and the town was officially recognized as a municipality in 1986. Over time, the town developed through economic activities such as cattle raising and wood exploitation, industries that have been developing rapidly in the region since the 1980's, and had major implications in the landscapes, bringing extensive deforestation and forest degradation.

2.1.6.6 Municipality of Itaúba

2.1.6.6.1 Population, age and gender

The population of the Municipality of Itaúba was 3,609 inhabitants in 2021 according to the IBGE estimates, with a projected population density of 0.79 inhabitants per square kilometer [21]. The age pyramid of the municipality also has an evident triangular shape (see Figure 10) and the population is characterized by having an equal sex ratio between males and females.

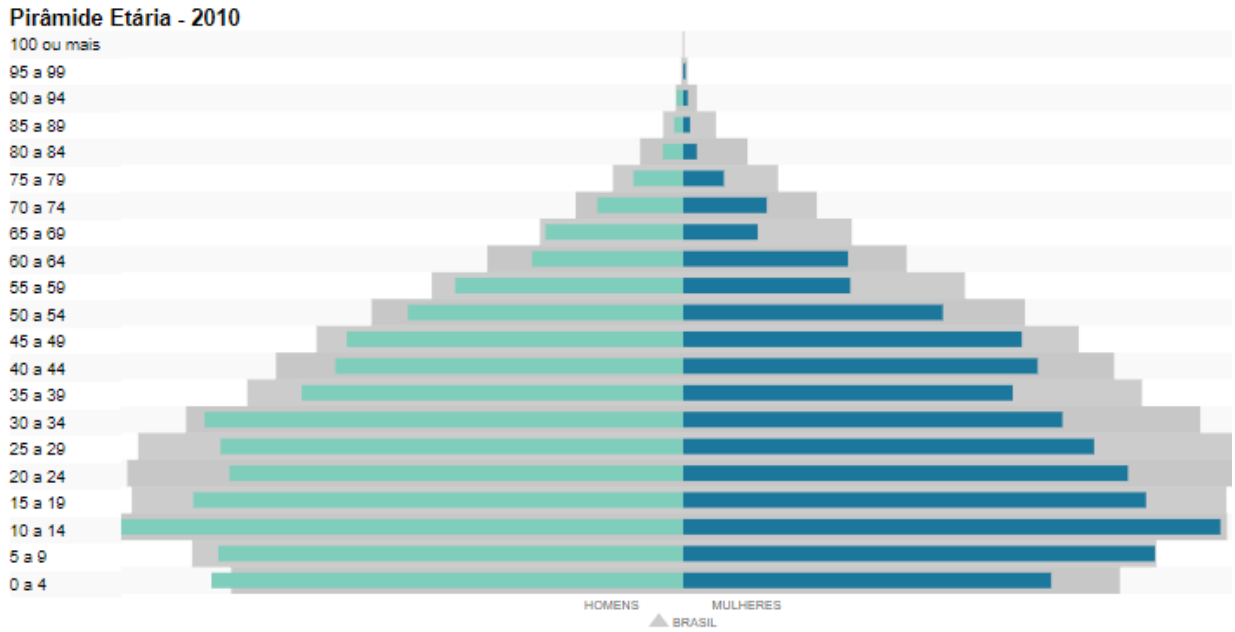


Figure 10: Age and gender structures of Itaúba population [22].

2.1.6.6.2 Migration patterns

The municipality has a considerable immigration flow, once 12.90% of the older than 5 years old residents in 2010 were still not living in Itaúba in 07/31/2005 [16].

2.1.6.6.3 Health

The municipality has two healthcare facilities, being one of them a public hospital (Municipal Hospital Foundation of Itaúba), which is in the urban area of the municipality. The average infant mortality rate in the city is 10.99 per 1,000 live births [23]. Compared with all the municipalities in the state, it ranks 73rd out of 141 and compared to cities across Brazil, 2847th out of 5570. There are not available data about hospitalizations due to diarrhea for the Municipality of Itaúba. Only 9.4% of the residences count with appropriate sanitation systems [21].

2.1.6.6.4 Education

The Municipality of Itaúba has 4 elementary schools, with 53 professors and 663 students enrolled, and 1 secondary school, with 23 professors and 183 students enrolled [22]. The Basic Education Development Index (IDEB) of the municipality is 5.6 for the early years of the primary education and 4.4 for the last years [24], being lower then Marcelândia but still higher than the State of Mato Grosso and the national indexes. The schooling rate for people between 6 and 14 years old is 98.3%, but approximately 62% of the population did not complete the elementary school years [21].

2.1.6.6.5 Income

The average monthly salary in Itaúba is 2.3 minimum wages[15]. The proportion of formally employed persons in relation to the total population was 26.4%. In comparison with the scenario in Mato Grosso, Itaúba is ranked 52nd and 17th, respectively, out of 141 municipalities, in these indexes. In comparison with cities across the country with the Brazilian scenario, it is ranked 861st and 742nd out of 5570, respectively. Considering households with monthly income of up to half a minimum wage per person, 35.3% of the population were in these conditions, which ranked it in position 102 out of 141 among cities in the state and in position 3505 out of 5570 among cities in Brazil [22].

2.1.6.6.6 Land use and economic activities

The economy of Itaúba is mainly concentrated in agricultural, livestock and logging establishments and its GDP per capita was R$ 49,587.44 in 2019 [22].

The municipality has 69.79% of its territory designated for agricultural uses and these areas are divided into three segments: farming (16.97%), pasture (24.05%) and forest (58.42%). Most of the farming areas are covered by temporary crops and, in terms of participation in the municipality's, GDP the most expressive are soy (69.64%), corn (10.22%%) and rice (4.65%). In the forestry segment, the most expressive activity is the extraction of round wood (2.52%), followed by firewood and extraction of Brazilian nuts, in smaller quantities. In the livestock segment, there are more than 101,000 heads of beef and dairy cattle in the municipality, more than fifteen times the population of the city. There is also the creation of approximately 11,000 chicken heads and other animals, in smaller numbers. Considering the forest areas located inside of agricultural establishments, 53.83% are natural areas under the regimes of permanent preservation or legal reserves [22].

2.1.6.6.7 Relevant historical conditions

Itaúba was settled in the early 1970's, by the Bedim brothers, from the Municipality of Abelardo Luz, in the State of Santa Catarina, southern Brazil, who acquired land with the express intention of exploiting wood and opening new pasture areas. The access to the territory was made possible by the construction of the BR-163. Over time, many settlers came, and sowed the seed of the settlement nucleus that would become the city of Itaúba. The town was named after the Itaúba tree, which is described by its especially hard wood and is using for building diverse infrastructures in the region.
Until 1979, Itaúba was a district of the neighbor Municipality of Colíder, when it was elevated to the category of independent municipality.

[15] Considering formal employment.

There are several archeological sites in the Municipality of Itaúba, most of them classified by the National Historic and Artistic Heritage Institute (IPHAN) [25] as lithoceramic sites. In a range of 20 km from the Project Area, there are more than a hundred, but none of them is located inside it. None of the sites are expected to influence or be influenced by the project activities in any way.

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

The Figure 11 shows the Project Area, Indigenous Land, Railroads and Settlements in the Reference Region, Figure 12 shows the Project Area 1 in the municipality of Itaúba (presenting 2 of the 9 farms) and the Figure 13 shows the Project Area 2 in the Municipality of Marcelândia (presenting 7 of the 9 farms).

Table 12: PA Properties Information

Property (Farm)	Total Area (ha)	Project Area (ha)	Ownership
Casa Blanca	3,046.52	2,435.15	Maria Auxiliadora Basílio Grimas Ferreira and José Celso Ferreira
Natal	2,987.15	2,413.22	Maria Auxiliadora Basílio Grimas Ferreira and José Celso Ferreira
São Judas Tadeu	1,783.89	972,31	Maria Auxiliadora Basílio Grimas Ferreira and José Celso Ferreira
Guanabara	1,781.78	1,586.43	Maria Cristina Basílio Grimas Almeida
Vale Verde	2,271.24	1,538.95	Maria Cristina Basílio Grimas Almeida
Ponderosa	1,782.13	1,535.28	Maria Cristina Basílio Grimas Almeida
Santa Maria	2,003.95	1,165.76	Maria Cristina Basílio Grimas Almeida
Julian Grimas	2,287.78	1,521.12	Maria de Fátima Grimas Senedese
Nossa Senhora Salete	2,400.85	2.184.68	Maria de Fátima Grimas Senedese

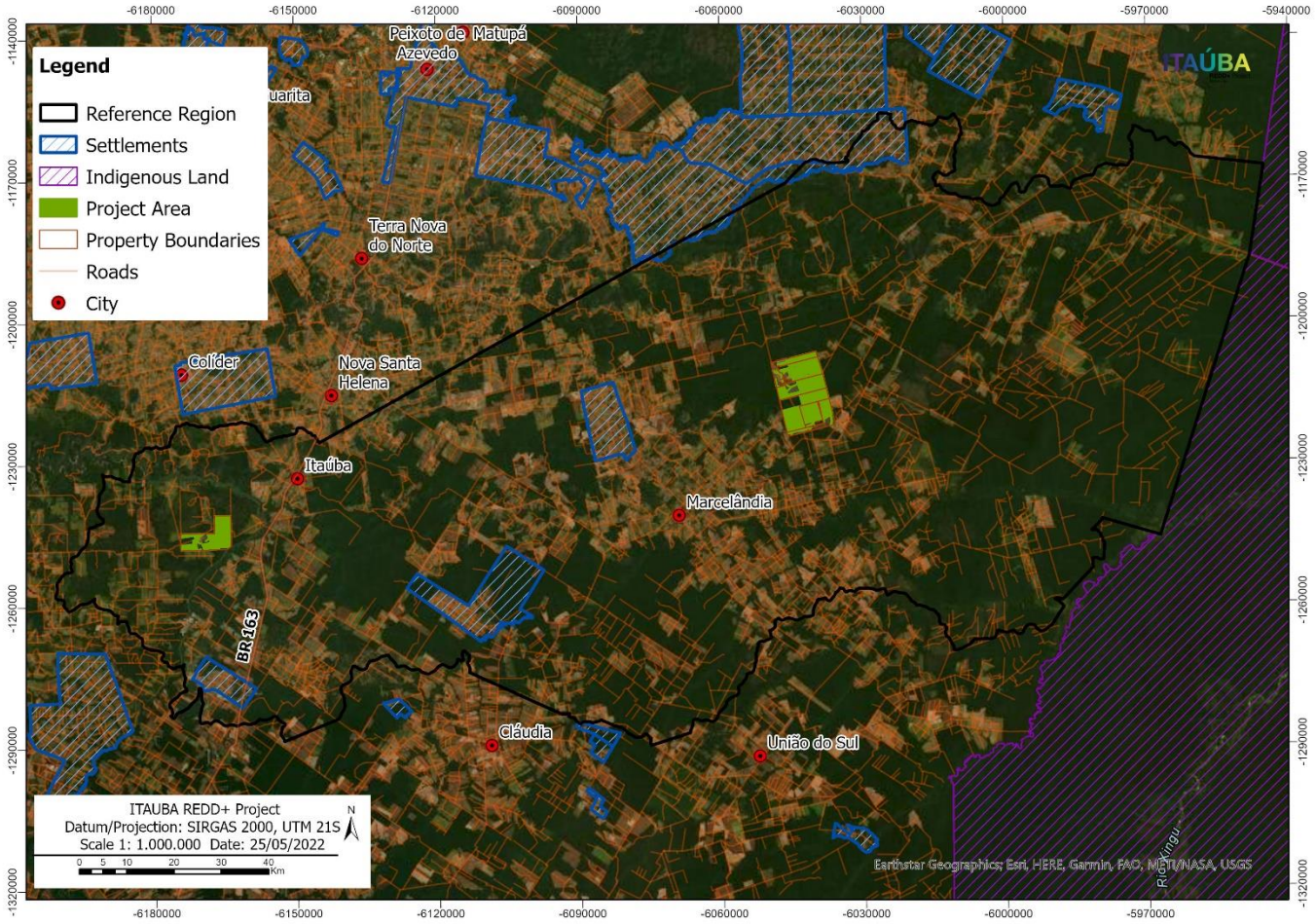


Figure 11: Project Zone Map. Source: Carbonext (2022)

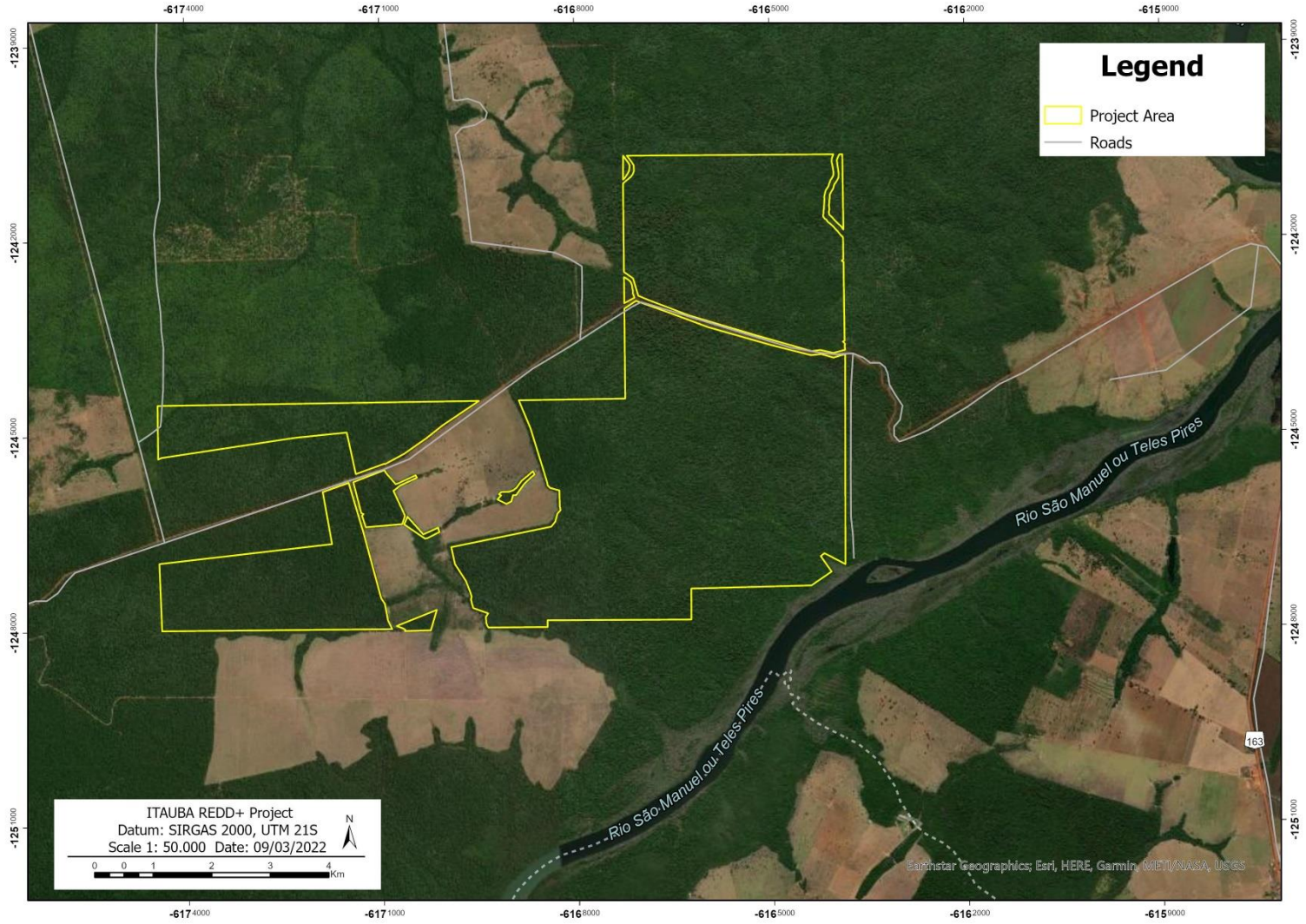


Figure 12: Project Area 1 located in Itaúba. Source: Google Earth, 2022.

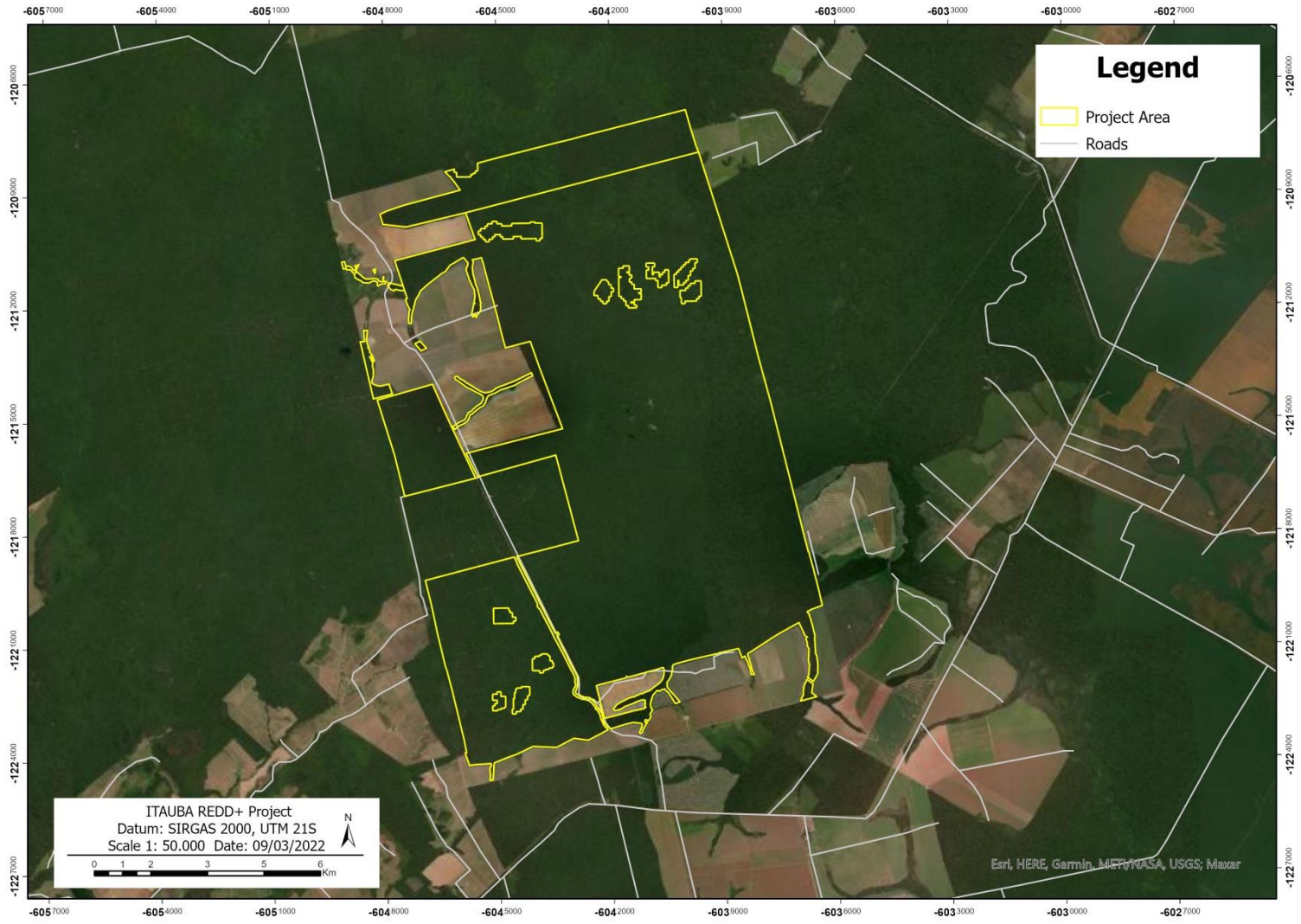


Figure 13: Project Area 2 located in Marcelândia. Source: Google Earth, 2022.

2.1.8 Stakeholder Identification (G1.5)

The general objective of the stakeholder's identification was to enable discussions with potentially interested communities about the most relevant aspects of the project and make them participants in the decision-making processes. Once the Project Area and the Reference Region were stablished, it was sought to understand more about the interested parties that were geographically closest to the Project Area or institutionally related to it and could either influence or be influenced by the project activities, positively or negatively.

Following the recommendation for non-permanence risk analysis (AFOLU Non-Permanence Risk Tool V4.0), the surrounding region was established as a buffer of 20 kilometers from the boundaries of the Project Area, where it is possible to identify existing infrastructure that could indicate human occupation in the surrounding area.

Institutional Stakeholders

The identification of institutional stakeholders was done through landowner reports and local consultation, to build bridges with organizations, public entities, and other interested institutions that could help contributing to the local development and mitigate significant problems in their region, enhancing the quality and accuracy of the decision-making processes in the social aspects of the project.

Local Stakeholders / Community Groups

The local community's identification had been made initially through remote sensing imagery analysis, combined with projections of the Project Area in conjunction with official cartographic and no cartographic databases, to verify if there were overlaps between the Project Area and other destined or non-destined areas and their shared limits. During the remote analysis step, extensive research was made using official databases, being the main one consulted from the following institutions: FUNAI – National Indian Foundation (indigenous territories); ICMBIO - Chico Mendes Institute for Biodiversity Conservation - Ministry of the Environment (conservation units); IPHAN - National Historic and Artistic Heritage Institute (quilombola communities); INCRA - National Institute of Colonization and Agricultural Reform (rural settlements).

From all the local communities' potential stakeholders, the only identified in the proximities of the project area, represented in the map below as a 20 kilometers buffer, was the "Gleba Cafezal" settlement, but considering the distance and the lack of interactions of any kind between the settlement and the project properties, the settlement was not considered as a stakeholder.

Once the greatest part of the surrounding areas is occupied by large properties covered by agricultural activities and pastures, there are not communities and community groups that will have any interaction with the project other than the rural workers of the properties of the Project Area, which will be involved in the project activities and benefit from its impact.

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

Table 13: Stakeholder's Rights, Interest and Overall Relevance to the Project. Source: Carbonext (2022)

Institutional Stakeholders	Rights, Interest and Overall Relevance to the Project
Marcelândia City Hall	Responsible for public management, promoting sustainable, social and economic development in the municipality.
Itaúba City Hall	Responsible for public management, promoting sustainable, social and economic development in the municipality.
Municipal Secretariat of Agriculture, Environment and Tourism of Marcelândia	Responsible for carrying out activities related to environmental management, promoting environmental education, regulation, control, regularization, protection, conservation, and recovery of natural resources in the municipality
Municipal Secretariat of Agriculture, Development, Environment and Tourism of Itaúba	Responsible for carrying out activities related to environmental management, promoting environmental education, regulation, control, regularization, protection, conservation, and recovery of natural resources in the municipality
SEMA - MT (Mato Grosso State Secretariat of Environment)	Responsible for carrying out activities related to environmental management, promoting environmental education, regulation, control, regularization, protection, conservation, and recovery of natural resources in the State of Mato Grosso.
School of Forestry Engineering of the Federal University of Mato Grosso (UFMT)	Educational institution. Carries out research in the field of forestry engineering and sustainability.

Centro de Vida Institute (ICV)	Non-profit organization. Works to promote shared solutions for sustainability of land use and use of natural resources.

2.1.10 Sectoral Scope and Project Type

The project is inserted into the Sectoral Scope 14 Agriculture, Forestry and Other Land Use (AFOLU) in the category of REDD Avoided Unplanned Deforestation and Degradation. Two project areas were delimited within the reference region, whose distance is of 116.84 km (Figure 14), characterizing the project as a grouped one.

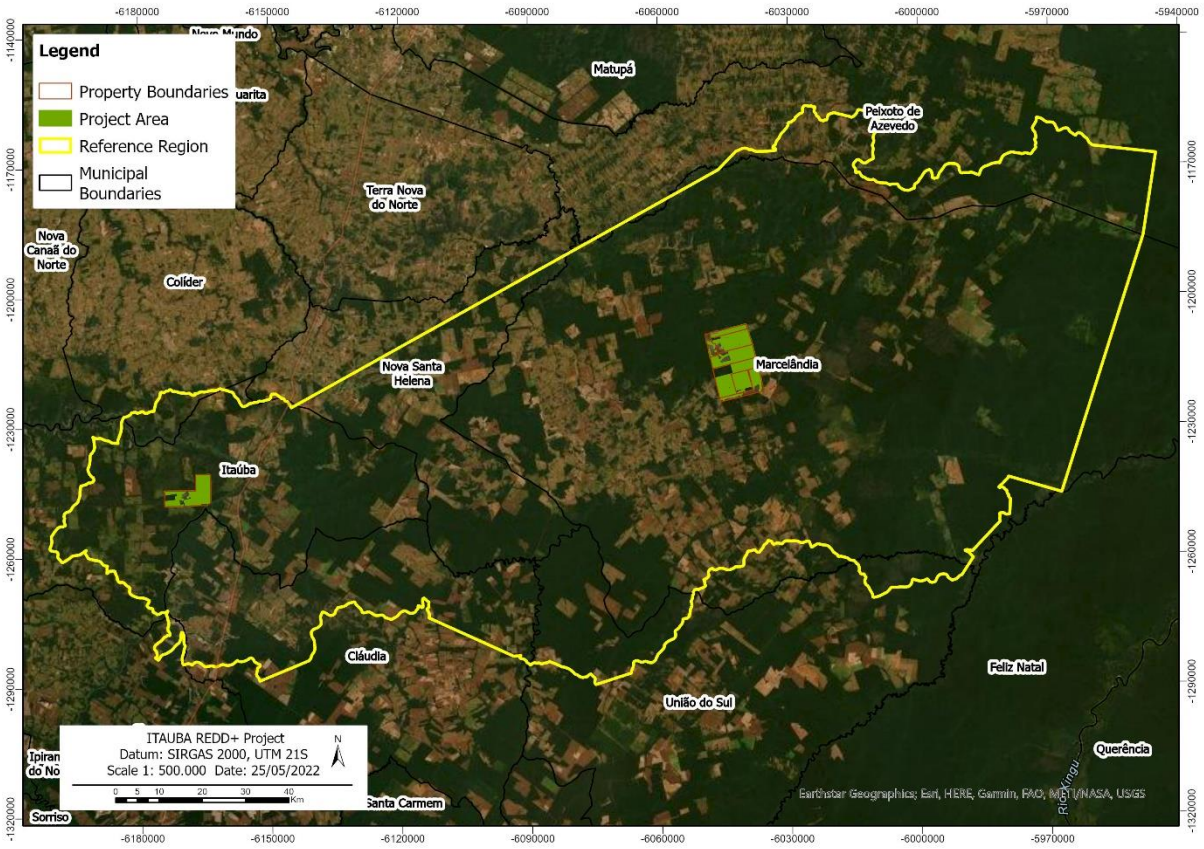


Figure 14: Project area and reference region. Source: Carbonext (2022)

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

The Project Area defined for the ITAÚBA REDD+ Project is critical for local conservation due to the threats caused by agricultural and livestock expansion trends in the region. The ITAÚBA REDD+ Project aims to ensure the preservation of fauna and flora in its limits, which are essential to the provision of ecosystem services provided to the local communities and the sustainable use of natural resources. Observing the guidelines of REDD+ projects, the planned activities are focused on: (i) Reduce threats in forest areas, (ii) promote sustainability practices along with awareness about the importance of green areas and (iii) fortify management, governance, and technical capacities to ensure the efficient development of the REDD+ project. The joint actions aim to reduce GHG emissions from unplanned deforestation and forest degradation.

Through the carbon credits registered in the VCS (Verified Carbon Standard) together with social development actions and environmental conservation practices, these objectives will be ensured, as well as the maintenance of the project activities, which are described below:

- Monitoring of deforestation and forest degradation satellite imagery remote sensing:

The Project Area will be monitored with high-resolution satellite images on an annual basis to track land use and possible changes in the area. The environmental monitoring will be carried out jointly and consequently critical points of deforestation and invasions will be identified, making it possible to diagnose focal areas as a preventive factor. This monitoring is also linked to the maintenance of the vegetation cover and the biodiversity present in the region, since with this activity the benefits to the climate provided by the development of the project will be addressed.

- Surveillance of the area:

Patrol and surveillance activities in the area will be carried out jointly by the employees of the properties and the remote monitoring carried out using satellite images. The purpose of this activity is to combine tactics that provide greater efficiency in surveillance, observing the displacement on the properties, the costs and the boundaries of the areas.

- Capacity building and environmental education:

To guarantee future generations the ability to meet production needs and quality of life, techniques that enhance the sustainability of cultivated crops and/or of sustainable forest management will be introduced. Sustainable agricultural management is important for the transition to lower levels of chemical fertilizers and more efficient land use. Its application ensures that deforestation does not occur for the expansion of

new agricultural areas and certifies the preservation of the productive capacity of the areas already open. Environmental education activities will also be implemented in local schools.

- Monitoring of biodiversity:

Inventories of fauna, flora and biomass will be held periodically in the Project Area, and ecologically relevant endangered species population trends will be monitored.

Table 14: Summary description of the activities and their expected results and impacts to achieve the benefits foreseen in the ITAÚBA REDD+ for Climate, Community and Biodiversity project.

Activity description	Expected climate, community, and/or biodiversity			Relevance to project's objectives
	Outputs (short term)	Outcomes (medium term)	Impacts (long term)	
Capacity building and Environmental Education	Securing land tenure Better understanding of the importance of protecting the forest and how forest conservation benefits their livelihoods.	Reduction of illegal activities in the areas, as well as enhanced forest protection	The forest is protected, and illegal activities are minimized	Better regenerative management practices with community participation Understanding the principles of sustainable development and environmental sustainability
Local large-scale agricultural activities	Diversification of products used to promote sustainable agriculture More efficient techniques to	Improving farming practices and promoting income from other activities	Food safety is increased Positive impact on the middle-income economy	Improving living conditions through environmentally friendly products and production capacities

	produce soy, corn and rice Income generation from monitoring activities			
Socio-environmental assessment	Survey conducted in an area consisting of the Project Boundary and a 20km buffer to collect socioeconomic information	Identification of deforestation factors and agents by survey Introduction of environmental education and research related to agricultural production	Implementation of mitigation measures to reduce the impact of large-scale agriculture factors A community aware of environmental issues and their impacts	Positive effect on the maintenance of carbon stocks
Health Improvement	Reducing use of agrochemicals	Better condition of agricultural products and assured air quality in households	Longer life expectancy	Improvement of livelihoods

2.1.12 Sustainable Development

The GHG Crediting Period is 30 years (2021 to 2051) during which net revenues from carbon payments will be used to further develop and implement surveillance and social activities that will yield net positive impacts to the climate, communities, and biodiversity in the Project Area and surroundings.

The Itaúba REDD+ Project complies with the environmental priorities defined by the Brazilian Federal Administration and its international commitments represented by the elements of the Brazilian NDC, which the country committed to adopt within the framework of the Paris Agreement, COP21 [26]. Ever since, Brazil has committed to reduce its emissions in 37% by 2025 and 43% by 2030, when compared with 2005 levels. It has also pledged to end illegal deforestation by 2030 [27]. To attain this goal, it is essential that independent and voluntary actions join government initiatives, such as the present project itself.

Due to the increase in deforestation in the Legal Amazon, the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm; *Plano de Ação para a Prevenção e Controle do Desmatamento na Amazônia Legal*) came into effect, starting mitigation and ongoing actions to reduce deforestation [28].

The PPCDAm goals are as follow [29]:

1) Promote land tenure regularization;
2) Promote territorial planning, strengthening protected areas;
3) Promote accountability for environmental crimes and infractions;
4) Implement shared forest management;
5) Prevent and combat the occurrence of forest fires;
6) Improve and strengthen forest cover monitoring;
7) Promote sustainable forest management;
8) Promote the sustainability of agricultural production systems;
9) Implement normative and economic instruments to control illegal deforestation.

The Itaúba REDD+ Project directly contributes with goals 4), 5), 6), 7) and 9). To attain these international commitments and national goals, an essential component will be to ally government initiatives with independent actions such as the present project itself.

The Itaúba Project is also aligned with the Brazilian commitments to the UN Sustainable Development Goals (SDGs) [30], being the more direct contributions to the agenda described as It follows:

Table 15: Project Activities and the SDGs

SDG	Project Benefits
1.5 - By 2030, build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to extreme weather-related events and other economic, social and environmental shocks and disasters	**Expected Community Benefits:** The project is expected to have a positive impact on local communities, strengthening awareness and capacity building in activities related to the reduction of deforestation and activities aimed at the conservation of natural resources, such as environmental education activities, climate change adaptation, soil conservation, and sustainable agriculture practices. Overall, the project aims to empower local communities and promote the principles of forest valuation and natural resource use. The climate adaptation fund will bring social safety in terms of climate resilience. **Section Reference: 4**
4.7 - By 2030, ensure that all students acquire the knowledge and skills necessary to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and the contribution of culture to sustainable development	
13.1 - Strengthen resilience and adaptability to climate-related risks and natural disasters in all countries	**Expected Climate Benefits:** the project aims to climate change mitigation by avoiding deforestation of 2,915 hectares in the Amazon Biome, mainly through local Surveillance, remote satellite monitoring, and a system of deforestation alerts in the Project Area for early identification of illegal trespassing. The project will also enhance climate adaptation by creating a climate adaptation private fund to build local financial resilience in terms of responsiveness to climate related disasters and/or emergencies. **Section Reference: 3**
13.3 - Improve education, raise awareness and human and institutional capacity on mitigation, adaptation, impact reduction and early warning of climate change	
15.1 - By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and arid lands, in accordance with obligations arising from international agreements	**Expected Biodiversity Benefits:** the project guarantees constant monitoring of the forest integrity inside the Project Area and ensures the conservation of local habitats and biodiversity, which includes at least nine species of fauna at some degree of threat according to IUCN Red List and the ICMBio Red Book. At least one endangered species will have its population trends monitored as an indicator of the effectiveness of its habitat conservation.
15.2 - By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and	

substantially increase afforestation and reforestation globally	**Section Reference: 5**
15.3 - By 2030, fight desertification, restore degraded land and soil, including land affected by desertification, droughts and floods, and strive to achieve a land degradation neutral world	
15.5 - Take urgent and significant measures to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	
15.7 - Take urgent action to end poaching and trafficking of protected flora and fauna species and address both the demand and supply of illegal wildlife products	

2.1.13 Implementation Schedule (G1.9)

During the project lifetime, from the development to implementation, some important dates and milestones will take place, such as introductory meeting dates, start and end dates of each project activity, start and end dates of the GHG accounting period, monitoring program, verification program, etc. The table below presents these milestones.

Year	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Start Date: contract signing for the development of REDD+ project																															
First meeting with the community, local consultations, socipeconomic diagnosis through ground survey																															
Institutional public consultation																															
Ground monitoring of the Project Area																															
Fire and deforestation monitoring via satellite																															
Fire and deforestation alert system on the Project Area																															
Occupational Health and Security Trainings																															
Fire Brigade Trainings																															
Environmental Education Workshops																															
Emergency Climate Adaptation Fund																															
Fauna Inventory and Monitoring of Red List Species																															
Flora and Biomass Inventories																															
Mapping and monitoring of community indicators																															
Mapping and monitoring of flora and fauna parameters																															
GHG accounting and crediting period																															

2.1.14 Project Start Date

The monitoring actions in the project area have been taking place since December 14, 2021, date when the contract was signed between the proponents, firming the intention, subsequently occurred the field visit of the social analyst in February 2022.

2.1.15 Benefits Assessment and Crediting Period (G1.9)

For the first instance of the ITAÚBA REDD+ project the duration of the project is 30 years, with crediting period is from December 14, 2021, to December 13, 2051.

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

No difference was identified between GHG emission accounting period, as well for the community and biodiversity benefits assessment periods.

2.1.17 Estimated GHG Emission Reductions or Removals

Year	Estimated net GHG emission reductions (tCO2e)
2021	0
2022	33,341
2023	2,991
2024	38,389
2025	45,052
2026	42,251
2027	91,503
2028	51,354
2029	33,440
2030	28,387
2031	36,400
2032	49,091
2033	40,101
2034	32,530
2035	34,235
2036	33,090
2037	23,749
2038	-18,229
2039	2,698
2040	36,595
2041	-19,587
2042	49,923
2043	-1,168

2044	19,265
2045	9,385
2046	41,677
2047	35,006
2048	-24,061
2049	38,034
2050	37,481
2051	36,718
Total estimated ERs	859,641
Total number of crediting years	30
Average annual ERs	28,655

2.1.18 Risks to the Project (G1.10)

Table 16: Project Risks

Identify Risk	Potential impact of risk on climate, community and/or biodiversity benefits	Actions needed and designed to mitigate the risk
Project Non-Permanence Risk*	Discontinuity of the project activities on climate, community and biodiversity.	To ensure the continuity of the project some actions are taken: • contract between the project proponents signing the commitment with the project activities during its entire lifetime; • engagement with the community to maintain their participation and project management; • project proponents have the necessary funds to maintain the project activities until the start of the GHG revenue; • team of specialists working on field and in the project PD and verifications.
Illegal deforestation inside the project area/ Invasion of Project area by outsiders	Deforestation inside the project area	Ground patrols and remote sensing monitoring of the project area in order to identify illegal deforestation as soon as possible and take action.

Inefficiency of project activities	Poor results on climate, community, or biodiversity aspects, differing from what was expected previously as a result from project activities	Guarantee that the local specific needs are being considered when designing and proposing activities; monitoring of indicators to quantify and qualify obtained results; collect feedback from stakeholders involved.

*more details on the project risk analysis will be available on the Non-Permanence Risk Report

2.1.19 Benefit Permanence (G1.11)

To maintain and enhance climate, community and biodiversity benefits beyond the project lifetime, a set of actions will be taken, which area described below. With respect of the financial support, the proponents have the funds needed to maintain the project activities until the first verification. After that, the project fund will come from the revenues obtained from the sales of carbon credits.

Climate

The project activities focused on climate benefits have as goal decrease deforestation and, as consequence, GHG emissions. For that, a more constant and effective monitoring of the project area will be maintained during the project lifetime, including local patrol and satellite surveillance with the MonitoraCarbon™ system.

Community

The community activities are designed to enhance the community's life quality. For that, workshops on health and safety and educational talks will also be carried out, among others. Continuous communication and consultation will be maintained though the project lifetime to ensure that the activities are reaching the goals and to hear recommendations, complaints and to implement necessary changes.

Biodiversity

For the biodiversity activities and benefits, a third-party team will be hired to develop an inventory of fauna and flora, producing a more exact diagnostic of the area, and, as consequence, enhancing the project assertiveness and effectiveness.

2.1.20 Financial Sustainability (G1.12)

Funding for project activities is secured by funds from the project proponents from the start date until the first verification (see Non-Permanence Risk Report). After that, the revenues from GHG emissions reductions will provide an additional flow of funds for the implementation and achievement of the project's climate, community and biodiversity benefits. The financial forecast of the project revenue from GHG emissions reduction is presented in the financial additionality analysis. Evidence of the proponents' funds will be made available to the audit team.

2.1.21 Grouped Projects

1) Eligibility Criteria for Grouped Projects (G1.14)

This is a grouped project. ITAÚBA REDD+ is an AFOLU project activity designed to include REDD Avoided Unplanned Deforestation (AUD) components. In this sense, this project activity is designed to include more than one "project activity instance", such as the accession new landowners to the project across its lifetime. Thus, this grouped project is designed to allow the expansion of the project activity, after the project validation.

This grouped project has a clearly defined geographic area within which project activity instances may be developed, which is defined using geodesic polygons, corresponding to the current Reference Region. The determination of baseline scenario and demonstration of additionality were based upon the initial project activity instances (9 farms), that are presented in this PD for validation. For inclusion of new geographic areas, it will be demonstrated that such areas are subject to the same baseline scenario and rationale for the demonstration of additionality as the geographic area that does include initial project activity instances.

A single baseline scenario is determined for the entire designated geographic area (Reference Region), in accordance with VM0015 methodology. The additionality of the initial project activity instances was demonstrated for each designated geographic area, in accordance with the methodology applied to the project. All factors relevant to the determination of the baseline scenario or demonstration of additionality (i.e., common practice; laws, statutes, regulatory frameworks or policies relevant to demonstration of regulatory surplus; historical deforestation rates) were assessed across the grouped project geographic area and respective Reference Region.

The project proponent has defined the capacity limit for this project activity in terms of the Reference Region. If exceptionally a new instance is located outside the Reference Region, it will be guaranteed that

all limit premises will respect the same conditions of similarity of historical deforestation rates as applied in the Reference Region to the initial project instances.

For this grouped project, the following set of eligibility criteria for the inclusion of new project activity instances has been defined, which is applicable for VM0015 REDD AUD activities, and the geographic area demarcated by the Reference Region:

1) Meet the applicability conditions set out in the methodology applied to the project: all the applicability criteria mentioned in VM0015 shall be met for any new instance: a) baseline activities shall include unplanned deforestation; b) project activities shall 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 VM0015); c) new instances may include different types of forest systems meeting the definition of “forest”; d) at the date of inclusion in this project, the new instance shall include only land qualifying as “forest” for a minimum of 10 years prior to the project start date; e) The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat;

2) Adopt and apply the project activities, technologies or measures specified in the project description: all new instances to be included in this project activity will necessarily be assessed using the same satellite imagery and field techniques as applied for the first 9 instances, as described in the PD;

3) All new instances shall be subject to the baseline scenario determined in the project description for the specified project activity and geographic area;

4) All new instances shall be subject to the same community and biodiversity without-project scenarios as determined for the project;

5) All new instances shall have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area. For example, the new project activity instances must have financial, technical and/or other parameters (such as the size/scale of the instances) consistent with the initial instances, or face the same investment, technological and/or other barriers as the initial instances;

6) All new instances shall be subject to the same processes for stakeholder engagement described in G3 and respect for rights to lands, territories and resources including free, prior and informed consent described in G5;

7) All new instances shall have similar monitoring elements.

In addition, new project activity instances shall:

1) Preferentially occur within the Reference Region (as mentioned above any instance to be included outside the Reference Region will undergo all the required similarity assessments);

2) Comply with all the set of eligibility criteria for the inclusion of new project activity instances (cited above);

3) Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body;

4) Be validated at the time of verification against the applicable set of eligibility criteria mentioned above;

5) Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions);

6) Have a start date that is the same as or later than the grouped project start date;

7) Be eligible for crediting from the start date of the instance through to the end of the project crediting period (only).

Where a new project activity instance starts in a previous verification period, no credit may be claimed for GHG emission reductions or removals generated during a previous verification period and new instances are eligible for crediting from the start of the next verification period. Where inclusion of a new project activity instance necessitates the addition of a new project proponent to the project, such instances shall be included in the grouped project within five years of the project activity instance start date. The procedure for adding new project proponents will respect the rules of the VCS Program document Registration and Issuance Process.

AFOLU non-permanence risk analyses will be assessed for each new geographic area. Activity-shifting, market leakage and ecological leakage assessments will be reassessed where new instances of the project activity are included in the project:

1) The geographic area within which all project activity instances shall occur is delineated with the Reference Region set in this PD;

2) The determination of the baseline for the project activity is in accordance with the requirements of the methodology applied to the project;

3) The demonstrations of additionality for the project activity are in accordance with the requirements of the methodology applied to the project;

4) A set of eligibility criteria for the inclusion of new project activity instances at subsequent verification events is defined in this PD (above in this topic);

5) A description of the central GHG information system and controls associated with the project and its monitoring is provided in the Monitoring Plan.

It is important to notice that the Leakage Management areas originally inserted in the project design will be priority to recruit new project instances. If the new instances involve the original Leakage Management areas, new areas shall be identified and adopted to manage leakage.

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

The project scalability is delimited by the geographic area, in this project defined as the reference region. If exceptionally a new instance is located outside the Reference Region, it will be guaranteed that all limit premises will respect the same conditions of similarity of historical deforestation rates as applied in the Reference Region to the initial project instances. Also, the eligibility criteria described in the section above shall be met. The landowner of the new instance shall have enough financial funds to maintain the instance activities until the beginning of revenue from GHG emissions reductions.

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

The risks associated with the non-continuity of benefits is reduced given that the project activities proposed for the new instances will be developed by Carbonext's technical team, which has the technical capacity to determine the strategies and activities of the project, in addition to offering technical support to the landowners for the proper execution of the activities and monitoring. Thus, the continuous technical and scientific accompaniment of Carbonext generates a support framework for monitoring, reporting and verification issues, which ensures the quality of the work and a continuous process of adjustment and improvement.

2.2 Without-project Land Use Scenario and Additionality

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

In order to identify the land use scenarios without the project, the VCS approved tool VT0001 – Tool for the Demonstration and Assessment of Additionality in VCS, was applied. Forest is expected to be converted to non-forest land in the baseline scenario. The region faces a high deforestation pressure, being the main post-deforestation use cattle ranching and soy agriculture. The baseline scenario identified is further discussed in Section 3.1.4, where it is presented the analysis of deforestation, vector agents and underline causes.

2.2.2 Most-Likely Scenario Justification (G2.1)

It is expected that with the absence of the project, the most likely scenario in land use is the continuation and expansion of deforestation drivers, such as cattle ranching and soy agriculture. For more details, see section 3.1.5.

2.2.3 Community and Biodiversity Additionality (G2.2)

The most likely scenario in the absence of the project is the continuation and expansion of cattle ranching and agricultural activities, typical of the region. Soy cultivation and cattle raising demand a significant expansion of new areas, where they present high productivity, as well as high environmental degradation. Despite this situation, it is still one of the most profitable forms of agriculture that moves the local economy. Even though landowners maintain the forest fragments, and cover the costs associated with their protection and management, these areas depend on the owners' will and their private economic resources and have no support from government initiatives. This puts them at a disadvantage compared to other land uses.

Therefore, the ITAÚBA REDD+ PROJECT seeks to improve the conditions of the area, promoting standing forest, as well as its ecosystem services, sustainability and the reduction of pressures from forest areas. The activities to be developed are aligned with Law No. 10.903/2019 of the state of Mato Grosso, which is currently not applied in schools and provides for environmental education.

The intention is to encourage individuals and collectivity the social and cultural values focused on awareness, prevention, conservation, preservation, recovery, and improvement of the environment linked to fauna and flora, as well as to demonstrate its impact on quality of life.

More details on the Project's additionality for community and biodiversity can be found in sections 4.1.4 Non-Project Scenario: Community and 5.1.3 Non-Project Scenario: Biodiversity.

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

In this project there will be no additional element from community and biodiversity benefits that can be used as an offset measure.

2.3 Stakeholder Engagement

2.3.1 Stakeholder Access to Project Documents (G3.1)

Project documents, such as project description documentation and monitoring reports, will be available through the VERRA[16] website and will be available for the public.

Information regarding the Project will also be distributed orally to the local communities, through local visits and meetings that will occur prior, during, and post Project implementation. This is done to ensure that all can have access to the information and ask any questions that may arise. It is important to note that the activities to be developed by the Project were previously validated by the local community, who voiced their concerns and demands through social visits, and told the Project Proponents which activities they think should be developed in the Project Area.

2.3.2 Dissemination of Summary Project Documents (G3.1)

On VERRA's official website will be available the summary of the project, as well as the information for G1.1-9. Likewise, the stakeholders will be invited to analyze the document and submit their main comments. For those without internet access, the printed document will be provided at accessible locations, such as schools and city halls from the municipalities of Itaúba and Marcelândia.

2.3.3 Informational Meetings with Stakeholders (G3.1)

The informal meetings with communities and local stakeholders were carried out from February 14 to 18, 2022.
The social analyst from Carbonext visited the region at the time mentioned with the prior consent of all involved. For further information on these meetings and how they were publicized, refer to the Local Stakeholder Consultation report available in the supporting documents.

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

[16] https://registry.verra.org/

During the community consultations, information on the benefits of the project was provided to the community members. No costs will be passed on to the communities, since all the project activities will be funded by the project proponents. On the contrary, the activities are planned to increase the community well-being. Also, the project will cause no risks for the communities. The consultation was held by a social specialist, who communicated in a manner that all presents could understand.

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

The method of communication on validation and verification process with the communities living around the project is mainly through meetings, where the project is presented orally, and a questionnaire is applied to measure the satisfaction level with the implementation of the project. Communication on verification will be presented annually or before any new verification.

Other institutional stakeholders were communicated about the project through email, where a material of the project was sent attached. The stakeholders were invited to comment on the project. As more visits are still taking place, additional information may be added in this section.

The validation and verification processes were explained using a power point presentation, where the steps and processes of the project were presented orally. All participants were informed about the mechanisms that generate the Carbon Credits and the validation and registration process, while it was pointed out that an external auditor (a validation and verification body) that visits the Project Area and executes the process, interacts with the stakeholders, evaluates the Project information and issues evaluation reports.

Printed project briefs were made available to schools and local agencies for future consultation, as well as communicated via email to other stakeholders, in which the project summary was sent as an attachment.

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

The auditor site visit will be communicated together with the invitations to the stakeholders for making comments about the project documents. This is normally carried out at least one month before the site visit, to enable stakeholders to plan ahead and be available during this visit. The results of the communication between communities and the auditor will define the audit plan, where the stakeholders to be interviewed should be defined. The interviews are done via direct and independent communication between the community members or other stakeholders and the auditor.

2.3.7 Stakeholder Consultations (G3.4)

During the of institutional public consultations, stakeholders were invited to comment on the project activity. Until now, no comments on the project were received. Thus, no change on the project design originated from the stakeholder consultation was made.

During the community consultation, points of improvement were mapped, and the community was consulted on how the project could assist them. The information gathered in these meetings has been taken into account for the definition of the project activities.

The institutional consultation with stakeholders has already taken place. As information becomes available, this section will be updated.

As more visits are still taking place, additional information may be added in this section.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

The project has an ongoing communication and consultation channel between the project proponents and communities and other stakeholders. The communication happens through the project team in the field and in the office, the latter being by email and telephone. Before every verification, the communities and other stakeholders will be contacted and consulted in order to receive updates on the project activities and results, but also to give inputs and considerations on the project.

2.3.9 Stakeholder Consultation Channels (G3.5)

The consultations are undertaken directly with the communities and other stakeholders or their legitimate representatives. They take place in a location of easy access to the community and the project is presented in full to the participants by social specialist. For the stakeholders that the project was presented by the email address redd.itauba@carbonext.com.br, a project summary with adequate level of information was sent and they were invited to comment on the project.

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

The consultations with the community and stakeholders were organized in a way to ensure adherence and a full understanding of the subject. The meetings with the communities took place in a place of easy access, all inside the community, and were conducted by a specialist, in order to communicate the content in a

culturally appropriated way so that all those present could understand. They were invited to comment and to question the project. The consultation reached men and women.

2.3.11 Anti-Discrimination Assurance (G3.7)

The proponents of the project, possess the principles of legality, impersonality, and morality, which enshrine the principles of anti-discrimination based on race, color, sex, or religion. In addition, the project proponents are in compliance with workers' rights and safety that are guaranteed by well-defined laws, such as the Consolidation of Labor Laws (CLT) Law No. 5,452/43, recently amended by law No. 13,467/2017 (labor reform), which provides for anti-discrimination in employment and occupation. Implementation reports are used to ensure transparency and avoid any form of discrimination.

Reporting channels were also presented during the meeting at Marcelândia and Itaúba's communities and should be used for any complaints from any stakeholder to ensure that the project will not be involved or be complicit in any form of discrimination or sexual harassment.

2.3.12 Feedback and Grievance Redress Procedure (G3.8)

The project proponent understands that stakeholders want and need to be involved in project design, implementation, monitoring and evaluation throughout the project lifetime. Therefore, communication channel was established for stakeholders to continually express their concerns and to solve eventual conflicts and grievances that arise during project planning, implementation, and monitoring. The main communication channel is the project's own email (redd.itauba@carbonext.com.br), which is managed by the Carbonext team.

It is expected that this communication channel will be a mechanism to ensure that the project proponent and all other entities involved in project design and implementation are not involved in or complicit in any form of discrimination or harassment with respect to the project. All denouncements will be available to stakeholders and auditors. In case of conflicts, the project proponent and stakeholders will be free to propose and take any appropriate corrective action. This is the formalized grievance redress procedure that will be used throughout the project lifetime to address disputes with stakeholders, which may arise during project planning and implementation.

The process for receiving, hearing, responding to and attempting to resolve Grievances will be performed within a reasonable time period. It is expected that each grievance is responded in a delay of 7 days, proposing and/or taking corrective actions. This Feedback and Grievance Redress Procedure has three stages:

1. The Project Proponent shall attempt to amicably resolve all grievances and provide a written response to the grievances in a manner that is culturally appropriate. (Action must be taken in 7 days);
2. Any grievances that are not resolved by amicable negotiations shall be referred to mediation by a neutral third party. (Action must be taken in 30 days);
3. Any grievances that are not resolved through mediation shall be referred either to a) arbitration, to the extent allowed by the laws of the relevant jurisdiction or b) competent courts in the relevant jurisdiction, without prejudice to a party's ability to submit the grievance to a competent supranational adjudicatory body, if any. (The time to accomplish this stage is dependent on local jurisdiction delays.)

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

The feedback and complaint procedure will be published at meetings held by Carbonext during the community public consultation period. In addition, during meetings with communities, the project team will make itself available at any time if community members had any feedback, complaints, or suggestions. More information about the complaint and communication process are described in section 2.3.

2.3.14 Worker Training (G3.9)

A relevant set of training are being organized and planned to take place periodically to build useful skills and knowledge for the community. Also, with the purpose of decrease GHG emission and increase the community participation on the project implementation, workshops and specific trainings sustainable forest management will be offered. The trainings will be held by specialized personnel, whenever possible, by local labor, and the participants will receive certificates attesting their participation.

2.3.15 Community Employment Opportunities (G3.10)

Employment opportunities will be offered without any discrimination of gender, age, religion, marital status or ethnicity. The selection will be made according to the person that better qualifies for the requirements of the position. Women and elderly will be encouraged to apply for the position. Once hired, the worker(s) will go through a training process and a trial period that lasts 3 months. All workers hired will be registered under Brazilian laws.

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

In Brazil, workers' rights are guaranteed by well-defined laws, such as the Consolidation of Labor Laws (CLT) Law No. 5.452/43, recently amended by law No. 13.467/2017 (labor reform). It is also worth to mention the existence of Law 5,889/73 which regulates specifically the rules applicable for rural employees.

The CLT has Brazilian Regulatory Norms (also known as NR) that are cited in Chapter V, Title II, and were approved by Ordinance no. 3214, in June 1978. The Brazilian Regulatory Norms (NR) regulate and provide guidance on mandatory procedures related to occupational safety and health.
The main NR regulations for the project are the following:

- NR 4- Specialized Occupational Health and Safety Services (Last update: MTPS Ordinance No. 510 of April 29, 2016);
- NR 5- Internal Commission for Accident Prevention. (Last updated: SIT Ordinance No. 247 of July 12, 2011);
- NR6: Personal Protective Equipment – PPE;
- NR 28: Deals with the inspection and penalties that can be applied to companies that do not comply with the other rules established by the Federal Government
- NR31: Safety and health at Work in Agriculture, Livestock forestry, forestry and Aquaculture [DO|C2]
- ILO Declaration on Fundamental Principles and Rights at Work;
- Conventions 87 and 98: Dealing with union freedom and protection of the right to union and collective bargaining.
- Convention 11: Right to Organize in Agriculture;

The project proponent complies with laws and regulations (as declared in the Partnership Agreement). These norms and laws will be presented for new workers as part of the Recruitment and Integration Operation Procedure. Current workers will go through a training on the topic. The full implementation and training of the workers on this procedure is expected to be finished by 2023, for the first monitoring report.

2.3.17 Occupational Safety Assessment (G3.12)

The Occupational Safety Assessment of the ITAÚBA REDD Project was developed based on the stages of hazard identification and risk analysis, as well as the proposition of prevention, mitigation and contingency measures.

Specific definitions, used in occupational health and safety and occupational hygiene, are described as follows:

1) Hazard: it is an intrinsic characteristic that, if materialized, can lead to an undesired event, is a condition with the potential to causa damage;
2) Danger: exposure to dangerous condition;
3) Risk: is a number that is usually a function of the probability of the hazardous condition materializing into an undesired event and the consequence that this materialization will cause;
4) Incident: it's an unplanned event with no worker injury, which has the potential to cause an accident;
5) Accident: it's an unplanned event with worker injury.
6) Damage: is the consequence of the release of energy associated with hazardous condition associated with the hazardous condition (material damage, injury, death).

Hazard Identifying

The prevention and mitigation of hazards related to field activities must consider from planning to completion. Thus, the possible scenarios and hazards were identified considering transportation, internal displacement, physical conditions and biological agents to which the worker may be exposed. For better management, the hazards were categorized as (A) accidental, (B) biological, (P) physical, (C) chemical and I ergonomic.

Risk Assessment

To analyze each identified risk, the risk matrix of probability versus severity was used, as shown in Figure 15. Five levels of probability and five levels of severity were defined, whose application results in the final risk classification, as shown in Figure 16. The risk degree will define the priority for taking prevention and mitigation actions.

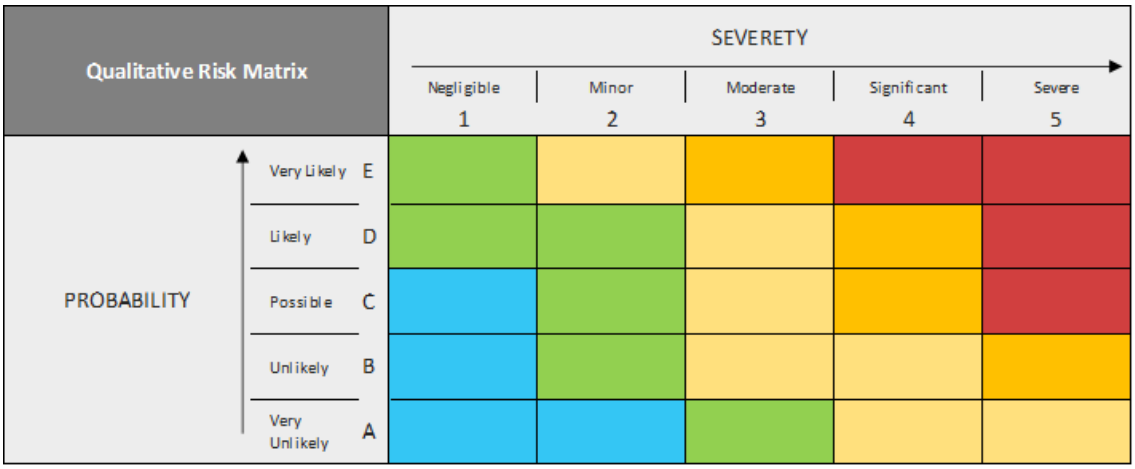


Figure 15: Risk matrix: (probability x severity). Source: Carbonext (2022)

	Trivial
	Tolerable
	Moderate
	Substantial
	Intolerable

Figure 16: Risk classification. Source: Carbonext (2022)

Severity values were analysed for each risk considering the scale and criteria described in Figure 17.

Risk Estimation: severity of consequence	
Index	**Definition**
1	Mild injuries without the need for medical attention, discomfort or discomfort.
2	Reversible serious injury or illness.
3	Irreversible critical injury or illness that may limit functional capacity.
4	Disabling or fatal injury or illness.
5	Multiple deaths or disabilities (>10).

Figure 17: Severity of consequence. Source: Carbonext (2022)

Probability values were analysed for each risk considering the scale and criteria described in Figure 18.

Qualitative Estimation: categories of exposure

Index	Category	Description
A	Very low exposure	< 5%
B	Low exposure	>5% a <30%
C	Moderate exposure	>30% e <70%
D	Hight exposure	>70%<95%
E	Very hight exposure	>95%

Figure 18: Categories of exposure. Source: Carbonext (2022)

The main prevention and mitigation actions of the identified risks are presented below, considering their causes and priority category.

Prevention, mitigation and emergency procedures:

The proponent developed the occupational health and safety manual, which presents risk prevention and mitigation actions, as well as procedures for emergency situations.

The manual also has contacts for activation in cases of emergency, a training schedule, a checklist for planning activities and work safety equipment for each specific risk, and details the accident occurrence flow, how the analysis and traceability of these accidents is done by the specialists.

The manual must be available for the audit.

2.4 Management Capacity

2.4.1 Project Governance Structures (G4.1)

Carbonext is responsible for all the activities necessary to develop the Project Description in the standards and methodology compatible with the project, for the calculation of the generation of carbon credits and the assistance for the project validation and verification under VCS/CCB and registration process. The technical team responsible for the mentioned activities is divided into three main areas (Figure 19).

Project Development REDD+: Technical team specialized in the development of REDD+ projects, being the main responsible for the project design, selection of activities, determination of specific objectives and to provide technical support to the owner and to monitor those activities are being carried out.

GIS (Geographic Information System): Team responsible for determining and reviewing the project baseline, deforestation dynamics, project leakage and monitoring via satellite images the occurrence of deforestation in the project area.

Social: Team responsible for socioeconomic analysis, engagement and articulation with communities and other stakeholders, development of social activities and indicators, in addition to monitoring socio-economic indicators.

The owner is responsible for managing and monitoring the project to avoid any invasions, changes in the biome or any other activity that could lead to deforestation and loss of biodiversity.

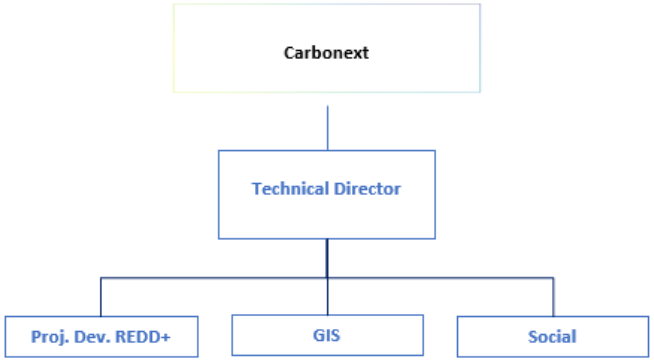


Figure 19: Carbonext's Governance Structure.

2.4.2 Required Technical Skills (G4.2)

Carbonext's technical team has experienced professionals in several areas of knowledge necessary for the planning and monitoring of the project, such as forestry engineers, social workers, biologists, oceanographers, geoprocessing analysts and other related areas, as described in the section below.

Carbonext will carry out the monitoring of carbon stocks from deforestation rates and greenhouse gas emissions produced or avoided during the project, which will be developed by a specialized team that has previous experience with other REDD projects. In addition, it has a team of social specialists, who have the necessary skills to engage the community and stakeholders, so the team will be able to ensure community participation, designing activities and monitoring socioeconomic indicators.

For the fauna and flora inventory, a third-party team will be hired to collect data in the field and generate the diagnostic report. Preference will be given to local teams that has knowhow of local conditions, but this activity will only take place after the first verification of the project.

2.4.3 Management Team Experience (G4.2)

Carbonext was founded in 2010 with the objective of preserving the Amazon Forest through the elaboration of REDD+ carbon credit projects. Since then, we have designed three REDD+ projects according to the VCS standard and have conserved more than 315,000 hectares to date, with new projects in progress. In addition, Carbonext has a multidisciplinary technical team, composed of forest engineers, biologists, ecologists, geographers, social workers, and others that integrate a skilled team of researchers and specialists able to conduct the project activities.

For more information about Carbonext, visit our website: *https://carbonext.com.br/*.

The summaries of the expertise of the technical team dedicated to the validation and monitoring of the ITAÚBA REDD+ Project are shown below:

Name	Janaina Dallan
Position	CEO at Carbonext
Education	Forestry Engineer by the Luiz de Queiroz College of Agriculture (ESALQ) and a Master's in business of the environment.

Resume summary	Janaína has been working with the carbon market since 2001 on projects around the world and, as CEO of Carbonext, she is directly involved in coordinating the development and implementation of carbon credit projects. Throughout her career, she has managed UNFCCC CDM (Clean Development Mechanisms) projects through several international companies such as Golder Associates, Global Energy Partners, Orbeo / Societé Generale, One Carbon and Ecofys. She is currently a member of the United Nations Framework Convention on Climate Change (UNFCCC), in which she has been a member of the Registration and Issuance Team (RIT) since 2013, she is president of the Brazil Alliance for Nature-Based Solutions and is a member of the experts for the Taskforce for Scaling Voluntary Carbon Markets (TSVCM).
Contact Information	janaina@carbonext.com.br
LinkedIn	https://www.linkedin.com/in/janainadallan/

Name	Luiz Fernando de Moura
Position	Technical Director at Carbonext
Education	Forestry Engineer by the Luiz de Queiroz College of Agriculture (ESALQ), M.Sc. and Ph.D. in Wood technology by the Université Laval (Quebec, Canada).
Resume summary	He is responsible for coordinating the technical group at Carbonext, working with projects for the Carbon Markets, mainly Forestry projects. Dr. de Moura had participation in the preparation of “Energia Verde Carbonization Proje–t - Mitigation of Methane Emissions in the Charcoal Production of Grupo Queiroz Galvão, Maranhão, Brazil”, registered on March 21, 2011. Dr. de Moura has also participation as project designer in Florestal Santa Maria REDD+ Project, Fortaleza Ituxi REDD+ Project, UNITOR REDD+ Project and Evergreen REDD+ Project.
Contact Information	luiz.moura@carbonext.com.br
LinkedIn	https://www.linkedin.com/in/luiz-fernando-de-moura-6077089/

Name	Larissa Albino da Silva Santos
Position	REDD+ Analyst
Education	Oceanographer by the Federal University of Espírito Santo – UFES, M.Sc. in Energetic and Environmental Planning by the Federal University of Rio de Janeiro (PPE/COPPE/UFRJ).
Resume summary	Larissa has experience in climate change and sustainability through data analysis for the public and private sectors. She worked as a consultant and researcher at WayCarbon, Control ParGroup, and conducted consultancies for the German development bank KfW and for the German Agency for International Cooperation (GIZ). She also was the technical lead for the service sector and supported the transport sector of the greenhouse gas inventory of the Third Brazilian National Communication to the United Nations Framework Convention on Climate Change
Contact Information	larissa.albino@carbonext.com.br
LinkedIn	https://www.linkedin.com/in/larissa-albino-da-silva-santos

Name	Thiago Bopp Resnitzky
Position	REDD+ Analyst
Education	Currently on studying in Economic Sciences in the University of São Paulo (bachelor's degree).
Resume summary	Experience with socioenvironmental entrepreneurship, conservation of protected areas, nature-based solutions, and climate change. Thiago previously worked in the implementation of the Acceleration Program for Municipal Conservation Units (2021), implemented by the German Agency for International Cooperation (GIZ) in partnership with ICLEI South America and IUCN, which promoted effectiveness in the management of six Brazilian protected areas. He is a member of the Youth Climate Leaders (YCL) and Climate Reality (CR) networks and has been part of organizations such as Enactus and Group Turing of Artificial Intelligence of the University of São Paulo.
Contact Information	thiago.bopp@carbonext.com.br

LinkedIn	https://www.linkedin.com/in/thiago-bopp

Name	Paula Dias Ho
Position	REDD+ Analyst
Education	Biologist by the University of São Paulo with an experience with Science Without Boarders from CNPq in the Ludwig Maximillian's University (Munich, Germany) and currently studying Sustainability and Economics by the Pontifical Catholic University of Rio Grande do Sul (post-graduation).
Resume summary	Experienced as laboratory technician with benthonic meiofauna in the characterization of the Santos Bay of Petrobrás, Paula also worked with educational activities as a monitor in the biology discipline at Escola Viva, in São Paulo.
Contact Information	paula.ho@carbonext.com.br
LinkedIn	https://www.linkedin.com/in/paula-dias-ho-1a54951b9/

Name	Raisa Fagundes de Figueiredo
Position	REDD+ Analyst
Education	Geologist by the Federal University of Roraima – UFRR, M.Sc. and Ph.D. in Geology and Natural Resources by the University of Campinas – UNICAMP. Post-doctoral research at Luiz de Queiroz College of Agriculture – ESALQ/USP.
Resume summary	Raisa has experience with geological mapping in Amazon, techniques of passive inorganic carbon capture, and evaluation of the agronomic potential of rock dust. She has worked in research focused on carbon dioxide storage through mineral carbonation in mine tailings and soils.
Contact Information	raisa.figueiredo@carbonext.com.br
LinkedIn	https://br.linkedin.com/in/raisa-fagundes-de-figueiredo-geologa

Name	Marcos Marques
Position	Project Social Analyst

Education	Forestry Engineer by the Federal University of Amazonas and M.Sc. in Forestry and Environmental Sciences also by the Federal University of Amazonas.
Resume summary	Experienced with forestry inventories and environmental dynamics, field research, remote sensing, biomass and carbon quantification in the National Institute for Amazonian Research. Marcos holds certificates of independent courses in Environmental Management Systems, by Senac São Paulo, and Ecosystemic Services Integration in Planning Processes by IPÊ – Instituto de Pesquisas Ecológicas. He is also a member of the Sustainable Development Solutions Network Amazonia (SDSN Amazonia).
Contact Information	marcos.marques@carbonext.com.br
LinkedIn	https://www.linkedin.com/in/marcos-marques-0a86341b2/

Name	Daniela Paes da Rocha
Position	Remote Sensing & GIS Analyst
Education	Geographic Information Systems and Remote Sensing from the Public University of Navarra and master in biosystems engineering from the Fluminense Federal University, in natural systems with an emphasis on microclimate. Forestry Engineer graduated from the Federal Rural University of Rio de Janeiro.
Resume summary	Experience with remote sensing and routines GIS, processes and solutions for conservation projects, land use and land cover management, forest management and forest integrity monitoring.
Contact Information	daniela.rocha@carbonext.com.br
LinkedIn	https://www.linkedin.com/in/danielapaesdarocha/

Name	Mateus da Silva Trez
Position	Remote Sensing & GIS Leader
Education	Environmental and Sanitary Engineer by the Engineering School of Piracicaba.

Resume summary	Experience with utilization of Geographic Information Systems and softwares such as ArcGIS, Spring, Quantum Gis, Saga Gis, GvSig and Kosmo for monitoring quality and quantity of water in hydrographic basins, developing hydrological models, climate monitoring, erosion estimations, identification of priority areas for conservation (AAVC), territorial planning for areas of permanent preservation and legal reserves, evolution of land use changes for prediction of future changes, consultancies for acquisition of environmental and forestry certifications such as FSC, CERFOR and 14000, remote sense imagery treatment and analysis for land use mapping, productivity assessments.
Contact Information	mateus.trez@carbonext.com.br
LinkedIn	https://www.linkedin.com/in/mateustrez/

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

As mentioned in section 2.4.2, for the fauna and flora inventory, a third-party company or independent specialists will be hired to carry out data collection in the field, giving preference to local teams that know the local reality. These activities will take place after the first verification report, so the contracted team has not yet been defined.

With respect to other capacities necessary for project formulation or implementation, no technical or administrative gaps have so far been identified that need to be filled by an entity. However, if during the monitoring work, the need to contract the services of independent professionals or companies to carry out the work is identified, the project team will take the necessary steps to find, contract and then manage any subcontractors. In addition, the project team will determine the time, resources, and level of participation of any external entities that provide services to the project in accordance with the internal processes.

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

Carbonext has more than 10 years of experience with REDD+ projects with the objective of preserving the Amazon Forest. Since then, we have designed three REDD+ projects according to the VCS standard and have conserved more than 315,000 hectares to date, with new projects in progress.

Supporting evidence of the financial health of both proponents will be made available to the audit team and reported in the Non-Permanence Risk Report.

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

In Brazil, the two main legal instruments that aim to prevent acts of corruption and unethical attitudes are (i) Law 12,846/2013 (Anti-Corruption Law); and (i) Law 8,429/1992 (Administrative Misconduct Law).

Law no. 12,846/2013, known as the Anti-Corruption Law, establishes rules regarding the administrative liability and civil liability of legal entities in the case of practice of acts against the public administration, national and/or foreign. Under Law 8,429/1992, administrative improbity is an immorality qualified by the dishonesty and acts of bad faith by the public agent.

Both practices, in addition to the legal risks, could represent enormous reputational risk to the project and to all that are involved. Due to this risks, Carbonext Legal Due Diligence aims to verify and, if possible, mitigate any involvement of the landowner (partner) with such practices.

The clearance certificates examined by Carbonext's legal team (applicable for all the project proponents/partners and real estate assets) during the Legal Due Diligence process cover a large spectrum of jurisdictional and administrative matters, such as, for example, consultation before State Courts of Justice and Superior Courts, State and Federal Public Prosecutors, Environmental Agencies, Protest Registry Offices, Real Estate Registry Offices, etc., significantly reducing the chances of both debts and/or acts of corruption (regarding the landowner partner or the real estate assets) go unnoticed. Eventual discovery of relevant debts and/or acts of corruption involving the landowner (partner) , is one of the many reasons for the termination of the intended partnership, as provided for in the contract.

Carbonext also has an internal Anti-Corruption Policy and an internal Code of Ethics and Organizational Conduct, in order to ensure non-involvement with bad practices or corruption[17].

To register your denunciation, send an e-mail to *compliance@carbonext.com.br*.

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

[17] Anti-corruption policy and code of ethics and organizational conduct in force: https://carbonext.com.br/governanca-corporativa/

Some information required by the VCS and CCB standards is considered confidential or commercially sensitive and cannot be made public by the project proponent. This information will be supplied to the audit team, but not available for the public. The documents are:

• Agreements and contracts between the parties involved;
• Financial evidence of the proponents' funds for the project;
• Property Right Documents.

2.5 Legal Status and Property Rights

2.5.1 Statutory and Customary Property Rights (G5.1)

For the implementation and development of the project, the business model and type of contract adopted by Carbonext is the partnership agreement, a modality in which the possession (and liabilities) and property (and liabilities) remain with the landowner (partner).

However, in order to guarantee the maintenance of the project, the contract provides "the right of first refusal" in the acquisition of the property by Carbonext. Said right guarantees that if the owner wishes to sell the property, he must first offer it to Carbonext. However, if Carbonext do not exercise the right of first refusal, the third party that will/shall acquire the real estate asset must fully observe/comply with the carbon project, until its termination. In this way, the maintenance of the project and the generation of credits is protected.

Considering the maintenance of the project, another important aspect is the verification of eventual of liens/encumbrances and possible rights of third parties that may threaten the real estate asset disposition in some way. At this point, we can indicate as possible risks environmental fines and unpaid taxes, disputes over possession (possessory actions), disputes over property (usucapion), succession disputes (inventory not finalized with disputes over real estate assets), guarantees recorded in the real estate record files (mortgage, fiduciary alienation, etc.). In general, these are situations that at some point may imply a change in ownership of the real estate asset, leading to the termination of the project. In this sense, Carbonext conducts the Legal Due Diligence, aiming to verify risk scenarios, protecting, as much as possible, these occurrences.

The project development depends, among many others, on the legal premise that there are no real (real estate asset) or personal (landowner) matters that would make the project unfeasible.

2.5.2 Recognition of Property Rights (G5.1)

All the real estate assets in which the project will be developed are private property rights are recognized, respected and supported by Brazilian Law. Information regarding the ownership and number of registration (real estate record file) of each real estate asset is listed in the table below. Documentation will be made available to the auditors.

Table 17: Ownership Assessment and Rural Property Registration Certificates.

Property (Farm)	Total Area (ha)	Project Area (ha)	Ownership	Rural Property Registration Certificate (CCIR)
Casa Blanca	3,046.52	2,435.15	Maria Auxiliadora Basílio Grimas Ferreira and José Celso Ferreira	950.017.730.998-8
Natal	2,987.15	2,413.22	Maria Auxiliadora Basílio Grimas Ferreira and José Celso Ferreira	950.025.448.478-0
São Judas Tadeu	1,783.89	972.31	Maria Auxiliadora Basílio Grimas Ferreira and José Celso Ferreira	950.025.448.605-7
Guanabara	1,781.78	1,586.43	Maria Cristina Basílio Grimas Almeida	950.025.448.508-5
Vale Verde	2,271.24	1,538.95	Maria Cristina Basílio Grimas Almeida	950.025.448.524-7
Ponderosa	1,782.13	1,535.28	Maria Cristina Basílio Grimas Almeida	950.025.448.494-1
Santa Maria	2,003.95	1,165.76	Maria Cristina Basílio Grimas Almeida	950.025.448.486-0
Julian Grimas	2,287.78	1,521.12	Maria de Fátima Grimas Senedese	950.025.448.532-8
Nossa Senhora Salete	2,400.85	2,184.68	Maria de Fátima Grimas Senedese	000.035.472.131-7

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

The project will not trespass nor affect other private or public real estate assets, traditional communities or environmental protection areas.

The consent necessary for the development of the project is as required by Brazilian legislation for all transactions in general, this is, the landowner partner must be a fully capable agent, willing to voluntarily execute the project, free from defects of consent.

The contract was widely and freely negotiated, being accepted and signed by those who had the legal powers to do so, as demonstrated by the partnership agreement signed.

2.5.4 Property Rights Protection (G5.3)

The execution of the project will not lead to involuntary removal or relocation of property rights holders from their lands or territories. In addition, it will neither force rights holders to relocate activities to their culture of livelihood. Furthermore, the proponents will keep constant communication with the stakeholders through the communication channel established between them, in order to protect the property rights and the culture of livelihood in the project area and project expansion area.

2.5.5 Illegal Activity Identification (G5.4)

In the baseline scenario, the illegal deforestation and forest fires in the project area can generated problems related to a scenario without the project, which aims to act in favor of forest conservation. The illegal deforestation (associated also with forest fires) of the project region is closely related to cattle ranching and soy agriculture.

To prevent such activities, the project will strengthen the local monitoring system by purchasing communication equipment for the resident population in the project area and in the project management area, as well as control and inspection training. Furthermore, the project has remote monitoring by satellite images from different sensors (Sentinel and Landsat) and radar images (Sentinel), with a maximum frequency of 7 days. This allows the project proponents to identify any illegal trespassing and take action.

2.5.6 Ongoing Disputes (G5.5)

In the project area, no conflicts or disputes over property rights, use of real estate, or access to natural resources have been identified, nor disputes with traditional third parties or squatters that may abrogate the right of ownership of the ITAÚBA REDD+ project area, as detailed above.

In relation to public entities, whether state, municipal or federal, of direct or indirect administration, the certificates analyzed indicate the legitimacy of the titling, from its ground zero, ruling out the possibility of irregular "dominion" over public lands (*grilagem*), a fact that would make the development of the project impossible, because regardless of the domain duration, it could not be regularized (public lands cannot undergo usucapion), except with the effective participation of the public entity that owns the area, through some legislative measure (law, decree , ordinance, etc.) that expressly legalizes this domain.

Under Brazilian legislation, we can say that the certificates from environmental, administrative, jurisdictional, and certifying bodies indicate that both possession and property belong to the proponent, being tame, peaceful, stabilized, fully legal and extensively documented and proven. In other words, the owner has full right to use, enjoy and dispose of the properties that make up the project, having legitimacy to allow the project to be developed.

2.5.7 National and Local Laws (G5.6)

2.5.7.1 International Agreements

- Convention on the International Trade in Endangered Species of Wild Flora and Fauna, 1973.
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2000;
- International Tropical Timber Agreement, 1994;
- United Nations Convention on Biological Diversity, 1992;
- United Nations Framework Convention on Climate Change, 1992;
- United Nations Declaration of the Rights of indigenous Peoples, 2007;
- The Kyoto Protocol to the Convention on Climate Change, 1997;

2.5.7.2 National and Local Laws (G5.6)

There is no specific governing legislation in Brazil about carbon credit projects or even for the carbon credits generation. However, Brazil is advancing on this theme, and there are draft bills being considered in the plenary (both Senate and Chamber of Deputies) regarding the carbon market, for example, PL 2148/2015 proposes the regulation of the carbon market in Brazil by creating a Brazilian system of emissions trading

in accordance with the Paris agreement on climate change. In addition, it provides for the certification of carbon credits for alternative source power generation projects. Also, PL 415/2020 establishes the Amazon Fund, a non-profit civil association, whose objective is to allocate the value of donations to the realization of non-refundable investments in actions to prevent, monitor and combat deforestation and to promote conservation and sustainable use of the Legal Amazon. The Amazon Fund will be eligible for access to payments for results of REDD+ projects, achieved by the country and recognized by the United Nations Framework Convention on Change of the Climate. In addition, PL 4516/2021 consolidates the incentive to issue green debentures, intended for investment projects in sustainable development. Although these proposals are being processed by the Brazilian legislature, please note that all projects must be aligned with the laws and principles that govern the legal sphere to be approved subsequently inserted to the Brazilian legal system.

In this context, there is a hierarchy between norms in the Brazilian legislation, which starts with the Federal Constitution as the main governing rule and, thereafter, subordinated to this are state and municipal laws. All branches of applicable and complementary laws to the carbon-generating project and their applicable rules have their origin, foundation, and validity in the Federal Constitution.

Regarding Environmental Law and the Environment, Article 225 of the Federal Constitution is the basis for all norms, principles, objectives, and policies. The National Land Policy is indicated in Article 184. Furthermore, rights such as possession, property, and free enterprise are also based on the Federal Constitution.

Thus, considering the premises contained in the brief explanation above, there are several rules applicable, directly, and indirectly, to the project generated from carbon credits, each one regulating a specific aspect.

- **Law nº 11. 284/2006** - Provides for the management of public forests for sustainable production, institutes the Brazilian Forest Service - SFB. Among other topics, this law deals with the management of public forests for sustainable production; Direct management; Forest concessions; Management and inspection bodies; Principles and concepts (http://www.planalto.gov.br/ccivil_03/_Ato20042006/2006/Lei/L11284.htm);

- **Law nº 12.651/2012 (Forest Code)** - The Forest Code establishes general rules on the protection of vegetation, Permanent Preservation areas and Legal Reserve areas, forest exploitation, the supply of forest raw materials, control of the origin of forest products and the control and prevention of forest fires. In addition, it provides economic and financial instruments to achieve its

objectives. Creates the CAR which was later regulated by MMA Normative Instruction No. 2 of May 5, 2014 (http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm);

Regarding the Forest Code, the following definitions of the Brazilian Forest Code stand out as being relevant:

- "*III – Legal Reserve (LR): area located inside a rural estate, excluding the Area of Permanent Preservation, necessary for sustainable use of natural resources, conservation and recovering of ecological processes to conservation of biodiversity and to shelter and protection of native fauna and flora.*
- *VI – Legal Amazon: the States of Acre, Pará, Amazonas, Roraima, Rondônia, Amapá and Mato Grosso, and the regions located to the North of parallel 13ºS, in States of Tocantins and Goiás, and to the West of meridian 44ºW, of the State of Maranhão.*"

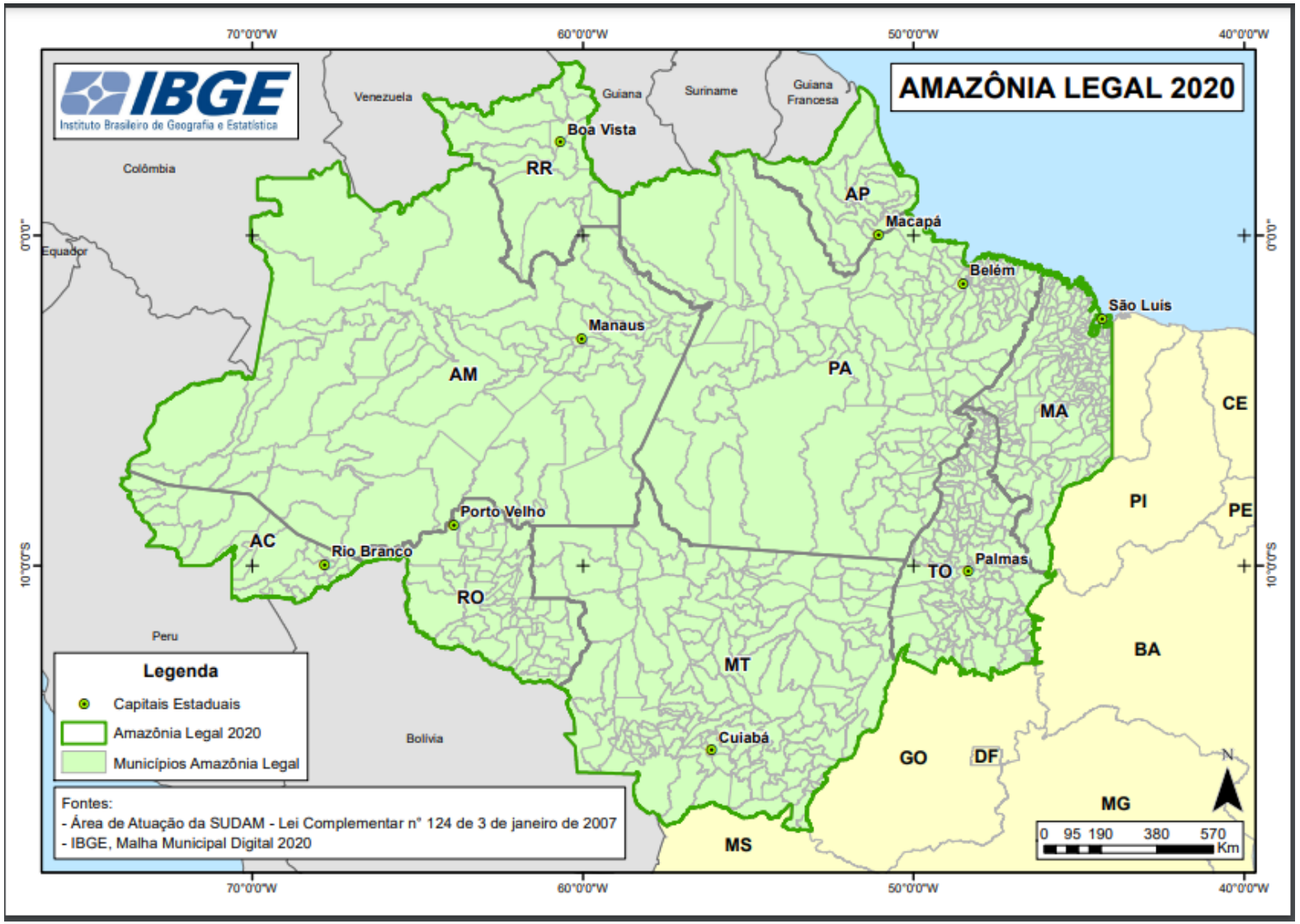


Figure 20: The Brazilian Legal Amazon States Acre (AC), Amapá (AP), Amazonas (AM), Maranhão (MA), Mato Grosso (MT), Pará (PA), Rondônia (RO), Roraima (RR), Tocantins (TO). Source [31]

The Legal Reserve (LR) must be registered in property deed in the Real Estate Registry Office: its location must be publicly known, and future landowners must know where it is located, its boundaries and frontiers. The LR can be located anywhere inside a rural estate. Brazilian Forest Code determines that, once allocated, LR may not be changed even in cases of real estate transfer, land dismembering or area rectification.

The LR allocation is a prerequisite to obtaining permission to exploit the native vegetation existing inside the rural estate. In order to obtain this Permit for Forestry Stewardship, the landowner must previously register the location of the LR in land property documents through the Real Estate Registry Office, before suppressing any kind of native vegetation. According to Provisory Measure No. 2166-67 (Medida Provisória nº 2.166-67) of August 24, 2001:

- "*Article 16. The forests and other types of native vegetation, excepting those located in Areas of Permanent Preservation, as well as those not subject to the politics of restricted use or subject to specific legislation, are susceptible to suppression, as long as a portion of vegetation is preserved, as Legal Reserve, at a minimum:*
- *I – eighty percent (80%), in rural estates located in forest zones located in the Legal Amazon.*"

However, according to first paragraph of article 62 from the Environmental State Code of Mato Grosso (see section 2.5.7.3), the local law allows Legal Reserve to be 50%:

- *Article 62. Forest or other forms of native vegetation that represent a minimum percentage of the rural property area are considered Legal Reserves, aiming to maintain its vegetation cover and all existing life forms:*
    - *§ For areas of forest or transitional woods, the minimum percentage allowed per property will be 50% of its surface area*

Thus, the Itaúba REDD project complies with the state law (first §, article 62 and with the Forest Code), with Legal Reserve equivalent to at least 50% of the area of the property. In this case, the project presents the following percentage of Legal Reserve.

Table 18: Properties Legal Reserve Areas

Property (Farms)	Total Area (ha)	Legal Reserve Area (ha)	Legal Reserve %
Casa Blanca	3,046.52	2,439.78	80.07
Natal	2,987.15	2,436.74	81.55
São Judas	1,783.89	976.97	54.76

Guanabara e Vale Verde	4,053.36	3,291.43	81.20
Ponderosa	1,779.80	1,431.05	80.40
Santa Maria	1,935.21	1,072.11	55.40
Julian Grimas	2,286.97	2,275.36	99.51
Nossa Senhora Salete	2,400.89	1,468.63	61.16

- **Law nº 9.433/1997 (The National Policy on Water Resources)** - The National Policy on Water Resources is based on the assumption that water is a limited natural resource, with economic value and public domain. Likewise, the management of water resources must always provide for the multiple use of water, and the management of water resources must be decentralized and count on the participation of the Public Power, users and communities (http://www.planalto.gov .br/ccivil_03/leis/l9433.htm);

- **Law nº 12.305/2010 (National Solid Waste Policy)** - The National Solid Waste Policy brings together the set of principles, objectives, instruments, guidelines, goals, and actions adopted by the Federal Government, alone or in cooperation with states, the Federal District, municipalities or individuals, with a view to the integrated management and environmentally appropriate management of solid waste. This is a milestone in Brazilian environmental legislation, as it is the first federal standard created with a focus on the problem of solid waste. Thus, the aforementioned law deals with relevant issues related to social, environmental and economic interests in practically all activities. It includes as instruments the environmental, sanitary and agricultural monitoring and inspection, technical and financial cooperation between the public and private sectors for the development of research on new products, methods, processes and technologies of management, recycling, reuse, waste treatment and final disposal environmentally sound tailings; scientific and technological research; environmental education, among others (http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm);

- **Law nº 12.187/09 (National Policy on Climate Change - PNMC)** - The PNMC's objectives are to make economic and social development compatible with the protection of the climate system, the reduction of anthropogenic greenhouse gas emissions in relation to their different sources , the strengthening of human removals by sinks of greenhouse gases in the national territory, the implementation of measures to promote adaptation to climate change by the 3 (three) spheres of the Federation, with the participation and collaboration of economic and social agents stakeholders or beneficiaries, in particular those especially vulnerable to its adverse effects; the

preservation, conservation and recovery of environmental resources, with particular attention to the great natural biomes considered National Heritage; the consolidation and expansion of legally protected areas and the encouragement of reforestation and the recovery of vegetation cover in degraded areas; and encouraging the development of the Brazilian Emissions Reduction Market – MBRE (http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l12187.htm);

- **Decree nº 9.578/2018** - Provides for the National Fund on Climate Change (FNMC), dealt with in Law no. 12,114, of December 9, 2009, and the National Policy on Climate Change, dealt with in Law n. 12,187, of December 29, 2009. Among the topics covered by the decree is the application of FNMC resources to projects to reduce carbon emissions from deforestation and forest degradation, with priority for natural areas threatened with destruction and relevant to conservation strategies biodiversity (art. 7, V) (http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/decreto/d9578.htm);

- **Resolution nº 001/1986 of CONAMA** - Deals with Environmental Licensing. It is an administrative procedure through which the Public Administration establishes conditions and limits for the exercise of certain activities (http://www.ibama.gov.br/sophia/cnia/legislacao/MMA/RE0001-230186.PDF) ;

- **Law nº 9.985/2000 (SNUC Law)** - This Law establishes the National System of Nature Conservation Units - SNUC, establishes criteria and norms for the creation, implementation and management of conservation units and presents a series of important concepts for a proper understanding conservation units (http://www.planalto.gov.br/ccivil_03/leis/l9985.htm);

- **Law nº 6.938/1981 (National Environmental Policy)** - The National Environmental Policy has the objective of preserving, improving and recovering the environmental quality conducive to life, aiming to ensure conditions for socio-economic development, the interests of national safety and the protection of human dignity;

- **Law nº 10.406/2002 (Civil Code)** - Deals with various rights and obligations, including possession, property and legal business (http://www.planalto.gov.br/ccivil_03/leis/2002/l10406compilada.htm) .

- **Law nº 6.015/1973 (Public Records Law)** - The law deals with public records and, especially, in its chapter V it refers to the registration of rural properties, through which the ownership of rural property is demonstrated (http:/ /www.planalto.gov.br/ccivil_03/leis/l6015compilada.htm);

- **Decree n° 11.075/2022 (Brazilian Carbon Market) –** Establishes the procedure for the elaboration of Sectoral Plans for the Mitigation of Climate Change and institutes the National System for the Reduction of Greenhouse Gas Emissions

2.5.7.3 State laws (G5.6)

- **Decree 1.245/2022** - Provides for rural land regularization in the State of Mato Grosso in areas that were donated to the State of Mato Grosso and regulates art. 9 to 9-D of Law No. 3.922, of September 20, 1977, which provides for the State Land Code;
- **Decree 1.160/2021** - Creates the "CARBONO NEUTRO MT" program; provides for the adhesion of the State of Mato Grosso to the "Race to Zero" campaign, in the scope of the United Nations Framework Convention on Climate Change; sets voluntary targets for the reduction of illegal deforestation in the State; creates the Action Plan for the Prevention and Control of Deforestation and Forest Fires in the State of Mato Grosso - PPCDIF/MT 4th phase (2021 - 2024), and makes other provisions;
- **Decree 1.1490/2018** - Establishes the Action Plan for Prevention and Control of Deforestation and Forest Fires in the State of Mato Grosso and makes other provisions;
- **Supplementary Law nº 38/1995**: Provides on the State Environmental Code and makes other provisions;
- **Normative Instruction SEMA/MT 1/2007**: Disciplines the technical and administrative procedures for environmental licensing of rural properties in the state of Mato Grosso;
- **Ordinance SEMA/MT 99/2007**: Lists the documents required to instruct the projects for Single Environmental Licensing, Forest Exploitation Plan, Multiple Use Sustainable Management Plan, Verification of Legal Reserve of Intact Properties, Forest Planting Project and Circumstantiated Survey;
- **Supplementary Law nº 327/2008**: Creates the Rural Environmental Legalization Program and regulates the stage of the environmental licensing process for rural properties;
- **Supplementary Law n° 38/1995**: Provides on the State of Mato Grosso the Environment Code and makes other provisions;
- **Law nº 11.606/2021**: Establishes the State Policy for the Promotion of the 2030 Agenda for Sustainable Development of the United Nations (UN) as a guideline for public policies in the State of Mato Grosso;
- **Law nº 11.506/2021**: Provides for the creation and implementation of the Sustainable School Program and the seal of the same name in the school system of the State of Mato Grosso;

- **Law nº 9878/2013**: Creates the State System for Reducing Emissions from Deforestation and Forest Degradation, Conservation, Sustainable Forest Management and Increasing Forest Carbon Stock - REDD+ in the State of Mato Grosso and makes other provisions;
- **Chapter III on Natural Resources of the Constitution of the State of Mato Grosso:** provides on definitions of the ecologically balanced environment, as defined in the Federal Constitution, and establishes other provisions of competence of the State System of Environment.

2.5.7.4 Municipal Laws (G5.6)

- **Section IV, art. 103 – Organic Law of Marcelândia:** The Municipality shall adopt programs for the development of the rural according to its economic, social and environmental aptitudes, jointly with the Union and the State of Mato Grosso;
- **Organic Law of Itaúba**: This assigns the entire section V on the environment, discussing its protection, command and control instruments, and forms of compensation for polluting activities.

2.5.8 Approvals (G5.7)

Brazil does not have a specific authority for the management and approval of projects that generate carbon credits, so there was no need for such formal approval of any kind.

Approvals for the project were obtained internally within the structure of the proponents, being approved by the partners and boards of both companies, in addition to having been approved regarding the legal and technical feasibility.

Although there is no specific need for approval by any administrative agency, it is worth mentioning that the project was built and will be conducted strictly within the legal dictates and, consequently, within all the regulations and principles of administrative entities in Brazil, such as IBAMA, FUNAI, INCRA, among others.

The project has the approval from the stakeholders described in section 2.3.5 throughout the meetings held between all parties involved.

2.5.9 Project Ownership (G5.8)

The proponents listed in 2.1.3 are the legal owners of this project area.

2.5.10 Management of Double Counting Risk (G5.9)

The project does not have any intend to generate or receive any form of environmental or social credit, including any tradable climate, community, or biodiversity unit. The strategies to avoid double counting risks are disposed in section 2.5.15.

2.5.11 Emissions Trading Programs and Other Binding Limits

This section is not applicable to the project, since there is no intended to use the GHG emission reductions and removals generated by the project for compliance under others trading program or mechanisms.

2.5.12 Other Forms of Environmental Credit

This section is not applicable to the project, since the project has no sought neither received any other form of GHG-related environmental credit.

2.5.13 Participation under Other GHG Programs

The ITAÚBA REDD+ Project was not registered or seeks for registration in any other GHG program.

2.5.14 Projects Rejected by Other GHG Programs

The ITAÚBA REDD+ Project was not rejected by any other GHG program as it has not undergone any type of validation/verification process.

2.5.15 Double Counting (G5.9)

As mentioned in sections 2.5.11, 2.5.12, 2.5.13 and 2.5.14, the current project is an independent REDD+ project, not related to any other GHG program in state of Mato Grosso or Brazil. Even so, the project has a strategy to avoid possible double counting in regional and national levels, with the implementation of the communication channel (section 2.3.9). This channel will share information regarding credit sold as offsets in the voluntary market and those generated for commercialization the Mato Grosso State System for Reducing Emissions from Deforestation and Forest Degradation, Conservation, Sustainable Forest

Management and Enhancement of Forest Carbon Stock. This system relates to the national one (National Commission for Reducing Emissions of Greenhouse Gases from Deforestation and Forest Degradation – CONAREDD).

3 CLIMATE

3.1 Application of Methodology

3.1.1 Title and Reference of Methodology

The methodology used in the project is the Methodology for Avoided Unplanned Deforestation VM0015 version 1.1 (3 December 2012).

The tools VT0001 Tool for The Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities – Version 3.0, and AFOLU "Non-Permanence Risk Tool" VCS Version 4, Procedural Document, 19 September 2019, v4.0 were used.

3.1.2 Applicability of Methodology

Table 19: Applicability Conditions for Project.

Applicability conditions	Project meets description
Baseline activities may include planned or unplanned logging for timber, fuel-wood collection, charcoal production, agricultural and grazing activities as long as the category is unplanned deforestation according to the most recent VCS AFOLU requirements.	The baseline activities include planned logging, agricultural and grazing activities.
Project activities may include one or a combination of the eligible categories defined in the description of the scope of the methodology.	According to Table 1 (table below) from VM0015 the eligible category to this project activity falls into category D, as it involves protection of forest with controlled logging, and the baseline consists of deforestation in old-growth forests with logging . For this type of project activity, the carbon balance is represented as shown in the figure below.
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 agroforestry systems meeting the definition of "forest".	The Project Area meets the internationally accepted definition of forest set out in the Decision 11/CP.7 of the Marrakesh Accord, which was also adopted by UNFCCC [32]: (a) "Forest" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 meters at maturity in situ. Young natural stands and all plantations

	which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily un-stocked as a result of human intervention such as harvesting or natural causes, but which are expected to revert to forest. Besides the PA meeting forest definition, the area is covered only by forest for at least 10 years before the Project start date: the date when activities are initiated to protect forests against the risk of future deforestation.
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.	An assessment of satellite images was done for the project area starting 10 years (2011 – 2021) and it was identified that those areas are following the adopted forest definition.
The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as 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 Area does not include forested lands growing on peat, as stated in section 2.1.5 of the present PD, none of which meet the criteria for turf, cited in the VM0015 methodology.

Table 20: Scope of the VM0015 methodology (Table 1 of the VM0015)

			PROJECT ACTIVITY	
			Protection without logging, fuel wood collection or charcoal production	Protection with controlled logging, fuel wood collection or charcoal production
BASELINE	Deforestation	Old-growth without logging	A	B
		Old-growth with logging	C[1]	D[1]
		Degraded and still degrading	E[1]	F[1]
		Secondary growing	G[1]	H[1]
	No-deforestation[2]	Old-growth without logging	No change	Degradation
		Old-growth with logging	IFM	IFM-RIL
		Degraded and still degrading	IFM	IFM
		Secondary growing	No change	Degradation

1. Accounting for carbon stock increase in the project scenario is optional and can conservatively be omitted.
2. If the baseline is not deforestation, the change in carbon stocks is not covered in this methodology.

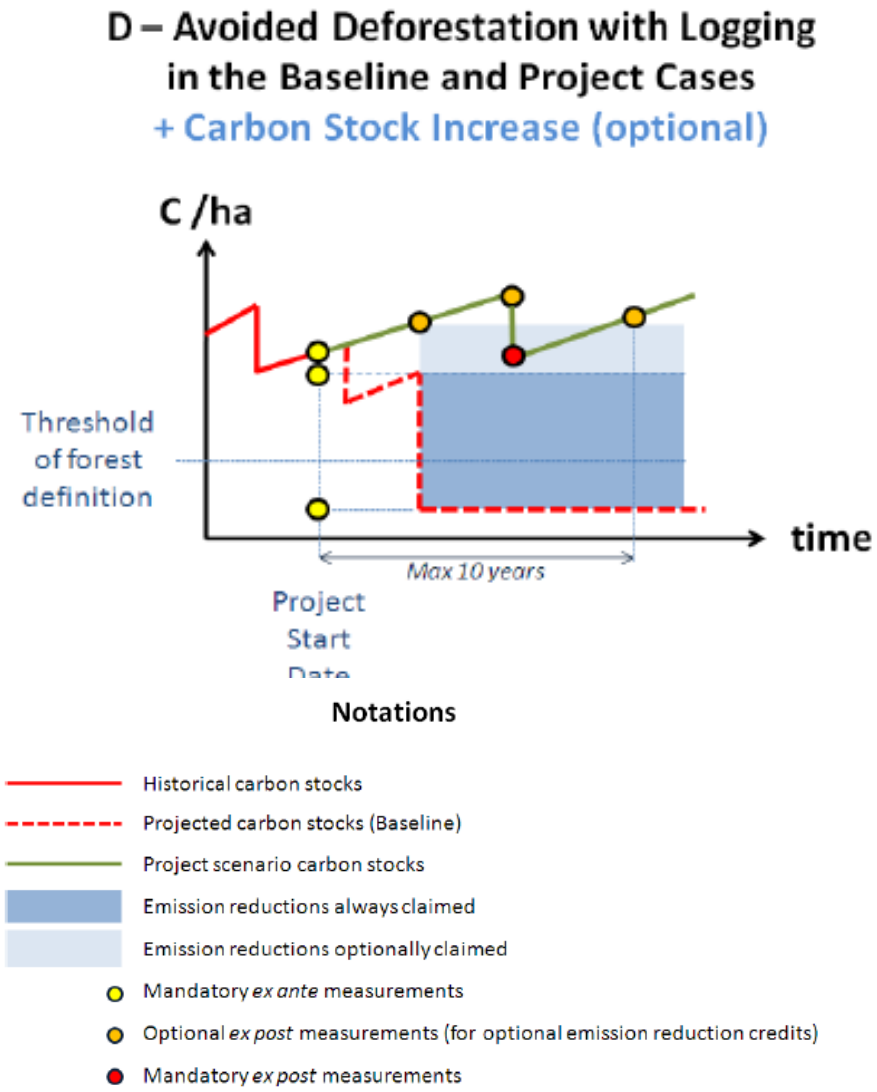


Figure 21: Carbon balance in project category D of VM0015 methodology.

In this context, it is demonstrated that the VM0015 methodology is applicable to the proposed AUD project activity.

As mentioned in section 3.1.1 of this PD, "VT0001 Tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities", Version 3.0, 1 February 2012, Sectoral Scope 14, was used in this project. The tool is applicable to this project, according to statements below:

a) The project activity does not lead to violation of any applicable law, even if the law is not enforced;

b) There is a baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario.
Section 3.1.1 of this VCS-PD also mentions the use of AFOLU “Non-Permanence Risk Tool” VCS Version 4, Procedural Document, 19 September 2019, v4.0, which is mandatory to be applied to GHG removals or avoided emissions through carbon sinks.

3.1.3 Project Boundary

Step 1.1 from VM0015 - Spatial boundaries
Step 1.1.1 from VM0015 - Region of reference

For delimitation of the Reference Region boundary and future deforestation projection, the main drivers of deforestation were defined:

- Accessibility of forests: The Reference region has a vast and dense network of primary, secondary and tertiary roads, rivers and streams (Igarapés). The nearest locations of these paths will have a greater potential of deforestation.

- Distance from Deforestation (Proximity to forest edges): Given the accessibility and physiographic conditions, regions near the ancient deforestation and communities, districts, municipal centers also tend to have a higher probability and risk of future deforestation.

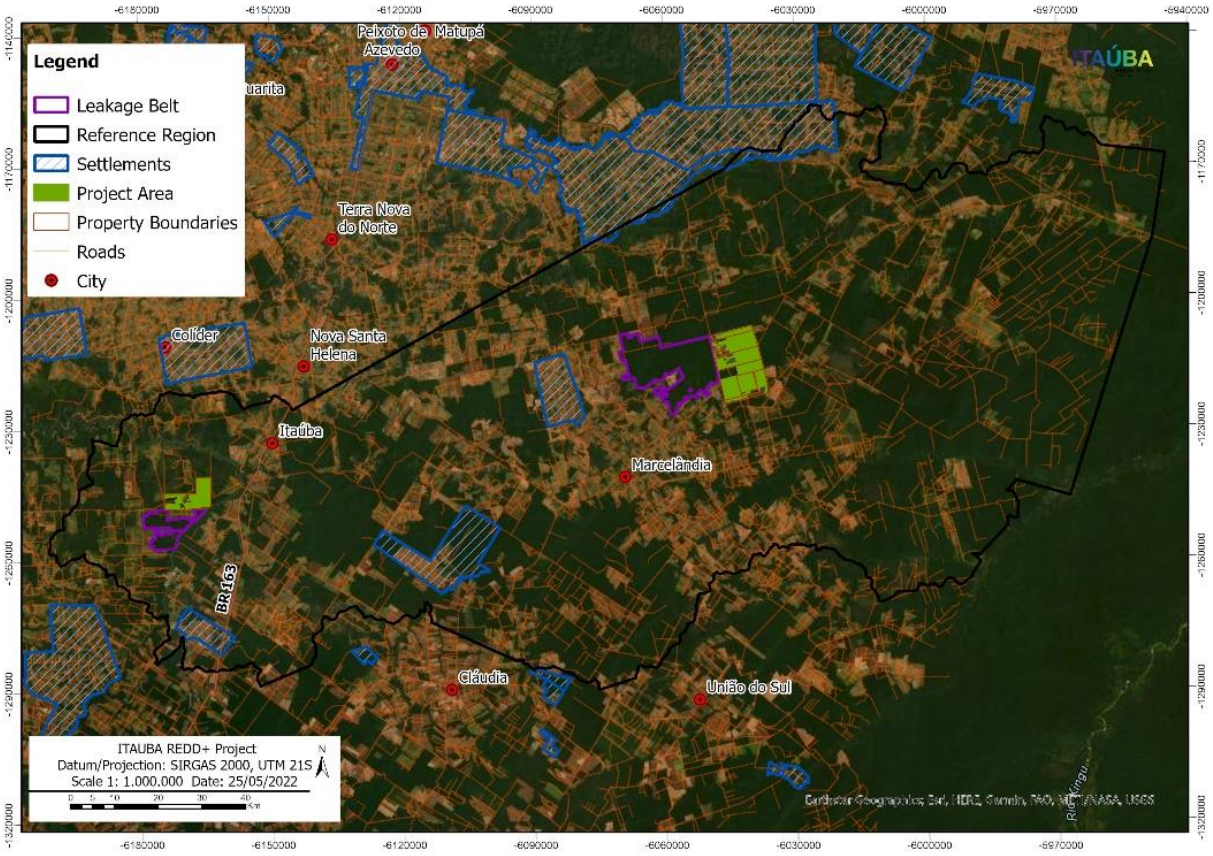


Figure 22: Location of Reference Region, Project Area, Leakage Belt.

3.1.3.1 Agents and drivers of deforestation

Agent groups: In the absence of the present REDD+ project, it is assumed that the property would undergo deforestation at the same intensity, carried out by the same agents and motivated by the same drivers, as that which occurs in the Reference Area. There is historical evidence by PRODES[1]images.

The PRODES project carries out satellite monitoring of clear-cut deforestation in the Legal Amazon and has produced, since 1988, annual deforestation rates in the region, which are used by the Brazilian government to establish public policies. Annual rates are estimated from the deforestation increments identified in each satellite image covering the Legal Amazon. The first presentation of the data is carried out until December of each year, in the form of an estimate, when approximately 50% of the images covering the Legal Amazon are normally processed. Consolidated data are presented in the first half of the following year. Regarding the acquisition, pre-processing, classification, post-classification, and evaluation of the accuracy of satellite images are described in detail in the item 3.1.4.1.3.

According with the PRODES data, the same deforestation pressures which apply to the Reference Region also act on the Project Area. The main agents come from livestock and soy cultivation, which are the main groups of agents of deforestation in the region.

3.1.3.2 Landscape configuration and ecological conditions

Forest types: The map below shows the forest topology on reference region. Evergreen Seasonal Forest represents 69% of reference region forests and 50,6% of project area, IBGE. Table below show the forest areas and typologies for the Reference Region (RR) and Project Area (PA). Therefore, it meets the methodology requirement for this specific similarity criterion, that states: “At least 90% of the project area must have forest classes or vegetation types that exist in at least 90% of the rest of the reference region”.

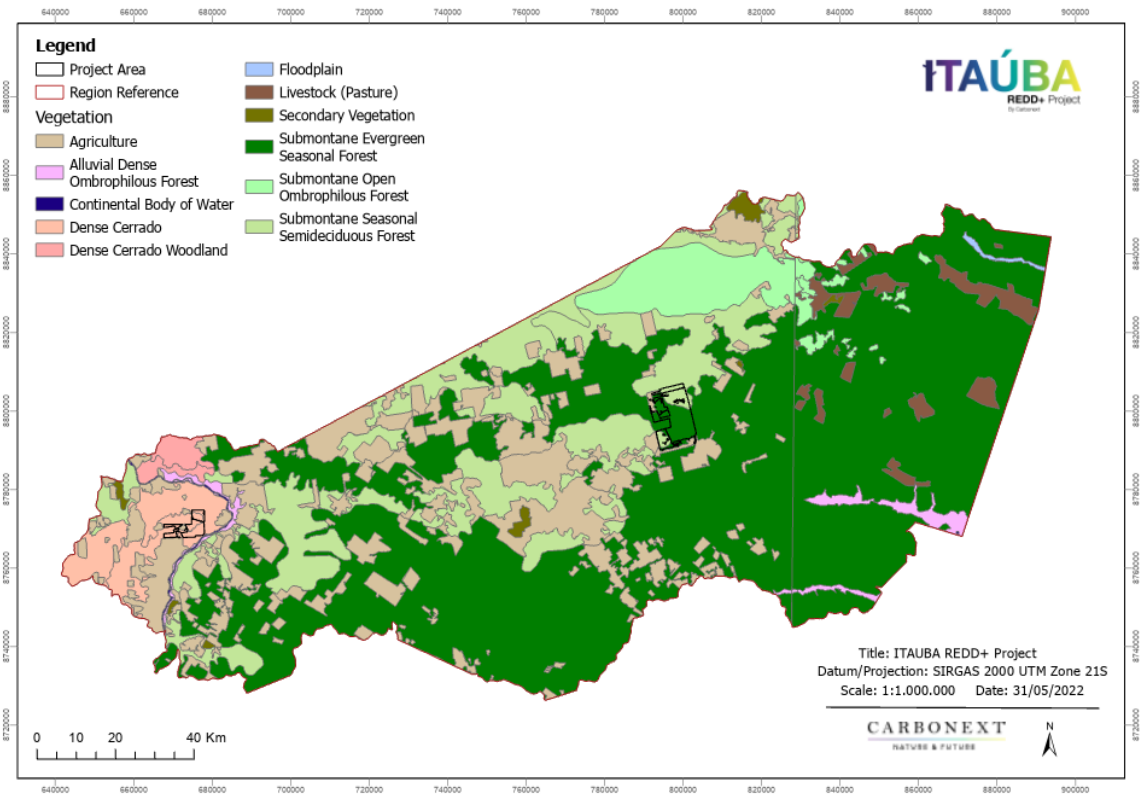


Figure 23: Forest typologies in the Reference Region and Project Area.

Table 21: Forest typologies in the Reference Region.

Vegetation			
Area	**Type**	**ha**	**%**
PA	Seasonal Semideciduous Forest	4,078	26.7%
	Evergreen Seasonal Forest	7,721	50.6%
	Dense Cerrado	3,461	22.7%
RR	Dense Ombrophylous Forest	21,395	1%
	Open Ombrophylous Forest	84,929	6%
	Seasonal Semideciduous Forest	271,765	19%
	Evergreen Seasonal Forest	1,007,867	69%
	Dense Cerrado	51,029	3%
	Dense Cerrado Woodland	14,281	1%
	Secondary Vegetation	9,529	1%

Banco de Dados de Informações Ambientais (BDiA) do IBGE.

3.1.3.2.1 Elevation

To classify the altitude of the Project Area and the Reference Region, in accordance with methodology criteria, which requires similarity of 90% between both areas, a mosaic of digital elevation models was prepared using scenes 10S54_ZN, 10S57_ZN, 10S555ZN; in TIFF format, provided by Topodata – INPE [33]. The map below shows the elevation levels of the RR and PA. The following graphs show the elevation distributions (Nº. of pixels/ Altitude) in the Project Area (red) and Reference Region (blue), demonstrating the similarity between them. The mean elevation of the project area is of 342.41 meters. The parameter in the reference region has an average value of 345.53 meters. This is in accordance with methodology criteria, which requires similarity of 90% between both areas.

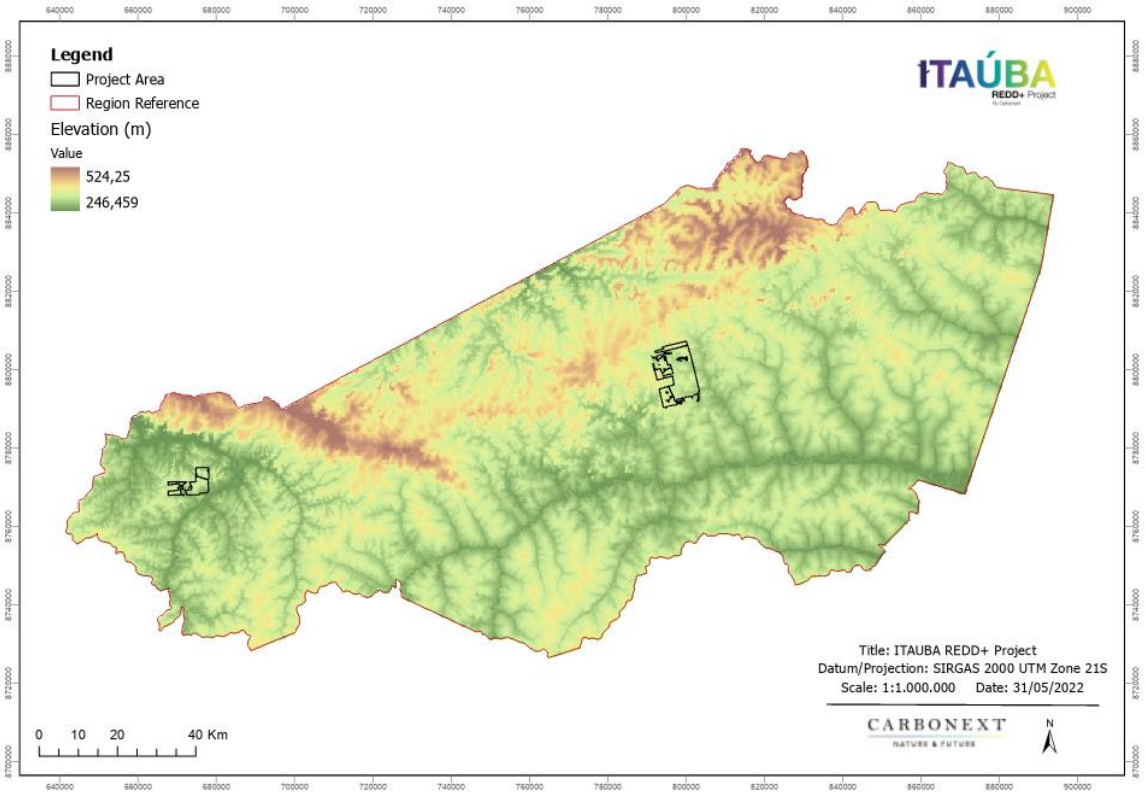


Figure 24: Elevation in the Reference Region and Project Area.

Table 22: Elevation in the Reference Region and Project Area.

	Elevation (m)		
Area	10% min	mean	10% max
PA	308.17	342.41	376.65
RR		345.53	

In this analysis, our main goal was to prove that the elevation in the PA is within the range of elevation in RR, so justifying that elevation factor would not hinder deforestation inside the PA in a different way it could affect deforestation in the RR. The fact that the PA has lower elevation than RR indicates that it can be more susceptible to deforestation than RR.

3.1.3.2.2 Slope

To analyse slope within the Project Area and the Reference Region, in compliance with methodology criteria, which require 90% similarity between the areas, a mosaic of digital elevation models was created using scenes 10S54_SN, 10S57_SN, 10S555SN; in TIFF format, sourced from Topdata - INPE, in which each pixel represents the average slope of the land. Project Description: VCS Version 4.0 86 The map below shows the similarity of the slope classes in the Reference Region and Project Area; and in the following Tables, these classes were quantified for both areas. The mean slope of the project area is of 5.28 degrees. The parameter in the reference region has an average value of 4.87 degrees. This is in accordance with methodology criteria, which requires similarity of 90% between both areas. In the reference region.

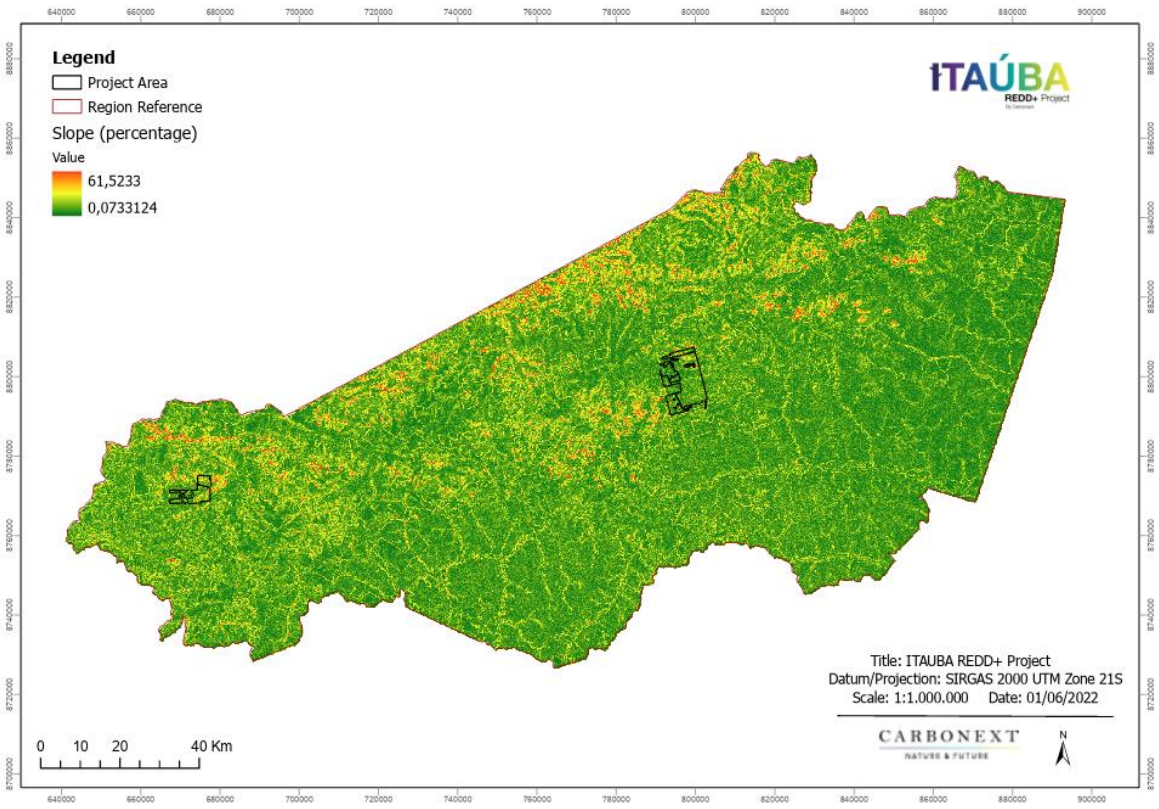


Figure 25: Slope in the Reference Region and Project Area.

Table 23: Slope in the Reference Region and Project Area.

	Slope (degree)		
Area	10% min	mean	10% max
PA	4.75	5.28	5.81
RR		4.87	

In this analysis, our main goal was to prove that the elevation in the PA is within the range of elevation in RR, so justifying that elevation factor would not hinder deforestation inside the PA in a different way it could affect deforestation in the RR. The fact that the PA has lower elevation than RR indicates that it can be more susceptible to deforestation than RR

Table 24: Slope class in the Reference Region.

Slope Class	Area ha	%
Flat	544,763	30.2
Slightly undulating	1,039,193	57.5
Undulating	211,346	11.7
Hilly	9,160	0.5
Mountainous	31	0.002
total	1,804,460	100

Conclusion regarding slope class: the same three slope classes cover 99,4% of both the Project Area and the Reference Region, specifically: Flat, Slightly undulating, and Undulating. Thus, the assessment of slope similarity is superior to 90% and meets methodology requirements.

3.1.3.2.3 Rainfall

To assess the climate and its similarity between the Project Area and the Reference Region, we used a study by World Clim. The data were created by Fick and Hijsmans (2017) [34] , represent average monthly climate data for 1970-2000. The Figure below shows a map of the climate classification of the Project Area and Region of Reference.

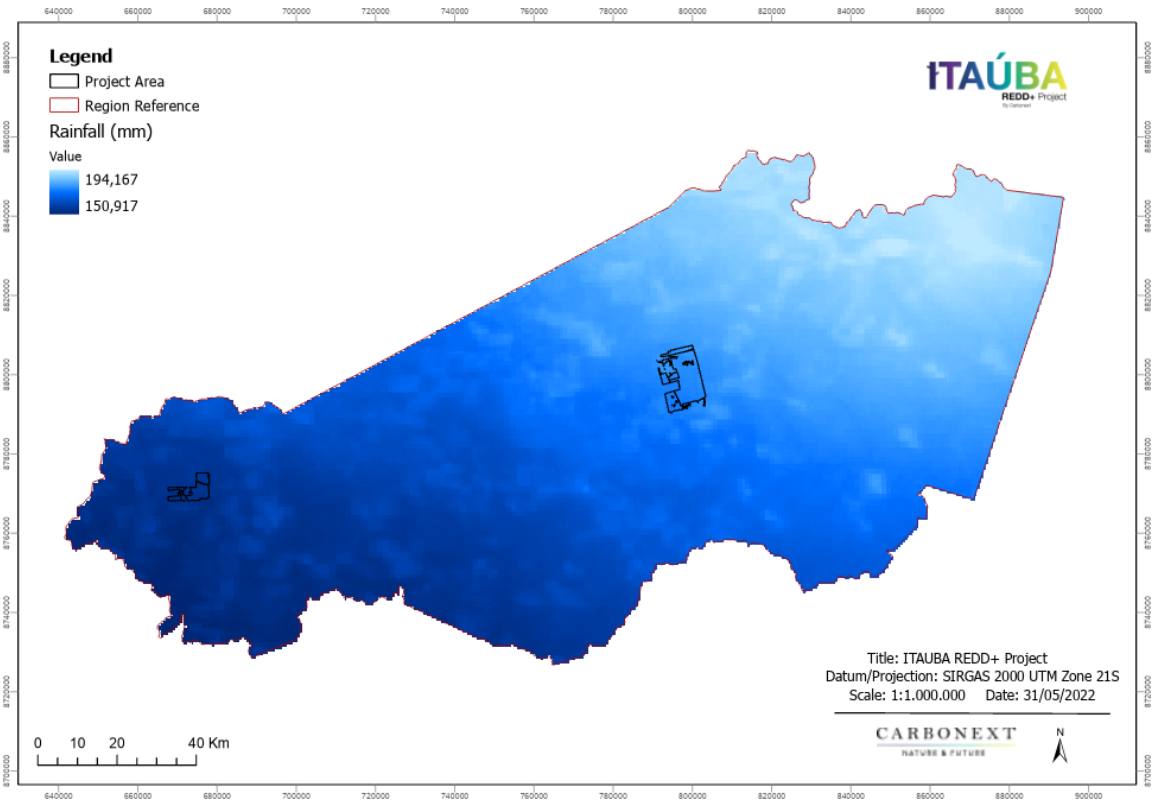


Figure 26: Climate and rainfall analysis in the Reference Region and Project Area.

Precipitation (1970-2000 average prec. *in mm*)			
area	**10% min**	**mean**	**10% max**
PA	153.51	170.57	187.62
RR		170.83	

Conclusion on rainfall climate similarity: The two project areas show no distinctions as to climatic variables.

3.1.3.3 Socio-economic and cultural conditions:

In regards of the socio-economic and cultural conditions, following VM0015, the project's area is also alike of the reference region, e.g., legal status of the land, land tenure, land use, enforced policies and regulations. Legal status of the land: the project area consists of private properties, the dominant legal status observed in the RR.

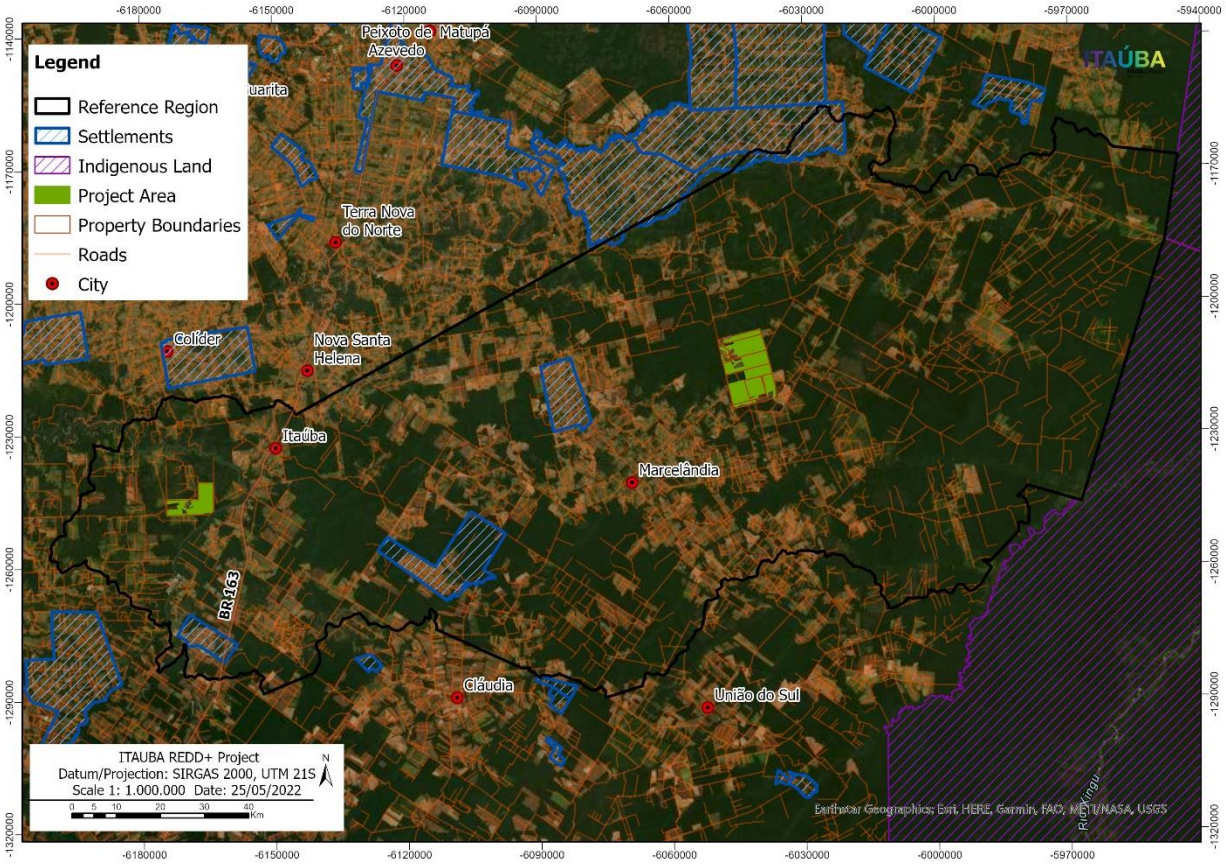


Figure 27: Land use map of the project region, showing the Project Area, Conservation Units, Settlements, Indigenous Territories, and private lands.

Land tenure: the land tenure is public and private which can be observed in the reference region.

Land use: current and projected classes of land-use (forest and non-forest) in the project area are the same found in the reference region.

Enforced policies and regulations: entire project area and reference is the same federative unit in Mato grosso –Brazil, therefore, the same policies, laws and regulation are applied to reference region and project area.

Step 1.1.2 from VM0015 -Project Area

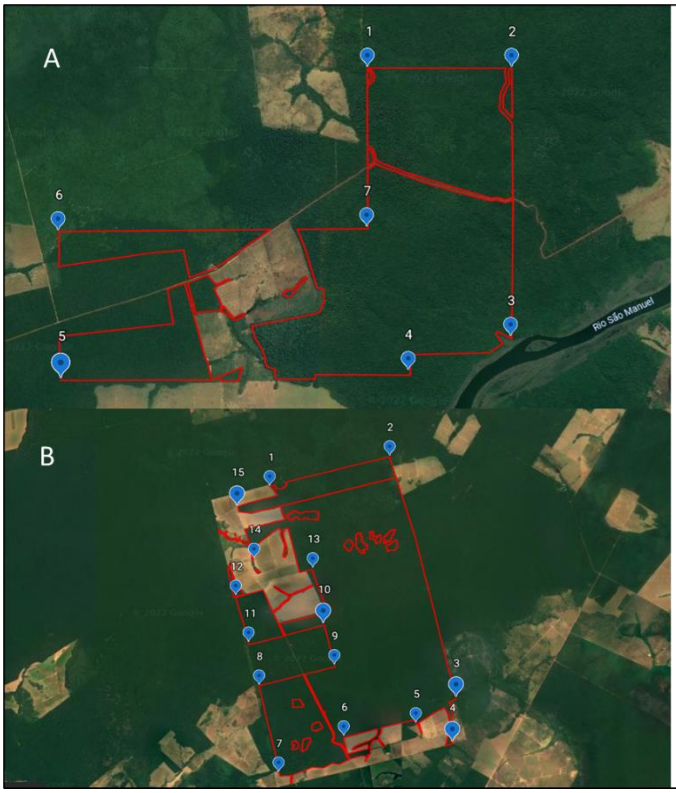
The project area, according to VM00015, is an area covered only by forest for at least 11 years before the Project start date: the date when activities are initiated to protect against the risk of future deforestation. The procedure excluded the deforested areas and included only areas covered in forest at start date: 14/12/2021.

Figure 28: Project Area in 2010 and 2021 Source: SENTINEL – 2 (INPE) [35]

As a result, we obtained an area of 15,352.90 hectares of forest as the Project Area. The geographic limits of the project area within properties are shown on the map below.

Figure 29: Project Area ITAUBA REDD+.

The boundaries of each project area are described below, with the information of the vertices of the polygons of each Project Area.



Vértices	Latitude (UTM)	Longitude (UTM)
1	8775152.40	674622.19
2	8775137.85	677923.93
3	8768258.94	677865.50
4	8768271.72	675523.53
5	8768125.77	667578.20
6	8771053.69	667594.23
7	8771535.49	674587.48

Vértices	Latitude (UTM)	Longitude (UTM)
1	798004.97	8802617.05
2	799255.98	8804618.06
3	805742.66	8796820.12
4	806325.41	8869520.13
5	807251.56	8797021.14
6	807942.71	8885820.15
7	808390.88	8797035.91
8	802990.29	8801035.12
9	803963.53	8799809.72
10	804063.44	8799838.43
11	805273.15	8800838.24
12	806136.26	8799738.51
13	807129.47	8801018.67
14	803963.59	8800918.17
15	804586.46	8799601.41

Figure 30: Geographic limits of the Project Area.

Step 1.1.3 from VM0015-Leakage Belt

The leakage belt is the land area or land areas surrounding or adjacent to the project area in which baseline activities could be displaced due to the project activities implemented in the project area.

To define the boundary of the leakage belt, Opportunity cost analysis (Option I) was tested, in accordance with Approved VCS Methodology VM0015 “Methodology for Avoided Unplanned Deforestation”, Version 1.1, 3 December 2012.

Opportunity cost analysis (Option I) is applicable where economic profit is an important driver of deforestation. To test the applicability of Option I, historical records have shown that at least 80% of the deforested area in the reference region (or some of its strata) during the historical reference period has occurred at locations where deforesting was profitable for cattle ranching and soy cultivation activities. In this context, literature studies, surveys and other credible and verifiable sources of information were used to demonstrate profitability of the main products of deforestation in the region: cattle and soy cultivation.

Opportunity cost analysis (Option I) is applicable where economic profit is an important driver of deforestation. To test the applicability of Option I, historical records have shown that at least 80% of the deforested area in the reference region (or some of its strata) during the historical reference period has occurred at locations where deforesting was profitable for cattle ranching and soy cultivation activities. In this context, literature studies, surveys and other credible and verifiable sources of information were used to demonstrate profitability of the main products of deforestation in the region: cattle and soy.

Based on Opportunity cost analysis (Option I) rationale, leakage can only occur in areas outside the project area where the total cost of establishing, raising cattle, soy cultivation and transporting the products to market is less than the price of the products (i.e., opportunity costs are > 0). To identify this zone, the following steps were applied:

a) List the main land-uses that deforestation agents are likely to implement within the project area in the baseline case.

b) Find credible and verifiable sources of information on the following variables:

$\boldsymbol{S\$x}$=Average selling price per ton of the main product (living cattle and soy) that would be established in the project area in the baseline case:

The average selling price of living cattle was obtained from Mato Grosso Institute of Agricultural Economics (Instituto Mato Grossense de Economia Agropecuária, IMEA): R$ 19,700/ton [36]. For soy the average selling price was obtained from Association of Soy and Corn Producers of Mato Grosso (Associação dos Produtores de Soja e Milho de Mato Grosso – APROSOJA) : R$ 3,204.17/ton.

$\boldsymbol{SPxi}$=Most important points of sale (spatial locations) for each main product Px in the reference region. In this assessment, it was considered that the most important selling points for living cattle are slaughterhouses in the region, along the BR-163 and MT-320 highways.

$\boldsymbol{PCxi}$=Average in situ production costs per ton of product

The average production costs of living cattle were obtained from Mato Grosso Institute of Agricultural Economics (Instituto Mato Grossense de Economia Agropecuária, IMEA):

→ The average production costs of living cattle: R$ 16,600.14/ton.

→ The average production costs of cultivation soy: R$ 2,165.47/ton.

The following transportation costs for tons of soy was obtained by consultation with local company that operates with the activity in the region. Once the RR is located inside the macro region of Sinop, a conservative simplification has been made, assuming the beginning of the transportation pathway is the municipality of Sinop. The average selling price of transportation: R$ 0.26/ton/km.

The most typical means of transportation available for cattle producers in the region is road transport by truck. Transportation average costs are estimated at R$ 1.37/km according to estimates based on

This cost indicates that cattle and soy could be transported at approximately 138 km by road. Considering that up to a distance of 138 km it will still be profitable for livestock production and soy cultivation; we generate a resulting surface that represents the potential profitability of livestock in the reference region. The BR-163 and MT-320 are the main highways in Mato Grosso and closest to the project area, was used as the main parameter for the for evaluation of profitable areas.

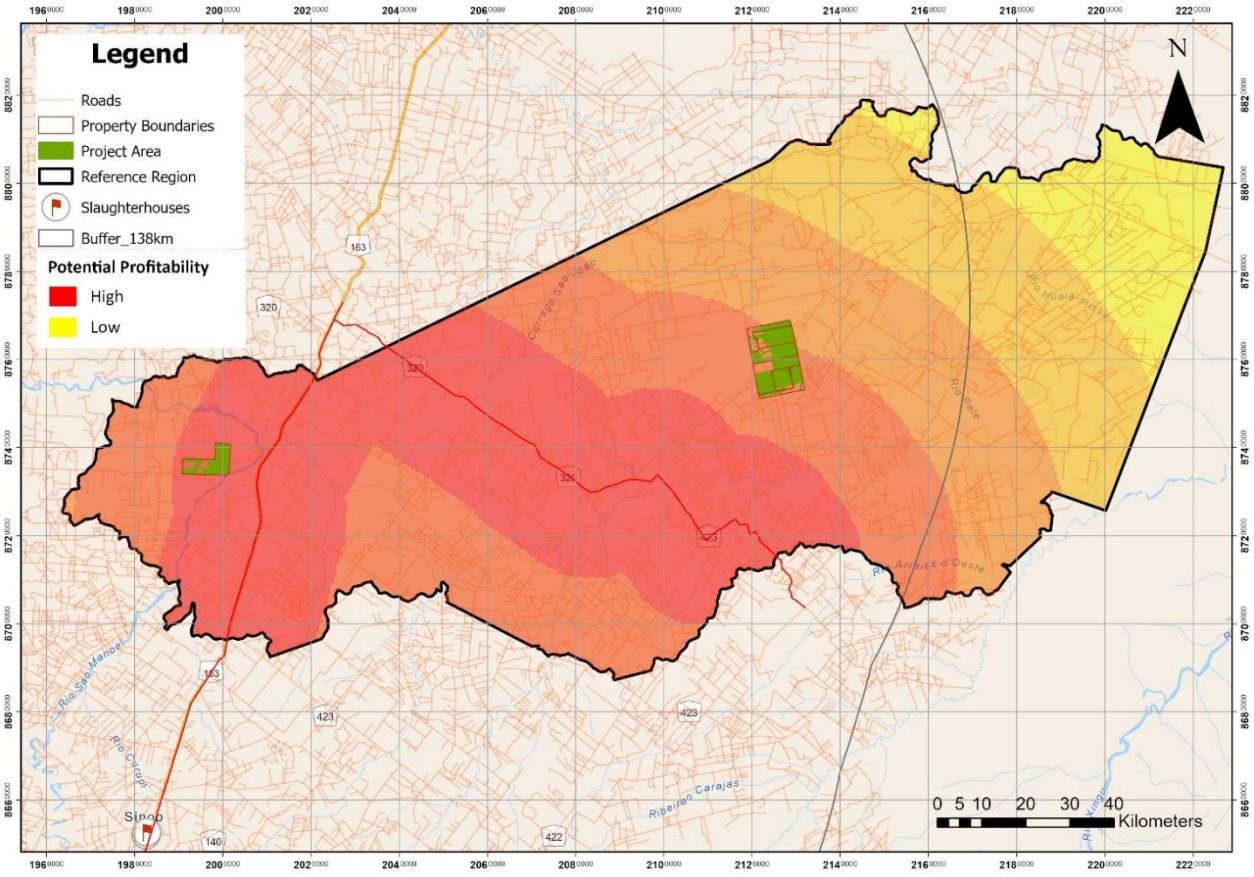


Figure 31: Leakage belt and the Reference Region considering that up to 138 km it will still be profitable for livestock production, soy cultivation and transportation costs.

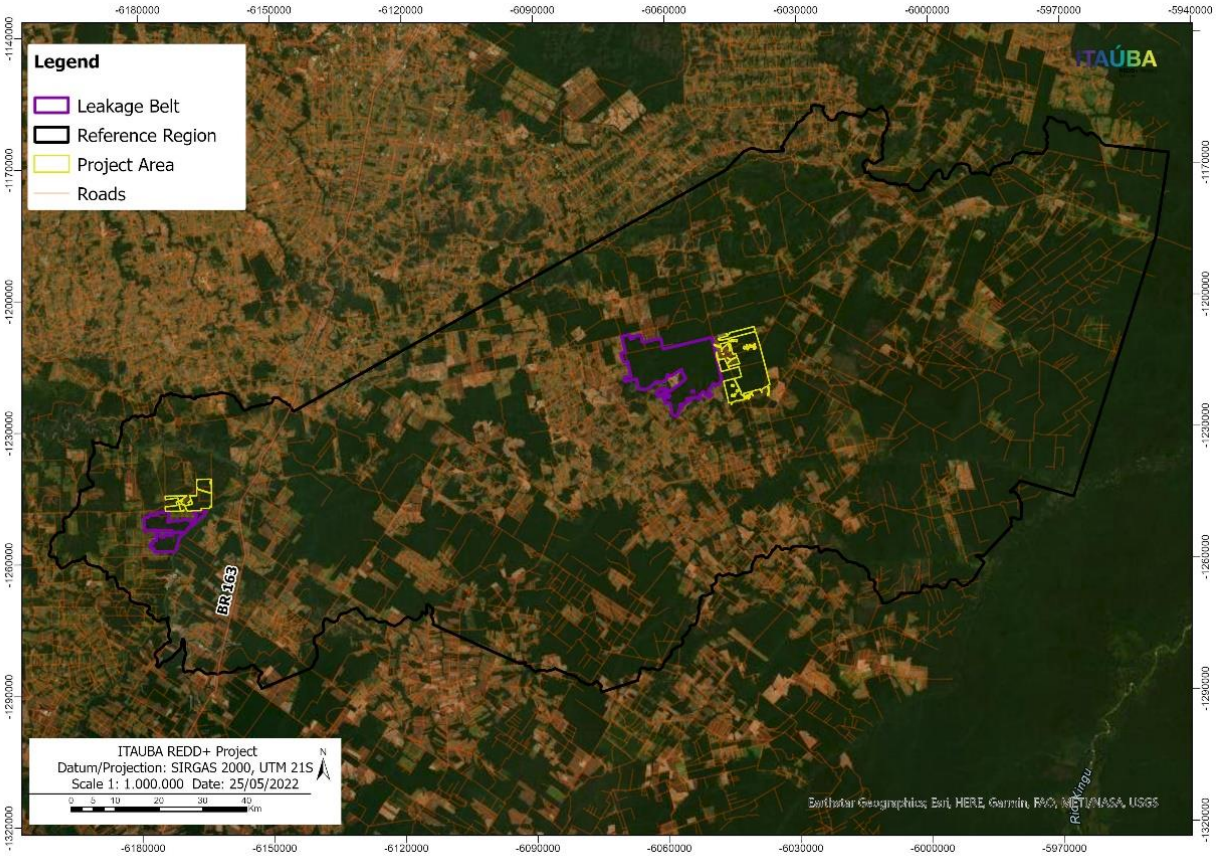


Figure 32: Geographic limits of the leakage belt.

Step 1.1.4 from VM0015 -Leakage Management Area

The Leakage Management Areas are non-forest areas located outside the project boundary, in which the project proponent intends to implement activities that will reduce the risk of activity displacement leakage. The boundary of leakage management areas is clearly defined using the common projection and GIS software formats used in the project.

i. Non-forest classes;
ii. Logistical proximity for the Project Proponents to conduct management near the REDD+ project, considering the main access point to the Project Area, with the objective of creating a barrier to stop deforestation entering the Project Area from the Reference Region;

iii. high potential for land-use changes in these areas, considering their proximity to roads and other deforested areas.

AFOLU non-permanence risk analyses will be assessed for each new geographic area. Activity-shifting, market leakage and ecological leakage assessments will be reassessed where new instances of the project activity are included in the project.

1. The geographic area within which all project activity instances shall occur is delineated with the Reference Region set in this PD.
2. The determination of the baseline for the project activity is in accordance with the requirements of the methodology applied to the project.
3. The demonstrations of additionality for the project activity are in accordance with the requirements of the methodology applied to the project.
4. A set of eligibility criteria for the inclusion of new project activity instances at subsequent verification events is defined in this PD.
5. A description of the central GHG information system and controls associated with the project and its monitoring is provided in the Monitoring Plan.
6. is important to notice that the Leakage Management areas originally inserted in the project design will be priority to recruit new project instances. If the new instances involve the original Leakage Management areas, new areas shall be identified and adopted to manage leakage.

Step 1.1.5 from VM0015 –Forest

The definition of "forest" used by the Project is in accordance with Resolution No. 2 of the Interministerial Commission on Global Climate Change (CIMGC). Data from the Deforestation Monitoring System in the Amazon (PRODES), prepared by the National Institute for Space Research (INPE), were used to produce the Forest Area Reference Map (VM0015 Step 1.1.5), described in Figure 33. The smallest mapping unit (MMU) of the PRODES Digital system is 1 hectare (GOFC-GOLD) [37].

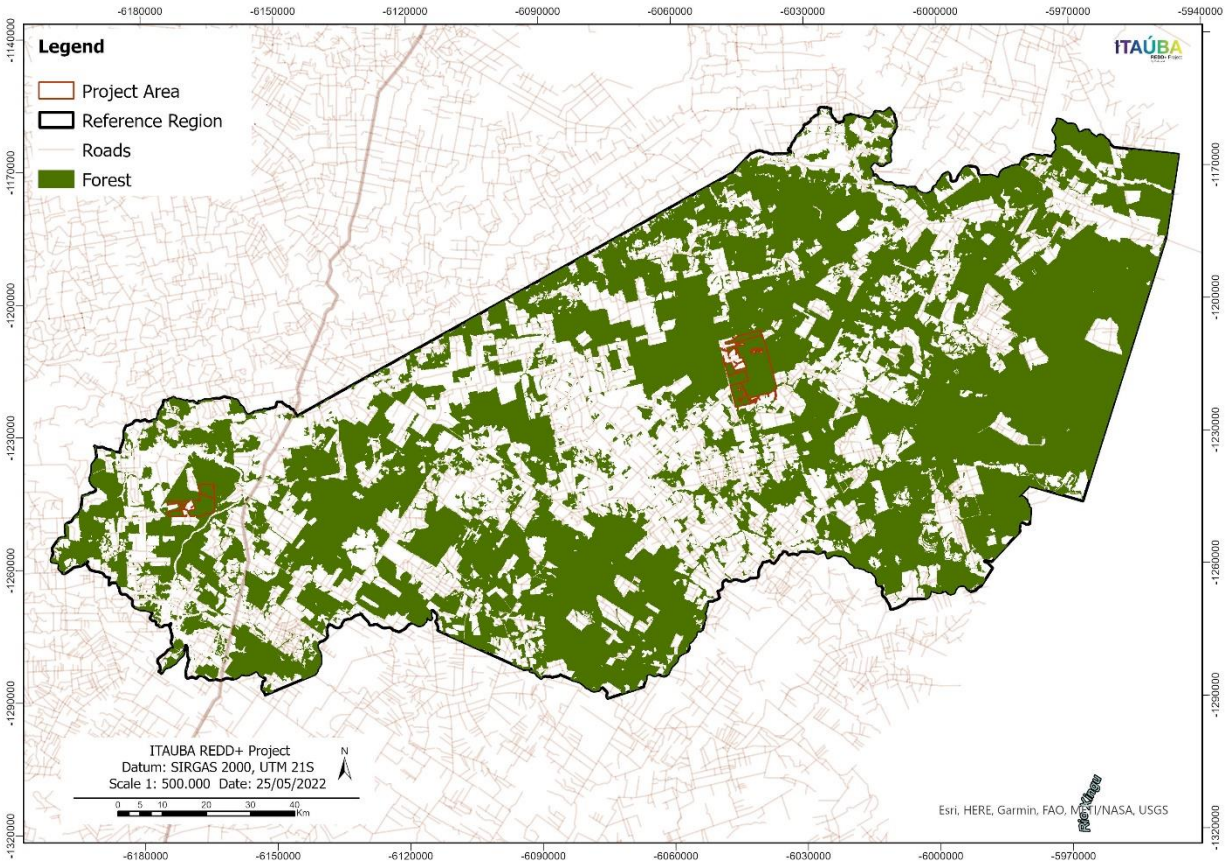


Figure 33: Forest cover benchmark map

Step 1.2 from VM0015 -Temporal Boundaries

Step 1.2.2 from VM0015 -Starting Date of the Project Crediting Period of the AUD Project Activity:

The project crediting period is between 14/12/2021 and 13/12/2051.

Step 1.2.3 from VM0015 -Starting Date and End Date of the First Fixed Baseline Period:

The first baseline period is from 14/12/2021 until 14/12/2027 as determined by VM0015.

Step 1.2.4 from VM0015 -Monitoring Period:

The first monitoring periods will have the minimum duration of one year.

Step 1.3 of VM0015 -Carbon Pools

Table 25: Carbon pools included or excluded within the boundary of the proposed AUD project activity (Table 3 of VM0015).

Carbon pools	Included/Excluded	Justification / Explanation
Above-ground	Tree: Included	Is mandatory according to the VM0015 Methodology.
	Non-tree: Excluded	For conservativeness purposes.
Below-ground	Included	Included as recommended in the VM0015 Methodology.
Dead wood	Excluded	Justification detailed in the text below.
Harvested wood products	Included	Included as recommended in the VM0015 Methodology.
Litter	Excluded	Excluded according to "VCS AFOLU Requirements, v3.2"
Soil organic carbon	Excluded	Not to be measured in conversions to pasture grasses, which is the case in this project, according to VCS Program Update of May 24th, 2010.

Deforestation emissions were estimated for all forest strata (conservatively excluding non-tree biomass), of which the above- and belowground carbon pools were previously determined by means of a literature survey of data from the Project Area region. It is considered that a certain portion of logged wood is

converted into long-term wood products, which serve as carbon pools after deforestation However, there is no logging activities in the project area.

Justification for not including the dead wood carbon pool

The omission of the dead wood carbon pool was determined as a matter of conservativeness, given that in the baseline scenario this carbon pool is likely to have much lower values than in the project scenario. So, even though dead wood carbon pool is significantly lower in the baseline than in the project scenario, the project proponent opted not to include this carbon pool in accounting of VCU benefits.

Table 26: Sources and GHG included or excluded within the boundary of the proposed AUD project activity (Table 4 of VM0015).

Source		Gas	Included?	Justification/Explanation
Baseline	Biomass burning	CO_2	No	Counted as carbon stock change
		CH_4	Yes	Methane emissions during burning of biomass for land clearance.
		N_2O	Yes	Nitrous oxide emissions during burning of biomass for land clearance
		Other	-	Not applicable.
	Livestock emissions	CO_2	No	Not a significant source
		CH_4	No	Not a significant source
		N_2O	No	Not a significant source
		Other	-	Not applicable.
Project	Biomass burning	CO_2	No	Counted as carbon stock change
		CH_4	Yes	Methane emissions during burning of biomass for land clearance.
		N_2O	Yes	Nitrous oxide emissions during burning of biomass for land clearance
		Other	-	Not applicable.
		CO_2	No	Not a significant source

Source		Gas	Included?	Justification/Explanation
	Livestock emissions	CH_4	No	Not a significant source
		N_2O	No	Not a significant source
		Other	-	Not applicable.

3.1.4 Baseline Scenario

Forest land is expected to be converted to non-forest land in the baseline scenario. As the region faces a high deforestation pressure, the project falls within the category AFOLU – REDD – Avoiding unplanned deforestation (AUD). The baseline scenario identified (Section 3.1.5) is forest loss followed by cattle ranches and soy agriculture.

According to the descriptions above, it is expected that unplanned deforestation is most likely to occur in the Project Area in case of absence of the REDD Project. The rate of deforestation adopted for calculation of REDD Project benefits was obtained from the PRODES database.

In the absence of the REDD project, it is assumed that the property would certainly undergo the same deforestation intensity as other neighboring lands.

Above and belowground carbon pools were determined by means of a literature survey regarding the Project region. It is assumed that the Project Activity preserves soil organic carbon and litter pools to a greater extent than BAU activities. However, for conservativeness purposes, the project proponents decided not to include the soil and litter carbon pools in the REDD Project benefits.

Fossil fuel emissions were not accounted for in the Reference Area (baseline case) or for the Project Activity. It is assumed that the Project Activity also reduces emissions from fossil fuel burning, in comparison with BAU activities. However, this factor was also not accounted for conservativeness purposes and difficulties in monitoring during the project period.

Selection of the most probable baseline scenario for the project

For the selection of the most probable baseline scenario, steps 2 and 3 of the VM0015 were applied, as follow.

3.1.4.1 STEP 2: ANALYSIS OF HISTORICAL LAND-USE AND LAND-COVER CHANGE

3.1.4.1.1 Collection of appropriate data sources

Data from software Digital PRODES [38] were used for mapping land use and cover classes, available in vector format (shapefile). A total of 47 satellite images were used to map the classes Forest, Disturbed Vegetation (Deforestation), Hydrography, and Non-forest Vegetation. The images cover the historical reference period (2010 to 2021) and correspond to the following orbits/points of Landsat satellite: 231/66, 231/67, 232/65, 232/66 and 232/67 (Table 27). PRODES classification and evaluation was carried out using high spatial resolution images available on Google Earth.

PRODES uses LANDSAT class satellite images (20 to 30 meters of spatial resolution and 16-day revisit rate) in a combination that seeks to minimize the problem of cloud cover and ensure interoperability criteria. The images from the American LANDSAT-5/TM satellite were, historically, the most used by the project, but the images from the CCD sensor on board the CBERS-2/2B, satellites of the Sino-Brazilian remote sensing program, were widely used. PRODES also made use of LISS-3 images from the Indian satellite IRS-1 and also images from the British UK-DMC2 satellite. It currently makes massive use of images from LANDSAT 8/OLI, CBERS 4 and IRS-2. Regardless of the instrument used, the minimum area mapped by PRODES is 6.25 hectares. The total of 46 images, composed of four scenes (orbits: 244, 245 and 246 / points: 64 and 65), were adopted to map the land use classes of interest in the reference region within the historical period

Table 27: Data used for historical LU/LC change analysis (Table 05 of VM0015)

Vector (Satellite or Airplane)	**Sensor**	**Resolution**		**Coverage**	**Acquisition date**	**Scene or Point identifier**	
		Spatial	Spectral	km	(YYYY)	Path / Latitude	Row / Longitude
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2010	244	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2010	245	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2010	245	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2010	246	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2011	244	65

Vector (Satellite or Airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene or Point identifier	
		Spatial	Spectral	km	(YYYY)	Path / Latitude	Row / Longitude
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2011	245	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2011	245	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2011	246	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	244	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	245	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	245	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	246	64

Vector (Satellite or Airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene or Point identifier	
		Spatial	Spectral	km	(YYYY)	Path / Latitude	Row / Longitude
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	245	65

Vector (Satellite or Airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene or Point identifier	
		Spatial	Spectral	km	(YYYY)	Path / Latitude	Row / Longitude
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	246	64

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

The land use and cover classes used in this project are shown in Table 28. The description of each class and the existing area before the Project start year are shown below: Table 28 Land use and LAND cover classes existing in the Reference Region (VM0015 Table 6).

Table 28: List of all land use and land cover classes existing at the project start date within the reference region (Table 6 of VM0015)

Class Identifier		Trend in Carbon stock[1]	Presence in[2]	Baseline activity[3]			Description (including criteria for unambiguo
ID_{cl}	Name			LG	FW	CP	
1	Forest Land	decreasing	RR; LK; LM; PA	yes	no	no	Determined by automated classification methods
2	Non-Forest Land	increasing	RR; LK; LM; PA	yes	no	no	Determined by automated classification methods

Source: Remote Sensing data from PRODES: database indicates that virtually all deforestation is converted in pasture.
1. Note if "decreasing", "constant", "increasing"
2. RR = Reference region, LK = Leakage belt, LM = Leakage management Areas, PA = Project area
3. LG = Logging, FW = Fuel-wood collection; CP = Charcoal Production (yes/no)
4. Each class shall have a unique identifier (IDcl). The methodology sometimes uses the notation icl (= 1, 2, 3, … Icl) to indicate "initial" (pre-deforestation) classes, which are all forest classes; and fcl (= 1, 2, 3, … Fcl) to indicate final" (post-deforestation) classes. In this table all classes ("initial" and "final") shall be listed.

• **Forest Land:** areas of remaining forest. This class includes all areas classified as forest since 2010 and that have not changed class during the historical period. In other words, it has been a forest since the beginning of the historical period.

• **Non-Forest Land:** areas occupied by any anthropic use at some point in the historical period.

• **Others natural formations**: areas of natural formation, which, when vegetated, have a different physiognomy from the Forest (Savannah, Cerrado, Campo, etc.).

• **Hydrography:** water bodies of any kind.

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

The potential LU/LC-change categories that could occur within the Project Area during the project crediting period, in both the baseline and project case, are presented below.

Table 29: Potential land-use and land-cover change matrix (Table 7.a of VM0015).

BASELINE SCENARIO					
			Initial LU/LC class (2021)		**Total (ha)**
			Forest	***Pasture/soy***	
		ID_{cl}	***I1***	***I2***	
Final LU/LC class (2051)	**F1**	***Forest***	1,110,738	0	1,110,738
	F2	***Pasture/soy***	750,340	693,722	1,444,062
Total (ha)			**1,861,078**	**693,722**	**2,554,800**

PROJECT CASE					
			Initial LU/LC class (2021)		**Total (ha)**
			Forest	***Pasture/soy***	
		ID_{cl}	***I1***	***I2***	
Final LU/LC class (2051)	**F1**	***Forest***	1,861,078	0	**1,861,078**
	F2	***Pasture/soy***	0	693,722	**693,722**
Total (ha)			**1,861,078**	**693,722**	**2,554,800**

Table 30: List of land-use and land-cover change categories (Table 7.b of VM0015).

IDct	**Name**	**Trend in Carbon stock**	**Presence in**	**Activity in the baseline case**			**IDct**	**Name**	**Trend in Carbon stock**	**Presence in**	**Activity in the project case**		
				LG	**FW**	**CP**					**LG**	**FW**	**CP**
I1/F1	Forest / Forest	Constant	RR; LK; PA	yes	no	no	I1/F1	Forest / Forest	Constant	RR; LK; PA	yes	no	no
I1/F2	Forest / soy	Decreasing	RR; LK; PA	yes	no	no	I1/F2	Forest / soy	Decreasing	RR; LK; PA	yes	no	no
I2/F1	soy / Forest	Increasing	RR; LK; PA	yes	no	no	I2/F1	soy / Forest	Increasing	RR; LK; PA	yes	no	no
I2/F2	soy / soy	Constant	RR; LK; PA	yes	no	no	I2/F2	soy / soy	Constant	RR; LK; PA	yes	no	no
I1/F3	Forest / pasture	Decreasing	RR; LK; PA	yes	no	no	I1/F3	Forest / pasture	Decreasing	RR; LK; PA	yes	no	no
I3/F1	pasture / Forest	Increasing	RR; LK; PA	yes	no	no	I3/F1	pasture / Forest	Increasing	RR; LK; PA	yes	no	no
I3/F3	pasture / pasture	Constant	RR; LK; PA	yes	no	no	I3/F3	pasture / pasture	Constant	RR; LK; PA	yes	no	no

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

Deforestation mapping data provided by PRODES were used to analyze the history of land use changes. The main methodological steps conducted by PRODES [39] to map deforestation in the Brazilian Amazon are as follows:

- **Preprocessing**: the main images preprocessing procedures carried out by PRODES consist of selection images with less cloud incidence, with the acquisition date closest to the dry season in the Amazon, and with proper radiometric quality; georeferencing of the images with a spatial resolution of 30 meters with topographic maps at 1: 100,000, and NASA orthorectified images in MrSID format.
- **Interpretation and classification:** the satellite images classification method used by PRODES follows four main steps. First it generates a spectral mixture model identifying t the vegetation components, soil, and shade in the images. This technique is known as spectral linear mixture models (SLMM), which attempts to estimate the percentage of vegetation, soil, and shade components for each cell (pixel) of the image. The second step is the application of the segmentation technique, which identifies, in the satellite image, spatially adjacent regions (segments) with similar spectral characteristics. After segmentation, the classification of segments take places individually, to identify the forest, non-forest vegetation, hydrography, and deforestation (anthropic vegetation) classes Finally, the result of the classified segmentation is subjected to the editing process, or classification audit, performed by a specialist, ending with the creation of the state mosaics.
- **Post-processing**: The classification result is then subjected to an audit process conducted by a GIS analyst.
- **Map accuracy check:** The mapping check conducted by PRODES was carried out by comparing each class of the most recent land use and coverage map class (2010), with a set of 89 points randomly distributed on the reference region. The reference data used for this step came from visual interpretation of high spatial resolution images available on Google Earth. Using the reference points and the 2010 land use and land cover map, it was possible to check the mapping performance through the analysis of the confusion matrix . The overall accuracy of the mapping for the different classes of land use and cover showed values greater than 80%. The overall accuracy of the forest cover reference map was of 97%.

3.1.4.2 STEP 3: ANALYSIS OF AGENTS, DRIVERS AND UNDERLYING CAUSES OF DEFORESTATION AND THEIR LIKELY FUTURE DEVELOPMENT

3.1.4.2.1 Identification of agents of deforestation

Pasture and agriculture (cultivation of soy) accounts for virtually all the deforested land occupation in the project region. The following information is provided for the identified agent of deforestation:

a) Name of the main agent: Cattle Ranchers and Producer Soy

b) Description of the main features of the main agent of deforestation: Cattle ranching (pasture) and agriculture areas usually financed by means of initial capital obtained in wood logging. Deforestation is considered to occur through clear-cutting of forests for logging followed by pasture and agricultural installation. This deforestation pattern may be caused by private landowners themselves and also by professional land-grabbers, through invasions of unguarded areas. Thus, it can be affirmed that the deforestation agent group is composed by large and small-scale cattle ranchers supported by land-grabbers and loggers in the initial stage of deforestation. This group is composed by private owners and itinerant land-grabbers. It can also be affirmed that this group of deforestation agents is culturally and economically adapted to this "business cycle" of deforestation, whose results are clearly demonstrated in the Reference Region during the reference period.

c) Assessment of the most likely development of the population size of the deforestation agent group in the Reference Region, Project Area and Leakage Belt: As the main deforestation agent in the region, cattle ranching (pasture) and agriculture (producer soy) are expected to increase in the project region. l According to IBGE [40] Mato Grosso is responsible for the largest production of cattle in Brazil, creating more than 30 million heads in the state. The amount is equivalent to almost 14% of the herd produced in the national territory. In addition, the State also stands out in the international ranking, being the sixth largest producer of cattle in the world.

Analysis of land use, via project analysis of PRODES data indicate that of the 22.23% of the Reference Region is pasture lands and 10.03%, cultivation of soy as seen in the figure below. There are no other significant land uses within the deforested lands in the Reference Region. This corroborates the strong activity of cattle ranchers and producer soy in the Reference Region. Thus, it is confirmed that virtually all deforestation in the Reference Region is attributed to the group of deforestation agents related to conversion of forest to pasture for cattle ranching and cultivation for agriculture.

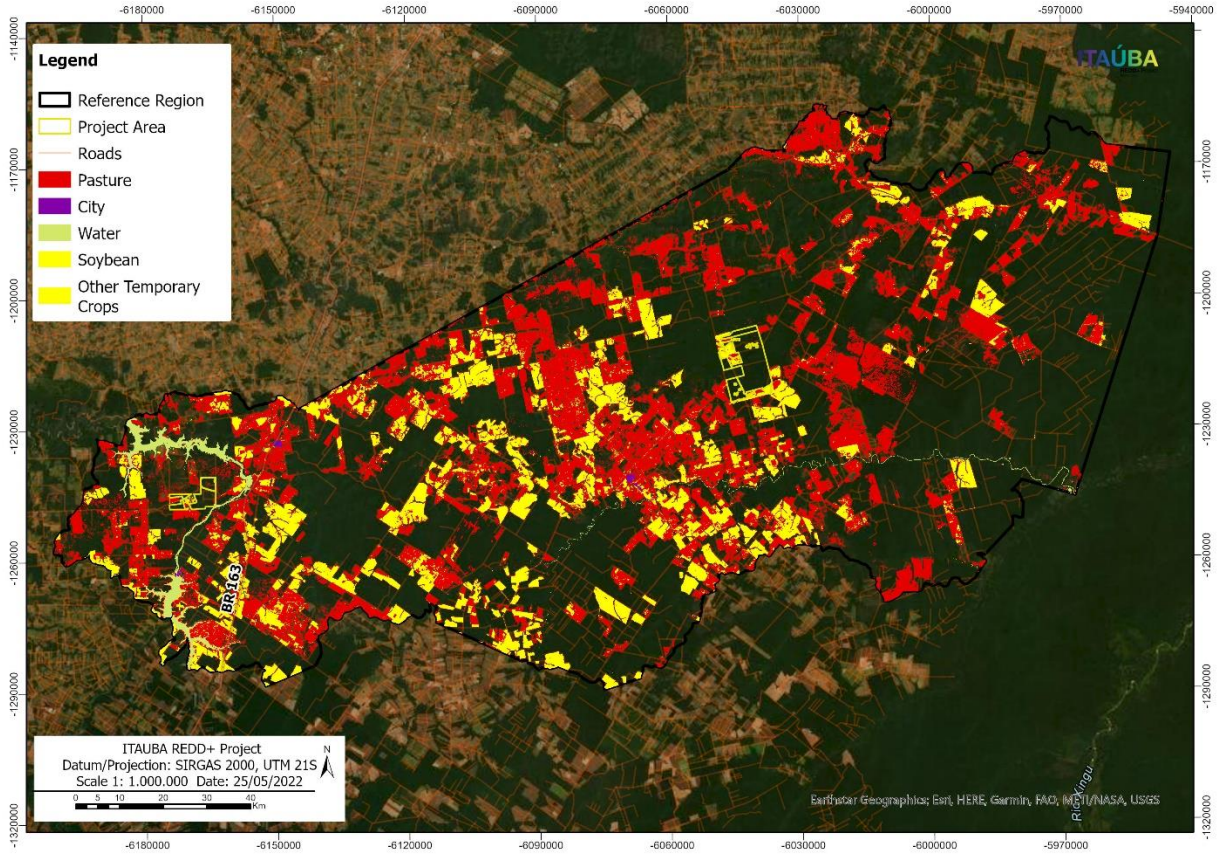


Figure 34: History of deforestation in the Reference Region between 2010-2021.

3.1.4.2.2 Identification of deforestation drivers

In this step, the factors that drive the land-use decisions of the agent group are analyzed to identify the immediate causes of deforestation. For this analysis, two sets of driver variables are distinguished:

a) Driver variables explaining the quantity (hectares) of deforestation:

Currently, the State holds more than 17% of the national agricultural production, followed by Paraná in 2nd position, São Paulo appears in 3rd place, Minas Gerais in 4th place and Rio Grande do Sul in 5th in the ranking. . Mato Grosso is the largest producer of soybeans, corn, cotton and cattle in the country. Together, the four commodities are responsible for 93.5% of the gross amount collected in the State, totaling R$ 180,571.02 billion (MAPA).

Cattle prices

According to CEPEA (2022), the price of cattle increased 257% over the 2012 to 2022 period. This economic phenomenon can be observed throughout the country

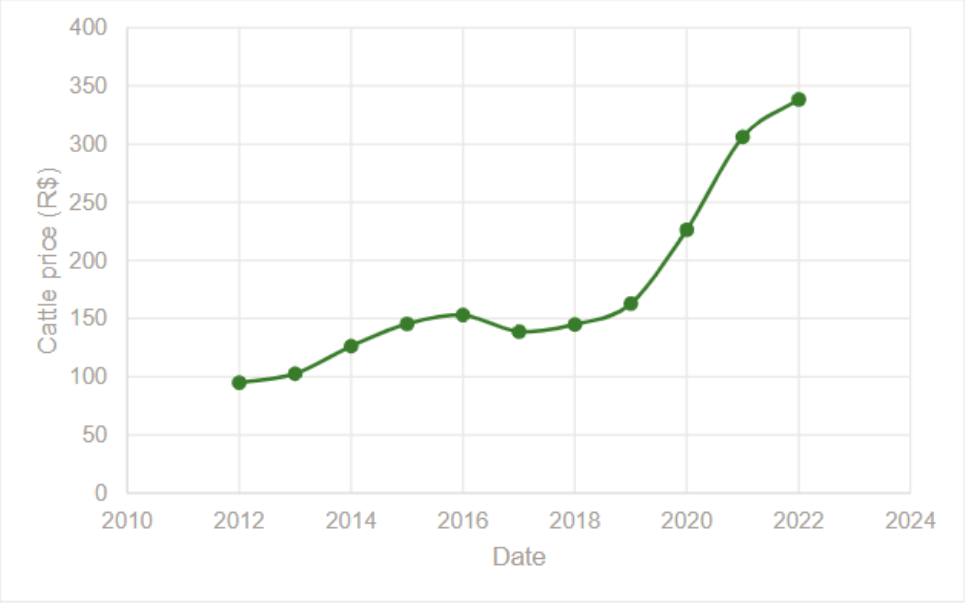


Figure 35: Cattle price in Brazil [41].

Soybean prices

According to IBGE [42], the price of soy increased 257% over the 2012 to 2022 period.

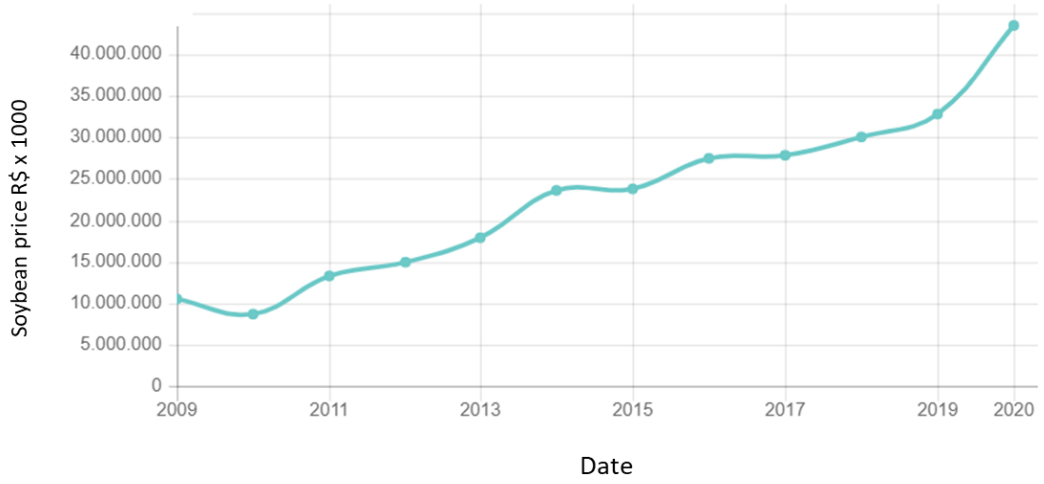


Figure 36: Soybean price in Mato Grosso [42]

Access to forests (existing roads and navigable rivers):

Studies on historical location of deforestation in the Reference Region can evidence that this factor has been a driver for deforestation during the historical reference period. It is broadly recognized that deforestation is accelerated in regions that have denser road networks [43]. The presence of roads and navigable rivers is a logical deforestation driver, since it facilitates the flow of wood and other products harvested from the forest. The capacity to transport wood logs, rapidly clear the land for pasture and place wood logs in sawmills, quickly obtaining revenues, certainly has a major impact on cattle ranchers' decision to deforest the most accessible forest areas.

The Reference Region holds a dense network of primary, secondary, and tertiary roads. The lands located near these roads are more likely to undergo deforestation, generating a progressive fishbone effect. This deforestation pattern may even increase exponentially in some cases, given that a single road may originate several other offshoot roads in the future, and so on. In a brief analysis of deforestation location, the existence of the fishbone deforestation patterns can be noted, which indicates the creation of secondary and tertiary roads, mainly from the major federal highway (BR-163) and state highway (MT 320) in the Reference Region. [44] in their study on deforestation drivers in the Amazon.

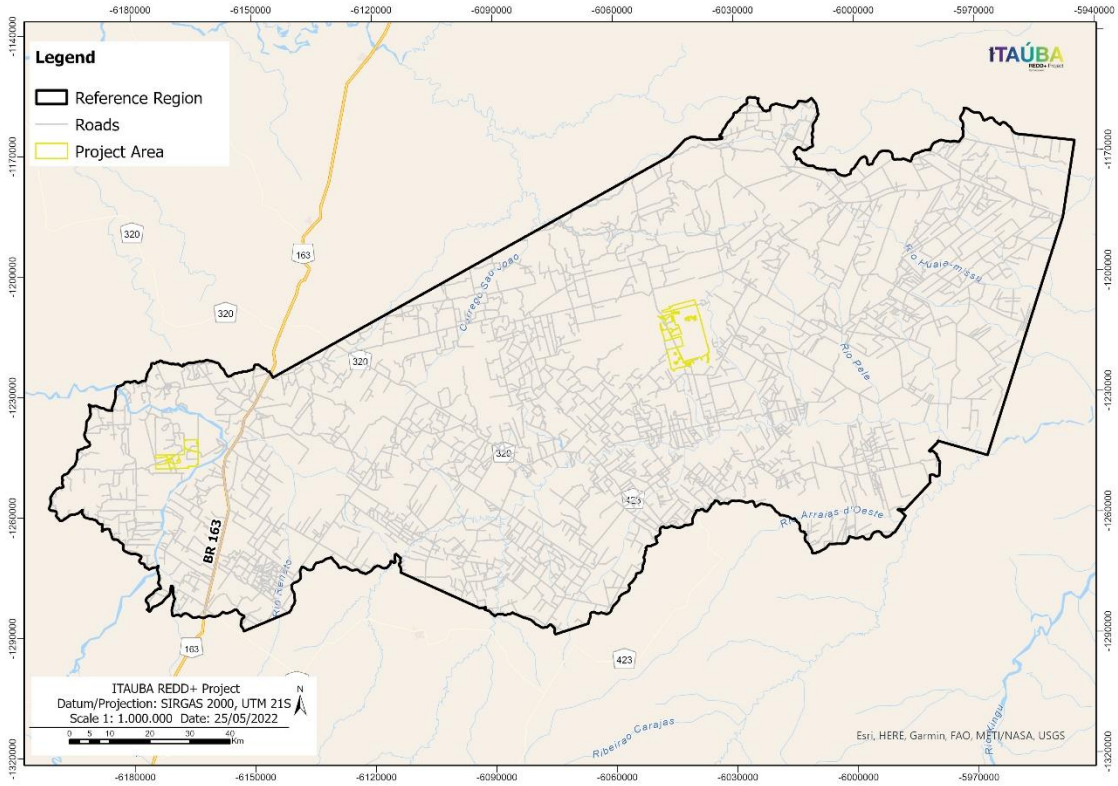


Figure 37: Roads in the Reference Region.

Proximity to forest edges:

Studies on historical location of deforestation in the Reference Region provide evidence that this has also been a driver for deforestation over the historical reference period. Similarly, to the proximity to roads and navigable rivers, the effect of this driver on deforestation decisions is related to easier logistics when clearing areas and easier and quicker revenue from logging. The proximity to forest edges has been used in similar ways by other REDD projects, including the "The Suruí Forest Carbon Project", the "RMDLT Portel-Pará REDD Project", the "Florestal Santa Maria REDD Project". Furthermore, this deforestation driver has been used to explain the dynamics of deforestation in similar analyses [45]. According to Rosa et al. (2013) [46], deforestation is contagious, such that local deforestation rates increase over time if adjacent locations are deforested.

3.1.4.2.3 Identification of underlying causes of deforestation

According to literature surveys and local interviews, it is concluded that the underlying causes of deforestation are as follows:

- Land-use policies and their enforcement;

- Poverty and wealth.

Land-use policies and their enforcement:

As previously mentioned in this PD, in spite of the legal provisions intended to preserve at least 80% of the Amazon forest cover, the lack of law enforcement by local authorities along with the increase in production and prices of cattle has created a scenario of almost complete disregard of the mandatory provisions of the Forest Code. High rates of criminality associated with land disputes usually jeopardize efforts concerning law enforcement improvement. In addition to that, to cover vast distances of areas with low demographic density makes tracking of illegal activities and land surveillance very difficult for the authorities. Accordingly, policies implemented to address illegal deforestation only by means of command-and-control approaches have proven to be ineffective so far (IPAM, 2011). Analysis of land use, via project analysis of PRODES data indicate that on deforestation history show a cumulative data from 2010 to 2021 out of 112,040 hectares

Poverty and wealth:

This key underlying cause has a strong effect on the decisions of the main deforestation agents, as they are at liberty to continue their illegal business activities with very low probability of being detained by authorities. The problem of lack of command-and-control measures to contain deforestation in the Amazon Biome is a widespread issue, which has been getting worse and worse every year, due to lack of personnel and infrastructure of legal authorities, in addition to schemes of corruption and violence established by illegal agents to maintain the status quo. In this context, the lack of law enforcement can be assumed to be a constant underlying cause of deforestation during the project lifetime. Although the project activity cannot solve the problem of lack of enforcement in Brazil, it can serve as a case of success, to encourage neighbors to adopt sustainable practices as a profitable land-use alternative.

3.1.4.2.4 Identification of chain of events leading to deforestation.

According to literature surveys and local interviews, it is concluded that the underlying causes of deforestation are as follows: -Land-use policies and their enforcement; -Poverty and wealth. Land-use policies and their enforcement: As previously mentioned in this PD, in spite of the legal provisions intended to preserve at least 80% of the Amazon forest cover, the lack of law enforcement by local authorities along with the increase in production and prices of cattle has created a scenario of almost complete disregard of the mandatory provisions of the Forest Code. High rates of criminality associated with land disputes usually jeopardize efforts concerning law enforcement improvement. In addition to that, to cover vast distances of areas with low demographic density makes tracking of illegal activities and land surveillance very difficult for the authorities. Accordingly, policies implemented to address illegal deforestation only by means of command-and-control approaches have proven to be ineffective so far (IPAM, 2011). Analysis of land use, via project analysis of PRODES data indicate that on deforestation history show a cumulative data from 2010 to 2021 out of 112,040 hectares.

This key underlying cause has a strong effect on the decisions of the main deforestation agents, as they are at liberty to continue their illegal business activities with very low probability of being detained by authorities. The problem of lack of command-and-control measures to contain deforestation in the Amazon Biome is a widespread issue, which has been getting worse and worse every year, due to lack of personnel and infrastructure of legal authorities, in addition to schemes of corruption and violence established by illegal agents to maintain the status quo. In this context, the lack of law enforcement can be assumed to be a constant underlying cause of deforestation during the project lifetime. Although the project activity cannot solve the problem of lack of enforcement in Brazil, it can serve as a case of success, to encourage neighbors to adopt sustainable practices as a profitable land-use alternative.

3.1.4.2.5 Description of baseline scenario adopted

According to the descriptions above, it is expected that unplanned deforestation is most likely to occur in the Project Area in case of absence of the REDD Project. The rate of deforestation adopted for calculation of REDD Project benefits was obtained from the PRODES database and is presented in item 3.1.7.1.

In the absence of the REDD project, it is assumed that the property would certainly undergo the same deforestation intensity as other neighboring lands.

Above-and below ground carbon pools were determined by means of a literature survey regarding the Project region. It is assumed that the Project Activity preserves soil organic carbon and litter pools to a

greater extent than BAU activities. However, for conservativeness purposes, the project proponents decided not to include the soil and litter carbon pools in the REDD Project benefits.

Fossil fuel emissions were not accounted for in the Reference Area (baseline case) or for the Project Activity. It is assumed that the Project Activity also reduces emissions from fossil fuel burning, in comparison with BAU activities. However, this factor was also not accounted for conservativeness purposes and difficulties in monitoring during the project period.

3.1.5 Additionality

The Project's additionality is demonstrated below, according to "VT0001 - Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities", Version 3.0, 1 February 2021, Sectoral Scope 14. The tool is applicable to this project, according to statements below:

a) The project activity does not lead to violation of any applicable law, even if the law is not enforced;

b) There is a baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario.

According to the tool, Project proponent(s) applied the following four steps:

(i) STEP 1. Identification of alternative land use scenarios to the AFOLU project activity;

(ii) 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

(iii) STEP 3. Barriers analysis; and

(iv) STEP 4. Common practice analysis.

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

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

The identified credible non-excluding alternative land use scenarios to the proposed VCS AFOLU project activity include:

SCENARIO 1: Continuation of the pre-project land use

In this scenario, the project proponent would carry out sustainable forest management activities. This scenario complies with item (iii) of the methodological tool: "*activities similar to the proposed project activity on at least part of the land within the project boundary of the proposed VCS AFOLU projec*t". Although the pre-project scenario is similar to what is purposed for part of the Project Area in the project scenario, additional avoiding unplanned deforestation activities, such as improved surveillance and monitoring of deforestation, control by satellite imagery and fire brigade trainings, would not be undertaken. Activities associated with the CCB standards, which bring social benefits and biodiversity benefits, e.g., inventories of fauna and flora, monitoring of threatened species, and training for employees and community members, would not be carried out once they depend on the revenue associated with the VCS registration. This scenario is improbable to happen, given the patterns of deforestation generated by the drivers of the Reference Region.

SCENARIO 2: Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project

This scenario differs from first scenario because, in addition to carrying out sustainable forest management, all the REDD project activities would be implemented, however, without the revenue generated by the sale of VCUs. Given the high expense to intensify deforestation monitoring actions, implementing training and monitoring biodiversity, in addition to the costs of designing the project and audits, it would be unfeasible to conduct a REDD project according to the CCB and VCS Standards without the revenue from the VCUs.

SCENARIO 3: Conversion from forest to pastures (cattle ranching) and soy crops

In the absence of the project, deforestation caused by rural producers to expand pasture and soy plantations would prevail. Between the years of the reference period (2011 – 2020), 333,461.8 hectares were deforested in the Reference Region to install these activities. In the 30 years of the project, the forecast is that 375,975 hectares will be deforested to install these activities in the Reference Region, and the Project Area could lose 2,915 hectares of forest. In this scenario, several negative impacts would occur in the social, economic, biological and climatic dimensions, such as the immediate loss of local biodiversity, habitat fragmentation, impact on water resources, and reduction of several essential ecosystem services. It is known that a common practice of these deforestation agents is to burn the area to clean forest residues before installing pasture and soy plantations, and this process emits large amounts of greenhouse gases,

which cause pollution problems, respiratory diseases, and reduce climate resilience, in addition to making the remaining forests more susceptible to new forest fires.

Outcome of Sub-step 1a: The credible alternative land-use scenarios that could have occurred on the land within the project boundary are scenarios **(1)**, **(2)** and **(3)**, described above.

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

The following procedure was applied:

i) Demonstration that all land-use scenarios identified in the sub-step 1a are in compliance with all mandatory applicable legal and regulatory requirements:

SCENARIOS **(1)** and **(2)** are in accordance with current legislation and regulations regarding the implementation of sustainable forest management. The Law Nº 12,651 of May 25, 2012, provides for the protection of native vegetation, and recognizes sustainable forest management as a viable, low-impact activity to be carried out in the Legal Amazon. The Normative Instruction 5, of December 11, 2006, establishes the technical procedures for the preparation, presentation, execution, and technical evaluation of sustainable forest management plans, the main relevant rules being:

i. It falls under the category of Full Sustainable Forest Management (SFM), for the production of wood, the one that foresees the use of machines for log skidding;
ii. Initial cutting cycle of at least 25 years and maximum of 35 years for the Full SFM and at least 10 years for the Low-Intensity SFM;
iii. Establishes the maximum cutting intensity to be authorized of 30m³/ha for the Full SFM with an initial cutting cycle of 35 years;
iv. Establishes the minimum diameter for cutting of 50cm for all species, for which the specific minimum diameter has not yet been established.
v. Maintenance of at least 10% of the number of trees per species, in the area of effective management, respecting the minimum maintenance limit of 3 trees per species per 100 ha.

Every forest management operation is sustained by the respective forest management plan, which formalizes the total authorized area for exploitation and the volume allowed for management, and includes actions to mitigate the impacts of management operations.

ii) Demonstration that applicable mandatory legal requirements are systematically not enforced and that non-compliance with requirements is widespread:

SCENARIO (3) is not in compliance with applicable mandatory legal requirements, because they are systematically not enforced, and this scenario is widespread.

The State of Mato Grosso is in third place in the ranking of deforestation of the Amazon forest in the year 2021. The state devastated 1,504 km² between January and December 2021 [47]. The municipality of Marcelândia had the largest deforested area (83 km²) [48] in rural properties registered between 2018 and 2019. The state government itself stated that it recognizes that the deficit of investments necessary to leverage sustainable development in the state is still very large [48].

Between August 2008 and July 2019, rural properties with soy cultivation accounted for 20% of deforestation in Mato Grosso, which is the largest producer of the commodity in Brazil. Of the more than 2.5 million hectares of native vegetation lost in the last 11 years in the state, 500 thousand hectares were registered in soy farms. Of this total, 92% was carried out illegally, that is, without authorization from environmental agencies. Only 30% of those properties that carried out illegal deforestation had some type of federal or state embargo, imposed by Ibama and Sema/MT, respectively [49]. The embargoes are punitive and preventive measures that seek to promote the recovery of degraded areas.

As mentioned in section 3.2.1, the price of soy in Mato Grosso increased 152% from January to November 2020, and the higher the agricultural prices, the higher is the pressure to expand agricultural land, which results in deforestation.

The State of Mato Grosso also has the largest cattle herd in the country (32.7 million head in 2020) and is the largest Brazilian meat exporter. Studies note that illegal levels of deforestation are necessary preconditions to make cattle ranching financially viable [50].

In the Reference Region, 168,774 hectares (21.16 %) are occupied by pasture and 139,980.79 (17.55 %) by soybean plantations, therefore this scenario is widespread.

Outcome of Sub-step 1b: It has been demonstrated that scenarios **(1)**, **(2)** and **(3)** are plausible alternative land-use scenarios to this AFOLU project activity. Although scenario **(3)** is not in compliance with mandatory legislation and regulations, it was shown that those applicable regulatory requirements are systematically not enforced and that non-compliance with those requirements is widespread.

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

Outcome of Sub-step 1c:
SCENARIO 3, conversion from forest to pastures and soy crops**,** is considered to be the baseline scenario, as it is the most prevalent post-deforestation land use in the Reference Region.

STEP 2. Investment analysis

Sub-Step 2a. Determine appropriate analysis method:

The project scenario without VCU revenue (**2**) generates economic benefits beyond the VCU revenue, so an Opportunity Cost Analysis (Option II) was applied. Apart from the VCUs, this scenario is expected to generate income from the continuity of the sustainable forest management practices. The main expected expenses besides the implementation of project activities are sustainable management operation costs, and maintenance costs from the properties.

The Investment analysis demonstrates that the proposed project activity without the revenue from the sale of GHG credits is far less economically attractive that the baseline scenario. Evidence of all the estimated costs and revenue of each scenario are available to the auditors.

3.1.6 Methodology Deviations

The ITAÚBA REDD+ Project has no methodology deviations.

3.2 Quantification of GHG Emission Reductions and Removals

3.2.1 Baseline Emissions

3.2.1.1 PROJECTION OF THE QUANTITY OF FUTURE DEFORESTATION

This section refers to the following steps of the VM0015 Methodology: 4.1.1: Selection of the baseline approach; and Step 4.1.2: Quantitative projection of future deforestation.

The Modelling approach “b” has been chosen to project future deforestation, which involves estimation of deforestation as a function of the historical trend observed within the reference region as a function of time using linear regression. The analysis of the deforestation history in the RR for the historical period (2011 to 2021) shows that the deforestation rate presented periods with a large increase in the deforestation rate, in the years 2019, 2020 and 2021. The behavior of the rate corroborates the chain of deforestation events and factors already described in the baseline, such as extensive cattle ranching and agriculture. The historical deforestation rate can be described linearly by the equation $y = 0.0015x - 0.0157$ ($R^2 = 0.82$, $p = 0.0004$).

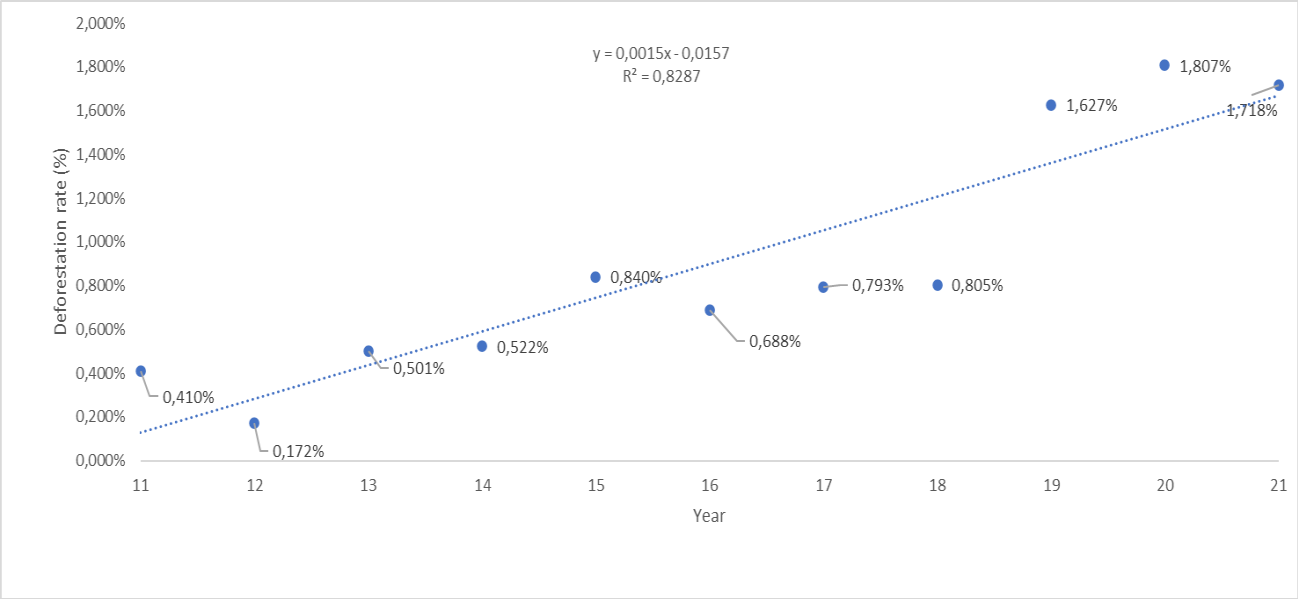


Figure 38: Analysis of the deforestation history in the RR for the historical period (2011 to 2020).

3.2.1.2 PROJECTION OF THE LOCATION OF FUTURE DEFORESTATION

This section refers to Step 4.2 of the VM0015 Methodology.

The basic tasks to perform this analysis are as follows, which is also represented in the flowchart below:

- Preparation of factor maps;

- Preparation of risk maps for deforestation;

-Selection of the most accurate deforestation risk map; and-Mapping of the locations of future deforestation.

Table 31: List of dynamic variables, maps and factor maps (Table 10 of VM0015).

Factor Map	Source	Variable represented		Meaning of the categories or pixel value		Other Maps and Variables used to create factor map			Algorithm or Equation used	Comments
ID	*File Name*	Source	Unit	Description	Range	Meaning	ID	File Name	File name	
1	dist_desmat_1	MapBiomas (2009 - 2018)	meters	Distance to existing deforestation	0 - 11.370	Values close to 0 are closer to the deforestation	1A	land use maps	Euclidean Distance - ArcGis (Esri)	N/A
2	dist_roads_1	Imazon (2014)	meters	Distance to main roads	0 - 11.591	Values close to 0 are closer to main roads	2A	estradas_driver.tif	Euclidean Distance - ArcGis (Esri)	N/A
3	dist_city_1	IBGE (2010)	meters	Distance to urban areas	0 - 82.144	Values close to 0 are closer to urban areas	4A	cidades_driver.tif	Euclidean Distance - ArcGis (Esri)	N/A
4	elevation	Topodata (INPE)	meters	Distance to elevation	0 1	Values close to 0 have low elevation	5A	elevacao_driver.tif	Euclidean Distance - ArcGis (Esri)	N/A
5	slope	Topodata (INPE)	degree	Distance to slope	0-1	Values close to 0 have low slope	6A	declividade_driver.tif	Euclidean Distance - ArcGis (Esri)	N/A

Definition of the Model

Future deforestation location projection was found through Dinamica-EGO software version 6.1.0. The selection for Dinamica-EGO was made the following reasons: a) it is a model available in the scientific publications of Rodrigues *et al.* (2007)[51] and Yanai *et al.* (2012) [52]; b) it holds transparent process for input and output of data and parameters processed with user-friendly graphical interface; c) it incorporates the use of appropriate data to explain the location of deforestation.

The main steps conducted with Dinamica-EGO at this stage was: (i) organization of maps on land use and land cover, and maps with deforestation explanatory factors; (ii) model calibration by determining the weight of evidence and analyzing correlations between variables; (iii) assessment of model accuracy; (iv) development of deforestation baseline scenarios. Dinamica-EGO used spatial data with 30 x 30 m pixel size, GeoTIFF format.

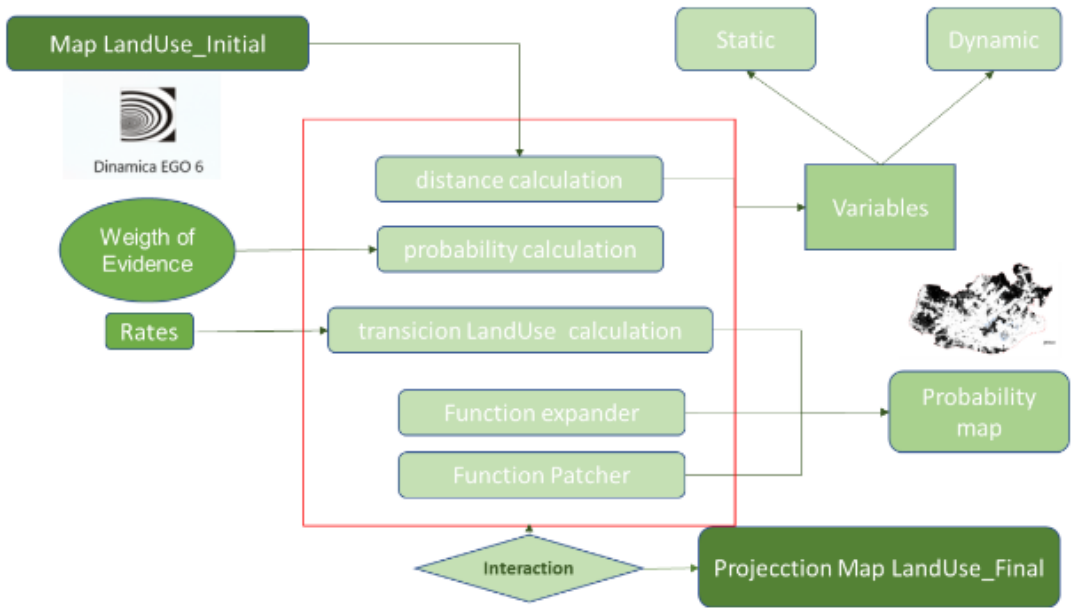


Figure 39: Flowchart of the process type model developed in the dynamic program-EGO.

This study took the following drivers into account: distance from deforestation, distance from roads, distance from cities, elevation, soil types, vegetation, types and slope to evaluate the variables and combinations can better explain the dynamics of historical deforestation in the region.

This step used an empirical approach, defining functions to represent the probability of allocation of deforestation from five key spatial variables selected from among nine initial variables. The method used in Dinamica-EGO is called Weight of Evidence, a Bayesian method. This method requires that the variables used to produce the map of deforestation risk are independent. According to an interval of classes, for each variable, a weight of evidence will be assigned, for this, the classes of deforestation distance of 100 meters and for classes of elevation and inclination of 1 meter were used.

The calculation of weights of evidence for each variable (or factor) examines their historical influence in relation to the deforestation observed. This influence of the variable is obtained from the amount of pixels representing forest area destroyed during the analysis period (the chosen calibration period was between 2019 and 2020).

During the analysis of deforestation dynamics in the Reference Region, the input data (explanatory variables) of network models were all analyzed, despite the possibility of correlation and redundancy of information between them. The only assumption for the Weights of Evidence method is that the input maps have to be spatially independent. A set of measures can be applied to assess this assumption, such as the Cramer test and the Joint-Uncertainty Information [53].

As a result, correlated variables must be disregarded or combined into a third that will replace the correlated pair in the model. This model performs pairwise tests for categorical maps in order to test the independence assumption. Methods employed are the Chi^2, Cramer, the Contingency, the Entropy, and the Uncertainty Joint Information [53]. In addition to the links to be connected, the only parameter to be set in the Determine Weights of Evidence Correlation is the transition as follows.

Different models were tested, all if the allocation pattern of new deforestation considered 25% for new patches and 75% for expansion of already deforested areas (patcher and expander) and alternating combinations of explanatory variables.

Quality Control of the Model

According to the VM0015 methodology, one of the evaluation techniques that can be used is the “Figure of Merit” (FOM) that confirms the prediction of the model in a statistical way, which for this project was the technique used.

To evaluate the accuracy of the models, it was necessary to compare the land use map obtained by the prediction model with observed land use map at the same year: i) Estimated / modelled map up to 2020, and ii) actual observed deforestation map of 2020.

The FOM is a ratio of the intersection of the observed change (change between the reference maps in time 1 and time 2) and the predicted change (change between the reference map in time 1 and simulated map in time 2) to the union of the observed change and the predicted change. The FOM is a ratio of the intersection of the observed change and the predicted change to the union of the observed change and the predicted change.

Variable / Model	Dist_city	Dist_deforest	Dist_roads	Elevation	Vegetation	Slope	Soil	FOM
m_1	x	x	x	x	-	x	-	72.97%
m_2	-	x	x	x	-	x	x	95.50%
m_3	x	-	x	x	-	x	x	45.06%
m_4	x	x	-	x	-	x	-	81.98%
m_5	-	x	x	-	x	-	-	75.93%
m_6	x	x	x	x	-	x	x	81.94%
m_7	x	x	x	x	x	-	-	62.91%
m_8	x	x	x	x	-x	x	x	65.02%
m_9	x	x	x	-	x	x	-	51.91%
m_10	x	x	x	x	x	x	-	81.91%

3.2.1.3 DEFINITION OF THE LAND-USE AND LAND-COVER CHANGE COMPONENT OF THE BASELINE

This section refers to Step 5 of the VM0015 Methodology, the goal of which step is to calculate activity data (hectares per year) of the initial forest classes (icl) that will be deforested and activity data of the post-deforestation classes (fcl) that would replace them in the baseline case.

After step 4, the area and location of future deforestation are both known and pre-deforestation carbon stocks are being determined by matching the predicted location of deforestation with the location of forest classes with known carbon stocks.

3.2.1.3.1 Calculation of baseline activity data per forest class

Annual areas deforested per forest class within the leakage belt area and project area in the baseline case will be presented in the next sections.

3.2.1.4 ESTIMATION OF BASELINE CARBON STOCK CHANGES AND NON-CO2 EMISSIONS

This section refers to Step 6 of the VM0015 Methodology, the goal of which is to finalize the baseline assessment by calculating:

- Baseline carbon stock changes; and (optionally)
- Baseline non-CO_2 emissions from forest fires used to clear forests.

3.2.1.4.1 Estimation of baseline carbon stock changes

The use of carbon stock estimates in similar ecosystems derived from local studies, literature and IPCC defaults is permitted, provided the accuracy and conservativeness of the estimates are demonstrated.

As noted under section 3.1.3, Project Boundary, the project area presents Lower Montane Semideciduous Forest (Fs) and Wooded Savana (Sa). Biomass data for were taken from literature [11], which contains data relating to the total carbon stocks in those Forests. In order to calculate the above and below-ground data, it was applied the root-to-shoot ratio of 0.37 [54] in the total biomass.

The table below shows the carbon stock per hectare of Lower Montane semideciduous Forest and Wooded Savana present in the project area and leakage belt.

The table below shows the carbon stock per hectare present in the project area and leakage belt (Table 32).

Table 32: Carbon stocks per hectare of initial forest classes icl existing in the project area and leakage belt: Estimated values (Table 15.a of VM0015).

Year	Project year t	Initial forest class *icl* Name: Lower Montane Semideciduous Forest (Fs) ID_{icl} 1 Average carbon stock per hectare ± 90% CI											
		Cab_{icl}		Cbb_{icl}		Cwp_{icl}						$Ctot_{icl}$	
						short lived		*medium lived*		*long lived*			
		C *stock*	± 90% CI	C *stock*	± 90% CI	C *stock*	± 90% CI	C *stock*	± 90% CI	C *stock*	± 90% CI	C *stock*	± 90% CI
		t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2019	0	348	0	129	0	0	0	0	0	35	23	430	-23
2020	1												
2021	2		0		0	0	0	0	0		46		-46
...	...												
2049	30												

Year	Project year t	Initial forest class *icl* Name: Wooded savana (Sa) ID icl 2 Average carbon stock per hectare ± 90% CI											
		Cab icl		Cbb icl		Cwp icl						Ctot icl	
						short lived		medium lived		long lived			
		C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI
		t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2019	0	114	0	42	0	0	0	0	0	31	19	113	-19
2020	1												
2021	2		0		0	0	0	0	0		42		-42
...	...												
2049	30												

The averages of above and below-ground biomass were used for calculations, since an official source was applied and therefore the average is statistically representative. 90% Confidence Intervals have been used to define whether the most suitable choice would be the average or the lower limit of the range, to mitigate uncertainties in estimates for wood product carbon pool. The upper limit of the interval was used for the calculations related to the wood products carbon pool, for conservativeness purposes and mitigation of uncertainties.

Table 33: Carbon stocks per hectare of initial forest classes icl existing in the project area and leakage belt: Values to be used after discounts due to uncertainties (Table 15.b of VM0015).

Year	Project year t	Initial forest class *icl* Name: Lower Montane Semideciduous Forest (Fs) ID icl 1 Average carbon stock per hectare ± 90% CI											
		Cab icl		Cbb icl		Cwp icl						Ctot icl	
						short lived		medium lived		long lived			
		C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change
		t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2021	0	348	0	129	0	0	0	0	0	46	12	430	-12
2022	1												
2023	2												
...	...												
2051	30												

Year	Project year t	Initial forest class *icl* Name: Wooded savana (Sa) ID icl 2 Average carbon stock per hectare ± 90% CI											
		Cab icl		Cbb icl		Cwp icl						Ctot icl	
						short lived		medium lived		long lived			
		C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change
		t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2021	0	114	0	42	0	0	0	0	0	42	12	113	-12
2022	1												
2023	2												
...	...												
2051	30												

The same reasoning is applicable to post-deforestation classes, for which the upper limit of the interval was taken in the case, for conservativeness purposes and mitigation of uncertainties. As the project presents two end uses, the weighted average of the representativity of the area of each one in the reference region was applied (see Post-deforestation carbon stocks can either be determined as the historical area-weighted average carbon stock, or using location analysis (modeling). Pg 55 VM0015).

Table 34: Long-term (20-year) average carbon stocks per hectare of post-deforestation LU/LC classes present in the Reference Region (Table 16 of VM0015).

Year	Project year t	Post deforestation class *fcl* Name: pasture/soy ID $_{fcl}$ Average carbon stock per hectare ± 90% CI											
		Cab $_{fcl}$		Cbb $_{fcl}$		Cwp $_{fcl}$ *short lived*		Cwp $_{fcl}$ *medium lived*		Cwp $_{fcl}$ *long lived*		Ctot $_{fcl}$	
		average stock t CO_2e ha^{-1}	± 90% CI t CO_2e ha^{-1}	*average stock* t CO_2e ha^{-1}	± 90% CI CO_2e ha^{-1}	*average stock* CO_2e ha^{-1}	± 90% CI CO_2e ha^{-1}	*average stock* CO_2e ha^{-1}	± 90% CI CO_2e ha^{-1}	*average stock* CO_2e ha^{-1}	± 90% CI CO_2e ha^{-1}	*average stock* CO_2e ha^{-1}	± 90% CI t CO_2e ha^{-1}
2021	0												
2022	1		8		9		0		0		0		17
2023	2	13		14		0		0		0		27	
...	...		18		19		0		0		0		37
2051	30												
Average		13		14		0		0		0		27	
Average to be used in calculations		18		19		0		0		0		37	

Table 35: Long-term (20-year) area weighted average carbon stock per zone (Table 17 of VM0015).

Zone		Post -deforestation LU/LC-class *fcl* Name: Pasture/soy ID $_{fcl}$ 1			Area weighted long-term (20 years) average carbon stocks per zone *z*			
IDz	Name	Cab $_{fcl}$ *C stock* t CO_2e ha^{-1}	Cbb $_{fcl}$ *C stock* t CO_2e ha^{-1}	Cwp $_{fcl}$ *C stock* t CO_2e ha^{-1}	Cab $_z$ *C stock* t CO_2e ha^{-1}	Cbb $_z$ *C stock* t CO_2e ha^{-1}	Cwp $_z$ *C stock* t CO_2e ha^{-1}	Ctot $_z$ *C stock* t CO_2e ha^{-1}
1	RR	18	19	0	18	19	0	37

The carbon stock change factors shown below were calculated based on VM0015 premises, using Method 2, as activity data are available for categories.

Table 36: Carbon stock change factors for land-use change categories (ct or ctz) (Method 2) (Table 20.c of VM0015) in the Forest Class (Fs).

Year after deforestation		$\Delta Cab_{ctz,t}$	$\Delta Cbb_{ctz,t}$	$\Delta Cwp_{ctz,t}$ long-lived
1	2021	-345.74	-10.95	0
2	2022	1.79	-10.95	0
3	2023	1.79	-10.95	0
4	2024	1.79	-10.95	0
5	2025	1.79	-10.95	0
6	2026	1.79	-10.95	0
7	2027	1.79	-10.95	0
8	2028	1.79	-10.95	0
9	2029	1.79	-10.95	0
10	2030	1.79	-10.95	0
11	2031	0	0.00	0
12	2032	0	0.00	0

13	2033	0	0.00	0
14	2034	0	0.00	0
15	2035	0	0.00	0
16	2036	0	0.00	0
17	2037	0	0.00	0
18	2038	0	0.00	0
19	2039	0	0.00	0
20	2040	0	0.00	0
21	2041	0	0.00	0
22	2042	0	0.00	0
23	2043	0	0.00	0
24	2044	0	0.00	0
25	2045	0	0.00	0
26	2046	0	0.00	0
27	2047	0	0.00	0
28	2048	0	0.00	0
29	2049	0	0.00	0
30	2050	0	0.00	0
31	2051	0	0.00	0

Table 37: Carbon stock change factors for land-use change categories (ct or ctz) (Method 2) (Table 20.c of VM0015) in the Forest Class (Sa).

Year after deforestation		$\Delta Cab_{ctz,t}$	$\Delta Cbb_{ctz,t}$	$\Delta Cwp_{ctz,t}$ long-lived
1	2021	-111.88	-10.95	0
2	2022	1.79	-10.95	0
3	2023	1.79	-10.95	0
4	2024	1.79	-10.95	0
5	2025	1.79	-10.95	0
6	2026	1.79	-10.95	0
7	2027	1.79	-10.95	0
8	2028	1.79	-10.95	0
9	2029	1.79	-10.95	0
10	2030	1.79	-10.95	0
11	2031	0	0.00	0
12	2032	0	0.00	0
13	2033	0	0.00	0
14	2034	0	0.00	0
15	2035	0	0.00	0
16	2036	0	0.00	0
17	2037	0	0.00	0
18	2038	0	0.00	0
19	2039	0	0.00	0
20	2040	0	0.00	0
21	2041	0	0.00	0

22	2042	0	0.00	0
23	2043	0	0.00	0
24	2044	0	0.00	0
25	2045	0	0.00	0
26	2046	0	0.00	0
27	2047	0	0.00	0
28	2048	0	0.00	0
29	2049	0	0.00	0
30	2050	0	0.00	0
31	2051	0	0.00	0

The following tables show the calculation of baseline carbon stock changes in above-ground biomass, below-ground biomass and wood products in the Project Area, using the carbon stock change factors presented in the table immediately above.

Table 38:Baseline carbon stock change in the above-ground biomass in the project area (Table 22.b.1 of VM0015).

		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**	
		Lower Montane Semideciduous Forest (Fs)		**Wooded savana (Sa)**		**annual**	**cumulative**
		$ABSLPA_{ct,t}$	**$\Delta Cab_{ct,t}$**	**ABSLPAct,t**	**$\Delta Cab_{ct,t}$**	**$\Delta CabBSLPA_t$**	**$\Delta CabBSLPA$**
Year	**Project year t**	**ha**	**tCO_2-e ha^{-1}**	**ha**	**tCO_2-e ha^{-1}**	**tCO_2-e**	**tCO_2-e**
2021	0	0.0	0	0.0	0	0	0
2022	1	127.0	-346	23.0	-112	-46,482	-46,482
2023	2	108.0	-158	32.0	-64	-40,651	-87,133
2024	3	89.0	-94	41.0	-47	-34,838	-121,971
2025	4	110.0	-86	32.0	-27	-40,859	-162,830
2026	5	103.0	-65	16.0	-11	-36,394	-199,224
2027	6	243.0	-106	56.0	-30	-89,059	-288,284
2028	7	105.0	-39	65.0	-26	-41,819	-330,102
2029	8	52.0	-17	41.0	-13	-20,505	-350,607
2030	9	35.0	-11	37.0	-10	-14,013	-364,621
2031	10	58.0	-18	39.0	-10	-22,060	-386,681
2032	11	102.0	-33	32.0	-8	-36,584	-423,265
2033	12	79.0	-26	16.0	-3	-26,853	-450,118
2034	13	46.0	-15	45.0	-12	-18,751	-468,869
2035	14	52.0	-19	47.0	-12	-21,140	-490,009
2036	15	36.0	-14	85.0	-19	-19,896	-509,905
2037	16	29.0	-15	31.0	-6	-11,753	-521,658
2038	17	53.0	-32	89.0	-20	-26,737	-548,395
2039	18	58.0	-35	24.0	-4	-21,106	-569,501
2040	19	52.0	-30	19.0	-3	-18,454	-587,955

2041	20	83.0	-47	15.0	-2	-28,771	-616,726
2042	21	72.0	-43	39.0	-9	-27,717	-644,443
2043	22	78.0	-47	26.0	-5	-28,309	-672,752
2044	23	54.0	-31	41.0	-9	-21,666	-694,418
2045	24	63.0	-36	38.0	-9	-24,449	-718,867
2046	25	58.0	-32	41.0	-11	-23,092	-741,958
2047	26	0.0	2	0.0	2	1,618	-740,341
2048	27	0.0	2	0.0	2	1,363	-738,977
2049	28	0.0	2	0.0	2	1,216	-737,761
2050	29	0.0	2	0.0	2	1,089	-736,672
2051	30	0.0	2	0.0	2	914	-735,758

Table 39: Baseline carbon stock change in the below-ground biomass in the project area (Table 22.b.2 of VM0015).

		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**	
		Lower Montane Semideciduous Forest (Fs)		**Wooded savana (Sa)**		**annual**	**cumulative**
Year	**Project year t**	**$BBSLPA_{ct,t}$**	**$\Delta Cbb_{ct,t}$**	**$BBSLPA_{ct,t}$**	**$\Delta Cbb_{ct,t}$**	**$\Delta CbbBSLPA_t$**	**$\Delta CbbBSLPA$**
		ha	**tCO_2-e ha^{-1}**	**ha**	**tCO_2-e ha^{-1}**	**tCO_2-e**	**tCO_2-e**
2021	0	0.0	0.00	0.00	0.00	0	0
2022	1	127.0	-10.95	23.00	-10.95	-1,643	-1,643
2023	2	108.0	-10.95	32.00	-10.95	-3,176	-4,819
2024	3	89.0	-10.95	41.00	-10.95	-4,600	-9,419
2025	4	110.0	-10.95	32.00	-10.95	-6,156	-15,575
2026	5	103.0	-10.95	16.00	-10.95	-7,459	-23,034
2027	6	243.0	-10.95	56.00	-10.95	-10,734	-33,768
2028	7	105.0	-10.95	65.00	-10.95	-12,596	-46,364
2029	8	52.0	-10.95	41.00	-10.95	-13,614	-59,978
2030	9	35.0	-10.95	37.00	-10.95	-14,403	-74,381
2031	10	58.0	-10.95	39.00	-10.95	-15,465	-89,846
2032	11	102.0	-10.95	32.00	-10.95	-15,290	-105,137
2033	12	79.0	-10.95	16.00	-10.95	-14,797	-119,934
2034	13	46.0	-10.95	45.00	-10.95	-14,370	-134,304
2035	14	52.0	-10.95	47.00	-10.95	-13,899	-148,203
2036	15	36.0	-10.95	85.00	-10.95	-13,921	-162,124
2037	16	29.0	-10.95	31.00	-10.95	-11,303	-173,428
2038	17	53.0	-10.95	89.00	-10.95	-10,997	-184,425
2039	18	58.0	-10.95	24.00	-10.95	-10,876	-195,301
2040	19	52.0	-10.95	19.00	-10.95	-10,865	-206,166
2041	20	83.0	-10.95	15.00	-10.95	-10,876	-217,042
2042	21	72.0	-10.95	39.00	-10.95	-10,624	-227,666
2043	22	78.0	-10.95	26.00	-10.95	-10,723	-238,389
2044	23	54.0	-10.95	41.00	-10.95	-10,767	-249,156

2045	24	63.0	-10.95	38.00	-10.95	-10,789	-259,945
2046	25	58.0	-10.95	41.00	-10.95	-10,548	-270,492
2047	26	0.0	-10.95	0.00	-10.95	-9,890	-280,383
2048	27	0.0	-10.95	0.00	-10.95	-8,335	-288,718
2049	28	0.0	-10.95	0.00	-10.95	-7,437	-296,155
2050	29	0.0	-10.95	0.00	-10.95	-6,659	-302,814
2051	30	0.0	-10.95	0.00	-10.95	-5,586	-308,400

Table 40: Baseline carbon stock change in the wood products in the project area (Table 22.b.6 of VM0015).

		Activity data per category x Carbon stock change factor for wood products biomass in the project area				**Total baseline carbon stock change in the project area**	
		Lower Montane Semideciduous Forest (Fs)		**Wooded savana (Sa)**		**annual**	**cumulative**
		$WPSLPA_{ct,t}$	**$\Delta Cwp_{ct,t}$**	**$WPSLPA_{ct,t}$**	**$\Delta Cwp_{ct,t}$**	**$\Delta CwpBSLPA_t$**	**$\Delta CwpBSLPA$**
Year	**Project year t**	**ha**	**tCO_2-e ha^{-1}**	**ha**	**tCO_2-e ha^{-1}**	**tCO_2-e**	**tCO_2-e**
2021	0	0.0	0.00	0.00	0.00	0	0
2022	1	127.0	0.00	23.00	0.00	0	0
2023	2	108.0	0.00	32.00	0.00	0	0
2024	3	89.0	0.00	41.00	0.00	0	0
2025	4	110.0	0.00	32.00	0.00	0	0
2026	5	103.0	0.00	16.00	0.00	0	0
2027	6	243.0	0.00	56.00	0.00	0	0
2028	7	105.0	0.00	65.00	0.00	0	0
2029	8	52.0	0.00	41.00	0.00	0	0
2030	9	35.0	0.00	37.00	0.00	0	0
2031	10	58.0	0.00	39.00	0.00	0	0
2032	11	102.0	0.00	32.00	0.00	0	0
2033	12	79.0	0.00	16.00	0.00	0	0
2034	13	46.0	0.00	45.00	0.00	0	0
2035	14	52.0	0.00	47.00	0.00	0	0
2036	15	36.0	0.00	85.00	0.00	0	0
2037	16	29.0	0.00	31.00	0.00	0	0
2038	17	53.0	0.00	89.00	0.00	0	0
2039	18	58.0	0.00	24.00	0.00	0	0
2040	19	52.0	0.00	19.00	0.00	0	0
2041	20	83.0	0.00	15.00	0.00	0	0
2042	21	72.0	0.00	39.00	0.00	0	0
2043	22	78.0	0.00	26.00	0.00	0	0
2044	23	54.0	0.00	41.00	0.00	0	0
2045	24	63.0	0.00	38.00	0.00	0	0
2046	25	58.0	0.00	41.00	0.00	0	0
2047	26	0.0	0.00	0.00	0.00	0	0

2048	27	0.0	0.00	0.00	0.00	0	0
2049	28	0.0	0.00	0.00	0.00	0	0
2050	29	0.0	0.00	0.00	0.00	0	0
2051	30	0.0	0.00	0.00	0.00	0	0

The following tables show the calculation of baseline carbon stock changes in above-ground biomass, below-ground biomass and wood products in the Leakage Belt, using the carbon stock change factors.

Table 41: Baseline carbon stock change in the above-ground biomass in the leakage belt area (Table 22.c.1 of VM0015).

		Activity data per category x Carbon stock change factor for above-ground biomass in the leakage belt				**Total baseline carbon stock change in the leakage belt**	
		Lower Montane Semideciduous Forest (Fs)		**Wooded savana (Sa)**		**annual**	**cumulative**
		$ABSLLK_{ct,t}$	**$\Delta Cab_{ct,t}$**	**$ABSLLK_{ct,t}$**	**$\Delta Cab_{ct,t}$**	**$\Delta CabBSLLK_t$**	**$\Delta CabBSLLK$**
Year	**Project year t**	**ha**	**tCO_2-e ha^{-1}**	**ha**	**tCO_2-e ha^{-1}**	**tCO_2-e**	**tCO_2-e**
2021	0	0	0	0	0	0	0
2022	1	301	-346	72	-112	-112,122	-112,122
2023	2	99	-84	31	-32	-37,028	-149,150
2024	3	101	-68	41	-31	-38,605	-187,756
2025	4	107	-59	12	-7	-37,181	-224,937
2026	5	276	-107	23	-13	-96,628	-321,565
2027	6	134	-44	36	-17	-48,452	-370,017
2028	7	77	-23	16	-6	-26,203	-396,220
2029	8	60	-16	12	-4	-19,711	-415,931
2030	9	73	-19	24	-8	-25,419	-441,350
2031	10	118	-29	16	-5	-39,909	-481,259
2032	11	82	-23	13	-5	-27,555	-508,814
2033	12	83	-24	8	-3	-27,404	-536,218
2034	13	83	-25	16	-9	-28,390	-564,608
2035	14	98	-30	23	-12	-34,395	-599,003
2036	15	54	-20	6	-2	-17,600	-616,603
2037	16	110	-44	32	-20	-40,067	-656,670
2038	17	68	-27	14	-8	-23,444	-680,114
2039	18	55	-21	16	-9	-19,156	-699,270
2040	19	89	-35	9	-5	-30,174	-729,444
2041	20	88	-36	23	-15	-31,459	-760,903
2042	21	85	-35	19	-11	-29,946	-790,849
2043	22	90	-36	5	-2	-30,085	-820,934
2044	23	89	-36	12	-7	-30,530	-851,463
2045	24	80	-33	19	-12	-28,237	-879,700

2046	25	0	2	0	2	1,618	-878,082
2047	26	0	2	0	2	1,363	-876,719
2048	27	0	2	0	2	1,216	-875,503
2049	28	0	2	0	2	1,089	-874,413
2050	29	0	2	0	2	914	-873,500
2051	30	0	2	0	2	715	-872,785

Table 42: Baseline carbon stock change in the below-ground biomass in the leakage belt area (Table 22.c.2 of VM0015).

Year	Project year t	Activity data per category x Carbon stock change factor for below-ground biomass in the leakage belt				Total baseline carbon stock change in the leakage belt	
		Lower Montane Semideciduous Forest (Fs)		**Wooded savana (Sa)**		**annual**	**cumulative**
		$BBSLLK_{ct,t}$	**$\Delta Cbb_{ct,t}$**	**$BBSLLK_{ct,t}$**	**$\Delta Cbb_{ct,t}$**	**$\Delta CbbBSLLK_t$**	**$\Delta CbbBSLLK$**
		ha	**tCO_2-e ha^{-1}**	**ha**	**tCO_2-e ha^{-1}**	**tCO_2-e**	**tCO_2-e**
2021	0	0	0.00	0.00	0.00	0	0
2022	1	301	-10.95	72.00	-10.95	-4,085	-4,085
2023	2	99	-10.95	31.00	-10.95	-5,509	-9,595
2024	3	101	-10.95	41.00	-10.95	-7,065	-16,659
2025	4	107	-10.95	12.00	-10.95	-8,368	-25,027
2026	5	276	-10.95	23.00	-10.95	-11,643	-36,670
2027	6	134	-10.95	36.00	-10.95	-13,505	-50,175
2028	7	77	-10.95	16.00	-10.95	-14,524	-64,699
2029	8	60	-10.95	12.00	-10.95	-15,312	-80,011
2030	9	73	-10.95	24.00	-10.95	-16,375	-96,385
2031	10	118	-10.95	16.00	-10.95	-17,842	-114,228
2032	11	82	-10.95	13.00	-10.95	-14,797	-129,025
2033	12	83	-10.95	8.00	-10.95	-14,370	-143,395
2034	13	83	-10.95	16.00	-10.95	-13,899	-157,294
2035	14	98	-10.95	23.00	-10.95	-13,921	-171,215
2036	15	54	-10.95	6.00	-10.95	-11,303	-182,519
2037	16	110	-10.95	32.00	-10.95	-10,997	-193,515
2038	17	68	-10.95	14.00	-10.95	-10,876	-204,392
2039	18	55	-10.95	16.00	-10.95	-10,865	-215,257
2040	19	89	-10.95	9.00	-10.95	-10,876	-226,133
2041	20	88	-10.95	23.00	-10.95	-10,624	-236,757
2042	21	85	-10.95	19.00	-10.95	-10,723	-247,480
2043	22	90	-10.95	5.00	-10.95	-10,767	-258,247
2044	23	89	-10.95	12.00	-10.95	-10,789	-269,036
2045	24	80	-10.95	19.00	-10.95	-10,548	-279,583
2046	25	0	-10.95	0.00	-10.95	-9,890	-289,474
2047	26	0	-10.95	0.00	-10.95	-8,335	-297,809

2048	27	0	-10.95	0.00	-10.95	-7,437	-305,246
2049	28	0	-10.95	0.00	-10.95	-6,659	-311,905
2050	29	0	-10.95	0.00	-10.95	-5,586	-317,491
2051	30	0	-10.95	0.00	-10.95	-4,370	-321,861

Table 43: Baseline carbon stock change in the wood products in the leakage belt area (Table 22.c.6 of VM0015).

		Activity data per category x Carbon stock change factor for wood products biomass in the leakage belt area				**Total baseline carbon stock change in the leakage belt area**	
		Lower Montane Semideciduous Forest (Fs)		**Wooded savana (Sa)**		**annual**	**cumulative**
		$WPSLLK_{ct,t}$	$\Delta Cwp_{ct,t}$	$WPSLLK_{ct,t}$	$\Delta Cwp_{ct,t}$	$\Delta CwpBSLLK_t$	$\Delta CwpBSLLK$
Year	**Project year t**	**ha**	**tCO_2-e ha^{-1}**	**ha**	**tCO_2-e ha^{-1}**	**tCO_2-e**	**tCO_2-e**
2021	0	0.0	0.00	0.00	0.00	0	0
2022	1	301.0	0.00	72.00	0.00	0	0
2023	2	99.0	0.00	31.00	0.00	0	0
2024	3	101.0	0.00	41.00	0.00	0	0
2025	4	107.0	0.00	12.00	0.00	0	0
2026	5	276.0	0.00	23.00	0.00	0	0
2027	6	134.0	0.00	36.00	0.00	0	0
2028	7	77.0	0.00	16.00	0.00	0	0
2029	8	60.0	0.00	12.00	0.00	0	0
2030	9	73.0	0.00	24.00	0.00	0	0
2031	10	118.0	0.00	16.00	0.00	0	0
2032	11	82.0	0.00	13.00	0.00	0	0
2033	12	83.0	0.00	8.00	0.00	0	0
2034	13	83.0	0.00	16.00	0.00	0	0
2035	14	98.0	0.00	23.00	0.00	0	0
2036	15	54.0	0.00	6.00	0.00	0	0
2037	16	110.0	0.00	32.00	0.00	0	0
2038	17	68.0	0.00	14.00	0.00	0	0
2039	18	55.0	0.00	16.00	0.00	0	0
2040	19	89.0	0.00	9.00	0.00	0	0
2041	20	88.0	0.00	23.00	0.00	0	0
2042	21	85.0	0.00	19.00	0.00	0	0
2043	22	90.0	0.00	5.00	0.00	0	0
2044	23	89.0	0.00	12.00	0.00	0	0
2045	24	80.0	0.00	19.00	0.00	0	0
2046	25	0.0	0.00	0.00	0.00	0	0
2047	26	0.0	0.00	0.00	0.00	0	0
2048	27	0.0	0.00	0.00	0.00	0	0
2049	28	0.0	0.00	0.00	0.00	0	0
2050	29	0.0	0.00	0.00	0.00	0	0

2051	30	0.0	0.00	0.00	0.00	0	0

3.2.1.4.2 Baseline non-CO2 emissions from forest fires

Table 44: Parameters used to calculate non-CO2 emissions from forest fires (Table 23 of VM0015) for Fs (above) and Sa (below).

Initial Forest Class		Parameters								
IDcl	Name	$Fburnt_{icl}$ N/A	*Cab* $tCO_2e\ ha^{-1}$	$Pburnt_{ab,icl}$ N/A	*CEab,icl* N/A	*ECO2-ab* $tCO_2e\ ha^{-1}$	*EBBCO2-tot* $tCO_2e\ ha^{-1}$	$EBBN2O_{icl}$ $tCO_2e\ ha^{-1}$	$EBBCH4_{icl}$ $tCO_2e\ ha^{-1}$	$EBBtot_{icl}$ $tCO_2e\ ha^{-1}$
1	Lower Montane Semideciduous Forest (Fs)	1.0	348	0.60	0.5	105	105	0.83	12.8	13.60

Initial Forest Class		Parameters								
IDcl	Name	$Fburnt_{icl}$ N/A	*Cab* $tCO_2e\ ha^{-1}$	$Pburnt_{ab,icl}$ N/A	*CEab,icl* N/A	*ECO2-ab* $tCO_2e\ ha^{-1}$	*EBBCO2-tot* $tCO_2e\ ha^{-1}$	$EBBN2O_{icl}$ $tCO_2e\ ha^{-1}$	$EBBCH4_{icl}$ $tCO_2e\ ha^{-1}$	$EBBtot_{icl}$ $tCO_2e\ ha^{-1}$
2	Wooded savana (Sa)	1,0	114	0.33	0.5	19	19	0.2	2.32	2.47

Table 45: Baseline non-CO2 emissions from forest fires in the project area (Table 24 of VM0015).

Year	Project year t	Emissions of non-CO2 gasses from baseline forest fires		Emissions of non-CO2 gasses from baseline forest fires		Total baseline non-CO2 emissions from forest fires in the project area	
		Lower Montane Semideciduous Forest (Fs)		*Wooded savana (Sa)*		annual	cumulative
		$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$EBBBSLPA_t$	EBBBSLPA
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2021	0	0.0	13.60	0.0	2.47	0	0
2022	1	127.0	13.60	23.0	2.47	1,784	1,784
2023	2	108.0	13.60	32.0	2.47	1,548	3,333
2024	3	89.0	13.60	41.0	2.47	1,312	4,645
2025	4	110.0	13.60	32.0	2.47	1,575	6,220
2026	5	103.0	13.60	16.0	2.47	1,441	7,661
2027	6	243.0	13.60	56.0	2.47	3,444	11,105
2028	7	105.0	13.60	65.0	2.47	1,589	12,694
2029	8	52.0	13.60	41.0	2.47	809	13,502
2030	9	35.0	13.60	37.0	2.47	568	14,070
2031	10	58.0	13.60	39.0	2.47	885	14,955
2032	11	102.0	13.60	32.0	2.47	1,467	16,422
2033	12	79.0	13.60	16.0	2.47	1,114	17,536
2034	13	46.0	13.60	45.0	2.47	737	18,273
2035	14	52.0	13.60	47.0	2.47	823	19,096
2036	15	36.0	13.60	85.0	2.47	700	19,796
2037	16	29.0	13.60	31.0	2.47	471	20,267
2038	17	53.0	13.60	89.0	2.47	941	21,208
2039	18	58.0	13.60	24.0	2.47	848	22,056
2040	19	52.0	13.60	19.0	2.47	754	22,811
2041	20	83.0	13.60	15.0	2.47	1,166	23,977
2042	21	72.0	13.60	39.0	2.47	1,076	25,052
2043	22	78.0	13.60	26.0	2.47	1,125	26,178
2044	23	54.0	13.60	41.0	2.47	836	27,014
2045	24	63.0	13.60	38.0	2.47	951	27,965
2046	25	58.0	13.60	41.0	2.47	890	28,855
2047	26	0.0	13.60	0.0	2.47	0	28,855
2048	27	0.0	13.60	0.0	2.47	0	28,855
2049	28	0.0	13.60	0.0	2.47	0	28,855
2050	29	0.0	13.60	0.0	2.47	0	28,855
2051	30	0.0	13.60	0.0	2.47	0	28,855

3.2.2 Project Emissions

3.2.2.1 Ex ante estimation of actual carbon stock changes

These carbon stock changes are due to the following:

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

Carbon stock changes due to possible future catastrophic events cannot be predicted and are therefore excluded from the ex-ante assessment. Certain discrete areas of forest within the project area will be subject to project activities that will change the carbon stocks of these areas compared to the baseline. In this Project Activity, such activities are related to planned controlled timber logging (sustainable forest management).

Some unplanned deforestation may happen in the project area despite the AUD project activity. The level at which deforestation will actually be reduced in the project case depends on the effectiveness of the proposed activities, which cannot be measured ex ante.

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.

$$\Delta \mathrm{CUDdPA}_t = \Delta \mathrm{CBSL}_t * (1 - \mathrm{EI})|$$

Where:

$\Delta \mathrm{CUDdPA}_t$	Total ex ante actual carbon stock change due to unavoided unplanned deforestation at year t in the project area; tCO_2-e GHG emission from biomass burning in forest class icl at year t; tCO_2-e ha^{-1}
$\Delta \mathrm{CBSL}_t$	Total baseline carbon stock change at year t in the project area; tCO_2-e
EI	Ex ante estimated Effectiveness Index; %
t	1, 2, 3 … T, a year of the proposed project crediting period; dimensionless

The results are listed below.

Table 46: Ex ante estimated actual carbon stock decrease due to planned logging activities in the project area (Table 25b of VM0015).

Year	Project year t	Areas of planned logging activities x Carbon stock change (decrease) in the project area		Areas of planned logging activities x Carbon stock change (decrease) in the project area		Total carbon stock decrease due to planned logging activities	
		IDcl = 1		*IDcl* = 2		annual	cumulative
		$APLPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$APLPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$\Delta CPLdPA_t$	$\Delta CPLdPA$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2021	0	0.0	0.00	0.00	0.00	0	0
2022	1	0.0	39.77	248.00	39.65	9,832	9,832
2023	2	0.0	39.77	992.00	39.65	39,329	49,161
2024	3	0.0	39.77	0.00	39.65	0	49,161
2025	4	0.0	39.77	0.00	39.65	0	49,161
2026	5	0.0	39.77	0.00	39.65	0	49,161
2027	6	0.0	39.77	0.00	39.65	0	49,161
2028	7	0.0	39.77	0.00	39.65	0	49,161
2029	8	0.0	39.77	0.00	39.65	0	49,161
2030	9	0.0	39.77	0.00	39.65	0	49,161
2031	10	0.0	39.77	0.00	39.65	0	49,161
2032	11	0.0	39.77	0.00	39.65	0	49,161
2033	12	0.0	39.77	0.00	39.65	0	49,161
2034	13	0.0	39.77	0.00	39.65	0	49,161
2035	14	0.0	39.77	0.00	39.65	0	49,161
2036	15	0.0	39.77	0.00	39.65	0	49,161
2037	16	0.0	39.77	0.00	39.65	0	49,161
2038	17	624.9	39.77	870.86	39.65	59,378	108,540
2039	18	911.3	39.77	0.00	39.65	36,240	144,780
2040	19	0.0	39.77	0.00	39.65	0	144,780
2041	20	865.7	39.77	914.82	39.65	70,697	215,477
2042	21	0.0	39.77	0.00	39.65	0	215,477
2043	22	1,407.6	39.77	0.00	39.65	55,978	271,455
2044	23	808.0	39.77	0.00	39.65	32,134	303,589
2045	24	1,211.0	39.77	0.00	39.65	48,159	351,749
2046	25	393.5	39.77	0.00	39.65	15,648	367,396
2047	26	0.0	39.77	0.00	39.65	0	367,396
2048	27	1,577.5	39.77	0.00	39.65	62,733	430,130
2049	28	0.0	39.77	0.00	39.65	0	430,130
2050	29	0.0	39.77	0.00	39.65	0	430,130
2051	30	0.0	39.77	0.00	39.65	0	430,130

Table 47: Ex ante estimated carbon stock increase following planned logging activities in the project area (Table 26b of VM0015)

Year	Project year t	Areas of planned logging activities x Carbon stock change (increase up to maximum long-term average)				Total carbon stock increase due to planned logging activities	
		IDcl = 1		*IDcl* = 2		annual	cumulative
		$APLPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$APLPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$\Delta CPLiPA_t$	$\Delta CPLiPA$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2021	0	0.0	0.00	0.00	0.00	0	0
2022	1	0.0	0.00	248.00	3.03	750	750
2023	2	0.0	0.00	992.00	3.03	3.751	4.501
2024	3	0.0	0.00	0.00	3.03	3.751	8.252
2025	4	0.0	0.00	0.00	3.03	3.751	12.003
2026	5	0.0	0.00	0.00	3.03	3.751	15.754
2027	6	0.0	0.00	0.00	3.03	3.751	19.505
2028	7	0.0	0.00	0.00	3.03	3.751	23.256
2029	8	0.0	0.00	0.00	3.03	3.751	27.007
2030	9	0.0	0.00	0.00	3.03	3.751	30.758
2031	10	0.0	0.00	0.00	3.03	3.751	34.509
2032	11	0.0	0.00	0.00	3.03	3.751	38.260
2033	12	0.0	0.00	0.00	3.03	3.751	42.011
2034	13	0.0	0.00	0.00	3.03	3.751	45.762
2035	14	0.0	0.00	0.00	3.03	3.751	49.513
2036	15	0.0	0.00	0.00	3.03	3.751	53.264
2037	16	0.0	0.00	0.00	3.03	3.751	57.015
2038	17	624.9	3.03	870.86	3.03	8.276	65.291
2039	18	911.3	3.03	0.00	3.03	11.032	76.323
2040	19	0.0	3.03	0.00	3.03	11.032	87.356
2041	20	865.7	3.03	914.82	3.03	16.419	103.774
2042	21	0.0	3.03	0.00	3.03	16.419	120.193
2043	22	1,407.6	3.03	0.00	3.03	20.677	140.869
2044	23	808.0	3.03	0.00	3.03	23.121	163.990
2045	24	1,211.0	3.03	0.00	3.03	26.784	190.775
2046	25	393.5	3.03	0.00	3.03	27.975	218.749
2047	26	0.0	3.03	0.00	3.03	27.975	246.724
2048	27	1,577.5	3.03	0.00	3.03	32.746	279.470
2049	28	0.0	3.03	0.00	3.03	32.746	312.217
2050	29	0.0	3.03	0.00	3.03	32.746	344.963
2051	30	0.0	3.03	0.00	3.03	32.746	377.709

Table 48: Ex ante estimated net carbon stock change in the project area under the project scenario (Table 27 of VM0015).

Year	Project year t	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
2021	0	0	0	0	0	0	0	0	0
2022	1	9,832	9,832	750	750	-4,812	-4,812	-13,895	-13,895
2023	2	39,329	49,161	3,751	4,501	-4,383	-9,195	-39,961	-53,855
2024	3	0	49,161	3,751	8,252	-3,944	-13,139	-193	-54,048
2025	4	0	49,161	3,751	12,003	-4,701	-17,840	-950	-54,999
2026	5	0	49,161	3,751	15,754	-4,385	-22,226	-634	-55,633
2027	6	0	49,161	3,751	19,505	-9,979	-32,205	-6,228	-61,861
2028	7	0	49,161	3,751	23,256	-5,441	-37,647	-1,690	-63,552
2029	8	0	49,161	3,751	27,007	-3,412	-41,059	339	-63,213
2030	9	0	49,161	3,751	30,758	-2,842	-43,900	909	-62,303
2031	10	0	49,161	3,751	34,509	-3,753	-47,653	-2	-62,305
2032	11	0	49,161	3,751	38,260	-5,187	-52,840	-1,436	-63,741
2033	12	0	49,161	3,751	42,011	-4,165	-57,005	-414	-64,155
2034	13	0	49,161	3,751	45,762	-3,312	-60,317	439	-63,717
2035	14	0	49,161	3,751	49,513	-3,504	-63,821	247	-63,470
2036	15	0	49,161	3,751	53,264	-3,382	-67,203	369	-63,100
2037	16	0	49,161	3,751	57,015	-2,306	-69,509	1,445	-61,655
2038	17	59,378	108,540	8,276	65,291	-3,773	-73,282	-54,876	-116,531
2039	18	36,240	144,780	11,032	76,323	-3,198	-76,480	-28,406	-144,936
2040	19	0	144,780	11,032	87,356	-2,932	-79,412	8,100	-136,836
2041	20	70,697	215,477	16,419	103,774	-3,965	-83,377	-58,243	-195,079
2042	21	0	215,477	16,419	120,193	-3,834	-87,211	12,584	-182,495
2043	22	55,978	271,455	20,677	140,869	-3,903	-91,114	-39,205	-221,700
2044	23	32,134	303,589	23,121	163,990	-3,243	-94,357	-12,256	-233,956
2045	24	48,159	351,749	26,784	190,775	-3,524	-97,881	-24,899	-258,855
2046	25	15,648	367,396	27,975	218,749	-3,364	-101,245	8,963	-249,892
2047	26	0	367,396	27,975	246,724	-827	-102,072	27,147	-222,745
2048	27	62,733	430,130	32,746	279,470	-697	-102,770	-30,684	-253,429
2049	28	0	430,130	32,746	312,217	-622	-103,392	32,124	-221,305
2050	29	0	430,130	32,746	344,963	-557	-103,949	32,189	-189,115
2051	30	0	430,130	32,746	377,709	-467	-104,416	32,279	-156,836

3.2.2.2 Ex ante estimation of actual non-CO2 emissions from forest fires

Where forest fires have been included in the baseline scenario, non-CO_2 emissions from biomass burning must be included in the project scenario. This is done by multiplying the baseline emissions by the factor (1 – EI).

$$EBBPSPA_t = EBBBSPA_t *(1 - EI)|$$

Where:

$EBBPSPA_t$ Total ex ante actual non-CO_2 emissions from forest fires due to unavoided unplanned deforestation at year t in the project area; tCO_2-e

$EBBBSPA_t$ Total non-CO_2 emissions from forest fires at year t in the project area; tCO_2-e

EI Ex ante estimated Effectiveness Index; %

t 1, 2, 3 … T, a year of the proposed project crediting period; dimensionless

Table 49: Total ex ante estimated actual emissions of non-CO2 gases due to forest fires in the project area (Table 28 of VM0015).

Year	Project year t	Total ex ante estimated actual non-CO2 emissions from forest fires in the Project area	
		annual	cumulative
		$EBBPSPA_t$	EBBPSPA
		tCO_2-e	tCO_2-e
2021	0	0	0
2022	1	178	178
2023	2	155	333
2024	3	131	464
2025	4	158	622
2026	5	144	766
2027	6	344	1,110
2028	7	159	1,269
2029	8	81	1,350
2030	9	57	1,407
2031	10	89	1,496
2032	11	147	1,642

2033	12	111	1,754
2034	13	74	1,827
2035	14	82	1,910
2036	15	70	1,980
2037	16	47	2,027
2038	17	94	2,121
2039	18	85	2,206
2040	19	75	2,281
2041	20	117	2,398
2042	21	108	2,505
2043	22	113	2,618
2044	23	84	2,701
2045	24	95	2,796
2046	25	89	2,885
2047	26	0	2,885
2048	27	0	2,885
2049	28	0	2,885
2050	29	0	2,885
2051	30	0	2,885

3.2.2.3 Ex ante estimation of actual carbon stock changes

Table 50: Total ex ante estimated actual net carbon stock changes and emissions of non-CO2 gases in the project area (Table 29 of VM0015)

		Total ex ante carbon stock decrease due to planned activities		Total ex ante carbon stock increase due to planned activities		Total ex ante carbon stock decrease due to unavoided unplanned deforestation		Total ex ante net carbon stock change		Total ex ante estimated actual non-CO2 emissions from forest fires in the project area	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
Year	Project year t	$\Delta CPAdPA_t$ tCO_2-e	$\Delta CPAdPA$ tCO_2-e	$\Delta CPAiPA_t$ tCO_2-e	$\Delta CPAiPA$ tCO_2-e	$\Delta CUDdPA_t$ tCO_2-e	$\Delta CUDdPA$ tCO_2-e	$\Delta CPSPA_t$ tCO_2-e	$\Delta CPSPA$ tCO_2-e	$EBBPSPA_t$ tCO_2-e	$EBBPSPA$ tCO_2-e
2021	0	0	0	0	0	0	0	0	0	0	0
2022	1	9,832	9,832	750	750	-4,812	-4,812	-13,895	-13,895	178	178
2023	2	39,329	49,161	3,751	4,501	-4,383	-9,195	-39,961	-53,855	155	333
2024	3	0	49,161	3,751	8,252	-3,944	-13,139	-193	-54,048	131	464
2025	4	0	49,161	3,751	12,003	-4,701	-17,840	-950	-54,999	158	622
2026	5	0	49,161	3,751	15,754	-4,385	-22,226	-634	-55,633	144	766
2027	6	0	49,161	3,751	19,505	-9,979	-32,205	-6,228	-61,861	344	1,110
2028	7	0	49,161	3,751	23,256	-5,441	-37,647	-1,690	-63,552	159	1,269
2029	8	0	49,161	3,751	27,007	-3,412	-41,059	339	-63,213	81	1,350
2030	9	0	49,161	3,751	30,758	-2,842	-43,900	909	-62,303	57	1,407
2031	10	0	49,161	3,751	34,509	-3,753	-47,653	-2	-62,305	89	1,496
2032	11	0	49,161	3,751	38,260	-5,187	-52,840	-1,436	-63,741	147	1,642
2033	12	0	49,161	3,751	42,011	-4,165	-57,005	-414	-64,155	111	1,754
2034	13	0	49,161	3,751	45,762	-3,312	-60,317	439	-63,717	74	1,827
2035	14	0	49,161	3,751	49,513	-3,504	-63,821	247	-63,470	82	1,910
2036	15	0	49,161	3,751	53,264	-3,382	-67,203	369	-63,100	70	1,980
2037	16	0	49,161	3,751	57,015	-2,306	-69,509	1,445	-61,655	47	2,027
2038	17	59,378	108,540	8,276	65,291	-3,773	-73,282	-54,876	-116,531	94	2,121
2039	18	36,240	144,780	11,032	76,323	-3,198	-76,480	-28,406	-144,936	85	2,206
2040	19	0	144,780	11,032	87,356	-2,932	-79,412	8,100	-136,836	75	2,281
2041	20	70,697	215,477	16,419	103,774	-3,965	-83,377	-58,243	-195,079	117	2,398

2042	21	0	215,477	16,419	120,193	-3,834	-87,211	12,584	-182,495	108	2,505
2043	22	55,978	271,455	20,677	140,869	-3,903	-91,114	-39,205	-221,700	113	2,618
2044	23	32,134	303,589	23,121	163,990	-3,243	-94,357	-12,256	-233,956	84	2,701
2045	24	48,159	351,749	26,784	190,775	-3,524	-97,881	-24,899	-258,855	95	2,796
2046	25	15,648	367,396	27,975	218,749	-3,364	-101,245	8,963	-249,892	89	2,885
2047	26	0	367,396	27,975	246,724	-827	-102,072	27,147	-222,745	0	2,885
2048	27	62,733	430,130	32,746	279,470	-697	-102,770	-30,684	-253,429	0	2,885
2049	28	0	430,130	32,746	312,217	-622	-103,392	32,124	-221,305	0	2,885
2050	29	0	430,130	32,746	344,963	-557	-103,949	32,189	-189,115	0	2,885
2051	30	0	430,130	32,746	377,709	-467	-104,416	32,279	-156,836	0	2,885

3.2.3 Leakage

Project emission will be calculated according to the VM0015 methodology. Below are presented the equations that will be used. The results will be added to the topic in the final PD.

The goal of this step (STEP 8) is to provide an ex-ante estimate of the possible decrease in carbon stock and increase in GHG emissions (other than carbon stock change) due to leakage.

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.

3.2.3.1 Ex ante estimation of the decrease in carbon stocks and increase in GHG emissions due to leakage prevention measures

If leakage prevention measures include tree planting, agricultural intensification, fertilization, fodder production and/or other measures to enhance cropland and grazing land areas, a reduction in carbon stocks and/or an increase in GHG emissions may occur compared to the baseline case. If this decrease in carbon stocks or increase in GHG emissions is significant, it must be accounted for, and monitoring will be required. If it is not significant, it must not be accounted for, and ex post monitoring will not be necessary.

The following activities in leakage management areas could occasion a decrease in carbon stocks or an increase in GHG emissions:

- Carbon stock changes due to activities implemented in leakage management areas;

- Methane (CH_4) and nitrous oxide (N_2O) emissions from livestock intensification (involving a change in the animal diet and/or animal numbers).

In the case of this project activity, this component of the calculation is not applicable. The present project activity does not involve a decrease in carbon stocks or increase in GHG emissions associated with leakage prevention activities. In this project, leakage prevention activities do not involve any carbon stock reduction due to deforestation or additional emissions caused by increased grazing activities.

3.2.3.2 Ex ante estimation of the decrease in carbon stocks and increase in GHG emissions due to activity displacement leakage

Activities that will cause deforestation within the project area in the baseline case could be displaced outside the project boundary due to the implementation of the AUD project activity. If carbon stocks in the leakage belt area will 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. Leakage due to activity displacement can thus be estimated by ex post monitoring of deforestation in the leakage belt and comparing ex post observed deforestation with ex ante projected baseline deforestation.

Ex ante activity displacement leakage can only be guessed based on the anticipated combined effectiveness of the proposed leakage prevention measures and project activities. This is done by multiplying the estimated baseline carbon stock changes for the project area by a “Displacement Leakage Factor” (DLF) representing the percent of deforestation expected to be displaced outside the project boundary.

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.

It is expected that 100% of potential deforestation agents in the Reference Region will be given the opportunity to participate in leakage prevention activities. Thus, the “Displacement Leakage Factor” (DLF) will be conservatively considered as 0.05.

If emissions from forest fires have been included in the baseline, the ex-ante emissions from forest fires due to activity displacement leakage will be calculated by multiplying baseline forest fire emissions in the project area by the same DLF used to estimate the decrease in carbon stocks.

Table 51: Ex ante estimated leakage due to activity displacement (Table 34 of VM0015)

Year	Project year t	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 $\Delta CADLK_t$ tCO_2-e	cumulative $\Delta CADLK$ tCO_2-e	annual $EADLK_t$ tCO_2-e	cumulative EADLK tCO_2-e
2021	0	0	0	0	0
2022	1	-2,406	-2,406	89	89
2023	2	-2,191	-4,598	77	167
2024	3	-1,972	-6,570	66	232
2025	4	-2,351	-8,920	79	311
2026	5	-2,193	-11,113	72	383
2027	6	-4,990	-16,103	172	555
2028	7	-2,721	-18,823	79	635
2029	8	-1,706	-20,529	40	675
2030	9	-1,421	-21,950	28	703
2031	10	-1,876	-23,826	44	748
2032	11	-2,594	-26,420	73	821
2033	12	-2,083	-28,503	56	877
2034	13	-1,656	-30,159	37	914
2035	14	-1,752	-31,911	41	955
2036	15	-1,691	-33,601	35	990
2037	16	-1,153	-34,754	24	1,013
2038	17	-1,887	-36,641	47	1,060
2039	18	-1,599	-38,240	42	1,103
2040	19	-1,466	-39,706	38	1,141
2041	20	-1,982	-41,688	58	1,199
2042	21	-1,917	-43,605	54	1,253
2043	22	-1,952	-45,557	56	1,309
2044	23	-1,622	-47,179	42	1,351
2045	24	-1,762	-48,941	48	1,398
2046	25	-1,682	-50,623	45	1,443
2047	26	-414	-51,036	0	1,443
2048	27	-349	-51,385	0	1,443
2049	28	-311	-51,696	0	1,443
2050	29	-279	-51,974	0	1,443
2051	30	-234	-52,208	0	1,443

3.2.3.3 Ex ante estimation of total leakage

Table 52: Ex-ante estimated total leakage (Table 35 of VM0015)

		Total ex ante increase in GHG emissions due to displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	Project	$EADLK_t$	EADLK	$\Delta CADLK_t$	$\Delta CADLK$	ΔCLK_t	ΔCLK	ELK_t	ELK
Year	year t	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2021	0	0	0	0	0	0	0	0	0
2022	1	89	89	-2,406	-2,406	-2,406	-2,406	89	89
2023	2	77	167	-2,191	-4,598	-2,191	-4,598	77	167
2024	3	66	232	-1,972	-6,570	-1,972	-6,570	66	232
2025	4	79	311	-2,351	-8,920	-2,351	-8,920	79	311
2026	5	72	383	-2,193	-11,113	-2,193	-11,113	72	383
2027	6	172	555	-4,990	-16,103	-4,990	-16,103	172	555
2028	7	79	635	-2,721	-18,823	-2,721	-18,823	79	635
2029	8	40	675	-1,706	-20,529	-1,706	-20,529	40	675
2030	9	28	703	-1,421	-21,950	-1,421	-21,950	28	703
2031	10	44	748	-1,876	-23,826	-1,876	-23,826	44	748
2032	11	73	821	-2,594	-26,420	-2,594	-26,420	73	821
2033	12	56	877	-2,083	-28,503	-2,083	-28,503	56	877
2034	13	37	914	-1,656	-30,159	-1,656	-30,159	37	914
2035	14	41	955	-1,752	-31,911	-1,752	-31,911	41	955
2036	15	35	990	-1,691	-33,601	-1,691	-33,601	35	990
2037	16	24	1,013	-1,153	-34,754	-1,153	-34,754	24	1,013
2038	17	47	1,060	-1,887	-36,641	-1,887	-36,641	47	1,060
2039	18	42	1,103	-1,599	-38,240	-1,599	-38,240	42	1,103
2040	19	38	1,141	-1,466	-39,706	-1,466	-39,706	38	1,141
2041	20	58	1,199	-1,982	-41,688	-1,982	-41,688	58	1,199
2042	21	54	1,253	-1,917	-43,605	-1,917	-43,605	54	1,253
2043	22	56	1,309	-1,952	-45,557	-1,952	-45,557	56	1,309
2044	23	42	1,351	-1,622	-47,179	-1,622	-47,179	42	1,351
2045	24	48	1,398	-1,762	-48,941	-1,762	-48,941	48	1,398
2046	25	45	1,443	-1,682	-50,623	-1,682	-50,623	45	1,443
2047	26	0	1,443	-414	-51,036	-414	-51,036	0	1,443
2048	27	0	1,443	-349	-51,385	-349	-51,385	0	1,443
2049	28	0	1,443	-311	-51,696	-311	-51,696	0	1,443
2050	29	0	1,443	-279	-51,974	-279	-51,974	0	1,443
2051	30	0	1,443	-234	-52,208	-234	-52,208	0	1,443

3.2.4 Net GHG Emission Reductions and Removals

Project emission will be calculated according to the VM0015 methodology. Below are presented the equations that will be used. The results will be added to the topic in the final PD.

3.2.4.1 Calculation of ex-ante estimation of total net GHG emissions reductions

The net anthropogenic GHG emission reduction (STEP 9 of the VM0015 Methodology) of the proposed AUD project activity is calculated as follows:

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

Where:

$\Delta REDD_t$ Ex ante estimated net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t; tCO_2e

$\Delta CBSLPA_t$ Sum of baseline carbon stock changes in the project area at year t; tCO_2e

Note: The absolute values of $\Delta CBSLPA_t$ shall be used in the equation above

$EBBBSLPA_t$ Sum of baseline emissions from biomass burning in the project area at year t; tCO_2e

$\Delta CPSPA_t$ Sum of ex ante estimated actual carbon stock changes in the project area at year t; tCO_2e of baseline emissions from biomass burning in the project area at year t; tCO_2e

Note: If $\Delta CPSPA_t$ represents a net increase in carbon stocks, a negative sign before the absolute value of $\Delta CPSPA_t$shall be used. If $\Delta CPSPA_t$represents a net decrease, the positive sign shall be used.

$EBBPSPA_t$ Sum of (ex ante estimated) actual emissions from biomass burning in the project area at year t; tCO_2e

ΔCLK_t Sum of ex ante estimated leakage net carbon stock changes at year t; tCO_2e

Note: If the cumulative sum of ΔCLK_t within a fixed baseline period is > 0, ΔCLK_t shall be set to zero.

ΔELK_t Sum of ex ante estimated leakage emissions at year t; tCO_2e

t 1, 2, 3 … T, a year of the proposed project crediting period; dimensionless

3.2.4.2 Calculation of ex-ante estimation of total net GHG emissions reductions

The number of Verified Carbon Units (VCUs) to be generated through the proposed AUD project activity at year t is calculated as follows:

$$VCU_t = REDD_t - VBC_t$$

$$VBC_t = (CBSLPA_t - CPSPA_t) * RF_t$$

Where:

VCU_t Number of Verified Carbon Units that can be traded at time t; tCO_2-e

$REDD_t$ Ex-ante estimated net anthropogenic greenhouse gas emission reductions attributable to the AUD project activity at year t; tCO_2-e ha^{-1}

VBC_t Number of Buffer Credits deposited in the VCS Buffer at time t; tCO_2-e

$CBSLPA_t$ Sum of baseline carbon stock changes in the project area at year t; tCO_2e

$CPSPA_t$ Sum of ex ante estimated actual carbon stock changes in the project area at year t; tCO_2-e ha^{-1}

RF_t Risk factor used to calculate VCS buffer credits; %

Note: RF_t is a risk factor to be determined using the latest version of the VCS-approved AFOLU Non-Permanence Risk Tool.

t 1, 2, 3 … T, a year of the proposed project crediting period; dimensionless

It is specified that the risk rating according to the AFOLU Non-Permanence Risk Tool is 20, being sub-divided into Internal Risk (17.0), External Risk (0) and Natural Risk (2.5), which is rounded up to 20 points.

Table 53: Ex ante estimated net anthropogenic GHG emission reductions (ΔREDDt) and Voluntary Carbon Units (VCUt) (Table 36 of VM0015)

Year	Estimated baseline emissions (tCO2e)	Estimated project emissions (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions (tCO2e)
2021	0	0	0	0
2022	49,909	14,073	2,495	33,341
2023	45,376	40,116	2,269	2,991
2024	40,750	324	2,038	38,389
2025	48,590	1,108	2,429	45,052
2026	45,294	778	2,265	42,251
2027	103,237	6,573	5,162	91,503
2028	56,003	1,849	2,800	51,354
2029	34,928	-258	1,746	33,440
2030	28,984	-853	1,449	28,387
2031	38,411	90	1,921	36,400
2032	53,341	1,583	2,667	49,091
2033	42,765	525	2,138	40,101
2034	33,858	-365	1,693	32,530
2035	35,863	-165	1,793	34,235
2036	34,516	-299	1,726	33,090
2037	23,528	-1,398	1,176	23,749
2038	38,674	54,970	1,934	-18,229
2039	32,830	28,490	1,642	2,698
2040	30,074	-8,025	1,504	36,595
2041	40,813	58,360	2,041	-19,587
2042	39,417	-12,477	1,971	49,923
2043	40,157	39,318	2,008	-1,168
2044	33,268	12,340	1,663	19,265
2045	36,189	24,994	1,809	9,385
2046	34,530	-8,874	1,726	41,677
2047	8,273	-27,147	414	35,006
2048	6,972	30,684	349	-24,061
2049	6,221	-32,124	311	38,034
2050	5,570	-32,189	279	37,481
2051	4,672	-32,279	234	36,718
Total	**1,073,013**	**159,721**	**53,651**	**859,641**

Table 54: Ex-ante Tradable VCUs and Buffer Credits.

year	Ex ante VCUs tradable		Ex ante buffer credits	
	annual VCU_t	cumulative VCU	annual VBC_t	cumulative VBC
	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2021	0	0	0	0
2022	26,495	26,495	6,846	6,846
2023	2,218	28,713	773	7,619
2024	30,540	59,252	7,849	15,468
2025	35,840	95,092	9,213	24,681
2026	33,607	128,699	8,644	33,325
2027	72,790	201,488	18,713	52,038
2028	40,809	242,298	10,545	62,583
2029	26,548	268,846	6,892	69,474
2030	22,522	291,368	5,865	75,340
2031	28,895	320,263	7,505	82,844
2032	39,003	359,267	10,088	92,932
2033	31,854	391,120	8,247	101,179
2034	25,818	416,939	6,712	107,891
2035	27,177	444,116	7,057	114,949
2036	26,253	470,369	6,837	121,786
2037	18,849	489,218	4,900	126,686
2038	-14,801	474,417	-3,429	123,258
2039	1,983	476,400	715	123,973
2040	29,111	505,511	7,484	131,457
2041	-15,868	489,643	-3,719	127,738
2042	39,738	529,381	10,185	137,923
2043	-1,134	528,247	-35	137,888
2044	15,230	543,477	4,035	141,923
2045	7,318	550,794	2,068	143,991
2046	33,157	583,951	8,520	152,512
2047	27,922	611,873	7,084	159,596
2048	-19,318	592,555	-4,742	154,853
2049	30,365	622,920	7,669	162,522
2050	29,929	652,849	7,552	170,074
2051	29,328	682,176	7,390	177,464

3.3 Monitoring

3.3.1 Data and Parameters Available at Validation

Data / Parameter	**CF**
Data unit	tC/tdm
Description	Default value of carbon fraction in biomass
Source of data	Values from the literature (e.g., IPCC 2003. Good practice guidance for land use, land-use change and forestry. Kanagawa: IGES, 2003. Available at: <http://www.ipccnggip. iges.or.jp/public/gpglulucf/gpglulucf.html>)
Value applied	0.5
Justification of choice of data or description of measurement methods and procedures applied	The default value was used for conservativeness purposes.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	If new and more accurate carbon fraction data become available, these can be used to estimate the net anthropogenic GHG emission reduction of the subsequent fixed baseline period.

Data / Parameter	**44/12**
Data unit	Dimensionless
Description	Carbon mass to CO_2e mass conversion factor

Source of data	From scientific literature: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 AFOLU
Value applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	Conversion from C to CO_2 based on molecular weights
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	IPCC standard value

Data / Parameter	**R**
Data unit	t root d.m.t^{-1} shoot d.m.
Description	Root to shoot ratio appropriate to species or forest type biome; note that as defined here, root to shoot ratio is applied as belowground biomass per unit area: aboveground biomass per unit area (not on a per stem basis)
Source of data	The "2006 IPCC Guidelines for National Greenhouse Gas Inventories", V. 4, Ch. 4, AFOLU, pg. 4.49, Table 4-4.
Value applied	0.37
Justification of choice of data or description of measurement methods and procedures applied	Local values are not known, and the IPCC is a conservative value.

Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	Peer-reviewed work performed in the region of the Project Area, with a similar vegetation typology. The statistical quality of model is in accordance with methodology requirements

Data / Parameter	**BEF**
Data unit	Dimensionless
Description	Biomass Expansion Factor
Source of data	According to "Brown, S., A. J. R. Gillespie, and A. E. Lugo, 1989. Biomass estimation methods for tropical forests with applications to forest inventory data. Forest Science, 35:881-902". (Table 4; pg. 890; minimum value deducted from lowest limit.: 1.743 - 0.083 = 1.66)
Value applied	1.66
Justification of choice of data or description of measurement methods and procedures applied	BEF was applied for conversion of merchantable volume to total aboveground tree biomass
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	N/A

Data / Parameter	**Cab_{icl}**
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the above-ground biomass carbon pool of initial forest class icl
Source of data	Third Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions and Removals, pg. 95, table 12. The conversion from total biomass to above-ground biomass is explained in Section 3.2.1.
Value applied	189.5
Justification of choice of data or description of measurement methods and procedures applied	Other secondary data was consulted, however the data from the Third Brazilian Inventory was chosen for being the most conservative. In order to convert the value from total biomass to above-ground biomass, the root-to-shoot ratio (0.37) was applied to calculate the above-ground biomass.
Purpose of Data	• *Calculation of baseline emissions*
Comments	NA

Data / Parameter	**Cbb_{icl}**
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the below-ground biomass carbon pool of initial forest class icl
Source of data	Third Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions and Removals, pg. 95, table 12.
Value applied	70.14

Justification of choice of data or description of measurement methods and procedures applied	Other secondary data was consulted, however the data from the Third Brazilian Inventory was chosen for being the most conservative. In order to convert the value from total biomass to below-ground biomass, first the root-to-shoot ratio (0.37) was applied to calculate the above-ground biomass. The below-ground is the difference between the total and the above-ground biomass.
Purpose of Data	• *Calculation of baseline emissions*
Comments	NA

Data / Parameter	**$Cabfcl_{cropland}$**
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the above-ground biomass carbon pool of final post-deforestation class fcl for cropland conversion
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 5: Cropland, pg. 5.41, Table 5.9 (for Annual cropland Tropical, moist)
Value applied	17.23
Justification of choice of data or description of measurement methods and procedures applied	*Conservative default value from IPCC, to estimate post-deforestation land use carbon stock.*
Purpose of Data	• *Calculation of baseline emissions*
Comments	Conservative average to be used in calculations, based on uncertainties in source values.

Data / Parameter	**$Cabfcl_{grassland}$**
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the above-ground biomass carbon pool of final post-deforestation class fcl for grassland conversion
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 6: Grassland, pg. 6.27, Table 6.4 (for Pasture)
Value applied	11.37
Justification of choice of data or description of measurement methods and procedures applied	Conservative default value from IPCC, to estimate post-deforestation land use carbon stock.
Purpose of Data	• Calculation of baseline emissions
Comments	Conservative average to be used in calculations, based on uncertainties in source values.

Data / Parameter	**$Cbbfcl_{cropland}$**
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the below-ground biomass pool of final post-deforestation class fcl for cropland conversion
Source of data	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 5: Cropland, pg. 5.41, Table 5.9 (for Annual cropland Tropical, moist) calculated using the root-shoot-ratio 0.175 described in [55].
Value applied	3.02

Justification of choice of data or description of measurement methods and procedures applied	Conservative default value from IPCC, to estimate post-deforestation land use carbon stock.
Purpose of Data	• Calculation of baseline emissions
Comments	Conservative value to be used in calculations, based on uncertainties in source values.

Data / Parameter	**$Cbbfcl_{grassland}$**
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the below-ground biomass pool of final post-deforestation class fcl for grassland conversion
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 6: Grassland, pg. 6.27, Table 6.4 (for Pasture)
Value applied	18.15
Justification of choice of data or description of measurement methods and procedures applied	Conservative default value from IPCC, to estimate post-deforestation land use carbon stock.
Purpose of Data	• Calculation of baseline emissions
Comments	Conservative average to be used in calculations, based on uncertainties in source values.

Data / Parameter	**EI**

Data unit	N/A
Description	Ex ante estimated effectiveness index
Source of data	Local assessment
Value applied	0.9
Justification of choice of data or description of measurement methods and procedures applied	The project design team conservatively considers that surveillance activities are able to attain 90% of effectiveness in avoiding unplanned deforestation inside the Project Area.
Purpose of Data	• Calculation of project emissions
Comments	This value is an ex-ante estimate. Accurate and actual values will be monitored and reported in verification periods.

Data / Parameter	**DLF**
Data unit	N/A
Description	Displacement Leakage Factor
Source of data	Local assessment
Value applied	0.05
Justification of choice of data or description of measurement methods and procedures applied	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 design team estimates that 100% of potential

	deforestation agents in the Reference Region will be given the opportunity to participate in leakage prevention activities. Projections of deforestation within the Leakage Belt have duly been made as part of the present project, according to projections of deforestation presented in Section 3.2.3. The project proponent has conservatively allowed 5% leeway on this estimate, which is unlikely to be surpassed. If this allowance is surpassed, an assessment of how much is due to the project will be conducted during monitoring. Thus, the "Displacement Leakage Factor" (DLF) was conservatively defined as 0.05. Leakage fighting activities are also listed in this PD, as fire brigade trainings, sustainable cattle raising etc.
Purpose of Data	• Calculation of leakage
Comments	This value is an ex-ante estimate. Accurate and actual values will be monitored and reported in verification periods

Data / Parameter	**Deforestation**
Data unit	ha
Description	Maps of forest cover areas converted into non-forest areas
Source of data	Measured through data from MapBiomas project (if available) or supervised classification.
Value applied	Yearly variable: deforestation values are presented for the Reference Region, Leakage Belt and Project Area (projections) in this PD
Justification of choice of data or description of measurement methods and procedures applied	The project area is located within a region that is subject to a monitoring program that is approved or sanctioned by the national government (*MapBiomas*). The data generated by this program is used in this project. *MapBiomas* data are applicable for use in this project, according to the criteria listed below (Methodology VM0015): i) *MapBiomas*

	monitoring occurs in the entire project area and leakage belt. ii) *MapBiomas* monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period. iii) *MapBiomas* monitors conversion of forest land to non-forest land. iv) Monitoring occurred during the entire fixed baseline period. v) data accuracies are acceptable according to the methodology criteria. An order of preference of data applies to the available sources of data: 1) MapBiomas in first order of preference; 2) PRODES in second place; and 3) place self-classification of images.
Purpose of Data	• Calculation of baseline emissions
Comments	N/A

3.3.2 Data and Parameters Monitored

Data / Parameter	ACPAt
Data unit	ha
Description	Annual area within the Project Area affected by catastrophic events at year t
Source of data	- Remote sensing data and GIS, -- Supervisor reports
Description of measurement methods and procedures to be applied	The following sources will be monitored: - INMET (INMET. Instituto Nacional de Meteorologia). https://www.gov.br/agricultura/pt-br/assuntos/inmet?r=home/page&page=%20rede_estacoes_conv_graf - Periodic reports from area supervisor - INPE (INPE. Instituto Nacional de Pesquisas Espaciais. https://queimadas.dgi.inpe.br/queimadas/portal - items 1 and 5)

Frequency of monitoring/recording	Each time a catastrophic event occurs
Value applied	The value will be calculated ex-post each time a catastrophic event occurs, when significant
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	Calculation of project emissions.
Calculation method	Remote sensing and GIS
Comments	N/A

Data / Parameter	**ABSLLKt**
Data unit	ha
Description	Annual area of baseline deforestation within the leakage belt at year t
Source of data	Remote sensing data and GIS

Description of measurement methods and procedures to be applied	Deforestation in the leakage belt area will be considered activity displacement leakage. Activity data for the leakage belt area will be determined using the same methods applied to monitoring deforestation activity data in the project area.
Frequency of monitoring/recording	Annually
Value applied	It will be indicated in the Project Description final version.
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Analysis of satellite images and maps
Comments	Where strong evidence can be collected that deforestation in the leakage belt is attributable to deforestation agents that are not linked to the project area, the detected deforestation will not be attributed to the project activity, thus not considered leakage.

Data / Parameter	**ABSLPAt**
Data unit	ha
Description	Annual area of baseline deforestation in the project area at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Forest cover change due to deforestation is monitored through periodic assessment of classified satellite imagery covering the project area.
Frequency of monitoring/recording	Annually
Value applied	It will be indicated in the Project Description final version.
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.

Purpose of data	• Calculation of project emissions • Calculation of baseline emissions
Calculation method	Analysis of satellite images and maps
Comments	N/A

Data / Parameter	**ΔCADLKt**
Data unit	tCO_2e
Description	Total decrease in carbon stocks due to displaced deforestation at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Deforestation in the leakage belt area will be considered activity displacement leakage. Activity data for the leakage belt area will be determined using the same methods applied to monitoring deforestation activity data in the project area.
Frequency of monitoring/recording	Annually
Value applied	It will be indicated in the Project Description final version.
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images.

	3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Emissions from deforestation are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	N/A

Data / Parameter	**ΔCPAdPAt**
Data unit	tCO_2e
Description	Total decrease in carbon stock due to all planned activities at year t in the project area.
Source of data	Documents, remote sensing and GIS.
Description of measurement methods and procedures to be applied	The planned activities in the project area that result in carbon stock decrease will be subject to monitoring, when significant.
Frequency of monitoring/recording	Annually.
Value applied	It will be indicated in the Project Description final version.
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed

	during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions
Calculation method	Emissions from all planned activities are estimated by the sum of the emissions from planned deforestation and emissions from planned logging activities.
Comments	N/A

Data / Parameter	**ΔCPSLKt**
Data unit	tCO_2e
Description	Total annual carbon stock change in leakage management areas in the project case
Source of data	- Activity reports related to leakage prevention measures. - Field assessments. - Remote sensing and GIS.
Description of measurement methods and procedures to be applied	The planned activities in leakage management areas that result in carbon stock decrease will be subject to monitoring, when significant.

Frequency of monitoring/recording	Annually
Value applied	0
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• *Calculation of leakage*
Calculation method	Emissions from are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	N/A

Data / Parameter	**ΔCUDdPAt**
Data unit	tCO_2e

Description	Total actual carbon stock change due to unavoided unplanned deforestation at year t in the project area
Source of data	Remote sensing and GIS
Description of measurement methods and procedures to be applied	Forest cover change due to unplanned deforestation is monitored through periodic assessment of classified satellite imagery covering the project area.
Frequency of monitoring/recording	Annually
Value applied	It will be indicated in the Project Description final version.
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions
Calculation method	Emissions from unavoided unplanned deforestation are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.

Comments	N/A

Data / Parameter	**EBBPSPAt**
Data unit	tCO_2e
Description	Sum of (or total) actual non-CO_2 emissions from forest fire at year t in the project area
Source of data	Remote sensing data and GIS, - Supervisor reports.
Description of measurement methods and procedures to be applied	If forest fires occur, these non-CO_2 emissions will be subject to monitoring and accounting, when significant.
Frequency of monitoring/recording	Annually
Value applied	0
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed.

	4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions
Calculation method	Analysis of satellite images and maps to determine the incidence of deforestation and multiplying it by the respective emission factors.
Comments	If forest fires occur, these non-CO_2 emissions will be subject to monitoring and accounting, when significant.

Data / Parameter	**EADLKt**
Data unit	tCO2e
Description	Total ex ante increase in GHG emissions due to displaced forest fires at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	When significant, GHG emissions due displaced forest fires will be monitored.
Frequency of monitoring/recording	Annually
Value applied	It will be indicated in the Project Description final version.
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image

	acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Analysis of satellite images and maps to determine the incidence of deforestation and multiplying it by the respective emission factors.
Comments	Where strong evidence can be collected that forest fires in the leakage belt is attributable to deforestation agents that are not linked to the project area, the detected deforestation will not be attributed to the project activity, thus not considered leakage.

Data / Parameter	**RFt**
Data unit	%
Description	Risk factor used to calculate VCS buffer credits
Source of data	- VCS Non-Permanence Risk Report (v3.1), - Remote sensing data and GIS, - Supervisor report. - Literature data.

Description of measurement methods and procedures to be applied	All sources of data from the VCS Non-Permanence Risk Report will be used to measure the various risk factors.
Frequency of monitoring/recording	Annually
Value applied	10
Monitoring equipment	VCS-approved AFOLU Non-Permanence Risk Tool
QA/QC procedures to be applied	Literature data from reputed sources will be used and critically checked. When possible, the average of two or more sources will be used.
Purpose of data	• Calculation of VCS buffer credits
Calculation method	All the risk factors described in the VCS Risk Report were assessed.
Comments	N/A

Data / Parameter	**Deforestation in the project area and leakage belt**
Data unit	ha
Description	Forest cover areas converted into non-forest areas inside the Project Area and Leakage Belt
Source of data	Calculated through remote sensing images
Description of measurement methods and procedures to be applied	The monitoring of the forest cover in the Project Area and Leakage Belt will be done through satellite image analysis. When data from the MapBiomas system are not available, the forest cover monitoring will

	be carried out by automatic classification and visual interpretation of images from other optical sensors or SAR data.
Frequency of monitoring/recording	Annually
Value applied	N/A
Monitoring equipment	Remote sensing images digital processing program, geographic information systems
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	Calculation of project emissions Calculation of leakage
Calculation method	Analysis of satellite images and maps
Comments	N/A

Data / Parameter	**ΔCabBSLLKt**
Data unit	tCO_2e
Description	Total baseline carbon stock changes for the above-ground biomass pool in the leakage belt
Source of data	Calculated
Description of measurement methods and procedures to be applied	- leakage prevention activities will be listed; - a map showing areas of intervention and type of intervention will be created; - areas where leakage prevention activities impact carbon stock will be identified; - non-forest classes existing within these areas in the baseline case will be identified; - carbon stocks will be measured on the identified classes or conservative literature estimates will be used; - carbon stock changes in the leakage management areas under the project scenario will be reported using table 30b of the VM0015; - net carbon stock changes that the leakage prevention measures cause during the fixed baseline period and, optionally, the project crediting period will be calculated; - results of the calculations will be reported in table 30.c of the VM0015.
Frequency of monitoring/recording	To be determined depending on the activity
Value applied	0
Monitoring equipment	Remote sensing images digital processing program, geographic information systems

QA/QC procedures to be applied	Best practices in remote sensing and GIS: *1)* Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. *2)* Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. *3)* For analysis of areas with cloud cover, visual interpretation of radar image is performed. *4)* Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• *Calculation of leakage*
Calculation method	Analysis of satellite images and maps to determine deforestation in Leakage Belt and multiplying it by the carbon stocks previously set.
Comments	N/A

3.3.3 Monitoring Plan

This Monitoring Plan was developed according to Methodology VM0015 “Methodology for Avoided Unplanned Deforestation”, Version 1.1.3 The methodology encompasses three main monitoring tasks:

i) Monitoring of actual carbon stock changes and GHG emissions within the project area;

ii) Monitoring of leakage; and

iii) Ex post calculation of net anthropogenic GHG emission reduction.

This Monitoring Plan describes how these tasks will be implemented. For each task, the monitoring plan includes the following aspects:

a) Technical description of the monitoring tasks.

b) Data to be collected.

c) Overview of data collection procedures.

d) Quality control and quality assurance procedures.

e) Data archiving.

f) Organization and responsibilities of the parties involved in all the above.

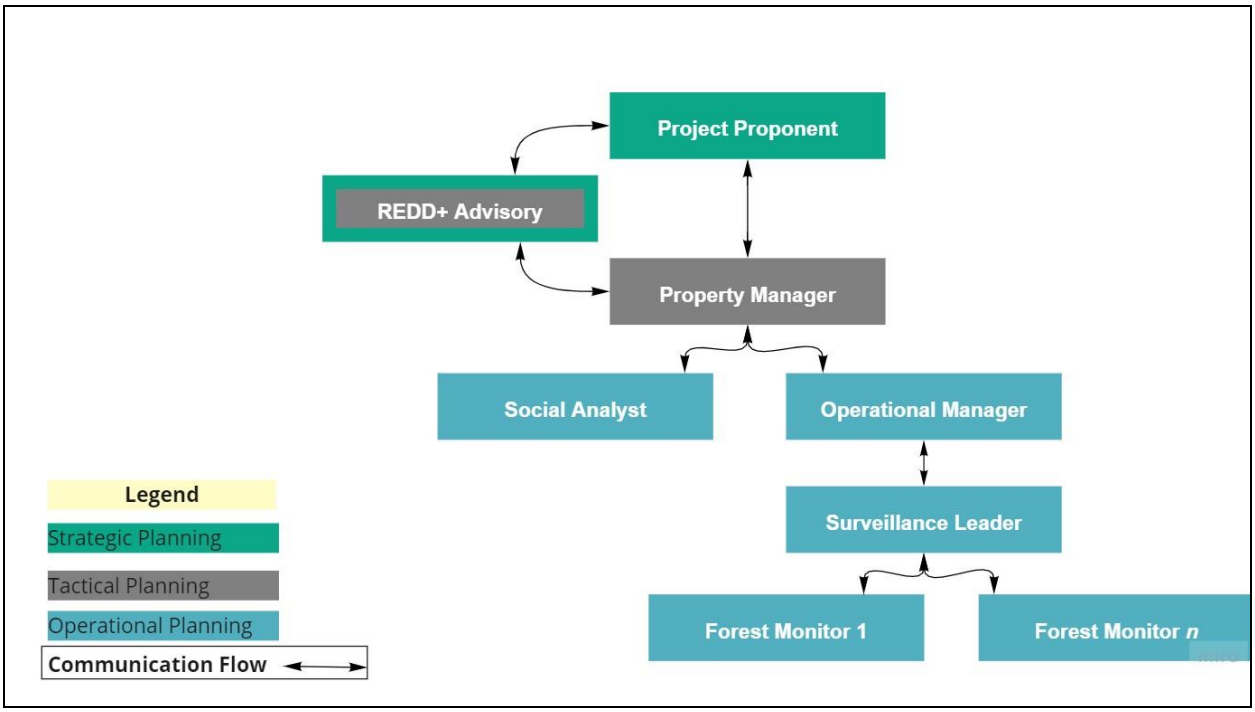


Figure 40: General overview of staff in the Project Area. Source: Carbonext (2022)

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

3.3.3.1.1 Monitoring of project implementation

a) Technical description of the monitoring tasks.

Project activities implemented within the project area will be monitored to be consistent with the management plans of the project area and the PD.

b) Data to be collected.

Monitoring of deforestation-avoidance activities will be performed by means of evaluations of the surveillance rounds and using satellite imagery to continuously inspect the forest condition within the Project Area. All images, maps and records generated during project implementation should be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has actually been implemented.

Monitoring of social and biodiversity parameters of project implementation will be based on data presented in sections 4.4.2 and 5.4.2, respectively, which attest that foreseen activities are being effectively implemented. A system will be implemented to record data on costs and investments, based on invoices, receipts and contracts related to activity implementation, as well as signed attendance lists.

c) Overview of data collection procedures.

All invoices, receipts and contracts related to activities implemented in this REDD project shall be conserved in printed version. Whenever possible, documentation should be kept in electronic format.

d) Quality control and quality assurance procedures.

The project proponent will train personnel to collect and keep all documentation in a sure place. All electronic documentation should also be sent to Carbonext to further safety and checking.

e) Data archiving.

All maps and records generated during project implementation will be conserved and made available to VCS verifiers at verification. Backup copies of files should be available in the project proponent facilities, as well as in Carbonext facilities.

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

f) Organization and responsibilities of the parties involved in all the above.

The project proponents are responsible to implement this monitoring item. Carbonext is co-responsible in archiving, and quality control and quality assurance procedures.

Monitoring of land-use and land-cover change within the project area

a) Technical description of the monitoring tasks.

Monitoring of land-use and land-cover change within the Project Area will be performed annually by analyzing satellite imagery of the Project Area.

Imagery analysis of land use will be based on secondary information from MapBiomas, referring mainly to the classes "Forest Land" and "Non-Forest Land".

b) Data to be collected.

The categories of change that will be subject to MRV-A (monitoring, reporting, verification and accounting) are “Area of forest land converted to non-forest land”, “Area of forest land undergoing carbon stock decrease” and “Area of forest land undergoing carbon stock increase”. These categories are mandatory in AUD project activities having the same characteristics as this project (i.e., planned logging above the baseline and claiming carbon credits for carbon stock increase).

In this context, data to be collected consists of annual satellite imagery processed by MapBiomas, for the entire land coverage of Project Area.

The satellite images used will be four scenes of satellite Landsat 8 TM (orbits 001/65, 001/66, 233/65, and 233/66) to the total geographic scope of the Project Area and Reference Region.

c) Overview of data collection procedures.

The project area is located within a region that is subject to a monitoring program that is approved or sanctioned by the national government (MapBiomas). The data generated by such program is used in this project. MapBiomas data are applicable for use in this project, according to the criteria listed below (Methodology VM0015):

i) MapBiomas monitoring occurs in the entire project area and leakage belt.

ii) MapBiomas monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period.

iii) MapBiomas monitors conversion of forest land to non-forest land.

iv) Monitoring occurred during the entire fixed baseline period.

d) Quality control and quality assurance procedures.

The validation of land-use data used for modeling of land use will be performed by using the confusion matrix, in order to calculate the overall index of success by period and by class. Three specific classes will be used: forest, accumulated deforestation and other (hydrography, not forest, clouds, roads, residues, unclassified objects, and others).

The validation will be performed by using the land use mapping MapBiomas. The satellite images used will be four scenes of satellite Landsat 8 TM (orbits 001/65, 001/66, 233/65, and 233/66) to the total geographic scope of the Project Area and Reference Region.

With the help of the "Create Random Points" tool in ArcGIS 10.0, 100 random points will be generated for each class / year as samples for evaluation, using satellite images as reference, making it possible to generate a confusion matrix for calculation of the accuracy indexes, and the Kappa index (indicators for validation of mapping accuracy).

Land use classes must have higher values than 90% accuracy for the accuracy and Kappa index, as required in VM00015 1.1.3 methodology.

e) Data archiving.

All maps and records generated during project implementation will be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has actually been implemented.

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

f) Organization and responsibilities of the parties involved in all the above.

All satellite imagery assessments will be performed by Carbonext, also responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits.

3.3.3.1.2 Monitoring of carbon stock changes and non-CO_{2e} emissions from forest fires

a) Technical description of the monitoring tasks.

Monitoring of carbon stocks is mandatory in the following cases:

Within the project area:

a) Areas subject to significant carbon stock decrease in the project scenario according to the ex-ante assessment. These will be areas subject to controlled deforestation and planned harvest activities, such as logging, fuel wood collection and charcoal production. In these areas, carbon stock changes must be estimated at least once after each harvest event.

b) Areas subject to unplanned and significant carbon stock decrease, e.g., due to uncontrolled forest fires and other catastrophic events. In these areas, carbon stock losses must be estimated as soon as possible after the catastrophic event.
Within leakage management areas:

a) Areas subject to planned and significant carbon stock decrease in the project scenario according to the ex-ante assessment. In these areas, carbon stocks must be estimated at least once after the planned event that caused the carbon stock decrease.

b) Data to be collected.

The results of monitoring activity data and carbon stocks must be reported using the same formats and tables used for the ex-ante assessment, according to Methodology VM0015 (the applicability of each table must be evaluated ex post, in the Monitoring Report):

Table 15 Ex post carbon stock per hectare of initial forest classes icl existing in the project area and leakage belt.

Table 16 Ex post carbon stock per hectare of final classes fcl existing in the project area and leakage belt.

Table 25.a Ex post carbon stock decrease due to planned and unplanned deforestation in the project area.

Table 25.b Ex post carbon stock decrease due to planned logging activities.

Table 25.c Ex post carbon stock decrease due to planned fuel-wood and charcoal activities.

Table 25.d Total ex post carbon stock decrease due to planned activities in the project area.

Table 25.e Ex post carbon stock decrease due to forest fires.

Table 25.f Ex post carbon stock decrease due to catastrophic events.

Table 25.g Total ex post carbon stock decrease due to forest fires and catastrophic events.

Table 26.a Ex post carbon stock increase due to growth without harvest.

Table 26.b Ex post carbon stock increase following planned logging activities.

Table 26.c Ex post carbon stock increase following planned fuel-wood and charcoal activities.
Table 26.d Total ex post carbon stock increase due to planned activities in the project area.

Table 26.e Ex post carbon stock increase on areas affected by forest fires.

Table 26.f Ex post carbon stock increase on areas affected by catastrophic events.]

Table 26.g Ex post carbon stock increase on areas recovering after forest fires and catastrophic events.

Table 27 Ex post total net carbon stock change in the project area.
Non-CO_2 emissions from forest fires are subject to monitoring and accounting, when significant. In this case, under the project scenario it will be necessary to monitor the variables of table 23 within the project area and to report the results in table 24, according to VM0015.

Decreases in carbon stocks and increases in GHG emissions (e.g., in case of forest fires) due to natural disturbances (such as hurricanes, earthquakes, volcanic eruptions, tsunamis, flooding, drought, fires, tornados or winter storms) or man-made events, including those over which the project proponent has no control (such as acts of terrorism or war), are subject to monitoring and must be accounted under the project scenario, when significant. Use tables 25.e, 25.f and 25.g to report carbon stock decreases and, optionally, tables 26.e, 26.f and 26.g to report carbon stock increases that may happen on the disturbed lands after the occurrence of an event. Use tables 23 and 24 to report emissions from forest fires.

If the area (or a sub-set of it) is affected by natural disturbances or man-made events generated VCUs in past verifications, the total net change in carbon stocks and GHG emissions in the area(s) that generated VCUs must be estimated, and an equivalent amount of VCUs must be cancelled from the VCS buffer.

Summarize the results of all ex-post estimations in the project area using the same table format used for the ex-ante assessment:

Table 29: Total ex post estimated actual net changes in carbon stocks and emissions of GHG gases in the project area.

c) Overview of data collection procedures.

The project area is located within a region that is subject to a monitoring program that is approved or sanctioned by the national government (MapBiomas). The data generated by such program is used in this project. MapBiomas data are applicable for use in this project, according to the criteria listed below (Methodology VM0015):
MapBiomas monitoring occurs in the entire project area and leakage belt.
MapBiomas monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period.
MapBiomas monitors conversion of forest land to non-forest land.
Monitoring occurred during the entire fixed baseline period.

d) Quality control and quality assurance procedures.

The validation of land-use data used for modeling of land use will be performed by using the confusion matrix, in order to calculate the overall index of success by period and by class. Three specific classes will be used: forest, accumulated deforestation and other (hydrography, not forest, clouds, roads, residues, unclassified objects, and others).

The validation will be performed by using the land use mapping MapBiomas. The satellite images used will be four scenes of satellite Landsat 8 TM (orbits 001/65, 001/66, 233/65, and 233/66) to the total geographic scope of the Project Area and Reference Region.

With the help of the "Create Random Points" tool in ArcGIS 10.0, 100 random points will be generated for each class / year as samples for evaluation, using satellite images as reference, making it possible to generate a confusion matrix for calculation of the accuracy indexes, and the Kappa index (indicators for validation of mapping accuracy).

Land use classes must have higher values than 90% accuracy for the accuracy and Kappa index, as required in VM00015 1.1 methodology.

e) Data archiving.

All maps and records generated during project implementation will be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has actually been implemented.

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period

f) Organization and responsibilities of the parties involved in all the above.
All satellite imagery assessments will be performed by Carbonext, also responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits.

3.3.3.2 Revisiting the baseline projections for future fixed baseline period

According to VM0015, the baseline will be revisited every 6 years. Thus, the first revision of the baseline is scheduled for 2025. For this purpose, the following tasks will be carried out:

- Updating information on agents, drivers and underlying causes of deforestation, which involves the following sub-tasks:
    - Collecting information that is relevant to understand deforestation agents, drivers and underlying causes;
    - Redoing step 3 of the ex-ante methodology, as specified in the methodology;
    - Recalibrating the model for projection of future deforestation, using new “Factor Maps” for the subsequent fixed baseline period.
- Adjusting the land-use and land-cover change component of the baseline, which involves reassessing the following components of the baseline projections:
    - The annual areas of baseline deforestation.
    - The location of baseline deforestation.
    - Adjustment of the annual areas of baseline deforestation.
    - Adjustment of the location of the projected baseline deforestation.

Adjusting, as needed, the carbon component of the baseline (this task will only be carried out if more accurate methods for carbon stocks estimates are available in the occasion of baseline revision).

3.3.4 Dissemination of Monitoring Plan and Results (CL4.2)

Monitoring plan and results will be publicly available at Verra and Carbonext's website. A summary of the results will be presented for the communities and other stakeholders during the consultations.

3.4 Optional Criterion: Climate Change Adaptation Benefits

3.4.1 Regional Climate Change Scenarios (GL1.1)

Amazonian forests constitute one of the major carbon sinks on Earth (Pan et al., 2011), playing a crucial role in the climate system and regional balance of water and carbon (Marengo et al., 2018; Molina et al., 2019). Deforestation, temperature increase and any factor affecting the forests ecosystem dynamics will have an impact on the atmospheric CO_2 concentration and hence on the global climate.

This section aims to present regional climate change and climate variability scenarios as well as their local impacts, specially identifying potential changes in the local land use scenario in the absence of the project. The analyses are mainly based on the IPCC Sixth Assessment Report (AR6) results [56], [57]. Although the four main IPCC greenhouse emissions scenarios are briefly described below, we chose a more conservative approach to based most of the following discussion, since the changes here presented are already being observed or predicted in all scenarios. However, it is important to notice that the most conservative scenarios are already strongly seen as an underestimation of emissions expected for the next decades and, consequently maybe undiminishing the likely impacts for the next decades.

The Sixth IPCC report provided its results for specific regions of the globe. One of them is the South America Monsoon region, which includes part of the Amazon biome and is where the Project Zone is located. Generally, the following figures provide the observed and modelled mean temperature and changes in the number of consecutive dry days for the region for four different climate change scenarios (1.8ºC, 2.7ºC, 3.6ºC and 4.4ºC increase in mean global temperature by 2100). Overall, it is possible to see a rising trend for both temperature and number of consecutive dry days for all scenarios.

Mean Temperatures in South America Monsoon Region [58]

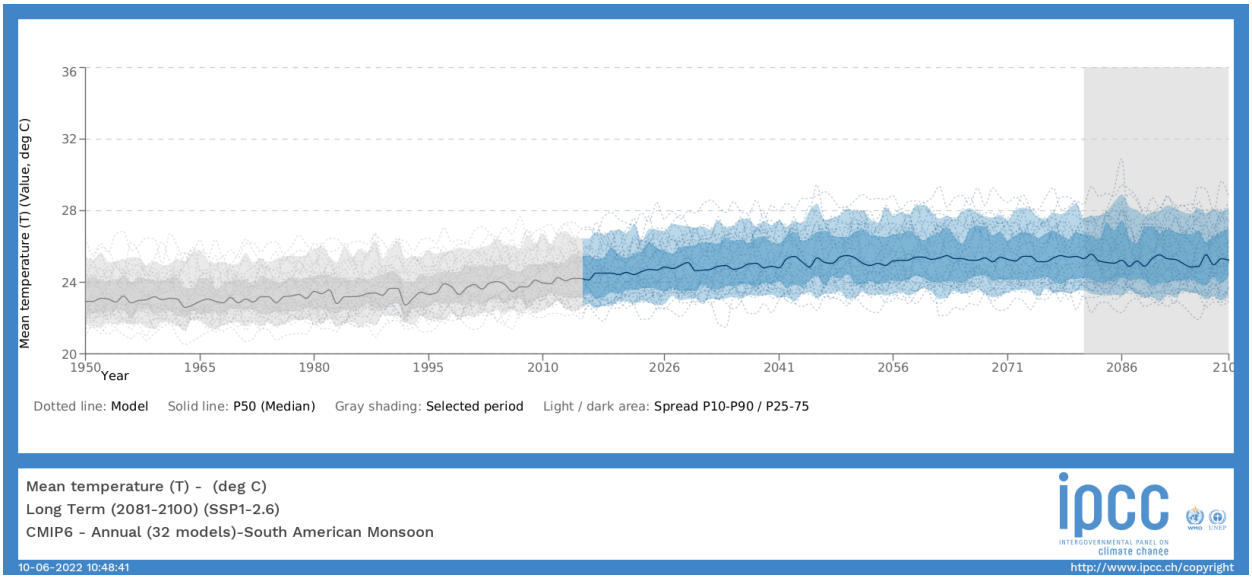


Figure 41: Sustainable Development Scenario – SSP1-2.6: 1.8 ºC by 2100.

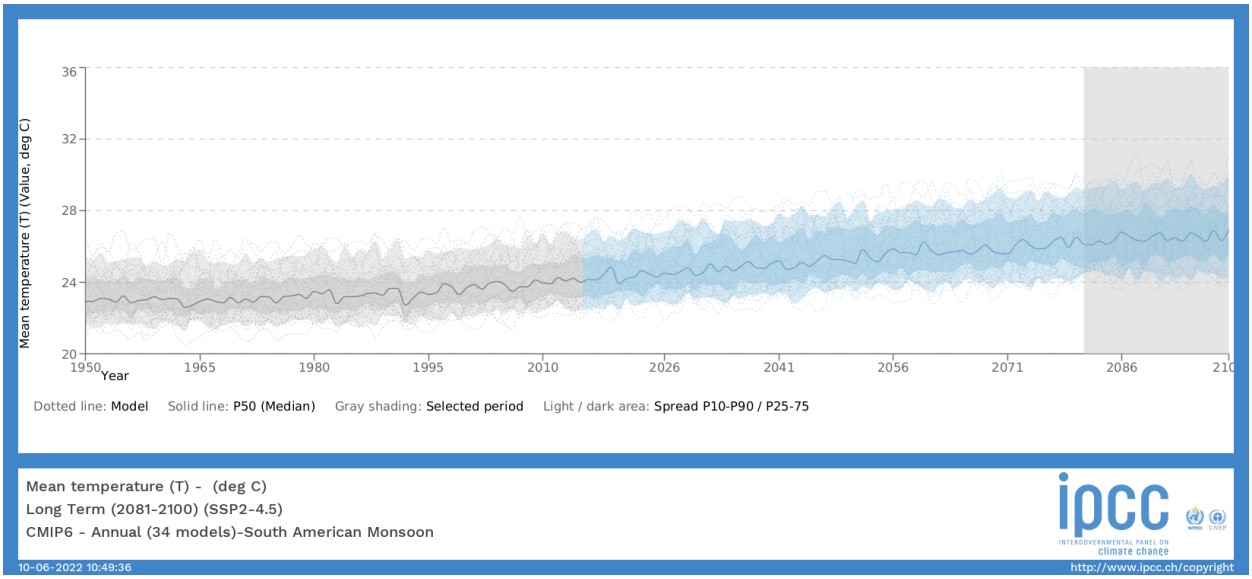


Figure 42: Intermediate Development Scenario SSP2-4.5: 2.7 ºC by 2100.

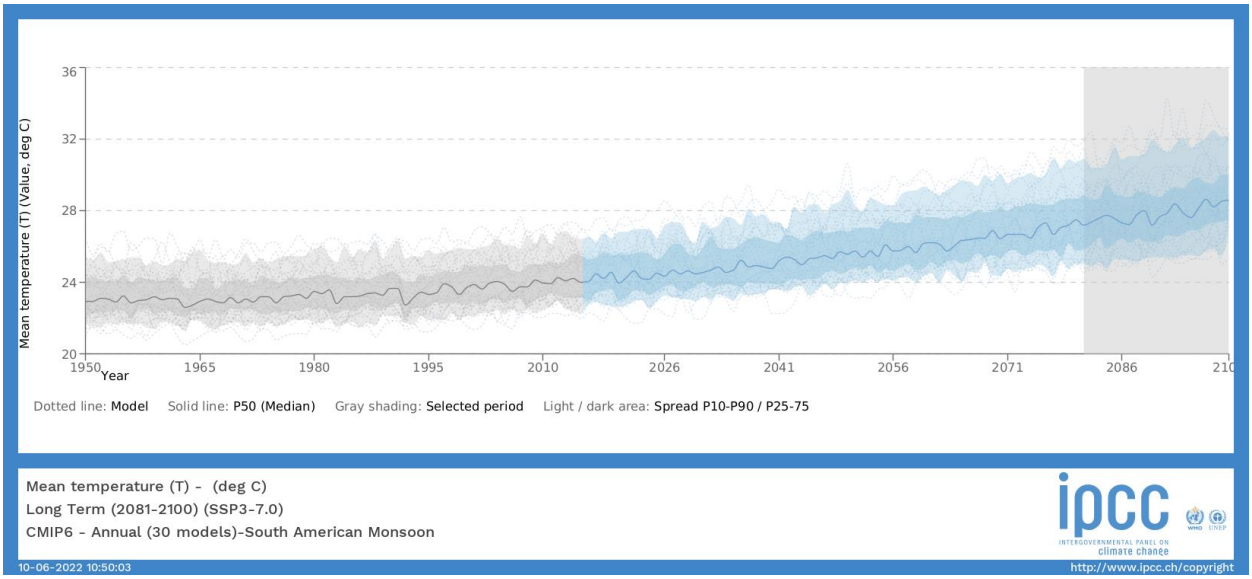


Figure 43: Regional Rivalry Scenario SSP-7.0: 3.6ºC by 2100.

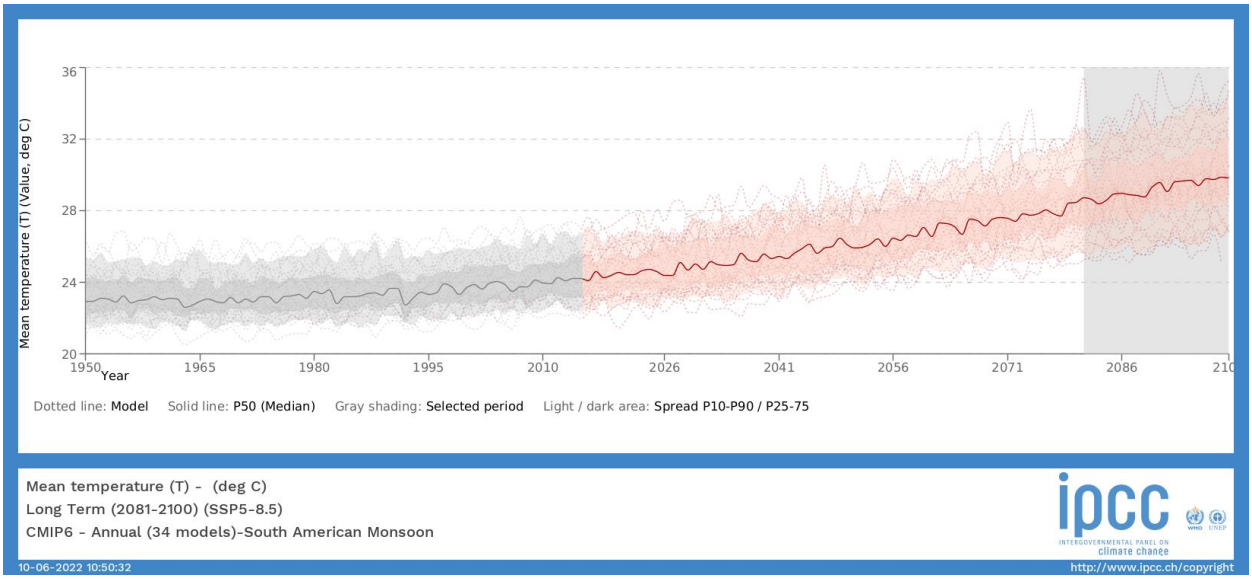


Figure 44: Fossil-fuel Based Development Scenario SSP-8.0: 4.4ºC by 2100.

Changes in the number of consecutive dry days [58]

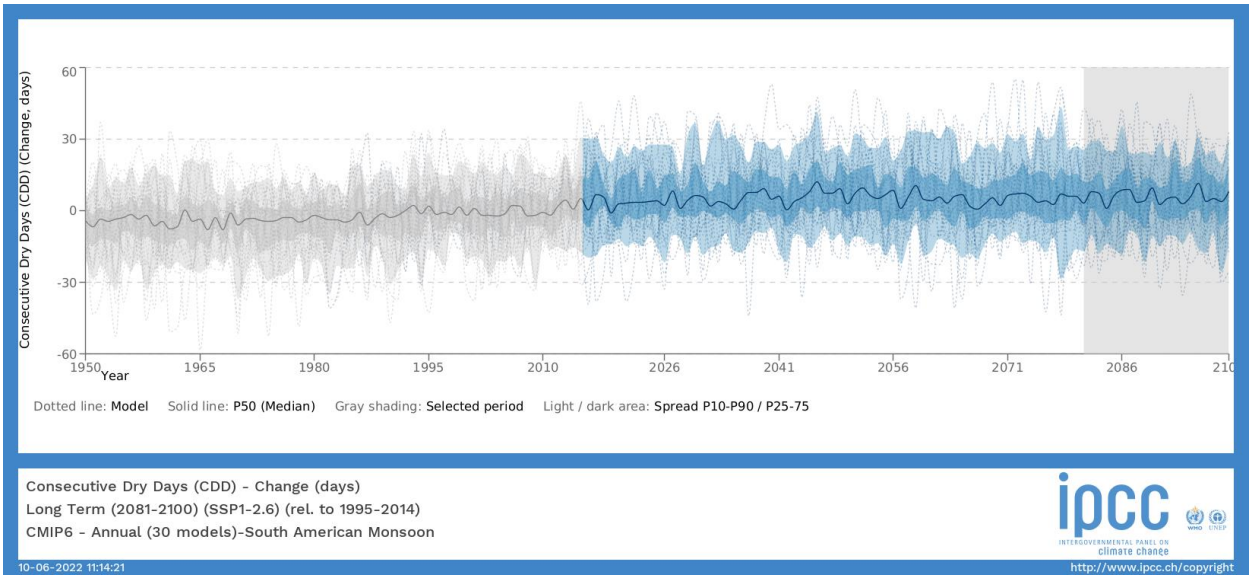


Figure 45: Sustainable Development Scenario – SSP1-2.6: 1.8 ºC by 2100.

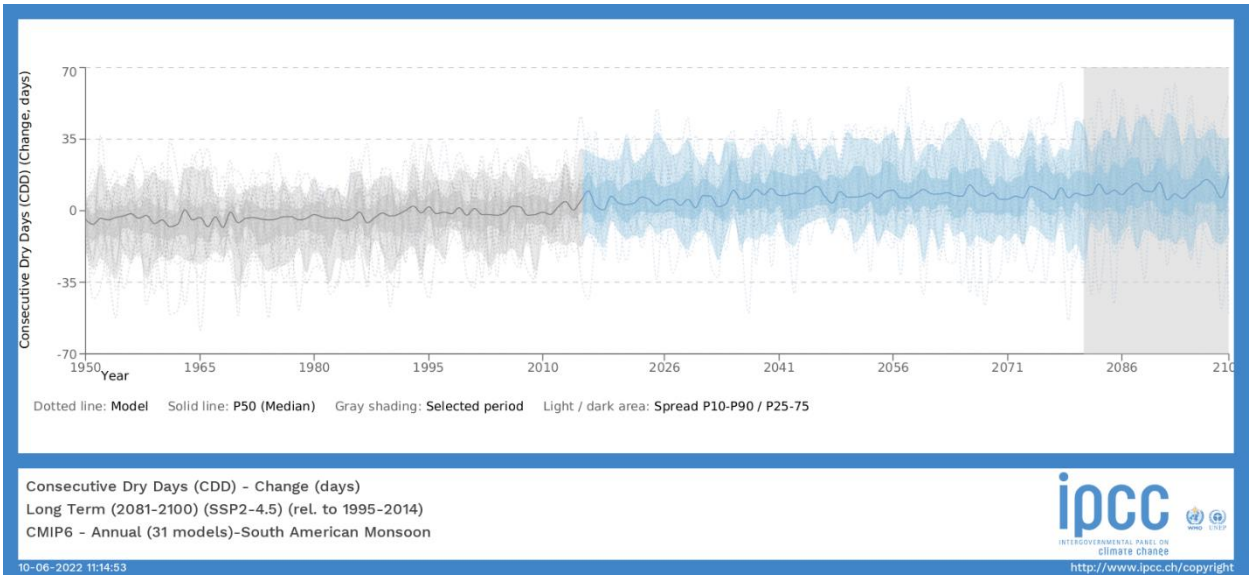


Figure 46: Intermediate Development Scenario SSP2-4.5: 2.7 ºC by 2100.

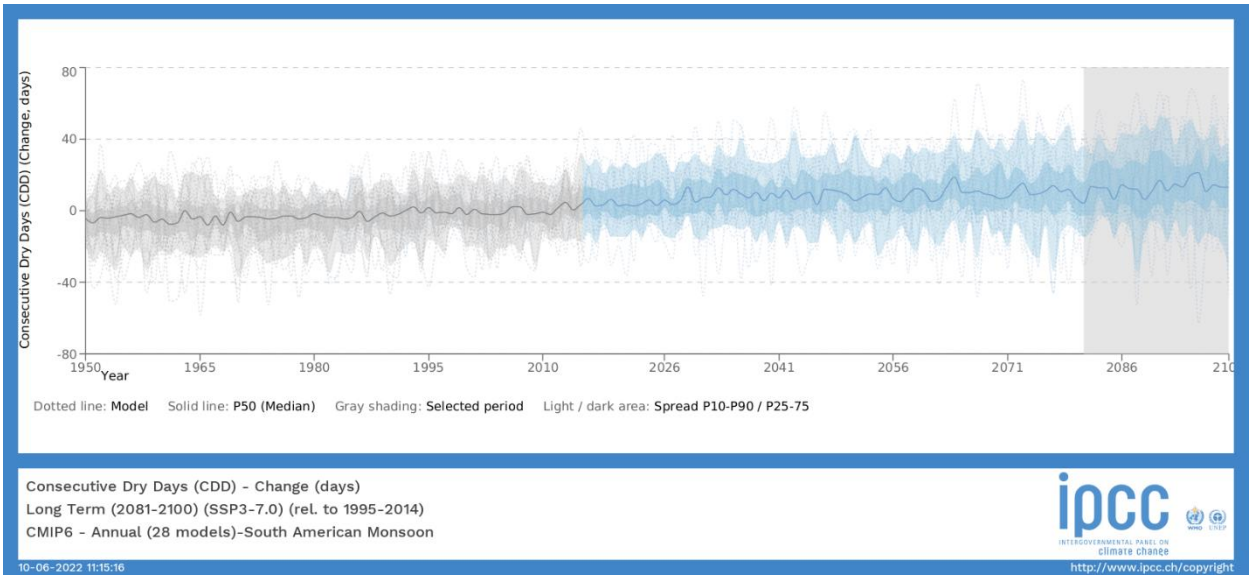


Figure 47: Regional Rivalry Scenario SSP-7.0: 3.6ºC by 2100.

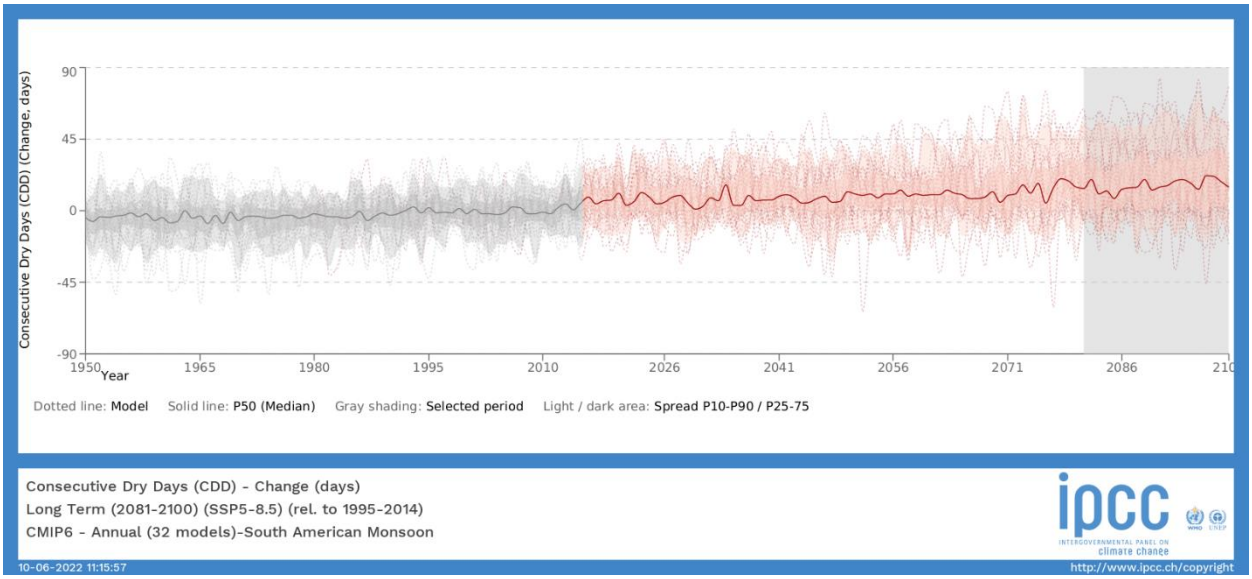


Figure 48: Fossil-fuel Based Development Scenario SSP-8.0: 4.4ºC by 2100.

3.4.2 Climate Change Impacts (GL1.2)

The 2021 Sixth IPCC chapter II on “Climate Change 2022: Impacts, Adaptation and Vulnerability” (AR6-II) provides detailed analyses and revision of recent research on the environmental and social impacts of climate change are deeply connected, especially considering the local people reality. Overall, South America is considered a region highly exposed, vulnerable, and deeply impacted by climate change. AR6-

II pointed out that communities living under widespread poverty, weak water governance, unequal access to safe water and sanitation services and lack of infrastructure and financing have a diminished adaptation capacity creating new population vulnerabilities.

These impact of climate changes on water availability and food security are two aspects analyzed in the last IPCC report. In short, these changes could compromise freshwater availability and its ecosystems service as well as food production. AR6-II strongly reinforced evidence showing the synergy among fire, land use change, particularly deforestation, and climate change, directly impacting human health, ecosystem functioning, forest structure, food security and the livelihoods of resource-dependent communities over the Amazon. The report also demonstrated, with high confidence, that one of climate change affects expected in the region is the epidemiology of climate-sensitive infectious diseases, negatively affecting the local communities.

The unprecedented extreme events of floods (2009, 2012 and 2014) and drought (2010 and 2015) in the Amazon basin led to increased societies vulnerability. The disruption of the region natural hydrology dynamics, because of extreme events increases the sensitivity of the food and transport systems of rural resource-dependent communities. The local people migration to cities have increased due to urbanization, development of extractive activities, agroindustry and infrastructure. Upon migrating, they are forced to abandon their traditional livelihoods in order to acquire temporary jobs and to live in poverty and exclusion. That is one of the important reasons why it is essential to ensure better living conditions for small rural communities and small urban cities, to ensure they have better well-being where they traditionally are and avoid the migration problems aggravated by climate change.

AR6-II already pointed out that there is an important relationship between the outbreak of vector-driven diseases, such as malaria, dengue and leishmaniasis, and changes in climatic events (e.g., droughts, floods, ENSO) or environmental events (e.g., deforestation, habitat fragmentation). Forest fires are a major concern to public health in the region as they relate to an increase in hospital admissions due to respiratory problems, mainly among children and the elderly. The amount of air pollutants detected is sometimes higher than that observed in large urban areas, especially during dry seasons when biomass burning increases.
The main climate change impacts happening or likely to happen in the Project Zone and surrounding areas on community well-being and biodiversity are the following:

Community well-being

Community well-being might be reduced due to loss of human lives and greater injuries, morbidity and diseases due to higher temperatures, extreme weather events, and greater occurrence of floods, droughts, disease pathogens and vector insect reproduction change;

Loss of productive assets of crops and livestock due to greater floods damages, droughts, rain and temperature pattern change;

Income Reduce and livelihoods earning opportunities;

Loss of infrastructure and access to various services;

Increased cost of living due to greater cost involved in access to various services and inflation;

Displacements and migration necessitated by floods, droughts, etc.

Biodiversity conservation status

Loss and fragmentation of tropical forest habitats, including loss of food and shelter sources, due to fire weather events increase, loss of vegetation, changes on precipitation pattern, greater temperatures on the surface of land, etc;

Loss of species and genetic diversity, particularly of endemic, rare and sensitive species which are not adapted to the new climatic situation and its greater variability;

Increased chances of poaching due to wildlife getting exposed and people capturing wildlife to meet their income and livelihoods needs;

Greater prevalence of diseases and pathogens and onslaught of invasive and exotic species.

Preserving the Amazon tropical forest is creating a chain of positive impacts that goes from a small scale, like local community well-being to global climate. In the next section we will explore a bit more on the measures needed to improve local adaptation under this scenario and how, in a local scale, the forest preservation has a significant impact.

3.4.3 Measures Needed and Designed for Adaptation (GL1.3)

Given the wide-ranging and anticipated negative consequences of climatic change for the social, economic, and ecological systems in the Project Zone and its particularly adverse impacts on the poor and most vulnerable segments of the society, immediate and targeted actions are needed to deal with and adapt to the repercussions of climate change. In particular, the project has designed and will implement a climate adaptation fund, where 1% of the VCUs revenue will be destinated, contributing to the financial resilience

and capacity of the municipalities of Itaúba and Marcelândia to respond in the event of climate related crisis or disaster.

4 COMMUNITY

4.1 WITHOUT-PROJECT COMMUNITY SCENARIO

4.1.1 Descriptions of Communities at Project Start (CM1.1)

The Project Area and the Reference Region, similarly to the broader scenario of the municipalities of Marcelândia and Itaúba, are characterized by having high concentration levels of agricultural land property rights. In both the municipalities the greatest part of the territory is covered by agricultural and livestock economic activities (58% of Marcelândia and 70% of Itaúba). Furthermore, most of these rural areas are covered by *latifundios* (large rural properties). The referred historical process of occupation of these territories, since its colonization, discouraged the permanence of the local and traditional communities that used to live there in the past, thereby shrinking the presence of settlers and small holders, local indigenous and/or traditional communities that could still live in the immediate surroundings of the Project Area nowadays.

Since traditional communities and community groups are not present in the immediate surrounding of the Project Area, the community-centered efforts of the project will be focused on the schools of the municipalities of Marcelândia and Itaúba:

- Pedro Bianchini State School

Pedro Bianchini State School has 20 employees and 150 active enrollments, 71 students in the final years, 79 in high school, and 16 students in special education. Its infrastructure has friendly accessibility with food supply and treated water, sewage, besides a sports court, special assistance room, computer and science labs[59].

According to the 2019 census, the school shows orange coloring referring to the 3rd goal of the National Education Plan, which states that less than 50% of students have adequate learning. The learning percentage of 9th year junior high students for Portuguese was 45%, while for mathematics it was 25%. For 3rd year high school students, the value is 40% for Portuguese and 10% for math. This is well below the stipulated minimum of 70% [59].

In the questionnaire applied by the National System for the Evaluation of Basic Education [59] for 9th year junior high students, 56% of students identify with the color/race pardo/mixed, 28% white, 6% for black or

yellow, and 6% did not want to answer the survey. The students' maternal education is concentrated in complete high school with 33% and only 17% present complete higher education. According to the survey, only 33% of the parents usually talk about what is going on in school, and 5% of the students usually read books that are not related to the subjects.

The diagnosis of the 3rd year high school students shows that 44% identify themselves as pardo/mixed, 33% as black, 11% as white, and 11% did not want to declare themselves. The education of the students' mothers is concentrated in complete high school education, representing 44% of the women, where only 11% have complete higher education. According to the reported, 11% of parents usually talk about what is happening at school and 33% of students usually read books that are not of the school subjects [59].

- Paulo Freire State School

Paulo Freire State School has 16 employees with 762 active enrollments where 225 students are in the final years, 408 in high school and 22 students in special education. Its infrastructure has friendly accessibility with food supply and treated water, sewage, besides a sports court and a special assistance room [60].

According to the 2019 census, the school shows mostly red coloring referring to the 3rd goal of the National Education Plan, which states that less than 25% of students have adequate learning. The learning percentage of 9th junior high students for Portuguese was 25%, while math was 11%. For 3rd year high school students, the figure is 33% for Portuguese and 3% for math. This is much lower than the Escola Estadual Pedro Bianchini, which is in the same area [60].

Through the questionnaire applied by the National System for Evaluation of Basic Education [60] for 9th year junior high students, 53% of the students identify themselves as pardo/mixed, 27% white, 15% black, and 5% yellow. The maternal education of the students is concentrated in complete high school representing 28% of the sample, where 7% of the mothers present complete higher education. Only 35% of the parents usually talk about what is happening at school and 13% of the students usually read books that are not related to the subjects.

The diagnosis of the 3rd year high school students shows that 55% identify themselves with the color pardo/mixed, 25% white, 12% black, 2% for indigenous or yellow, with an undeclared percentage of 4%. The schooling of the mothers of the students is expressive in the range of completed high school with 32%, while only 11% finished college. In the analysis it was observed that 28% of parents usually talk about what is happening at school and 10% of students usually read books that are not of the school subjects [60].

- Papa João Paulo II State School

Papa João Paulo II State School has 21 employees with 524 active, enrollments of which 301 students in the final years, 223 in high school, 134 students in the EJA system (Education for Youth and Adults) and

22 students in special education. Its infrastructure has friendly accessibility with food and treated water supply, in addition to a sports court, special care room, computer and science labs [61].

According to the 2019 census, the school is in the orange to red range referring to the 3rd goal of the National Education Plan, which states that around 25% of students have learning between adequate and inadequate. The percentage of learning Portuguese in the 9th year junior high was 26%, while mathematics was 12%. As for the 3rd year high school students, the value was similar to the 9th year junior high students, with 26% for Portuguese. On the other hand, the percentage for mathematics was higher than 9th junior high students with 17%. These values are within the corresponding range of the municipality and below the value tabulated by the National Education Plan [61].

Through the questionnaire applied by the National System for the Evaluation of Basic Education [61] for 9th year junior high students, 49% of students identify themselves with the color pardo/mixed, 24% white, 16% black, 3% yellow, and 7% chose not to declare themselves. The mother's education is concentrated in complete higher education with 29% representation. Only 35% of the parents usually talk about what is happening at school and 13% of the students usually read books that are not related to their subjects.

The diagnosis of the 3rd year high school students shows that 46% identify themselves as pardo/mixed, 32% white, 13% black, 7% indigenous, and 3% chose not to declare themselves. The schooling of the students' mothers is more expressive in the complete high school range, with 29% of representativity. Only 50% of parents usually talk about what is happening at school and 21% of students usually read books that are not of the subjects [61].

4.1.2 Interactions between Communities and Community Groups (CM1.1)

The state schools Pedro Bianchini and Paulo Freire belonging to the municipality of Marcelândia, present a good interaction, where because of their proximity, they already carry out recreational activities among their students. The schools present a good relationship, having social relations among themselves. The state school Papa João Paulo II, for being the only state school in the municipality of Itaúba, presents a good social relationship with the community, with no evidence of conflicts.

4.1.3 High Conservation Values (CM1.2)

The High Conservation Values (HCVs) identified and related to community in this project were HCV 2 – Landscape-level Ecosystems, Ecosystem Mosaics and IFLs and HCV 4 – Ecosystem Services.

High Conservation Value	HCV 2 – Landscape-level Ecosystems, Ecosystem Mosaics and IFL
Qualifying Attribute	Enable the availability as well as the range and distribution of abundance patterns for the local flora and fauna
Focal Area	It is necessary to conserve and protect in totality the current vegetation in the Project Area (15,352.90 ha), maintaining populations of naturally occurring species in natural patterns of distribution and abundance.

High Conservation Value	HCV 4 – Ecosystem Services
Qualifying Attribute	Provide support and regulation of the climate, control diseases, maintain nutrient cycling and soil conservation aiming at the vulnerability of the economic activity of the region (agriculture and cattle raising).
Focal Area	It is necessary to conserve and protect in totality the current vegetation in the Project Area (15,352.90 ha), maintaining preserving the provisioning services linked to water and its regulation, such as prevention of soil degradation and nutrient cycling.

4.1.4 Without-Project Scenario: Community (CM1.3)

The territory's current scenario presents few economic alternatives, where the main activities are linked to agribusiness. Therefore, this factor can be considered the main cause that leads to deforestation risk in the Itaúba REDD+ Project areas.

Within the communities, the following vectors are highlighted:

Financial dependence: Due to the strong performance of agribusiness in the region, the surrounding communities have a low diversification of opportunities and access to other labor markets.

Environmental vulnerability: The uncertainties arising from climate change make local agribusiness susceptible to problems with water supply, soil conservation, and productive areas. This could jeopardize the region's entire income.

Low educational level: About 60% of the population of the cities involved in the project have a relatively low level of education, where they have not completed elementary school. Dependent on activities linked to land use and its management.

Activities developed: Despite having machinery to carry out agricultural and livestock activities, there is still a lack in knowledge about good productive practices linked to agroecology in the region.

Another important measure for the success of these actions is the empowerment of the community, based on the access to information about relevant environmental guidelines for the region, aiming at the participation of future generations in decision making and contributing to the management of risks associated with rural activities and the improvement of socioeconomic aspects by the community members themselves.

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CM2.1)

Community Group	Overall community
Impact(s)	Provide tools for the resolution of socio-environmental conflicts and promote the protection of natural resources
Type of Benefit/Cost/Risk	• Direct benefits for community members through training in earth sciences, as well as viewing new job opportunities that are in increasing demand in the region. In addition, teachers and students in the schools would benefit from learning how to deal with sustainable development and introduce sustainability practices in their daily lives. • With the growth and deepening of these themes nowadays, several undergraduate and graduate courses have been created in this area of knowledge. It is a transversal theme and necessary for the execution of projects in the public and private spheres.
Change in Well-being	The activities will impact and increase well-being as follows: • The permanence of the activities will ensure the ecosystem services, with direct impact and increased food safety and access to higher quality water. • The development of the activities will enable the perception of the benefits of conservation of natural resources and their importance for agricultural activities and human well-being

4.2.2 Negative Community Impact Mitigation (CM2.2)

The project activities are not expected to cause any negative impacts in the communities, only positive impacts. Thus, there is no need for mitigation.

4.2.3 Net Positive Community Well-Being (CM2.3, GL1.4)

The project activities are designed to bring only positive impacts, such as increased community awareness about conservation and care of natural resources, as well as training in environmental education with the goal of improving the quality and quantity of ecosystem services that are the basis of community well-being. In addition to clarifying the fragilities linked to agribusiness and climate change.

4.2.4 High Conservation Values Protected (CM2.4)

The HCVs related to the well-being of the community will not be negatively affected by the project activities, rather the opposite. The objective of the project activities is to protect the local ecosystem and to highlight its importance to the people living around it. If any negative impact happens, it will be identified and through the grievance mechanism, a mitigation plan to reduce and stop such an impact will be developed.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (CM3.1)

The project is designed to generate only positive impacts for stakeholders living within and outside the project area. The activities developed will only raise awareness for the stakeholders in the environmental conservation area and will promote a diversification of potential activities in the project region.

4.3.2 Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

As mentioned in the previous item, there are not expected negative impacts, thus, no mitigation strategies are needed.

4.3.3 Net Impacts on Other Stakeholders (CM3.3)

As described in section 4.3.1 Impacts on other stakeholders, negative impacts on the well-being of local stakeholder groups are unlikely, since the activities to be carried out in relation to the communities are mainly based on promoting the improvement of living conditions, promoting inclusion in issues related to climate change and its impact on the main activity in the region. The proposal is to show the sensitivity of the environmental issue and its various aspects.

4.4 Community Impact Monitoring

4.4.1 Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

The following table (Table 55) shows a non-comprehensive list of activities and indicators that will be considered during monitoring. A complete and detailed list will be presented in the monitoring plan that will be developed and presented within the first six months after validation.

Monitoring frequency: Training and awareness campaign - continuous effort.

Frequency of reporting: Training and awareness campaigns will be reported at least once for each verification period.
Methods: Training and awareness campaigns, consisting of a prepared session to build community capacity on a project-related topic or to raise awareness on REDD+ related topics.

Table 55: Some activities and indicators of the social monitoring.

Activity	Product Indicator
1. Training related to monitoring and good agricultural and forestry management practices 2. Opportunities to work as a control/supervisory team	• Provide training so that the community within the project area can develop skills in forest fire prevention and combat • Provide knowledge in sustainable agriculture practices and soil management • Enable by means of the trainings a leadership or management position
3. Training for the development of first aid techniques and work safety in remote areas	• Avoid unwise exposure to risk • Emphasize the importance of personal protective equipment • Make it possible to avoid the aggravation of accidents
4. Training related to regenerative farming practices	• Understand different agricultural techniques that aim to rehabilitate and conserve agricultural and food systems.
5. Environmental Education Activities	• Activities that aim to bring knowledge about climate change and its impacts on environment as well as on the agrobusiness
6. Emergency Climate Adaptation Fund	• An emergency fund will be set up to provide support for eventualities and

	unforeseen events by providing basic supplies

4.4.2 Monitoring Plan Dissemination (CM4.3)

All results will be publicly available on the Internet and summaries will be communicated to Communities and Other Stakeholders through appropriate media. In addition, all documents and information on the monitoring and verification results of this project will be published on the VCS and CCB standards platforms as usual.
The process will be agreed with the communities on workshops with the newsletter reporting the progress of the project. The monitoring plan and the result of the monitoring will be disseminated through the school board.

4.5 Optional Criterion: Exceptional Community Benefits

Does not apply. This project is not intended to be validated for the Gold Level of this section.

4.5.1 Exceptional Community Criteria (GL2.1)

Not applicable.

4.5.2 Short-term and Long-term Community Benefits (GL2.2)

Not applicable.

4.5.3 Community Participation Risks (GL2.3)

Not applicable.

4.5.4 Marginalized and/or Vulnerable Community Groups (GL2.4)

Not applicable.

4.5.5 Net Impacts on Women (GL2.5)

Not applicable.

4.5.6 Benefit Sharing Mechanisms (GL2.6)

Not applicable.

4.5.7 Benefits, Costs, and Risks Communication (GL2.7)

Not applicable.

4.5.8 Governance and Implementation Structures (GL2.8)

Not applicable.

4.5.9 Smallholders/Community Members Capacity Development (GL2.9)

Not applicable.

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (B1.1)

As described in section 2.1.5.6, the project area is under the influence of the Amazon Forest biome, the largest biome in Brazil. The biodiversity associated with it is extremely high, associated with a wide diversity of existing vegetation [9]. It is estimated that the biome is home to at least 10% of all known biodiversity in the world, however, it also contains numerous endemic and endangered species of fauna and flora [62].
For the project's biodiversity analysis, secondary data from scientific studies and publications in the region was used, as well official data from federal government platforms (Ministry of the Environment and Chico Mendes Conservation of biodiversity Institute) and reports from the Land Fauna Monitoring and Conservation Programs and the Flora Rescue Program of the Colíder Hydroelectric Power Plant. Database platforms for occurrence, sightings and vulnerability status were also used, such as Wikiaves [63], The

IUCN Red List of Threatened Species [64], the Red book of the Brazilian fauna threatened with extinction [65] and the CNCFlora's 2014 Red List of Threatened Brazilian Flora [66].

No fauna survey has been conducted ex ante to the project. Biodiversity survey and monitoring fields to be conducted by Carbonext are planned for the Monitoring Report verification phase.

5.1.1.1 Amazon Biodiversity

The Amazon Biome is 6.7 million km^2 in area and covers 8 countries: Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana and Suriname, also including the overseas territory of French Guyana. This biome is defined by its predominantly dense tropical rainforest vegetation cover, but with the presence of several other types of vegetation such as savannas, floodplain forests, grasslands, swamps, bamboo and palm forests [62].

Within this immense territory lies the largest hydrographic basin in the world: the Amazon basin. It covers about 6 million km^2, with 1,100 tributaries. Its main river, the Amazon, crosses the continent flowing into the Atlantic Ocean, discharging into the sea about 175 million liters of water per second [67].

In Brazil, the Amazon biome extends over more than 40% of the national territory, with an immense cultural and biodiversity wealth. It is commonly agreed in the scientific community that the species of fauna and flora have not yet been fully documented and several new species are frequently described [68] [62]. According to the MMA there are more than 2,500 species of trees in the Amazon (which corresponds to one-third of all tropical wood in the world) and more than 30,000 species of plants[62].

The main factor of pressure to continental species is a result of anthropic activities such as farming in Amazonian lands, along with large enterprises such as hydroelectric dams. Each of these activities threatens approximately 94 different species [65].

Hunting, fishing, and capture affect 52 important species, ranking third in threats to the fauna of the Amazon. Although hunting and fishing provide food for consumption by local communities, they are also practiced in a sportive way and in retaliation for the predation of livestock, such as the persecution suffered by the big cats that sporadically feed on cattle ranches [65].

The capture of live individuals is practiced to assess and maintain the traffic in wild animals. There are many other legal and, especially, illegal practices that threaten the biodiversity of the Amazon biome, such as logging, road and residential construction, mining, housing development, and increased urbanization .

5.1.1.2 Biodiversity from the region of the project

To evaluate the biodiversity of the project region, data from specific works close to the region were used, such as reports from the Flora Rescue Program [69] and the Fauna Monitoring Program of UHE Colíder [70]. For the specific Avifauna of the municipalities of Itaúba and Marcelândia we also used the WikiAves data platform [63].

In addition to the secondary data survey, the threat and vulnerability status was checked for the fauna and flora species found on The IUCN Red List of Threatened Species [64], in the Red Book of the Brazilian Fauna Threatened with Extinction [65] by the Chico Mendes Institute for Biodiversity Conservation, and in the CNCFlora's 2014 Red List of Threatened Brazilian Flora [66].

Legend for the vulnerability status

CR= Critically Endangered
EN= Endangered
VU= Vulnerable
NT= Near Threatened

Increased threat level

Based on the biodiversity survey carried out with secondary data obtained from the above-mentioned works, 1859 species of flora and vertebrate fauna can be found (Table 56).

Table 56: Fauna and Flora's in the project area based in the desktop research. Source: [64][63] [66] [66] [70], [71].

Vertebrate Group	Number of species
Birdlife	690
Mammals	137
Herpetofauna	148
Ichthyofauna	97
Flora	787
Total	***1859***

Birdlife

To evaluate the birdlife, data from the Fauna Monitoring Program of UHE Colíder[18] [71] and bird sighting data [63] for the municipalities of Marcelândia and Itaúba were used. The fauna survey from the Inventory of Fazendas Casa Blanca and Fazenda Ponderosa, both in Marcelândia, were also used. A total of 690 species are expected in the project region, of which 52 are threatened and/or endangered (Table 57).

Table 57: Birdlife species under some degree of threat in the IUCN lists and in the Red Book of the Brazilian Fauna Threatened with Extinction. Source: [36][65]

TÁXON	SPECIES	IUCN	RED BOOK ICMBIO
RHEIFORMES			
RHEIDAE			
	Rhea americana	NT	
TINAMIFORMES			
TINAMIDAE			
	Tinamus tao	VU	VU
	Tinamus guttatus	NT	
	Crypturellus strigulosus		NT
	Taoniscus nanus	EN	EN
GALLIFORMES			
CRACIDAE			
	Penelope superciliaris	NT	
	Aburria cujubi	VU	NT
	Crax fasciolata	VU	
PELECANIFORMES			
ARDEIDAE			
	Agamia agami	VU	
	Zebrilus undulatus	NT	
CATHARTIFORMES			
CATHARTIDAE			
	Sarcoramphus papa		NT
ACCIPITRIFORMES			
ACCIPITRIDAE			
	Accipiter poliogaster	NT	
	Morphnus guianensis	NT	VU

[18] This reference was used since no secondary survey was identified for the municipalities of Itaúba and Marcelândia

	Harpia harpyja	VU	VU
	Spizaetus ornatus	NT	NT
GRUIFORMES			
PSOPHIIDAE			
	Psophia dextralis	EN	VU
RALLIDAE			
	Micropygia schomburgkii		NT
CUCULIFORMES			
NEOMORPHINAE			
	Neomorphus squamiger	VU	VU
STRIGIDAE			
	Strix virgata	NT	
APODIFORMES			
PHAETHORNITHINAE			
	Phaethornis aethopygus	VU	VU
TROCHILINAE			
	Lophornis chalybeus	NT	
GALBULIFORMES			
BUCCONIDAE			
	Nystalus torridus		NT
PICIFORMES			
CAPITONIDAE			
	Capito dayi	VU	VU
RAMPHASTIDAE			
	Ramphastos tucanus	VU	
	Ramphastos vitellinus	VU	
	Pteroglossus bitorquatus	EN	NT
PICIDAE			
	Celeus torquatus	NT	
FALCONIFORMES			
FALCONIDAE			
	Ibycter americanus		NT
	Micrastur mintoni		NT
	Falco deiroleucus	NT	
PSITTACIFORMES			

PSITTACIDAE			
	Anodorhynchus hyacinthinus	VU	NT
	Ara chloropterus	NT	
	Primolius maracana	NT	NT
	Pyrrhura snethlageae	VU	
	Touit huetii	VU	
	Pionites leucogaster	EN	
	Pyrilia vulturina	VU	VU
	Pyrilia aurantiocephala	NT	
	Alipiopsitta xanthops	NT	NT
	Amazona kawalli	NT	
	Amazona farinosa	NT	
	Amazona aestiva	NT	NT
PASSERIFORMES			
THAMNOPHILINAE			
	Hypocnemis ochrogyna	VU	VU
	Rhegmatorhina gymnops	VU	VU
SCLERURIDAE			
	Sclerurus albigularis	NT	
DENDROCOLAPTIDAE			
DENDROCOLAPTINAE			
	Campylorhamphus cardosoi		VU
	Dendrocolaptes ridgwayi		NT
FURNARIIDAE			
	Syndactyla ucayalae	NT	
SYNALLAXINAE			
	Synallaxis cherriei	NT	
	Synallaxis cabanisi	NT	
FLUVICOLINAE			
	Contopus cooperi	NT	NT
TROGLODYTIDAE			
	Odontorchilus cinereus	NT	

All species mentioned in the lists of threatened species both globally and nationally should always be a point of attention and priority in preservation projects. For the avifauna in the region of this project, the

species *Tinamos tao*, *Neomorphus squamiger*, *Phaethornis aethopygus*, *Harpia harpyja*, *Capito dayi*, *Pyrilia vulturina*, *Hypocnemis ochrogyna*, and *Rhegmatorhina gymnops* should be highlighted for their VU status in both the IUCN [64] and the Red Book of Endangered Brazilian Fauna [65]. The species *Taoniscus nanus*, *Psophia dextralis*, *Pteroglossus bitoruqatus*, and *Pionites leucogaster* should receive redoubled attention for their critical threat status (Table 57)

Mammals

The secondary data survey of mammals present in the region was based on data from the Fauna Monitoring Program of UHE Colíder[19][71]. The fauna survey from the Inventory of Fazendas Casa Blanca and Fazenda Ponderosa, both in Marcelândia, were also used. Considering this project, 137 mammal species were found in the region. Of these, 20 species are classified with some degree of threat (Table 58).

Table 58: Mammals species under some level of threat in Colíder. Source: [36][65]

TAXON	SPECIES	IUCN	RED BOOK ICMBIO
CINGULATA			
DASYPODIDAE			
	Priodontes maximus	VU	VU
PILOSA			
CYCLOPEDIDAE			
	Myrmecophaga tridactyla	VU	VU
PIMATES			
ATELIDAE			
	Ateles marginatus	EN	EN
	Ateles chamek	EN	VU
	Alouatta discolor	VU	VU
	Alouatta caraya	NT	NT
CEBIDAE			
	Chiropotes albinasus	VU	NT
PHYLLOSTOMIDAE			
	Lonchophylla mordax	NT	
CARNIVORA			
CANIDAE			
	Chrysocyon brachyurus	NT	VU
	Atelocynus microtis	NT	VU
	Speothos venaticus	NT	VU
FELIDAE			

[19] This reference was used since no secondary survey was identified for the municipalities of Itaúba and Marcelândia.

	Leopardus tigrinus	VU	EN
	Puma yagouaroundi		VU
	Puma concolor		VU
	Panthera onca	NT	VU
MUSTELIDAE			
	Lontra longicaudis	NT	NT
	Pteronura brasiliensis	EN	VU
ARTIODACTYLA			
CERVIDAE			
	Ozotoceros bezoarticus	NT	VU
TAYASSUIDAE			
	Tayassu pecari	VU	VU
PERISSODACTYLA			
TAPIRIDAE			
	Tapirus terrestris	VU	VU

Mammals are fundamental to the maintenance of ecosystems and, consequently, to the generation of associated ecosystem services. Small mammals, for example, play an important role at the base of the food chains of many other creatures. Together with tapirs, they are essential in seed dispersal. Carnivores play a fundamental role in the conservation of biodiversity and natural ecosystems. They regulate and structure the communities through predation and are therefore considered key species. Carnivores also function as "umbrella species", since efforts to conserve their populations end up also preserving other species in the community and are therefore essential targets for conservation projects [65].

Except for the bat species (*Lonchophylla mordax*), all other mammal species threatened in the project region are medium to large size. These are animals that need a balanced environment, allowing their adequate feeding, reproduction, safety, and survival in general, capable of maintaining the homeostasis of the ecosystem. Special attention should be given to *Priodontes maximus*, *Myrmecophaga tridactyla*, *Alouatta discolor*, *Tayassu pecari* and *Tapirus terrestres* for their VU status in both the IUCN and the Red Book of Endangered Brazilian Fauna. The species *Ateles marginatus*, *Ateles chamek*, *Leopardus tigrinus* and *Pteronura brasiliensis* appear on at least one of the query lists with critical status (EN / CR), being important target priorities for conservation projects [65].

Herpetofauna

To evaluate the herpetofauna, data from the Fauna Monitoring Program of UHE Colíder [71] were used. The following were considered in this survey: amphibians, snakes, chelonians, amphisbaenians, lizards and alligators. The survey found 145 species, among them *Podocnemis unifilis* (Figure 49, left), which is considered VU by the IUCN and NT by the Red Book; as well as frog *Allobates brunneus* (Figure 49, right), which has critical status (CR) in the Red Book [65].

Figure 49: On the left, the species Podocnemis unifilis (Source: https://www.icmbio.gov.br/portal/faunabrasileira/estado-de-conservacao/7426-repteis-podocnemis-unifilis-tracaja) and on the right the species Allobates brunneus (Source: https://ppbio.inpa.gov.br/sapoteca/allobates_brunneus).

Because they are animals sensitive to major changes in the environment, both in abiotic and biotic factors, many species belonging to class Amphibians are considered biological indicators of the quality of the ecosystem in which they are inserted. The presence of amphibian species such as *Allobates brunneus* (Figure 49) could be a sign of ecosystem balance, but its status as a "critically endangered" species indicates disturbance to its natural environment [65].

Ichthyofauna

The analysis of the Ichthyofauna composition in the project region was performed based on the 20th Ichthyofauna Monitoring Report on the Teles Pires River [70][20] conducted in the area of influence of the Colíder Hydroelectric Power Plant (in the state of Mato Grosso).

[20] This reference was used since no secondary survey was identified for the municipalities of Itaúba and Marcelândia.

A total of 97 inland water fish species were found. None of the species surveyed appear on the red lists of fauna in threatened. It is worth noting that there are few studies on ichthyofauna in the region and their absence from the lists of threatened species does not necessarily mean that they are not threatened in the environment but may mean insufficient data and lack of scientific studies in the area. Highlight for the species *Aequidens epae*, considered endemic to the Lower Tapajós River region (Figure 50).

Figure 50: The endemic species Aequidens epae from the Lower Tapajós River. Source: https://www.fishbase.in/photos/ThumbnailsSummary.php?ID=51471

Flora

The survey of the floristic composition of the project region was conducted based on the 8th Final Report of the UHE Colíder Flora Rescue Program [69] conducted in influence of the Hydroelectric Power Plant in the city of Colíder (in the state of Mato Grosso). The forest inventories of the farms Fazendas Casa Blanca, Natal, Ponderosa, Julian Grimas, Valle Verde, and Guanabara were also used. The analysis of the report found 785 species of flora, with 14 species present in The IUCN Red List [64] and the CNCFlora Red List of Threatened Brazilian Flora [66], [72] (Table 59).

Table 59: Flora species with some degree of threat on the global [64] *and national* [66] *red lists.*

TAXON	SPECIES	IUCN	RED LIST CNCFLORA
ORDER LAMIALES			
FAMILY BIGNONIACEAE	*Handroanthus capitatus*	VU	

	Handroanthus serratifolius	EN	
	Pleonotoma bracteate		VU
ORDER MALPIGHIALES			
FAMILY CALOPHYLLACEAE	*Caraipa rodriguesii*	VU	VU
FAMILY CLUSIACEAE	*Tovomita calophyllophylla*	VU	
FAMILY PODOSTEMACEAE	*Mourera weddelliana*		VU
ORDER FABALES			
FAMILY FABACEAE	*Hymenolobium excelsum*		VU
	Albizia duckeana	NT	
	Apuleia leiocarpa	VU	
ORDER GENTIANALES			
FAMILY RUBIACEAE	*Duroia gransabanensis*	NT	
ORDER LAURALES			
FAMILY LAURACEAE	*Mezilaurus itauba*	VU	VU
ORDER ERICALES			
FAMILY LECYTHIDACEAE	*Ocotea odorifera*		EN
	Cariniana legalis	VU	EN
	Bertholletia excelsa	VU	VU
FAMILY MORACEA	*Ficus mexiae*	VU	
Order Sapindales			
Family Meliaceae			
	Cedrela odorata		VU

Among with these important species, the *Handroanthus serratifolius*, *Cariniana legalis* and *Ocotea odorifera* are classified as “endangered” by the IUCN Red List and the last two in the ICMBio Red List. The three of them are used for medicinal purposes in traditional medicine. *C. legalis* and H. *serratifolius* are very explored for its timber as well [73]. The tree *Mezilaurus itauba* is very important economically since is harvested for logging and culturally because its previous abundant presence inspired the name of one city of this project: Itaúba.

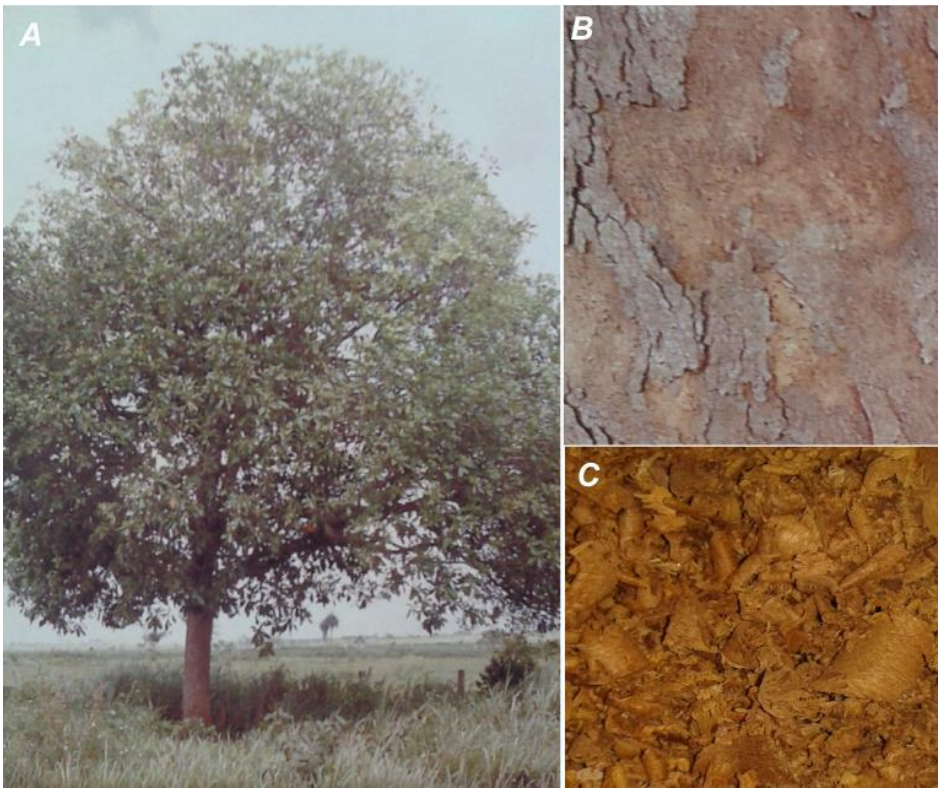


Figure 51: Mezilaurus itauba . A - Tree; B – Trunk; C – Sawdust. Source [73].

5.1.2 High Conservation Values (B1.2)

The High Conservation Values (HCVs) identified and related to biodiversity in this project were HCV 1 - Diversity of Species and HCV 3 - Ecosystems and Habitats, presented in the following tables.

High Conservation Value	HCV 1 – Diversity of Species
Qualifying Attribute	The project area has great areas with remaining forests and so it is habitat for priority species such as threatened, endemic and endangered species, specially of birds and mammals.
Focal Area	It is necessary to conserve and protect in totality the current vegetation in the project area (15,352.90), maintaining biodiversity monitoring and carrying out educational activities for

	create awareness on the importance of biodiversity and conservation.

High Conservation Value	HCV 3 – Ecosystems and Habitats
Qualifying Attribute	Amazon is the largest tropical forest in the world. The forest corresponds to globally important areas due to its ecosystem services provided, such as water production, habitat for threatened and key species of biodiversity, medicinal species provision. There are more than 23 million people living in the Legal Amazon, so it represents a place for recreation and tourism and has a very important and unique cultural value. The forests directly provide food for 20% of humanity and between 50-60% of the water in wetlands and more than 70-95% in semiarid and arid environments. The Central Amazon Humid Forest is considered "vulnerable" (VU) in the IUCN Red List of Ecosystems [74].
Focal Area	It is necessary to conserve and protect in totality the current vegetation in the project area (15,352.90 hectares), maintaining constant monitoring to protect it from illegal exploration and degradation and carrying out restoration activities if needed in the future.

5.1.3 Without-project Scenario: Biodiversity (B1.3)

The Mato Grosso State has a great history of deforestation, and it is the most important fact that must be consider in the without-project scenario. The less forest there is, more biodiversity loss. In 2020, the state was the second on the ranking (per state) of deforestation in Brazil, responsible for 15,9% of all deforestation detected. It corresponds to 1,767 km² of deforested forest area (INPE/PRODES *apud* [75]).

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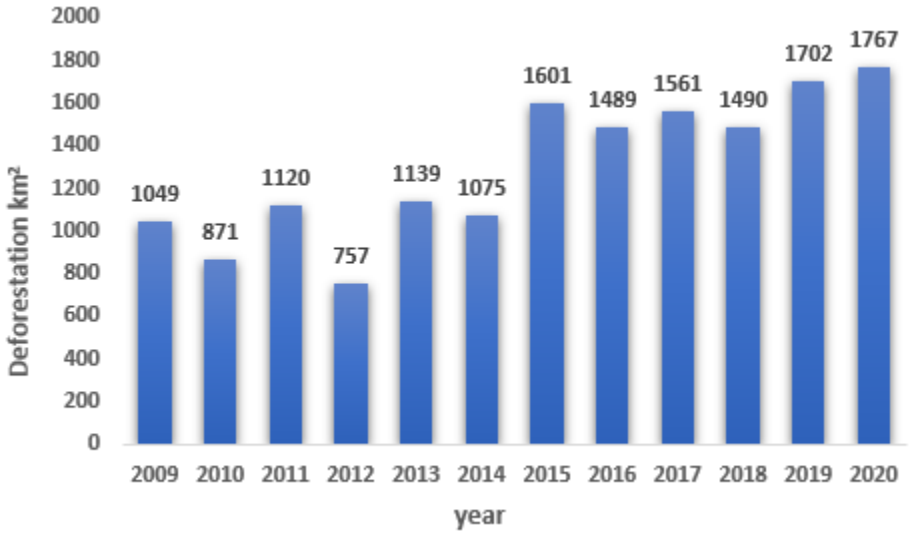

Figure 52: Deforestation data of the Amazon biome in the state of Mato Grosso (MT - Brazil) in km2, from August 2008 to July 2020. Source: INPE/PRODES [76]

The study presented by the Instituto Centro de Vida (ICV) [75] details the characteristics of the Amazon deforestation in Mato Grasso State. The land analyses show that in 2020 were deforested 947 km^2 in properties registered in the *Cadastro Ambiental Rural* (CAR – Registration of rural properties), that represents 54% of all deforestation of 2020. Areas not registered represent 31,4% (551 Km^2), followed by 11% from settlements and 3,7% from Units Conservation and Indigenous Lands combined. As seen, the most deforested areas are registered in CAR. So, since the forest areas in the properties protected by this proposed REDD project have also this registration, the project implementation would prevent such deforestation on this particular property (INPE/PRODES *apud* [75]).

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The without-project scenario is focused on the high levels of deforestation due to the increase of forest areas conversions into other land uses in the Mato Grosso State. The three land use activities that currently threaten biodiversity the most in the area are: cattle production (and its consequent soil management), agriculture, and logging. These activities, especially timber exploration, are practiced at legal standards but also mostly illegally, as seen above (INPE/PRODES *apud*[75]).

5.1.3.1 Agriculture and Cattle Raising

The Raw Value of Cattle Raising Production is an index calculated based on the agricultural production in one year in Brazil for every state and it shows the total amount of incomes (in reais) due to agriculture and cattle raising. Since 2018, Mato Grosso was the Brazilian state with the highest value in this index, mainly consequence of the production of cotton, corn, soy, and sunflowers, and cattle raising, corresponding to 18% of the national production of these products. In 2021 the VBP represented RS 193 billion for the economy [77].

The great increase of the livestock production and agriculture of grains and cotton in Mato Grosso shows the constant expansion of these activities, corresponding to 81,5% from value of the VBP index. From 1990 to 2020, the total area of production grew 634%, meaning that deforestation and invasion of the Amazon Forest for pasture and monoculture of commodities for exportation also increase along with the production[77]

The ITAÚBA REDD+ Project will protect 12,220.18 hectares of Amazon Forest, an essential area for biodiversity preservation and habitat integrity, avoiding fragmentation, destruction, and the conversion of natural forests of the project area into agriculture and pasture that would happen in the without-project scenario on the next few years. This means that this project intents to prevent the removal from floristic individuals, the soil degradation and consequently prevent genetic diversity loss, habitat loss, evasion and death of fauna and flora.

5.1.3.2 Logging and timber exploration

In 2020, 50% of the timber exploration in Brazil happened in the Mato Grosso State. The data indicates that in 2018, more than half (53%) of the total Amazon logs originated from Mato Grosso forests, a fact that highlights the state as the largest supplier of native wood in Brazil. If on the one hand this data shows the size of the opportunities in the timber market, on the other it highlights one of the biggest obstacles today for the conservation of the forests of the biome. This occurs because Amazon wood is a natural resource

extremely valued in the national and international markets, creating a high demand and consequent clear cutting of thousands of km^2 of forest areas, stimulating exploitation both legally and mainly illegally [78].

Illegal logging in the state affected 88.3 thousand hectares of forest in 2020, which corresponds to 38% of the total illegal logging mapped in Brazil. Compared to the previous year, which had 80.3 thousand ha, an increase of 10% of illegally exploited areas in Mato Grosso was calculated. Among the municipalities with the highest rate of illegality in the exploitation of native wood, Marcelândia leads the ranking, with 10,576 ha [78].

It could be said that sustainable forest management would be an alternative to reduce invasions and illegal logging, however, selective logging in Amazonian forests cannot provide enough timber to meet even the current regional demand, increasing extraction from primary forests. The low intensity and long cutting cycles do not provide enough timber and the intensive scenarios are not sustainable, insofar as they do not allow volume recovery during a cutting cycle. In addition, future deforestation, forest degradation and climate change will certainly worsen the picture. The development of REDD+ projects, such as this, are very important to avoid expansion of timber exploration areas, illegal deforestation, and degradation, providing direct benefits for conservation of great surfaces of native forest and consequently its biodiversity that would be destroyed in the without-project scenario, among many other positive effects.

5.2 Net Positive Biodiversity Impacts

5.2.1 Expected Biodiversity Changes (B2.1)

In the project area, the following beneficial changes to biodiversity are expected:

Biodiversity Element	Fauna
Estimated Change	Habitat / Biodiversity Conservation (positive)
Justification of Change	The activities of the Project aim at the reduction of deforestation and forest degradation, based on the practices of deforestation and degradation monitoring, patrimonial surveillance, and technical assistance service, thus generating a positive impact on habitat preservation, climate and consequently on biodiversity.

	The maintenance of the vegetation cover allows adequate living conditions for the countless Amazonian species present in the region. The presence of the ITAÚBA REDD+ project prevents the expansion of new pasture, agriculture, or logging areas, which may lead to soil contamination, suppression of ecosystem services such as water provision, pollination, climate regulation and others, which affects entire biotic communities and their consuming trophic chain, including local human populations.

Biodiversity Element	Flora
Estimated Change	Habitat / Biodiversity Conservation (positive)
Justification of Change	The ITAÚBA REDD+ Project consists of avoiding deforestation and degradation of Amazonian Forest ecosystems. The presence of the project prevents vegetation removal, degradation, and deforestation of 2,915 hectares due to cattle raising, agriculture and timber exploration activities expansion, minimizing these threats to flora species which have an essential role on the provision of ecosystem services as well as habitat for the local fauna biodiversity.

5.2.2 Mitigation Measures (B2.3)

The ITAÚBA REDD+ Project will work on maintaining the habitat of the species presented in the project area, avoiding deforestation and degradation, seeking to reduce and control the threats suffered by the biotic community with actions such as: monitoring of fauna and flora and surveillance of the area. In addition, the project's activities linked to climate, community and biodiversity aspects will strengthen the local community on environmental awareness and sustainable practices, making the conservation proposition more effective and meaningful, with a robust and relevant impact on the area, its surroundings and on its biodiversity. The Table 60 highlights and specifies the activities to be implemented to conserve the HCVs of this project and avoid other negative impacts on the area and the biodiversity.

Table 60: Mitigation measures of the project

Strategic lines	Main activities to be implemented
Illegal Logging Prevention	• Maintain and reinforce of surveillance in the project area; • Environmental education program to raise sustainable practices in the community;
Fire Prevention	• Fire Brigade training;
Biodiversity loss prevention	• Evaluate the impact of agriculture in biodiversity; • Promote environmental education program to raise awareness about the importance of conservation of nature and species; • Generate data for further studies and other conservation projects;
Deforestation prevention	• Implementation of a deforestation Alert System in the project region; • Promote the education of future generations about the importance of the forest on ecosystem services; • Building of environmental awareness; • Carbonext System Deforestation Monitoring (MonitoraCarbon™)

Further propositions will be made by Carbonext after a more detailed onsite analysis of the community's potential and characteristics to reduce the impacts of this project on biodiversity.

5.2.3 Net Positive Biodiversity Impacts (B2.2, GL1.4)

Without the project, the reminiscent forest at the properties involved in this project and its associated biodiversity would probably be affected by land use conversion and degradation in the next years, largely due to the increase in cattle raising, agriculture and logging in the region, which are economically attractive and in constant need of areas.

The ITAÚBA REDD+ Project will conserve a significant area of native Amazon Forest that is habitat for several species of birds, mammals, herpetofauna, invertebrates and flora, enabling their growth

(individually and in population level), reproduction, nourishment, genetic diversity and so on. Considering that the project only proposes preservation and conservation-compatible activities, the net impact on biodiversity will be positive, due to the maintenance and probable thrive of Amazonian fauna and flora in the region.

There will be a positive net impact in the biodiversity as consequence of all project's activities promoting sustainable development of the local communities involved, minimizing impacts in the environment, and mitigating any possible negative impact that could eventually happen in the future.

5.2.4 High Conservation Values Protected (B2.4)

The project activities aim to avoid deforestation and maintain forest cover by creating environmental awareness and preparing local communities and landowners to deal with eventual episodes of degradation. Therefore, there are no negative environmental impacts planned, and consequently there are no negative effects on the HCVs anticipated.

5.2.5 Species Used (B2.5)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.6 Invasive Species (B2.5)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.7 Impacts of Non-native Species (B2.6)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.8 GMO Exclusion (B2.7)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.9 Inputs Justification (B2.8)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.10 Waste Products (B2.9)

Initially, the activities proposed by the project are related to educational sessions and trainings, which will be conducted with trainings, field trips and lectures, which means that the waste products may consist of paper material and disposable utensils used during coffee-breaks. This type of residue, according to the normative ABNT NBR 10004, is classified as class two B ("non-hazardous and inert").

As new activities are selected to compose the project, the identification, classification, and management of their waste products will be properly conducted.

5.3 Offsite Biodiversity Impacts

5.3.1 Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

No potential negative impacts on biodiversity outside of the project zone are expected as result from the implementation of the project's activities. In addition, the proposed activities were developed to mitigate and minimize any possible leakages and other negative impacts. These activities will develop sustainable practices and promote environmental awareness in the future generations of the communities involved. Therefore, no mitigation measures were identified in this moment. If any negative offsite biodiversity impact is observed during the project, propositions will be made and implemented as soon as possible.

5.3.2 Net Offsite Biodiversity Benefits (B3.3)

The net offsite biodiversity impact of the ITAÚBA REDD+ Project is positive, since there are no identified negative offsite biodiversity impacts resulting from the project's activities until this point. On the contrary, there are substantial benefits on fauna and flora conservation in the PA, and in long term with the development of the environmental awareness in the local communities. In case of any negative impact observed, the project is prepared to mitigate and solve any unforeseen events, after technical and professional analysis made by Carbonext.

5.4 Biodiversity Impact Monitoring

The biodiversity impact monitoring aim to manage the impacts that the project could have in the fauna and flora. It examines the quality of the environment, the changes in population growth and behavior, the use of the habitat, the species that are occurring in the area, and the obtaining of other relevant data for conservation. The impact monitoring also assesses the level of awareness on conservation importance, as well as keep mechanisms to avoid forest fires and illegal practices inside the Project Area, guaranteeing that the project's activities will continue strengthen fauna and flora protection and even promote other biodiversity benefits.

5.4.1 Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4)

The maintenance of native forest as well as the conservation of species of fauna and flora of the Amazon Forest are extremely necessary to ensure the natural course of the ecosystem´s prosperity and the production of the ecosystem services consequently. This is a benefit for the community involved in the project, for other communities indirectly and mostly to the biodiversity related to project area. The advancement of deforestation would tend to reduce these forest areas, however the REDD+ mechanisms and resources for the sale of carbon credits contribute to and prevent the reduction of forest habitat loss and biodiversity loss. To guarantee the effectiveness of the Project, the monitoring of the biodiversity is as a fundamental tool to enable the measurement of the positive and, if there is, negative impacts of the activities of the Project on the biotic community, providing adjustments and relevant mitigation actions in order to pursuit the main goals on biodiversity conservation.

For the ITAÚBA REDD+ Project, monitoring of the fauna and flora of the managed areas will be systematically carried out by third party, hired local corporations and/or eventually by partnerships with universities and other interested entities. The impacts on biodiversity will be evaluated through periodic forest inventories and will follow the criteria of the certification standards, aiming at the short- and long-term impacts and consequences of the project. The general monitoring of the conservancy state, as well as the climate and social activities will also be carried out. Possible pro-biodiversity´s actions and improvements during the project´s execution will be constantly evaluated and implemented.

The biodiversity, fauna, and flora parameters to be monitored are displayed in the Table 61 below. This assessment depends on the carbon credit sales to happen.

Table 61: Monitoring plan activities dependent on carbon credit sale. Source: Carbonext (2022).

Monitoring Plan Activities							
Variable	Area	Aspect	Unity	Frequency	Inventory	Indicator	Assessment
Biomass, fauna and flora inventory	Project Area	Carbon Stock	tCO_2e per hectare	Ex-ante	Every 5 years	Maintenance or change of carbon stock	Increase in surveillance mechanism; Field monitoring; Develop conservation practices and environmental awareness; Consult specialists.
		Threatened and endangered fauna species	Nº of endangered fauna species and sightings			Maintenance or change on the number of endangered species and sightings	
		Total fauna species	Nº of total fauna species and individual sightings			Maintenance or change on the number of total fauna species	
		Endangered flora species	Nº of endangered flora species and sightings			Maintenance or change on the number of endangered species and sightings	
		Total flora species	Nº of total flora species			Maintenance or change on the number of total flora species	

5.4.2 Biodiversity Monitoring Plan Dissemination (B4.3)

The results of monitoring undertaken will be made publicly available online at the Carbonext´s website (carbonext.com.br). All documents and information about the results of the monitoring and verification of this project will be published in the platforms of the VCS and CCB standards as usual. Additionally, the results obtained with the monitoring of this project will be shared with local stakeholders at the most convenient moments, such as trainings, verifications, or visitation periods, to enhance and materialize the importance and effectiveness of the ITAÚBA REDD+ Project. If there is an agreement between all the parties established, the data obtained in the monitoring can proudly be used by scientific studies for biodiversity conservation.

5.5 Optional Criterion: Exceptional Biodiversity Benefits

The ITAÚBA REDD+ project zone is very abundant and rich in terms of fauna and flora species, due to its hydrology and vegetation physiognomy characteristic of the Amazon Forest. In the Project region, the presence of threatened fauna and flora species according to the secondary data revision was verified according to the IUCN Red List of Threatened Species [64], the Red Book of Threatened Species of the Brazilian Fauna [65] and the CNCFlora's Red List of Threatened Brazilian Flora [66], [72].

5.5.1 High Biodiversity Conservation Priority Status (GL3.1)

There are 9 species of fauna considered “critically endangered” and/or “endangered” (CR and EN) and 21 are classified as “vulnerable” (VU). The list of the species of fauna classified as CR and/or EN and their population trends will be in the section 5.2.2. The main threats for all these species are habitat loss, due to deforestation, and hunting, both activities related to anthropogenic actions.

For the flora, 2 species were identified as “endangered” (EN) and 9 other species as “vulnerable” (VU). Mainly causes of the existence of threatened flora species are exploration on logging and usage in traditional medicine and cultural habits.

Further data collection will be conducted after the accreditation to deepen the understanding on high biodiversity conservation priorities.

5.5.2 Trigger Species Population Trends (GL3.2, GL3.3)

Table 62: Fauna species classified as CR and EN in the IUCN Red List and in ICMBIO Red List.

TAXON	SPECIES	IUCN Red List classification	ICMBIO Red List classification
ORDER TINAMIFORMES			
FAMILY TINAMIDAE	*Taoniscus nanus*	EN	EN
ORDER GRUIFORMES			
FAMILY PSOPHIIDAE	*Psophia dextralis*	EN	VU
ORDER PICIFORMES			
FAMILY RAMPHASTIDAE	*Pteroglossus bitorquatus*	EN	NT
ORDER PSITTACIFORMES			
FAMILY PSITTACIDAE	*Pionites leucogaster*	EN	
ORDER PRIMATES			
FAMILY ATELIDAE	*Ateles marginatus*	EN	EN
	Ateles chamek	EN	VU
ORDER CARNIVORA			
FAMILY FELIDAE	*Leopardus tigrinus*	VU	EN
FAMILY MUSTELIDAE	*Pteronura brasiliensis*	EN	VU
ORDER ANURA			
FAMILY AROMOBATIDAE	*Allobates brunneus*	LC	CR

Table 63: Flora species classified as EN in the IUCN Red List and in CNCFlora Red List.

TAXON	SPECIES	IUCN Red List classification	CNCFLORA
ORDER LAMIALES			
FAMILY BIGNONIACEAE	*Handroanthus serratifolius*	EN	
ORDER ERICALES			
FAMILY LECYTHIDACEAE	*Ocotea odorifera*		EN

The trigger species population trends are presented in separated tables below.

Trigger Species	*Ateles marginatus* (Atelidae)
Population Trend at Start of Project	Ateles marginatus is classified as endangered species with trend of decreasing population. According to[79], their pattern of distribution and abundance in the lower Tapajós River (in Flona Tapajós) is heterogeneous. From the northwestern extreme of A. marginatus known distribution (bordered by the Tapajós and Amazon Rivers to the west and north), the authors pointed the species to be extinct and rare/absent in many fragments south. Their habitat quality is directly related to both natural and anthropogenic lacunas. Other complementary factors are hunting, habitat fragmentation and interspecific competition.
Without-project Scenario	Also, the [79] study shows that A. marginatus absence will continue to grow, due to intensification of habitat fragmentation and anthropogenic conversion of the land use.
With-project Scenario	The Itaúba REDD+ Project aim to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and consequent improvement in biodiversity conservation. In addition, the Project foresees fauna and flora monitoring that helps in the conservation of the fauna. The data generated from the monitoring can also be very important for future evaluations and scientific studies of the taxon, contributing for its conservation. Furthermore, the environmental education program will present this specie to the community and explain about its importance in the forest, which will stimulate its preservation and hunting prevention. Therefore, it is expected that

	there will be improvements in the trend of the population of *Ateles marginatus* in the project area.

Trigger Species	*Ateles chamek* (Atelidae)
Population Trend at Start of Project	*Ateles chamek* is classified as endangered and vulnerable species (IUCN List and Red List from Brazil, respectively) with trend of decreasing population. According to [80], the inference of population decline is of at least 50% in the past 45 years, which is a trend to the future. The specialists infer that habitat loss and degradation, in addition to threats faced by hunting are the mainly causes of *A. chamek* population decline.
Without-project Scenario	Since this is a taxon restricted to primary forest, deforestation of areas for agriculture, cattle raising and timber exploration that could happened in the without-project scenario would decline *A. chamek* population. It would also be possible to lead to local extinction of the species in areas with human activity, because of the hunting pressure that is often associated with habitat loss and due to disturbed/fragmented areas, since this specie generally do not persist for long periods in small areas.
With-project Scenario	The Itaúba REDD+ Project aim to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and consequent improvement in biodiversity conservation. In addition, the Project foresees fauna and flora monitoring that helps in the conservation of the fauna. The data generated from the monitoring can also be very important for future evaluations and scientific studies of the taxon, contributing for its conservation. Furthermore, the environmental education program will present this specie to the community and explain about its importance in the forest, which will stimulate its preservation and hunting prevention. Therefore, it is expected that there will be improvements in the trend of the population of *Ateles chamek* in the project area.

Trigger Species	*Leopardus tigrinus* (Felidae)
Population Trend at Start of Project	*Leopardus tigrinus* is classified as vulnerable and endangered species (IUCN List and Red List from Brazil, respectively) with trend of decreasing population. According to IUCN Red List [64], the inference of population decline is of at least 50% in the past 45 years, which is a trend to the future. The specialists infer that habitat loss and degradation, in addition to threats faced by hunting are the mainly causes of *A. chamek* population decline.
Without-project Scenario	The L. tigrinus is considered to be the rarest of the tropical species of Neotropical cat and its density is very low in the Amazon Forest, according to the IUCN Red List data [64]. This species is very sensible to disturbances in the environment and its main threats are habitat degradation and loss, road kills, retaliatory killing due to depredation of poultry, and the transmission of diseases by domestic carnivores [81] . The decline of theirs prey populations is also pointed as a cause for the *L. tigrinus* decline. Therefore, non-protected areas, approximation of anthropogenic activities and human presence, and the probable deforestation and degradation of forest for agriculture, cattle raising and logging that could happened in the without-project scenario would decline even more *its* population. All the infrastructure that follows these activities would also impact negatively.
With-project Scenario	The Itaúba REDD+ Project aim to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and consequent improvement in biodiversity conservation. In addition, the Project foresees fauna and flora monitoring that helps in the conservation of the fauna. The data generated from the monitoring can also be very important for future evaluations and scientific studies of the taxon, contributing for its conservation. Furthermore, the environmental education program will present this specie to the community and explain about its importance in the forest, which will stimulate its preservation and hunting prevention. Therefore, it is expected that there will be improvements in the trend of the population of *Leopardus tigrinus* in the project area.

Trigger Species	*Pteronura brasiliensis* (Mustelidae)
Population Trend at Start of Project	Pteronura brasiliensis is classified as endangered and vulnerable specie (IUCN List and Red List from Brazil, respectively) with trend of decreasing population. De acordo com dados da IUCN Red List [64], there is no current total population estimate. Surveys carried in Brazil estimate a total population size of 4,659 individuals. The P. brasiliensis population are decreasing due to habitat loss and degradation, and other human activities, such as hunting and resource competition. These surveys suggest a population of at least 1,296 breeding individuals, and a total population size of 4,659 individuals in Brazil.
Without-project Scenario	The specie P. brasiliensis is considered to be an important predator in the food chain of their habitats. Since most populations remain isolated from each other, drastic changes on their areas can lead to local extinction. This species is very sensible to disturbances in their environment, because it is restricted to aquatic ecosystems in tropical forests and wetlands. Therefore, non-protected areas, approximation of anthropogenic activities and human presence, and the eminent deforestation and degradation of forest for agriculture, cattle raising and logging that could happened in the without-project scenario would decline its population.
With-project Scenario	The Itaúba REDD+ Project aim to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and consequent improvement in biodiversity conservation. In addition, the Project foresees fauna and flora monitoring that helps in the conservation of the fauna. The data generated from the monitoring can also be very important for future evaluations and scientific studies of the taxon, contributing for its conservation. Furthermore, the environmental education program will present this specie to the community and explain about its importance in the forest, which will stimulate its preservation and hunting prevention. Therefore, it is expected that there will be improvements in the trend of the population of *Leopardus tigrinus* in the project area.

Trigger Species	*Allobates brunneus* (Aromobatidae)

Population Trend at Start of Project	*Allobates brunneus* is classified as least concern in the IUCN Red List but, on contrary, it is considered critically endangered in Red List from Brazil, with trend of decreasing population. According to Eduardo Bessa[82], from the University of Campinas the reproduction of these amphibians is peculiar and laborious, with a so-called K-Strategy reproduction, which involves parental care and special behavior from the male. There are fewer tadpoles and more efforts to their development. This characteristic leads to more vulnerability of this species.
Without-project Scenario	Amphibians are known to be sensible with environmental disturbances. The main threats for *A. brunneus* are habitat loss, fragmentation, and anthropogenic disturbances. According to Eduardo Bessa, the implementation of agriculture, pasture, logging and construction of hydroelectric power stations are the main causes of their population decline. In Rio Manso, in the Mato Grosso State, the fragmentation of the habitat led to a population´s of *A. brunneus* extinction. Without the Itaúba REDD+ Project, non-protected areas, fragmentation of the habitat, approximation of anthropogenic activities and human presence, and changes in the environment such as the eminent pollution of rivers, deforestation and degradation of forest for agriculture, cattle raising, and logging would decline its population and could also lead to local population extinctions.
With-project Scenario	The Itaúba REDD+ Project aim to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and consequent improvement in biodiversity conservation. In addition, the Project foresees fauna and flora monitoring that helps in the conservation of the fauna. The data generated from the monitoring can also be very important for future evaluations and scientific studies of the taxon, contributing for its conservation. Furthermore, the environmental education program will present this specie to the community and explain about its importance in the forest, which will stimulate its preservation and hunting prevention. Therefore, it is expected that there will be improvements in the trend of the population of *Allobates brunneus* in the project area.

Trigger Species	*Handroanthus serratifolius* (Bignoniaceae)
Population Trend at Start of Project	*Handroanthus serratifolius* is classified as endangered species with trend of decreasing population. According to IUCN Red List [64], this species is the highest traded for timber under the name “Ipê”. Brazil is its main exporter. The Ipê is explored only in native forests, since there are no *H. serratifolius* plantations. This fact stimulates the illegal logging, which is the primary illicit activity directly affecting these wild trees. According to the [83], the Ipê timber demand and value increased over 500% from 1998 to 2004. Additionally, since this species is slow growing and current lodge management uses 30 years of cutting cycle, the regeneration of the wild population of *H. serratifolius* does not happen due to its overexploitation, considered to be unsustainable. The habitat loss caused mostly by settlements, agriculture development, expansion of roads, cattle raising, and mining is responsible for the decline of Ipê’s population.
Without-project Scenario	With increasing demands and prices of timber of *Handroanthus serratifolius* in the trade market, added with the agriculture and cattle raising expansion in the Mato Grosso State, the Forest within the Project Area would suffer the conversion of the Amazon Forest into these land use activities. Consequently, this species will experience population decline and biodiversity in general would also decline very quickly. According to the IUCN, it is suspected that the decline will be at least 50% in the next 100 years.
With-project Scenario	The Itaúba REDD+ Project aim to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and consequent improvement in biodiversity conservation. In addition, the Project foresees fauna and flora monitoring that helps in the conservation of the fauna. The data generated from the monitoring can also be very important for future evaluations and scientific studies of the taxon, contributing for its conservation. Furthermore, the environmental education program will present this species to the community and explain about its importance in the forest, which will stimulate its

	preservation and logging prevention. Therefore, it is expected that there will be improvements in the trend of the population of *Handroanthus serratifolius* in the project area.

Trigger Species	*Cariniana legalis* (Lecythidaceae)
Population Trend at Start of Project	*Cariniana legalis* is classified as endangered species with trend of decreasing population. Apesar de ser considerada uma espécie da Mata Atlântica, *C. legalis* foi registrada em Colíder. Its timber is appreciated especially for furniture because of the quality and great dimensions of the tree. *C. legalis* has a slow growth and there are individuals estimated with more than 500 years. Since its distribution was mostly in the Mata Atlântica biome, it has been declining in terms of population following the destruction of the biome. It is suspected that the Jequitibá-rosa population has declined at least 50% in the last 300 years in Brazilian territory. *C. legalis* is ecologically important because its crown is home for different species of fungus, bugs, birds and even small mammals.
Without-project Scenario	The continue fragmentation of the forest's areas, increasing demands on timber, agriculture and cattle raising, the expansion of these activities would lead to the deforestation and degradation of the forest area that could have been protected with the Itaúba´s REDD+ Project implementation. Since its growth is slow, there would be no regeneration of the *C. legalis* individuals and the population would decline. The crowns of the trees would no longer be able to maintain life as before and the associated fauna and fungus would decline as well.
With-project Scenario	The Itaúba REDD+ Project aim to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and consequent improvement in biodiversity conservation. In addition, the Project foresees fauna and flora monitoring that helps in the conservation of the fauna. The data generated from the monitoring can also be very important for future evaluations and scientific studies of the taxon, contributing for its conservation. Furthermore, the environmental

	education program will present this species to the community and explain about its importance in the forest, which will stimulate its preservation and logging prevention. Therefore, it is expected that there will be improvements in the trend of the population of *Cariniana legalis* in the project area.

Trigger Species	*Ocotea odorifera* (Lecythidaceae)
Population Trend at Start of Project	*Ocotea odorifera* is classified as endangered species with trend of decreasing population [84]. According to the authors, the *O. odorifera* is largely explored for its timber and essential oils. Historically, its harvesting suffered for more than 150 years, causing the decrease of its distribution and population number in Brazil.
Without-project Scenario	The continue fragmentation of the forests, the increasing demand on timber due to agriculture and cattle raising, the expansion leads to deforestation and degradation of the forest areas that could have been protected with the Itaúba´s REDD+ Project implementation.
With-project Scenario	The Itaúba REDD+ Project aim to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and consequent improvement in biodiversity conservation. In addition, the Project foresees fauna and flora monitoring that helps in the conservation of the fauna. The data generated from the monitoring can also be very important for future evaluations and scientific studies of the taxon, contributing for its conservation. Furthermore, the environmental education program will present this species to the community and explain about its importance in the forest, which will stimulate its preservation and logging prevention. Therefore, it is expected that there will be improvements in the trend of the population of *Ocotea odorifera* in the project area.

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