MEJURUÁ PROJECT

Document Prepared by Plant Inteligência Ambiental

Project Title	Mejuruá Project
Version	1.0
Date of Issue	09/06/2023
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SUMMARY

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1 SUMMARY DESCRIPTION OF THE PROJECT

BR Arbo Forest Management S.A. is a Brazilian company that owns an extensive area of over 900,000 hectares in the state of Amazonas, which is almost entirely composed of Amazonian biome forest. The company aims to permanently conserve this area through its REDD+ Project.

The BR Arbo REDD+ Project (hereinafter called Mejuruá project) is represented by the "Project Description" (PD) document and aims to demonstrate the viability of meeting the eligibility and additionality requirements recommended by voluntary market systems. This project aims to conserve the forest, prevent deforestation, maintain water regimes, conserve biodiversity, and support the needs of the local community.

In addition to its environmental objectives, BR Arbo considers that the preservation of forest cover in the area it owns is a highly relevant asset, not only for the local community but also for the world at large. As a company with a long-standing presence in the region, BR Arbo opposes the deforestation trends that exist in the Amazon region and seeks to act as an example of how forest preservation can be viable and beneficial for everyone.

This project is eligible as an avoiding planned deforestation (APD) as it involves the conversion of forested land into non-forest land in the baseline scenario, and the land is legally permitted to be converted to non-forest. Subject to approval, this project seeks to implement the REDD+ activity on a designated 20% portion of the property, spanning 130,641 hectares. The anticipated outcome of this endeavor is a substantial reduction of approximately 82 million tons of greenhouse gases (GHG) over a span of 30 years. This initiative serves the overarching purpose of preserving the biodiversity of the Amazon rainforest while concurrently addressing the global challenge of climate change.

Furthermore, this project was designed as a grouped project aiming to increase its contribution to standing forests in the future, as well as to the reduction of greenhouse gas emissions. Thus, throughout the project, new project instances may be included within the same geographic area, corresponding to the designated Legal Reserve portion, which covers 80% of the total property area (543,721 hectares). In these areas, REDD activities can be developed with the objective of avoiding unplanned deforestation and/or degradation (AUDD). By incorporating future instances of project activity, this endeavor possesses the potential to serve as an exemplary model for forest conservation and climate change mitigation. It aims to establish a long-term strategy that can be emulated in other regions, effectively addressing global environmental challenges. Through a collaborative approach and active involvement from the local community, the project holds the capacity to generate enduring social, economic, and environmental benefits.

1.1 Sectoral Scope and Project Type

Sectorial Scope: 14 - AFOLU (Agriculture, Forestry and Other Land Use)

Project Category: APD (Avoided Planned Deforestation) and AUDD (Avoided Unplanned Deforestation and Forest Degradation)

This is a grouped project.

1.2 Project Eligibility

According to the VCS Standard v.4.4 and considering the Mejuruá project characteristics as an AFOLU project that includes REDD activities, some topics are presented in three main sections, pointing out specific eligibility requirements and then a brief description of how the project attends it and has successfully fulfilled the criteria for its validation.

Section 3.1 General Requirements

The project attends the following applicable requisites of Section 3.1:

• Section 3.1.1: This project is eligible in the sense that it respects all rules and requirements adopted by the VCS Program. For more details about the applicability of Methodology see the Section 3.2.

• Section 3.1.2: This project applies a methodology eligible under the VCS Program, as described in Section 3.

• Section 3.1.3: This project applies the latest version of the VCS-Applicable Methodology, as described in Section 3.

• Section 3.1.4: The implementation of this project activity does not lead to the violation of any applicable law under Brazilian legislation. All applicable laws considered during the compliance process are presented in Section 1.14 of this document.

• Sections 3.1.5 and 3.1.6- All models, factors or standards used to ascertain GHG emission data, and any supporting data meets the requirements set out in the VCS Program document VCS Methodology Requirements.

• Sections 3.1.7: 3.1.8: This project has not been registered under any other GHG Programs.

Section 3.2 AFOLU-Specific Matters

The project attends to the applicable requisites of Section 3.2 listed below:

• Section 3.2.1. This is an eligible AFOLU project category under the VCS Program: reduced emissions from deforestation and degradation (REDD).

• Section 3.2.2: This project is not located within a jurisdiction covered by a jurisdictional REDD+ program.

• Section 3.2.3: All implementation partners are identified in Section 1.6- Other Entities Involved in the Project- of this document.

• Section 3.2.4: This project does not convert native ecosystems to generate GHG. The project area only contains native forested land for a minimum of 10 years before the project start date, as shown in Section 1.12.

• Section 3.2.5: This project does not occur on wetlands and does not drain native ecosystems or degrade hydrological functions to generate GHG credits.

• Section 3.2.6: The project activities to reduce deforestation and its time implementation, which will be confirmed in each verification, are described in Section 5.3 of this PD.

• Sections 3.2.7 and 3.2.8: As an eligible REDD activity, the project is going to reassess the defined baseline every six years in order to consider possible interventions in relation to methodological updates and/or other changes needed.

• Section 3.2.10: Non-permanence risk will be analyzed in accordance with the VCS Program document AFOLU Non-Permanence Risk tool.

Appendix 1 Eligible AFOLU Project Categories

• Section A1.5 to A1.8: According to the AFOLU Requirements regarding Reduced Emissions from Deforestation and Degradation (REDD) projects, eligible activities are those which reduce net GHG emissions by reducing deforestation, which is the case for this project activity. This project reduces deforestation on forest lands that are legally authorized for conversion (APD) and intends to interrupt unsanctioned deforestation on forested lands (AUDD), and it is thus eligible as a REDD activity. The entirety of the Project Area currently meets the internationally accepted definition of forest and contains native forested land for a minimum of 10 years before the project start date.

1.3 Project Design

This is a Grouped Project, and it was designed as an Avoided Planned Deforestation and Avoided Unplanned Deforestation, applying VM0007 Methodology, v.1.6. According to elements mentioned in Section 3.6 of the VCS Standard v.4.4, projects may include multiple project activities where the methodology applied to the project allows more than one project activity, as is the case of this project.

Eligibility Criteria

As a grouped project, it allows for the inclusion of new project activity instances in the coming years throughout the project's duration, after the validation process. This grouped project has one clearly defined geographic area within which the initial project activity instances shall be developed but does not define a capacity limit for this project activity in terms of its total geographic area.

New geographic areas willing to become instances of the project shall demonstrate compliance with the applicability conditions of the methodology, according to those applied for each project activity. Next, Table 1 shows the general requirements needed for grouped projects, and Table 2 contains the set of eligibility criteria for the inclusion of that every new PAI needs to attend so it can be included in the Mejuruá project. The left side lists the eligibility criteria according to VCS Standard v4.4, and the right side gives a description of how this project attends it.

Table 1- Grouped Project eligibility criteria.

VCS Standard Eligibility Criteria	Mejuruá project attendance
3.6.10 Grouped projects shall specify one or more clearly defined geographic areas within which project activity instances may be developed.	The project area to compose its initial instance is clearly defined in this document (detailed information about its location is given in Section 1.12). All new instances will occur within the BR Arbo property.
3.6.11 Determination of baseline scenario and demonstration of additionality are based upon the initial project activity instances.	This grouped project assumes that the all-new instances will be subject to the baseline land use scenario for unplanned deforestation and degradation.

VCS Standard Eligibility Criteria	Mejuruá project attendance
3.6.12 As with non-grouped projects, grouped projects may incorporate multiple project activities	This project consists of two project activities involving the APD and AUDD approaches.
3.6.13 The baseline scenario for a project activity shall be determined for each designated geographic area, in accordance with the methodology applied to the project.	The geographic area was divided in two project activities (APD and AUDD) such that a single baseline scenario can be determined for each designated geographic area.
3.6.14 The additionality of the initial project activity instances shall be demonstrated for each designated geographic area, in accordance with the methodology applied to the project.	The additionality of the initial project activity instances will be designed for each project activity and the respective geographic area.
3.6.15 Where factors relevant to the determination of the baseline scenario or demonstration of additionality require assessment across a given area, the area shall be, at a minimum, the grouped project geographic area.	All relevant factors necessary to the baseline scenario and additionality indication are assessed across the project area.

Table 2- Criteria for the Inclusion of New Project Activity Instances.

VCS Standard Eligibility Criteria	Mejuruá project Activity Instance One
3.6.16 Grouped projects shall include one or more sets of eligibility criteria for the inclusion of new project activity instances. A set of eligibility criteria shall ensure that new project activity instances:	The set of eligibility criteria for inclusion of new project activity instances will be provided for each combination of project activity and geographic area specified in the project description. The Mejuruá project meet the applicability conditions by having the following characteristics:

VCS Standard Eligibility Criteria	Mejuruá project Activity Instance One
1) Meet the applicability conditions set out in the methodology applied to the project.	• All new instances will meet the applicability conditions applied in the project falling into the unplanned deforestation/degradation VCS category.
2) Use the technologies or measures specified in the project description.	• All new instances to be included in this project activity will be assessed using the definitions and measures applied for the initial instances, with the objective to avoid unplanned deforestation/ degradation.
3) Apply the technologies or measures in the same manner as specified in the project description.	• All new instances to be included will be subject to the same technologies or measures as specified in this project description in Section 5.
4) Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.	• All new instances to be included will be submitted to the baseline scenario to be determined in the project description, in Section 3.4, for the specific project activity and geographic area.
5) Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area.	• All new instances to be included will be consistent with the initial instances in terms of financial, technical and will be within the same geographic area.
3.6.17 Grouped projects provide for the inclusion of new project activity instances subsequent to the initial validation of the project. New project activity instances shall:	

VCS Standard Eligibility Criteria	Mejuruá project Activity Instance One
1) Occur within one of the designated geographic areas specified in the project description.	• The Mejuruá project geographic limits are well defined, as detailed in Section 3.
2) Conform with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial conformance with multiple sets of eligibility criteria is insufficient.	• It is assumed that the set of eligibility criteria is all the requirements presented in Section 1.4 of this PD. All new instances will comply with all the demands in this chapter for inclusion of new project activity instances.
3) Be included in the monitoring report with sufficient technical, financial, geographic, and other relevant information to demonstrate conformance with the applicable set of eligibility criteria and enable evidence gathering by the validation/verification body.	• All new instances will be included in the monitoring report with technical, geographic and any other relevant information sufficient to demonstrate instance compliance, with the same quality and reliability employed for the first instances of this project description.
4) Be included in an updated project description, with updated project location information (as set out in Section 3.11), which shall be validated at the time of verification against the applicable set of eligibility criteria.	• All new instances will be included in the project description with updated project location information to demonstrate compliance with the applicable set of eligibility criteria by project validation.
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	• Evidence of the Mejuruá project ownership held by the proponent from the respective start date is available in Sections 1.5 and 1.6.

VCS Standard Eligibility Criteria	Mejuruá project Activity Instance One
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.	• The start date for the new instance will be in the same as or later than the grouped project start date, which is July 26th, 2021.
7) Be eligible for crediting from the start date of the project activity instance through to the end of the project crediting period (only)	• All new instances will be eligible for crediting from the start date of the instance through to the end of the project crediting period.
8) Only eligible for crediting from the start of the verification period in which they were added to the grouped project. 9) Not be or have been enrolled in another VCS project.	• The Mejuruá project will not seek or receive another form of VCS project.
10) Adhere to the clustering and capacity limit requirements for multiple project activity instances set out in 3.6.8 - 3.6.9.	• There is no capacity limit applicable to the project activity type (APD and AUDD) considered in the grouped project in terms of geographic area. However, it has been established that such limit will respect the specified area for addition of the new instances, from which historical deforestation rates will be ascertained to predict deforestation quantities in the baseline scenario.

1.4 Project Proponent

Organization name	Br Arbo Forest Management
Contact person	Carlos Roberto Canabarro Gomes
Title	Main Project Proponent (Landowner)
Address	Av. Julio de Castilhos, nº 44, 14º Pavimento, Bairro Centro Histórico, Porto Alegre/RS, CEP 90030-130
Telephone	(51) 3527-4145
Email	contato@brarbo.com.br / carlos.canabarro@brarbo.com.br

1.5 Other Entities Involved in the Project

Entities involved in the project, other than the project proponent above, in alphabetical order:

Organization name	ATA Consultoria em Sustentabilidade
Role in the project	Carbon Project Coordination
Contact person	Ricardo Gustav Neuding
Title	Director
Address	Rua Americo Brasiliense 1923, conjunto 908 – São Paulo – SP – 04715-005 - Brazil
Telephone	+ 55 11 5505-9676
Email	ricardo@atapart.com.br

Organization name	Gibbi s.r.l.
Role in the project	Project Coordinator
Contact person	Maurizio Rocchi
Title	Technical Director
Address	Via Alessandro Farnese 9-00192 Roma
Telephone	+39 348 0063952
Email	mr@gibbisrl.it

Organization name	Plant Inteligência Ambiental
Role in the project	Project Developer
Contact person	Warwick Manfrinato
Title	CEO and Technical Director
Address	15 de Novembro Street, 1413 – Piracicaba – SP – 13419-230
Telephone	+ 55 19 991640284
Email	warwickmanfrinato@gmail.com / plant@plantbr.com.br

Organization name	PricewaterhouseCoopers Business Services s.r.l.
Role in the project	Professional services to the Project Proponent as Industrial Advisor

1.6 Ownership

Organization name	Br Arbo Forest Management
CNPJ	04.310.918/0001-98
Contact person	Carlos Roberto Canabarro Gomes
Title	Main Project Proponent (Landowner)
Address	Av. Julio de Castilhos, nº 44, 14º Pavimento, Bairro Centro Histórico, Porto Alegre/RS, CEP 90030-130
Telephone	(51) 3527-4145
Email	contato@brarbo.com.br / carlos.canabarro@brarbo.com.br

1.7 Project Start Date

The project start date is July 26th, 2021. On this date an agreement was signed between the main shareholder of the project proponent and the project developer. Please refer to the attached document.

1.8 Project Crediting Period

Start date: July 26th, 2021.

End date: July 26th, 2051

30 years

1.9 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

☐ <20,000 tCO_2e/year

☐ 20,000 – 100,000 tCO_2e/year

☐ 100,001 – 1,000,000 tCO_2e/year

☒ >1,000,000 tCO_2e/year

Project Scale	
Project	
Large project	x

Year	Estimated GHG emission reductions or removals (tCO_2e)
2021	1,930,914.38
2022	3,931,973.65
2023	4,072,263.41
2024	4,212,553.18
2025	3,965,269.86
2026	4,121,968.22
2027	4,278,666.58
2028	4,435,364.94
2029	4,592,063.30
2030	4,748,761.65
2031	4,840,155.78
2032	4,866,245.69
2033	4,892,335.59

2034	4,918,425.50
2035	4,944,515.40
2036	4,970,605.30
2037	4,996,695.21
2038	1,717,465.96
2039	981,975.79
2040	867,775.93
2041	748,735.41
2042	624,854.24
2043	500,973.06
2044	377,091.89
2045	253,210.72
2046	156,548.33
2047	136,873.82
2048	121,796.74
2049	413,887.78
2050	465,226.26
Total estimated ERs	82,085,193.58
Total number of crediting years	30
Average annual ERs	2,736,173.12

1.10 Description of the Project Activity

1.10.1 General

The BR ARBO property encompasses an area of around 900 thousand hectares, situated within the municipalities of Carauari, Jutaí, and Juruá in the state of Amazonas (Figure 1). The primary objective of the current REDD+ project is to preserve the Amazon Rainforest by preventing planned deforestation. It is worth noting that the project area is not situated within a jurisdictional REDD+ program.

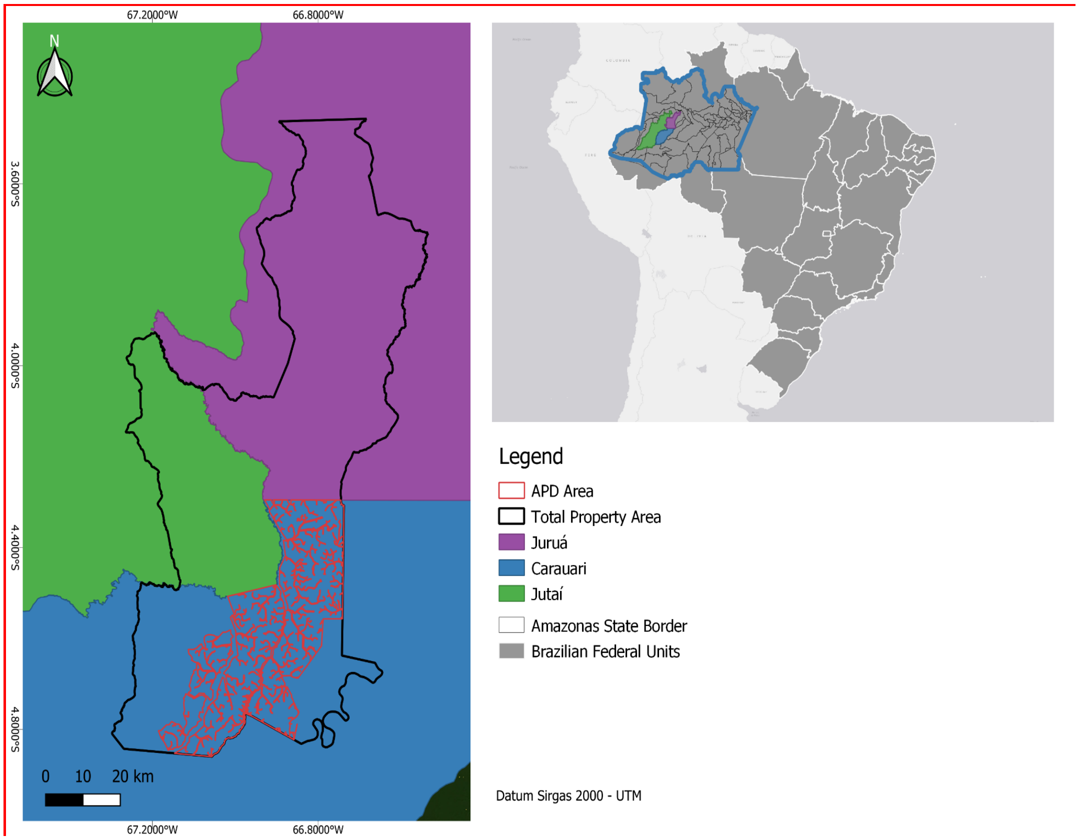

Figure 1- Project Location in Amazonas State Municipalities.

The Mejuruá project showcases a resolute commitment toward the preservation of the forested area within the property. In lieu of exercising the permissible 20% clear-cutting option outlined in the Brazilian Forest Code, the property owner has chosen to implement sustainable forest management practices. This decision not only aims to generate income and benefits for local communities but also ensures minimal environmental impact and safeguards the biome against escalating legal deforestation. As a result of this initiative, the project proponents are voluntarily relinquishing their right to deforest a substantial area totaling 130,640.54 hectares. This action contributes to the avoidance of an emission volume equivalent to 82 million tCO_2e over a span of 30 years.

The project also aims to incorporate new areas over the course of its duration to compose the Avoiding Unplanned Deforestation (AUDD) component. Without project intervention, an estimated 543,720 hectares of land could be susceptible to deforestation and illegal activities. This is due to the significant rise in deforestation observed in the Legal Amazon region in recent years, as depicted in Figure 1. Consequently, the property faces the potential threat of deforestation in the upcoming years, which would undermine ongoing forest conservation efforts.

The activities foreseen in the Mejuruá project are presented in the following sections.

1.10.2 Forest Biomass Inventory

Serving as a basis for strategic planning, the Forest Inventory aims to obtain quantitative and qualitative information on existing forest resources in a pre-established area (population). The forest inventory was carried out in accordance with the Standard Operating Procedures (SOP). This SOP was developed based on a compilation of knowledge, field experience and general forest inventory practices to provide guidance to field teams in performing the defined activities, providing quality assurance and quality control.

The assessment of aboveground biomass was conducted by implementing a systematic installation of permanent plots across the project area. Through these plots, tree diameter at breast height (DBH) and tree height (H) measurements were obtained. Periodic verification of these plots will be carried out throughout the project duration to ensure consistent monitoring. Furthermore, a more precise classification system for vegetation has been established, taking into consideration influential factors such as slope and elevation, which significantly affect the forest structure. As depicted in Figure 2, the area was divided into four distinct regions, using the IBGE definition for phytophysiognomies as a foundation and incorporating additional data to achieve a more accurate result.

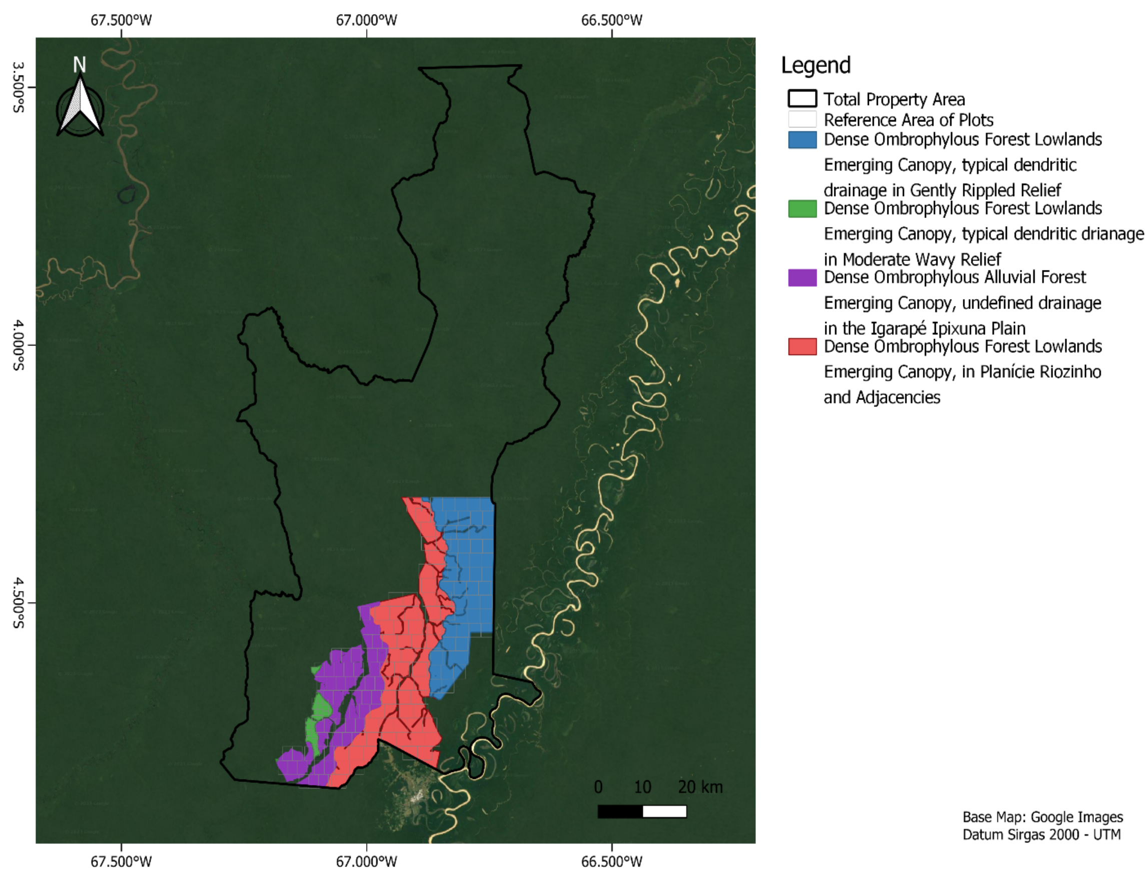

Figure 2- Map of vegetation zones considered for forest inventory.

1.10.3 Aerial monitoring

Monitoring of the project territory and the surrounding region will be carried out through the acquisition of satellite images, drone flight and monitoring data from PRODES, DETER/INPE, MapBiomas and ESA. The burned and degraded area will be measured according to the spectral index and verified with high-resolution spatial satellite images, which together with terrestrial information will accuse the occurrences of deforestation on the property.

1.10.4 Surveillance and Patrolling

- **Surveillance Team**

Local patrol will be set to monitor the territory and to protect the area from criminal fires, illegal logging, and private property appropriation. The patrols will follow surveillance routes to ensure comprehensive coverage of the area. In addition, satellite monitoring technology will be used to validate deforestation sites. This will enable the owners to pinpoint areas that require immediate attention and response. The goal is to provide comprehensive protection and prevent any unauthorized activity in the area.

The ground activities will be carried out by a team of up to four employees, plus a supervisor. All personnel involved here will undergo special training involving skills like conflict resolution, peaceful behavior, drone operation and other specifics.

The action will follow a previous schedule, planned in order to cover the entire area over the year, distributed according to the pressure that varies in time and space, due to climatic and other local conditions. In addition, there will be enough capacity to respond to the demands arising from alerts based on satellite images or from notices coming in from different sources.

Equipment, will include ground and water vehicles, communication devices and other relevant to the ground activity;

- **Forest Angels**

The Forest Angels program was created to engage the local population in protecting the area while solving a relevant social issue within the property. It aims to progressively provide land titles and property rights to the riverside dwellers who have occupied areas of the farm in good faith for a reasonable period.

It ensures their qualification and income without adversely impacting the sustainable use of the Amazon Rainforest. In accordance, these families will be trained and support the project to surveillance and protection of the area.

1.10.5 Wildfire prevention

Wildfires in tropical forests are often caused by human activity and are more frequent, intense, and severe during dry years and in degraded forests. In the case of the Amazon rainforest, natural fires are exceptionally rare. Even during the dry season, when conditions become more conducive to fires, the high humidity in the region acts as a deterrent against the occurrence of numerous hotspots. However, human activities have had a substantial impact on the prevalence of fire, resulting in a rapid alteration of the Amazon rainforest's natural state, particularly through deforestation[1].

In order to safeguard the carbon stocks in the project area, the initiative will employ some strategies. This includes the installation of monitoring towers equipped with smoke-detecting cameras, which will be complemented by satellite data and analysis to identify areas at the highest risk of fires. Additionally, the dedicated teams known as "Forest Angels" will be trained and deployed to proactively prevent the spread of fires into the forests together with the surveillance team. By implementing these comprehensive measures, the project aims to minimize the occurrence of wildfires and protect the forest cover, thereby preserving the area's rich biodiversity and making a meaningful contribution to global climate change mitigation efforts.

1.10.6 Leakage control

In the context of the APD project, it is anticipated that leakage will take place due to legal deforestation carried out by landowners (the deforestation agents) in their areas outside of the project site. The proponent, who is the landowner involved in the project, does not own any other properties apart from the one mentioned in this project. Leakage is expected to occur primarily due to changes in land use such as farming, ranching, and logging in the surrounding areas of the project site. These activities are often considered more financially lucrative than sustainable land management practices. However, the proponent believes that the implementation of the VCS project, with its positive contributions towards sustainable development in terms of the economic, environmental, and social pillars, will encourage other landowners to follow suit. Additional details are provided in Section 1.17.

1.10.7 Biodiversity Protection

The area's monitoring actions, in addition to preventing illegal deforestation that causes the destruction of biodiversity habitat, will also act with the objective of combating illegal hunting and the introduction of invasive exotic species.

1.10.8 Sustainable Forest Management of Br Arbo Project

The project aims to implement Sustainable Forest Management with Reduced Impact Logging (RIL), recognized as a sustainable practice. RIL involves selective logging and management of native timber species of commercial interest, in a limited volume form. This

[1] Source: https://ipam.org.br

practice not only maintains the forest standing and its functions and services to the environment, but also presents a viable approach to conserving biodiversity of flora and fauna.

To ensure sustainable forest management, the project includes rigorous planning and selection of forest species and individuals that will be harvested and those retained standing for seed-bearing, regeneration and to compose the harvesting stock in the second rotation cycle. The project also involves careful planning of the forest exploration infrastructures, techniques for directed felling of trees and previous cutting of vines, and elaborated planning of the skidding trails.

Furthermore, the project will implement a chain-of-custody control process for the harvested trees and logs produced, manage through specific software for the activity, and use geoprocessing tools. It will also implement a monitoring plan to track forest growth, maintain permanent infrastructure (main roads), and take actions to monitor and protect the forest, especially to curb invasions.

The Sustainable Forest Management system is called polycyclic and has a cutting cycle stipulated initially in 30 years. It has a maximum allowed exploitation volume of 25 m^3 per hectare, with minimum cutting diameter for all species of 50 centimeters at breast height (BHD 1.30 meters from the ground). The forest harvesting system is characterized as Reduced Impact Logging (RIL), adapted from the CELOS Logging System (SCE) with some adaptations from the systems disseminated by IMAZON and FFT (Tropical Forest Foundation).

In the BR ARBO projected activity, one plot of 5,457,10 hectares will be managed in each year, according to the criteria and limitations hereby described. Once the plot is managed, it is left untouched for the forest regeneration process to take place during the following 30 years, at least. In the next year a new plot is taken to be managed, and so on, creating a rotary activity that will cover the entire area divided in 30 plots, managing one plot per year.

Specifically, the main characteristics that outline the Sustainable Forest Management are:

● Rigorous planning and selection of forest species and individuals that will be exploited and retained standing for seed bearing, regeneration and to compose the harvest stock in the second rotation cycle.

● Application of targeted directional tree cutting techniques and prior cutting of lianas, in order to better conserve the remaining trees that will make up the second harvest cycle.

● Elaborated planning process for the drag trails, including their demarcation in the field, aiming at less damage to the remaining trees and natural regeneration.

● Implementation of a monitoring plan to control the forest growth, maintenance of permanent infrastructure and, above all, actions to monitor and protect the forest, especially to curb invasions.

● Polycyclic forest management system, with a cutting cycle initially set at 30 years in accordance with Resolution 17/2013 of SDS/CEMAAM and Resolution 406/09 of CONAMA, which establishes maximum values of Annual Average Increment - IMA of 0 .86 m^3/ha/year (CONAMA) and one (01) m^3/ha/year (SEMA-AM). The maximum permitted exploration volume is of 25 m^3 per hectare (Resolution 17/2013 – SDS/CEMAAM) or 30 m^3 per hectare (CONAMA Resolution 406/09), carried out through selective cuts of commercial species.

● Forest exploitation system characterized as Reduced Impact Exploitation (RIE), adapted from the CELOS Exploitation System (SCE) and with some adaptations arising from the systems disseminated by IMAZON and FFT (Tropical Forest Foundation).

● Silvicultural System to conduct natural regeneration with adaptations of the CELOS Silviculture System (SCS), supported by regional experiences of the system recommended by EMBRAPA/CPATU (SILVA et al. 1995) and by the INPA Tropical Silviculture department (HIGUCHI et al., 1991).

● Implementation of a chain-of-custody control process for exploited trees and produced logs.

● Management through specific software for the activity and use of geoprocessing tools.

The harvesting activity will be limited to 20 m^3 per hectare in this projected activity, which is below the maximum permitted. The minimum cutting diameter for all species will be 50 centimeters at breast height (DBH 1.30 meters from the ground).

With these limitations, the biomass removed will amount to around 3% of each plot in volume, once in each 30 years. This means removing 0.018% of the property overall biomass volume each year. It will regenerate during the following years into a healthier forest.

This process will be, at due time, fully certified by the FSC and/or PEFC.

1.10.9 Industrial activities

- **Sawmill**

The forest product from the Sustainable Forest Management activity with Reduced Impact Forest Exploitation, according to the Project, will be processed in a sawmill to be installed in the area, in a place close to the urban concentration of Carauari, and close to the existing river pier of adequate draft, which will allow the flow of the respective wood products.

The final products will naturally all be made of certified tropical hardwood, including blocks, boards, rafters, beams, slats, panels, floors, and other wood manufactured goods.

For shipment, the products will be classified and stored, cubed into volumes of individual products and products per log of each diameter class.

The outbound logistics of the products will always be by river from the existing port next to the industrial installation, with suitable draft, to international ports located in the Amazon basin, from which they will be exported by sea.

- **Power plant**

A 4.00 MW thermoelectric power plant will be part of the complex. Power generation will be fueled with wood residues from the sawmill and are this completely renewable. The power surplus will be available for distribution into the town, replacing the Diesel-based current generation. This is a complementary environmental positive impact provided by the BR Arbo Project.

1.10.10 Social activities

A wide range of social initiatives are being developed as a very relevant component of the BR Arbo Project. The prioritization and selection of these initiatives was based on the stakeholder engagement process developed so far, reported in this PDD. In the further development of that process other initiatives may come in place, in a continuous process of partnering with the local community.

The social action plan includes the following topics:

Electric Power

- to build an innovative biomass energy plant near the Project area, powered by wood processing waste, with the capacity to generate renewable energy for self-consumption and to provide the surplus to the town of Carauari (mentioned in point (1.11.10) above);
- to provide and install out-of-the-box photovoltaic generation kits to supply renewable and affordable electricity also to some of the remote communities, for a total of approximately 150 off-grid houses located in the Project area.

Internet

- to provide antennas and peripherals in communities to facilitate internet access and communication (including emergency communication) while avoiding community isolation.

Freshwater

- to provide water treatment equipment for domestic needs, including ultrafiltration for drinking water powered through photovoltaic systems and drinking water tanks.

Accessibility

- to improve the houses of approximately 150 families living near the river,
- to install toilets for the specially-abled in homes where people with reduced mobility reside.

Education and skill development

- to renovate and equip existing elementary public schools to ensure access to education for children and youth in the community;
- to build perimeter walls for the schools, as was specifically requested by the community;
- to fund scholarships and programs to support education for local youth to increase access to higher education, with a focus on reducing gender inequality;
- to fund the setting up of the first unit of the "Escola da Floresta" a special schooling project promoted by the Government of Amazonas, to be built near the project area.

Health

- to ensure the operation and availability of doctors from the existing health facility for local communities;
- to provide vehicles and devices for rescue operations like ambulances vehicles and provision of a special internet or radio system for emergency communications between communities, the municipality headquarters and hospitals;
- encourage and support the use of telemedicine as medical and information technology for remote care.

Collaboration with Universities

- to collaborate with Universities and Brazilian institutions to support the teacher training and development program, including institutions outside the community, to improve the quality of education and knowledge sharing;
- to collaborate with Brazilian universities and local institutions to identify and analyze risks and solutions in health care, aimed at bringing health personnel to the area on a periodic basis;
- to collaborate with Brazilian universities and institutions to facilitate the delivery of online courses for the community while avoiding the sometimes unfeasible travels in the region;

- to collaborate with institutions for the provision of necessary devices to enable telematics education.

Sustainable Agriculture Land Management (SALM)

- to provide advanced training in forest management (agroforestry techniques and conservation practices, fire prevention and management, use of GPS, tree nursery management, area protection and surveillance activities);
- to provide technological devices (such as solar panels, agricultural tools, etc.) and vocational training, focusing on);
- to create new job opportunities in this area.

NTFPs and Açaí berries

- Special attention is given to the traditional açaí berries value chain, that operates with different weaknesses in the area.
- The project will support directing this chain towards a better social and gender fairness, as well as economic balance in favor of the local communities, trough different mechanisms.
- This process, once developed, may be extended to the açaí production in other lands in the Amazon Region where it is frequently found, but presenting the same weaknesses. The social benefits of the project may so be enlarged to the entire region.
- The same initiatives may be also extended to other NTFPs, using the BR Arbo Açai case as a paradigm.

Community life

- to create community centers to provide space for social and cultural activities, fund indigenous cultural initiatives and meeting places for adults and children, such as movie theatres with projectors, baby clubs and cultural facilities;
- to support community-led initiatives to promote social cohesion, such as helping to create sports facilities (soccer fields, community festivals, etc.).

Jobs

- Mejuruá project will create over 400 new direct jobs, part of which are fixed and permanent in town (300) and part in the countryside, on a rotating basis (c. 100).
- The project will also train local people to plant and protect forest areas, creating new local employment opportunities, helping to generate shared value with local communities.

- The overall goal is to provide fair and equal opportunities for women and men in the Project area, therefore enhancing the Social Progress Index (SPI) in it.

The Forest Angels Program

- This program is directed to the approximately 100 families that live at the river margins within the property in a non-legalized land tenure situation.
- The action here is to legalize the land tenure situation of these families giving them, in time, access to de corresponding land deeds, and at the same time having them as watchers of the forest in the sense of protecting it from invasions and other illegal activities.

1.11 Project Location

The project area is located in the State of Amazonas. It spreads through three neighboring municipalities, occupying part of the territory of each. They are: Carauari, Jutaí and Juruá, in the East of the Amazonian Region.

The region suffers from a scarcity of built infrastructure, notably with a sparse road network. However, the Amazonas River basin offers a vital transportation system where riverboats serve as the primary routes for both people and goods, including within the project's location. The area of focus is referred to as Gleba Santa Rosa do Tenquê.

The property of BR Arbo has approximately 900,000 hectares of land, but in the northwest part, in the municipality of Jutaí-AM, there is an overlap with an indigenous land that has not yet been demarcated. Therefore, the owner opted for a delimitation of the project, excluding this area of approximately 200,000 hectares, resulting in the property being delimited to 679,355 hectares.

Carauari is the closest town to support the property, as it is located practically on its border, at the margin of the Jurua River (Figure 3).

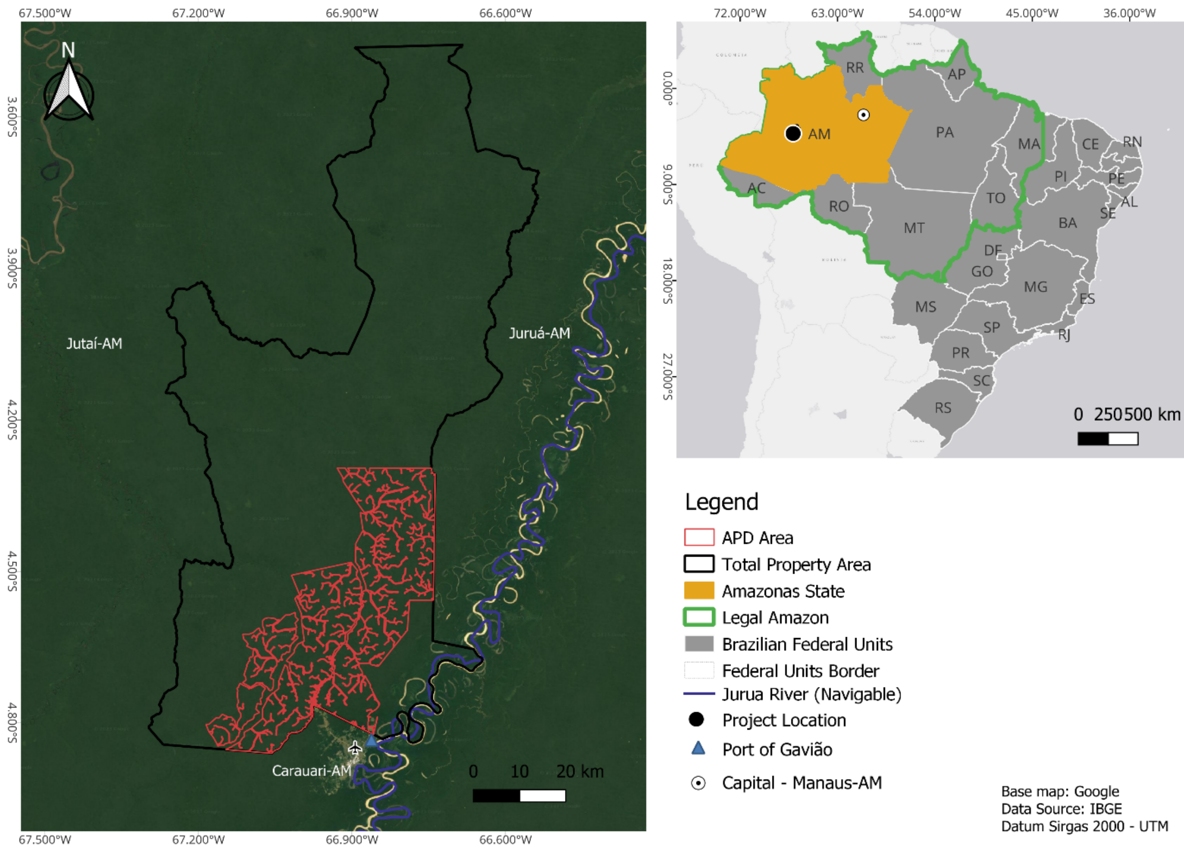

Figure 3- Location of the project area in relation to the nearest city.

To reach Carauari from the state capital Manaus: the distance from Manaus to Carauari is 780km in straight line and 1,676km by boat, using the river system of the Amazon region. By riverboat, the trip takes some 5 to 6 days, while by airplane it takes a few hours. However, the airport at Carauari is served only by small regional carriers offering regular flights only on some days of the week.

To reach the project area from the Carauari city: Carauari is very next to the project area, so its limits can be reached easily. However, accessing the interior of the property proves challenging due to the significant distances involved and the lack of existing infrastructure. Distances can easily reach the order of tenths, if not hundreds of kilometers. The area has its forest cover fully preserved, so there are no permanent roads, except for some occasionally open paths. Displacement is mainly done by walking across the forest. It is slow, even impossible during the rainy season. It is also possible to travel by riverboat starting from the Jurua River, where Carauari is located, using that river plus other local smaller water bodies. However, here one can travel only to reach destinations on the margins. From these, access to the interior is on foot again. By air, except for a mere overfly, access is hardly feasible, as there are no landing spots in the area.

The proposed project aims to address deforestation through two distinct areas. The Avoiding Planned Deforestation area encompasses approximately 130,000 hectares.

Additionally, the Avoiding Unplanned Deforestation area covers a vast expanse of approximately 543,720 hectares (Property's Legal Reserve), which will be further divided into new instances to be added in the future. The geographic coordinates of the project area are attached in KML format (GIS database).

As we can see in Figure 4, in the last twenty years, deforestation is getting closer to the project area. A report by Imazon[2] and data from SAD reveal that the Amazon rainforest is still under threat from rampant deforestation. In just one month (January/2023), 198 km² of the forest were destroyed, equivalent to almost 640 football fields lost every day. While this represents a 24% reduction from the same period last year, it is still the third-highest level of deforestation recorded for January in the past 16 years. This alarming trend underscores the urgent need for greater efforts to protect and preserve one of the world's most vital ecosystems.

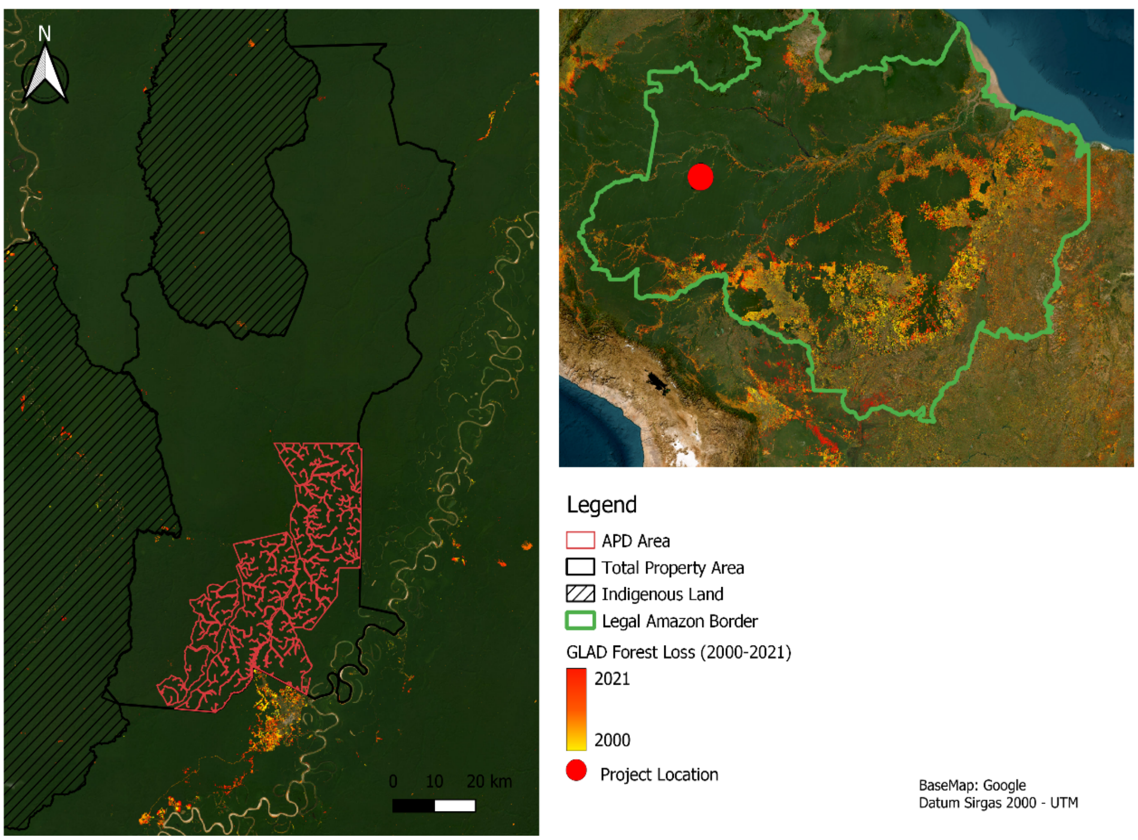

Figure 4- Forest loss in areas surrounding the project area from 2000 to 2021.

1.12 Conditions Prior to Project Initiation

[2] Source: https://imazon.org.br/imprensa/desmatamento-na-amazonia-tem-reducao-de-24-em-janeiro-mas-ainda-e-o-terceiro-maior-em-16-anos/

Ecosystem type: All Project Area Instance are insert in the Brazilian Amazon Rainforest. The area is covered by alluvial open ombrophylous forest, lowland open ombrophilous forest, dense alluvial ombrophylous forest and dense lowland ombrophylous forest (rainforest). According to the Brazilian Institute of Geography and Statistics (IBGE)[3], this formation generally occupies the coastal plain capped by Pliopleistocene plateaus of the Barreiras Group.

Current and historical land-use: The total area of the property has about 903 thousand hectares. The APD project area had a size of 130,640.542 hectares of which 100% occupied by forest formation. The areas classified as non-forest was excluded from the project area.

The urban occupation with the best access and closest to the APD project area is the city of Carauari-AM, which is on the border of the property where the management project will be carried out, to make the sawmill and disposal possible. The area does not show a significant amount of deforestation inside and around the property.

- **Has the land been cleared of native ecosystems within 10 years of the project start date?**

☐ Yes ☒ No

The conditions existing prior to the project initiation are the same in the baseline scenario (item 3.4).

1.13.1 Current and historical land use and land cover

In accordance with Map Biomas Collection 7[4], the property area has shown few changes in its territory over the years. Most of the project area is steel covered 99% by forest formation, as we can see in Figure 5.

[3] Instituto Brasileiro de Geografia e Estatística – IBGE. Manual Técnico da Vegetação Brasileira. 2ªed. Rio de Janeiro. ISSN 0103-9598. Rio de Janeiro. 2012

[4] Source: https://mapbiomas.org/colecoes-mapbiomas-1

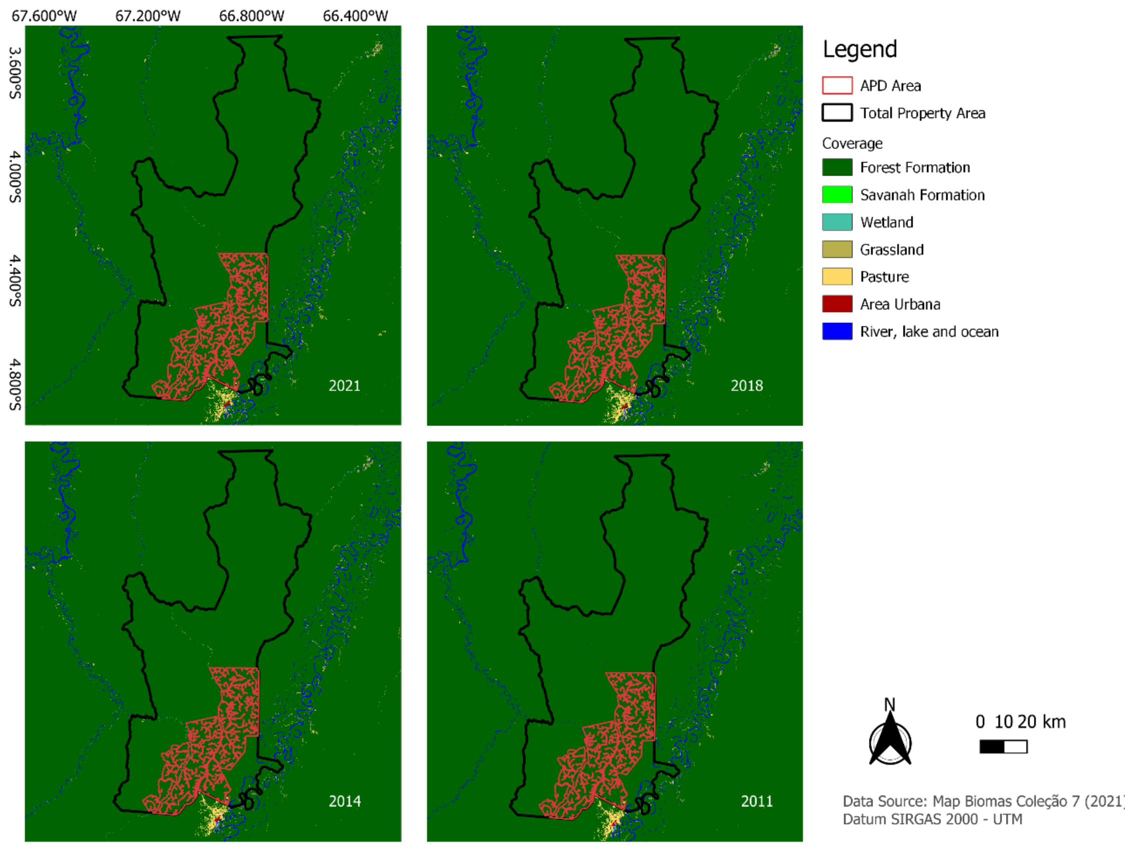

Figure 5- Land Use/Land Cover in a historical period.

The percentage of coverage of different land uses in the property area between 2011-2021 (historical land use data) can be seen in Table 3:

Table 3- Land Use Cover.

Type of coverage	Percent (%) 2011	Percent (%) 2014	Percent (%) 2018	Percent (%) 2021
Forest Formation	99,7	99,7	99,7	99,7
Savanna Formation	0	0	0	0
Wetland	0	0,1	0,1	0
Grassland	0,1	0,1	0,1	0,1
Pasture	0	0	0	0
Urban Area	0	0	0	0
River, lake, ocean	0,2	0,1	0,1	0,1

1.13.2 Climate:

According to ALVARES et al. (2013)[5], Brazil has been classified into 12 different climate types, with the tropical zone (A) being the largest, occupying 81.4% of the country's territory. The current climate classification used in this project is Af, which covers more than 80% of the Amazonas State (Figure 6).

Based on a spatial data of the global climate describe for the Koppen Geiger[6] definition, the area is in a humid equatorial forest or tropical rainforest (Af) climate type (Figure 4), without dry season, as we can see in the figure 5. It is always humid forest (60mm of precipitation approximately) with medium temperature around 18ºC all year. The climate is influenced by the movement of trade winds and the ability of the tropical forest to retain water. Due to its forest density, the Amazon has an important role in absorbing large amounts of carbon dioxide from the atmosphere, which has generated great concerns about the high rates of annual deforestation in the Amazon region.

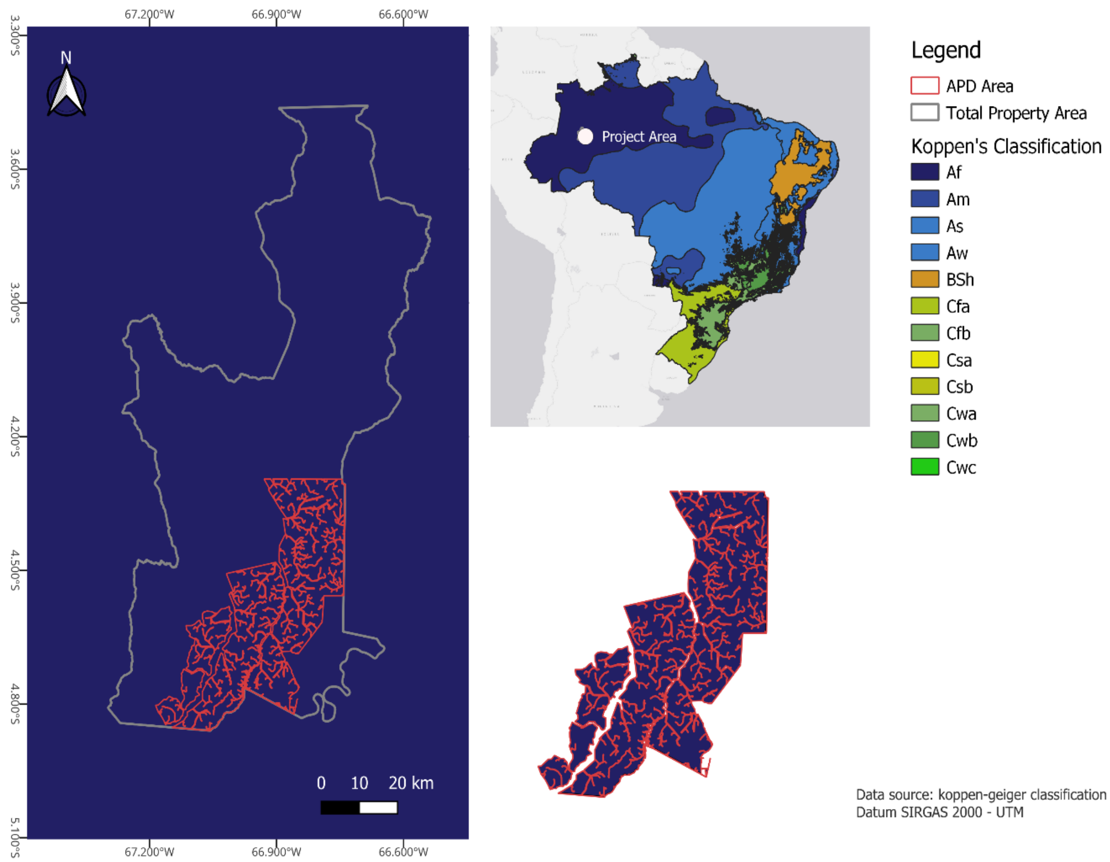

Figure 6- Koppen-Geiger Climate Classification.

1.13.3 Hydrography

[5] Alvares, C.A., Stape, J.L., Sentelhas, P.C., Gonçalves, J.L.M.; Sparovek, G. Köppen's climate classification map for Brazil. Meteorologische Zeitschrift, v. 22, n. 6, p. 711-728, 2013.

[6] Source: https://web.archive.org/web/20220901051523/http://koeppen-geiger.vu-wien.ac.at/shifts.htm

The Amazon is one of the regions with the greatest wealth of water resources. Its main river, the Amazon, is the second largest river in the world in volume and the largest in length. In the project region, the main rivers are the Rio Juruá, Rio Jutaí and Rio Biá (Figure 7). Within the property is the Igarapé Ipixuna on the left bank of the property, flowing into the Rio Biá. Most people in the area use the river as their primary means of transportation to travel to other cities, such as the capital city of Manaus, and to earn their livelihood. However, this mode of transportation is not easy, as Manaus is several days away by boat, and the only alternative is to travel by airplane.

The Amazon plain is located between the Guianas shield to the north and the Brazilian shield to the south. It is bounded on the west by the Andes mountain range, and on the east by the Atlantic Ocean. The Amazon basin is home to the largest river system and the largest liquid mass on the planet and is covered by the largest tropical rainforest. The Amazon basin covers an area of approximately 7 million km^2 of drainage area, of which 58% is located in Brazil, 16% in Peru, 10% in Bolivia and the rest in Colombia, Ecuador and Venezuela. The Amazon River discharges, on average, 175,000 m/second, which corresponds to about 20% of the fresh water input into the world's 3/4 oceans. It is considered the largest river in the world, both in length and water volume.

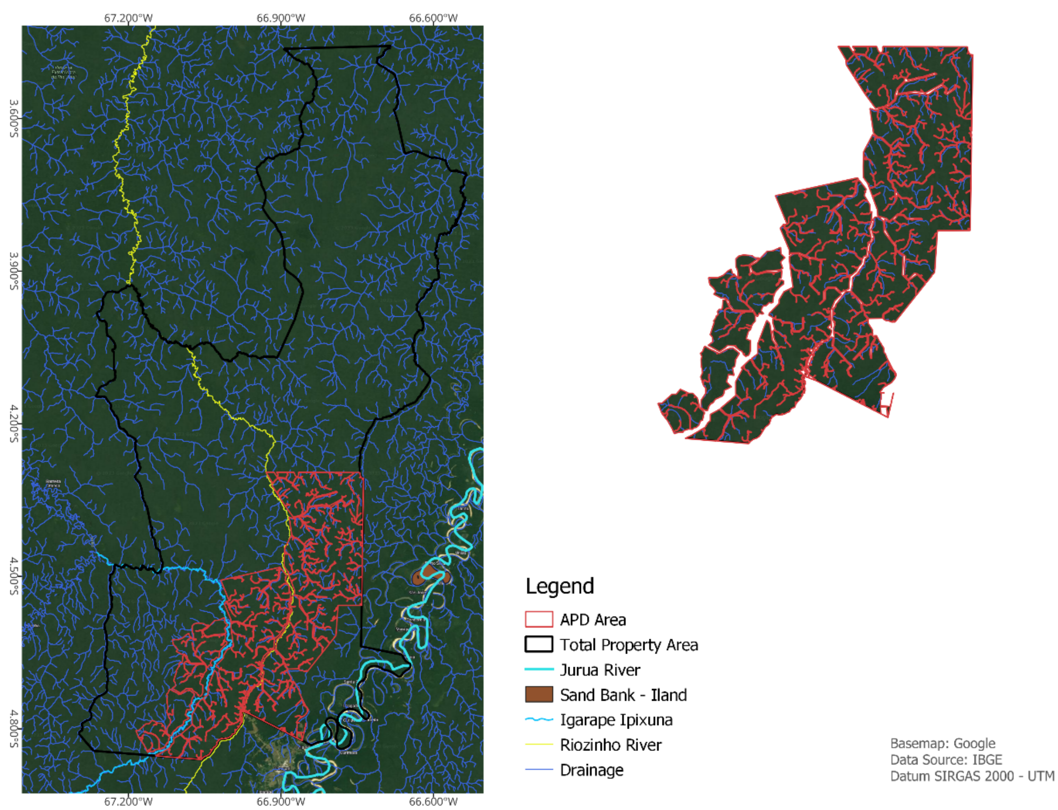

Figure 7- Hydrography Definition.

1.13.4 Topography, geology and soils

The geology of the project area dates back to the Quaternary period, specifically the Pleistocene Gelasian stage, which began approximately 2 million years ago during the ice age. This period is identified by the formation located in the Amazon-Solimões Basin, with the oldest and most present formation known as Iça and Solimões. These formations exhibit specific conditions related to the Solimões Basin. The river with the greatest width for navigation is the Juruá River (Figure 8).

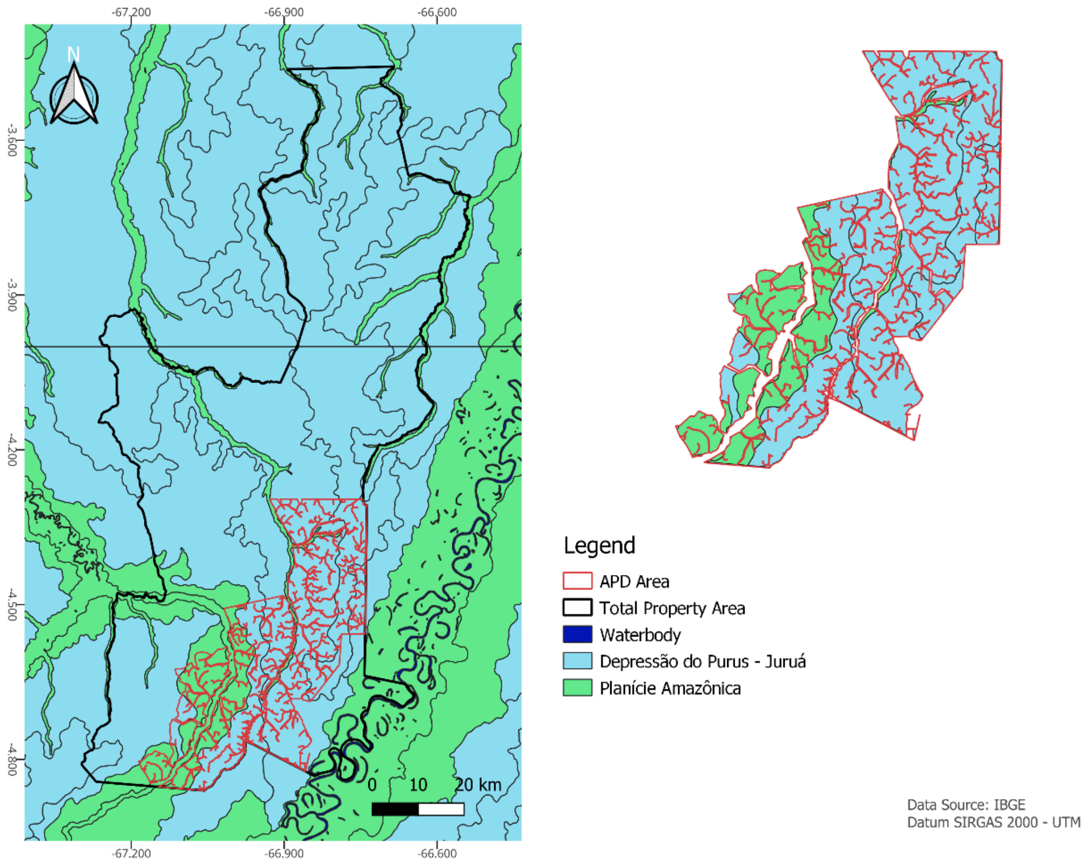

Figure 8- Geology Formation.

The soil types of the project area, as shown in Figure 9 below, are identified as dystrophic red-hardy plintosols, red-yellow dystrophic argosols, red-yellow dystrophic latosols, eutrophic ta felic gleissols and eutrophic ta fluvic neosols. These types of soils, according to Embrapa's definition[7], vary according to some basic characteristics. Plintosols are mineral soils formed under conditions of restricted water percolation subject to the temporary effect of excess moisture, generally imperfectly or poorly drained, and are characterized primarily by having significant plintitization with or without petroplintite on condition that they do not meet the requirements stipulated for the classes of Neosols,

[7]Source: https://www.alice.cnptia.embrapa.br/bitstream/doc/920216/1/GeodiversidadeAMCap6.pdf

Cambissolos, Luvissolos, Argissolos, Latosols, Planosols or Gleissols. The definition of the soils found in the area can be found below.

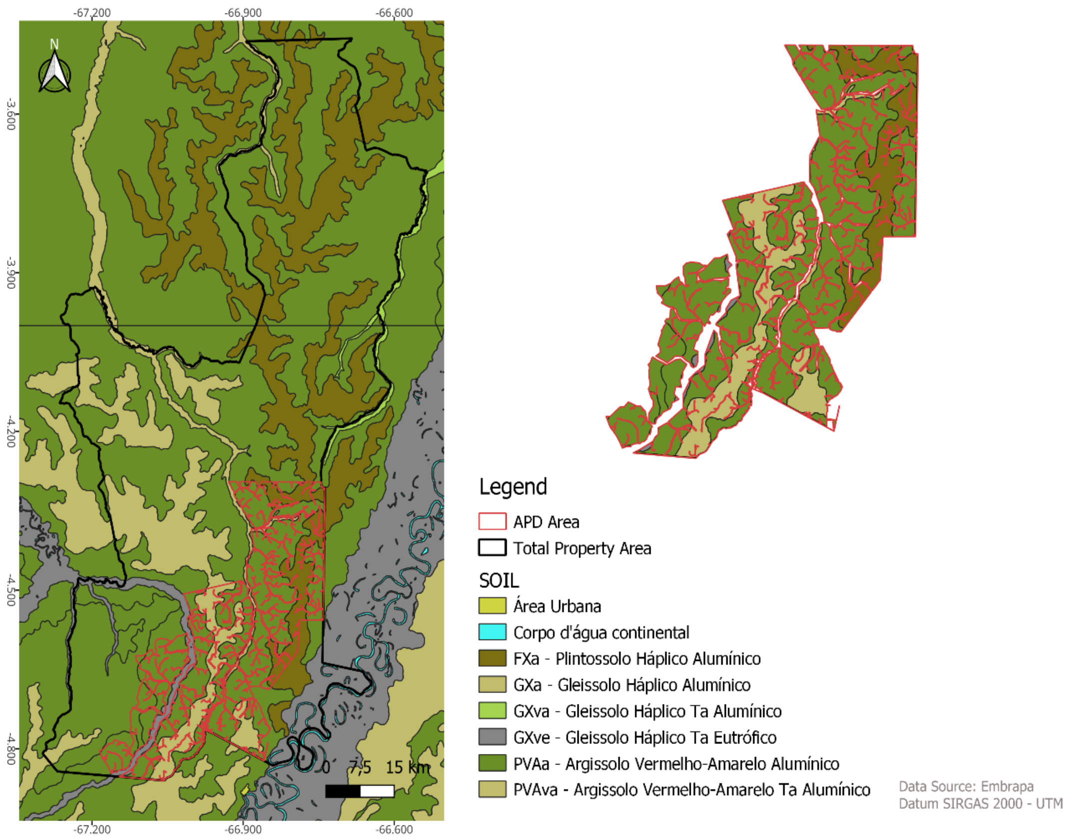

Figure 9- Type of soils.

According to EMBRAPA classification, the relief in Amazonian instances varies from Wavy to Smooth Wavy with some small patches of Strong Wavy relief, between 3 and 20%, according to Figure 10 below. Due to legal suppression restrictions imposed by the Brazilian Forest Code, areas with a slope greater than 25°, which is approximately 46%, were excluded from the project area.

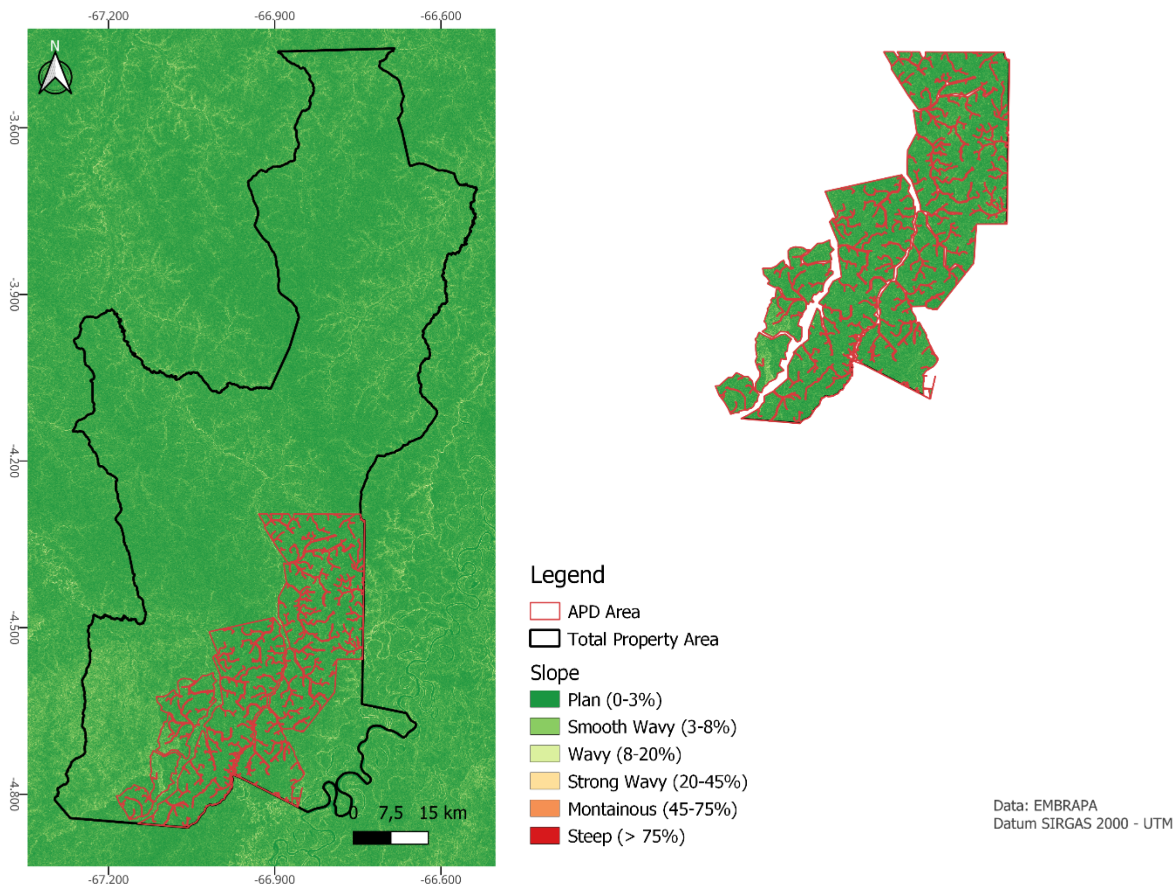

Figure 10- Slope definition.

The topographic information, as shown in Embrapa's SRTM[8] image, indicates that the terrain has low elevation, which influences the formation of rivers and local vegetation (Figure 11). According to BISPO et al (2009)[9], about shuttle, radar, topography and mission (SRTM) images, each variable influences vegetation in distinct ways, such as through temperature, solar exposure, hydrology, and direct control over the transport and accumulation of nutrients, biomass, and plant substances. These factors are crucial for understanding vegetation distribution and ecology. The elevation that corresponds to the altitude of the terrain is related to the altitudinal distribution of the soil and climate, conditioning different vegetation patterns in the landscape.

[8] Source: https://www.embrapa.br/en/satelites-de-monitoramento/missoes/srtm

[9] Source: https://www.scielo.br/j/aa/a/qvB3DYtzJGRzdtcykcZM7rk/?format=pdf&lang=pt

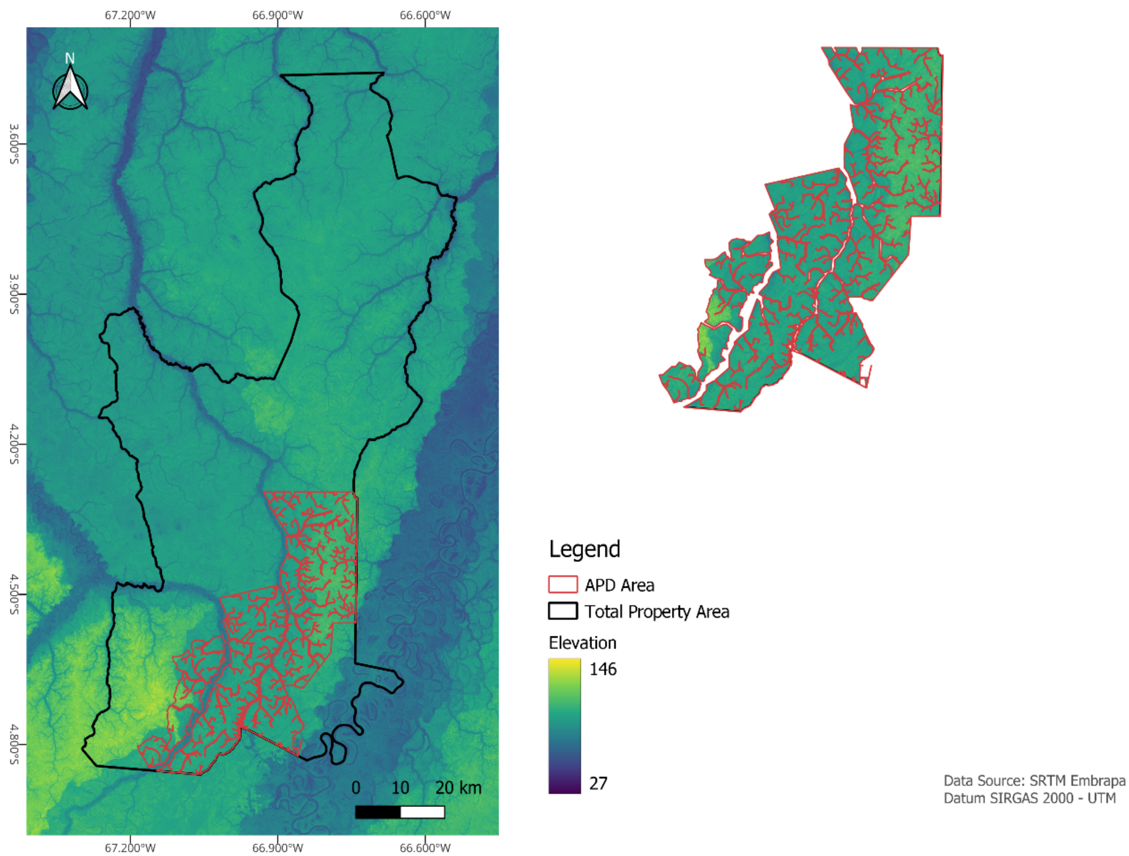

Figure 11- Elevation definition.

1.13.5 Vegetation and Biodiversity

Restor Data[10] indicates that the project area in the Brazilian Amazon is home to approximately 4,201 plant species, 103 amphibian species, 169 mammal species, and 516 bird species. According to LIMA et al (2012)[11] , a study conducted in Carauari, Amazonas, shows that the region has a great floristic diversity, as well as commercially exploitable products. Some of the most found species were Fabaceae (inga bean, fava bean), Chrysobalanaceae (Brazil nut, macucu), Lecythidaceae (Brazil nut tree, matamatá), Moraceae (muriçoca, apuí), Myrtacea (araça-da-mata), Lauraceae (bay leaf), among others.

The phytophysiognomies (description according to IBGE[12]) present in the project area are shown in Figure 12 and Table 4.

[10] Source: https://restor.eco/pt/platform/sites/new/analysis-results/

[11] LIMA, Rosival B. De A. Et al. Rev. Bras. Ciênc. Agrár. Recife, v.7, n.3, p.485-492, 2012. Available in: https://www.redalyc.org/pdf/1190/119024529018.pdf

[12] Instituto Brasileiro de Geografia e Estatística - IBGE: Manual técnico da Vegetação Brasileira. ISSN 0103-9598. 2012

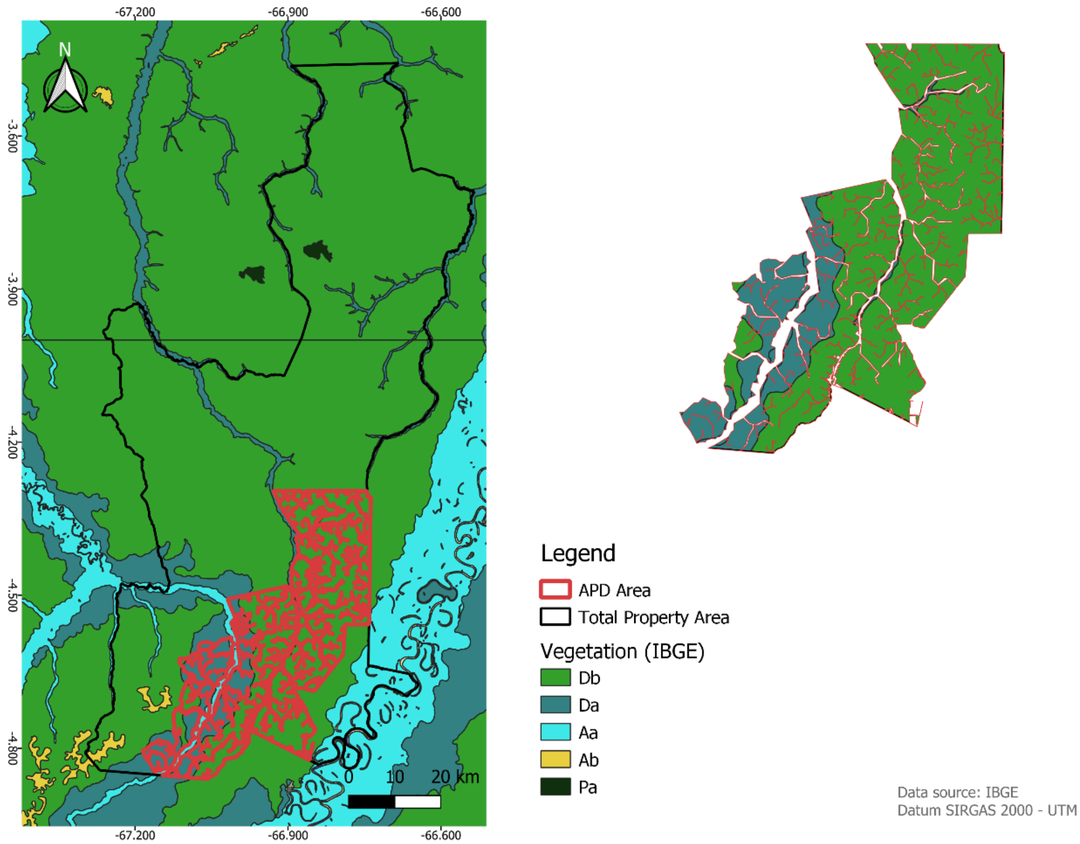

Figure 12- Vegetation cover type.

Table 4- Vegetation Cover.

Vegetation Type*	APD Area *Considering PA	(%) APD
Da	28,444.462	23%
Db	101,083.952	77%
Total	130,640.590	100%

Data Source: Shapefile of vegetation from IBGE (*Da: Ombrophilous Dense Forest Alluvial; Db: Dense Ombrophilous Forest Low Land).

- **Dense Ombrophylous Forest - Alluvial (Da):** It is a riverine formation or "riparian forest" that occurs along watercourses on former Quaternary plains. It is composed of fast-growing plants, including macro, meso, and microfanerophytes, usually with smooth bark, conical trunks, and sometimes the characteristic bottle shape. The forest has a uniform emergent canopy, but due to logging, its physiognomy has become quite open. The forest has many palm trees in the dominant stratum and submata, and also has nannophanerophytes and some chamaephytes among the seedlings of the natural reconstitution of the dominant stratum. However, the forest also has many woody and herbaceous lianas, as well as a large number of epiphytes and few parasites.

- **Dense Ombrophilous forest - lowland (Db):** This forest formation occupies the coastal plains and is delimited by pliopleistocene tablelands of the Barreiras Group, covering a vast area that goes from the Amazon to the Northeast of Brazil, to the state of Rio de Janeiro. In the region, the floristics is composed of typical species, including *Ficus*, *Alchornea*, *Handroanthus* and *Tapirira guianensis* Aubl. Moreover, along the plains formed by the silting up of the coastal mountain ranges, and in the maritime inlets, this formation is also found on Quaternary terrains slightly above sea level. In the formation, there is a dominance of two species, *Calophyllum brasiliense* Cambess. being the most prominent from the State of São Paulo southward.

1.13.6 Socioeconomic conditions:

Carauari, a municipality in Brazil, had an estimated population of 28,719 people in 2021, with a low demographic density of 1 person per square kilometer. The average monthly salary in the municipality was 1.9 minimum wages, and only 5.3% of the population were employed. The town is located in the Amazon region of Brazil, which offers generally low social indexes.

A particular historic event affected the socio-economic scenario of Carauari some decades ago, leaving its traces until today: from 1977 to 1988 it was impacted by significant internal and external migration movements and other changes resulting from the gas and oil prospecting activities carried out by Petrobras[13], when the discovery of some deposits of natural gas occurred. Later, these deposits showed to be sub-commercial, and the exploitation abandoned[14].

In 1977, at the start of the oil and gas project, the total population of the municipality was 20,162 inhabitants, with 5,536 in the urban area (27.5%) and 14,626 in the rural area (72.5%). With the start of the Petrobras activities that year, the prospect of better salary gains was created. The rural caboclo abandoned his swidden and went in search of a job with a formal contract and the respective labor rights.

These expectations were frustrated by the interruption of the Petrobras venture, in February 1988. Eleven years after the project start, the depopulation of the rural area led to 70% of the local inhabitants living in the urban environment with the consequent abandonment of traditional extractivism and other primary sector activities.

As a consequence, the disorderly growth of the urban and suburban areas of the municipal seat, with increase of deficits in infrastructure, services and urban equipment, with

[13] Petrobras S.A., the Brazilian state monopolistic oil and gas Compay

[14] Source: https://www.carauari.am.gov.br

worrying rates of unemployment, prostitution, drug use, destabilization and weakening of hundreds of families[15].

Despite the urban chaos created most workers from the rural area, who previously carried out activities in extractivism, fishing and agriculture, did not accept to return to these activities, starting to demand solutions to their problems from the Municipal Public Power, such as housing, work and other basic needs.

Presently, after a few decades of the oil and gas event, Carauari ranked 11th in terms of average monthly income and 35th in terms of employment rate, compared to other municipalities in the state. However, when compared to the national level, the municipality ranked much lower, at 2558th in terms of average monthly income and 5139th in terms of employment rate. Furthermore, over half (50.9%) of Carauari's population earned monthly incomes of up to half a minimum wage per person, placing it in 30th position among the cities of the state and 1220th position among the cities of Brazil.

Overall, these statistics illustrate the relatively low income and employment rates in Carauari, especially when compared to the rest of Brazil. In relation to education, Carauari presents low indexes, with only 4.2% of the population attending high school. According to the IBGE[16], Carauari ranks 32nd in education in the State of Amazonas and 4177th in Brazil.

The average infant mortality rate in the city is 11.97 per 1,000 live births (Figure 13), while the hospitalization rate for diarrhea is 0.7 per 1,000 inhabitants. Compared to other municipalities in the state, Carauari ranks 46th in relation to infant mortality rate and 38th in relation to diarrhea hospitalizations. At the national level, these positions are 2326th for infant mortality rate and 2889th for diarrhea hospitalizations.

[15] Instituto Brasileiro de Geografia e Estatística (IBGE) (27 de agosto de 2021). «Estimativas da população residente no Brasil e unidades da federação com data de referência em 1º de julho de 2021»

[16] Source: https://cidades.ibge.gov.br/brasil/am/carauari/panorama

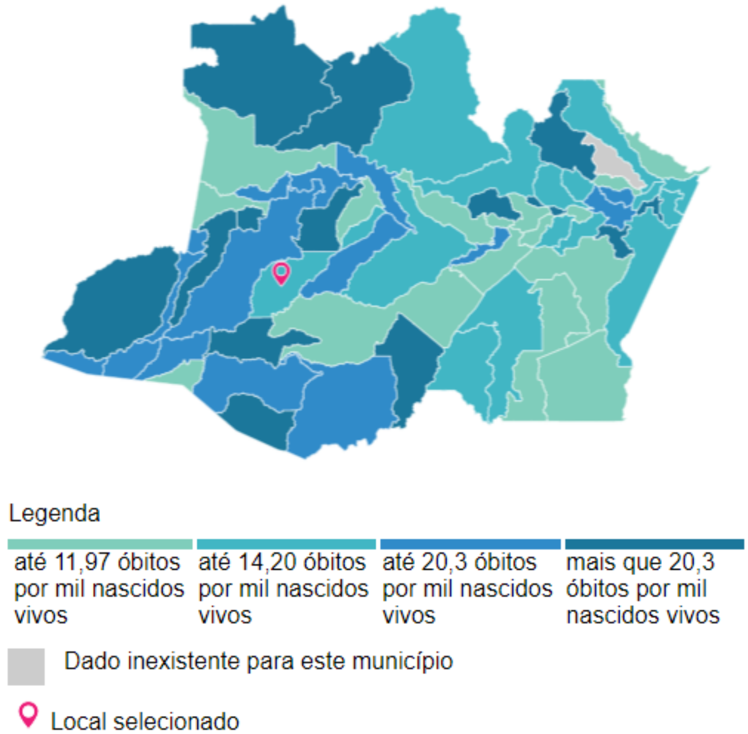

Figure 13- Number of deaths per thousand live births. Data source: Brazilian Institute of Geography and Statistics (IBGE).

The other municipalities, Jutaí and Juruá, in which the project property is located, do not have an urban area close to the property, with Carauri being the closest supporting city. In summary, according to data from the Brazilian Institute of Geography and Statistics[17] (IBGE), the municipality of Juruá has an approximate population (2021) of 15,495 and a territory of 19,442.548 km². Jutaí, on the other hand, has an approximate population of 13,462 people and a territory of 69,457.415 km².

1.13 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Brazilian Federal Constitution determines in its article 225 that "Everyone has the right to an ecologically balanced environment, a good of common use for the people and essential to a healthy quality of life, imposing on the Public Power and the community to defense and preservation of the environment for present and future generations[18]"

The Mejuruá project is aligned with paragraph 4 expressed in Article 225, which mentions that: "*The Brazilian Amazon Forest, the Atlantic Forest, the Serra do Mar, the Pantanal*

[17]Source: https://cidades.ibge.gov.br/brasil/am/jurua/panorama

[18] Source:https://constituicao.stf.jus.br/dispositivo/cf-88-parte-1-titulo-8-capitulo-6-artigo-225

Mato Grossense and the Coastal Zone are national heritage, and their u se shall happen under conditions that ensure the preservation of the environment and of natural resources".

The Mejuruá project also complies with National Policy Law for the Environment (PNMA)[19] Law Number 6,938 of August 31, 1981, which provides for the National Environmental Policy, its aims and mechanisms for the formulation and implementation, and other measures. The following principles of law will be addressed through the Mejuruá project activities: Maintenance of ecological balance; Rationalization of the use of soil, subsoil, water and air; Protection of ecosystems; Preservation of representative areas and protection of areas threatened by degradation.

Federal Law No. 12,651/2012 enacted the Brazilian Forestry Code[20], which has as purpose of stablishing the general rules on vegetation protection, permanent preservation areas and legal reserve areas, forest exploitation, the supply of forest raw materials, the control of the origin of forest products and the control and prevention of forest fires, as well as to provide for economic and financial instruments to achieve its objectives.

Under its Article 12, the Brazilian Forestry Code sets out that all rural properties must preserve a percentage of their areas with native vegetation coverage, as a "Legal Reserve". Pursuant to its Article 3, III, a Legal Reserve is defined as *"area located within a rural property or possession, limited under the rules established in Article 12, with the purposes of ensuring the sustainable economic use of the natural resources of the rural property, aid in the conservation and rehabilitation of ecologic processes and promote the conservation of the biodiversity, as well as the shelter and protection of the wild fauna and native flora".*

The Mejuruá project is located in the Legal Amazon region, region that includes the states of Acre, Pará, Amazonas, Roraima, Rondônia, Amapá and Mato Grosso and the regions located to the North of parallel 13ºS of Tocantins and Goiás states, and to the West of the meridian 44º W of Maranhão state (Figure 14).

[19] BRASIL. Lei N° 6.938, de 31 de Agosto de 1981. Dispõe sobre a Política Nacional do Meio Ambiente, seus fins e mecanismos de formulação e aplicação, e dá outras providências.

[20] BRASIL. Lei N° 12.651, de 25 de maio de 2012. Dispõe sobre a proteção da vegetação nativa; altera as Leis nºs 6.938, de 31 de agosto de 1981, 9.393, de 19 de dezembro de 1996, e 11.428, de 22 de dezembro de 2006; revoga as Leis nºs 4.771, de 15 de setembro de 1965, e 7.754, de 14 de abril de 1989, e a Medida Provisória nº 2.166-67, de 24 de agosto de 2001; e dá outras providências.

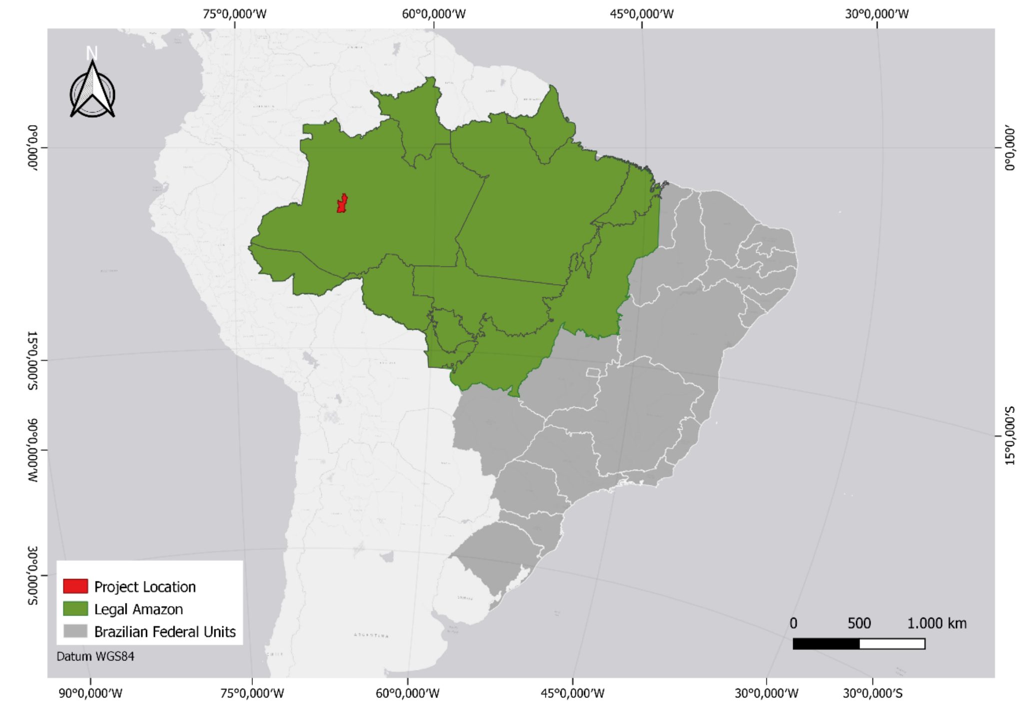

Figure 14- Location of the BR Arbo property in the Legal Amazon.

The legally required percentage of Legal Reserve varies according to the property location. As per Article 12, I, of the Brazilian Forestry Code, if properties are located within the Legal Amazon, they must observe the following minimum percentages in relation to the area of the property:

I - properties located in the Legal Amazon region:

a) if the property has a dense forest physiognomy, it must be maintained with 80% of the original vegetation physiognomy in its total area.

b) if the property is savannah (cerrado) physiognomy, it must be maintained with 35% of the original vegetation physiognomy in its total area;

c) in the case of areas of Campos Gerais, the property must maintain at least 20% of this physiognomy in total area.

As BR Arbo's property is located mainly in an area of Dense Ombrophilous Forest, the property must maintain a minimum of 80% of its area as a forested Legal Reserve.

The Brazilian Forestry Code also instituted a new instrument called the Rural Environmental Registry ("Cadastro Ambiental Rural CAR). It defines the CAR as "a nationwide electronic public record, mandatory for all rural properties, with the purpose of integrating environmental information on rural properties and possessions, composing a database for control, monitoring, environmental and economic planning and combating deforestation. It is through CAR that the landowner communicates to the competent environmental agency the location of the property's Legal Reserve and formalizes it for the purposes of its maintenance. Such agency must approve the location of the Legal Reserve, after its insertion in the Rural Environmental Registry, as established in Article 14 of the Brazilian Forestry Code.

In the remaining 20% of the property besides the Legal Reserve, the use of land for different purposes is allowed, but the owners of BR Arbo opted for the sustainable management of this area instead of the vegetation total suppression for other uses.

The Brazilian Forest Code is the main legislation that regulates forest management in the country. This law requires, in its Article 31, the development of a Sustainable Forestry Management Plan and previous licensing by the competent environmental agency. With regard to state laws, the state of Amazonas regulation, sets out the activities of exploitation, beneficiation and industrialization of forestry products and by products with logging purposes as licensable ones, under State Law No. 2,416/1996, which sets forth the requirements for the environmental licensing by IPAAM of such activities. It demands, for the activities of forestry exploitation with logging purposes, the presentation of a Sustainable Forestry Management Plan. Large projects are also expressly licensable, subject to additional requirements, as Article 7 of such Law indicates that the approval of Sustainable Forestry Management Plan and the granting of environmental licensing for areas over 50,000 hectares depend upon prior public consultation in the municipality where the area is located.

The Management Plan for the BR Arbo property will follow Resolution 17/2013 of the Environmental State Council of Amazonas (CEMAAM)[21] and Resolution 406/2009 of the National Environment Council (CONAMA)[22]. Resolution 17/2013 regulates the criteria for the preparation of Sustainable Forest Management Plans for Les ser and Greater impact of exploitation on native forests and succeeding formations. Resolution 406/2009 establishes technical parameters to be adopted in the elaboration, presentation, technical evaluation and execution of a Sustainable Forestry Management Plan for logging purposes, for native forests and their forms of succession in the Amazon biome.

Rural properties may have other areas subject to mandatory conservation and restrictions in use, including Permanent Preservation Areas. Pursuant to the Brazilian Forestry Code, Permanent Preservation Areas are protected areas which must have their vegetation coverage maintained, aiming at the protection and preservation of hydric resources, the landscape, the geological stability and biodiversity, the fauna and flora, the soil and

[21] BRASIL. Resolução n° 17 de agosto de 2013. Estabelece os procedimentos técnicos para elaboração, apresentação, execução e avaliação técnica de PMFS de Maior Impacto de Exploração e PMFS de Menor Impacto de Exploração nas florestas nativas e formações sucessoras no Estado do Amazonas.

[22] BRASIL. Resolução n° 406 de 02 de fevereiro de 2009. Estabelece parâmetros técnicos a serem adotados na elaboração, apresentação, avaliação técnica e execução de Plano de Manejo Florestal Sustentável- PMFS com fins madeireiros, para florestas nativas e suas formas de sucessão no bioma Amazônia.

reassure the well-being of human populations[23]. They are specifically set out for certain locations by Article 4 of the Forestry Code, such as the margins of rivers, surroundings of lakes, water springs, amongst others. Intervention in Permanent Preservation Areas will only be allowed in case of public utility, social interest or low environmental impact and must be authorized by the competent environmental agency through a specific authorization.

Indigenous lands are also subject to special protection. Forestry resources located within indigenous lands are to be exploited through the personal labor of the indigenous community[24]. In the environmental licensing of activities affecting indigenous lands, a consultation must be made to the National Indigenous Foundation (“FUNAI”) to confirm the feasibility of the installation and operation of the activity being licensed.

There is an area of 221,497 hectares which has been declared by a Federal Decree as indigenous land within the BR Arbo property, pending ratification and delimitation. This area is not considered within the PAIs in the Mejuruá project.

Although there are some laws that provide for the protection of native ecosystems in the Legal Amazon, it has been noted that the deforestation rate in the Legal Amazon has increased significantly in recent years. In 2022 this region had an estimated deforestation rate of around 11,568.00 km^2[25]. Among the factors that contribute to this increase in deforestation, the expansion of livestock stands out[26]. Although the project proponents act to preserve the area and comply with the laws, the Legal Reserve of BR Arbo property covers 544,290.95 ha, thus the monitoring of criminal acts in its most remote region becomes more vulnerable.

The Mejuruá project is also in line with Law 12,187 / 2009[27], which establishes the National Policy on Climate Change, seeking to contribute to the reduction of impacts arising from anthropic interference on the climate system and with the commitments assumed by Brazil in the United Nations Framework Convention on Climate Change, in the Kyoto Protocol. The contributions to Sustainable Development Goals in Brazil will be detailed in section 1.17.

All PAIs will be implemented in accordance with existing legal requirements.

[23] As per Article 1, par. 3, II, and Article 7 of the Brazilian Forestry Code.

[24] Art.3, sole paragraph, c.c. item V, of the Brazilian Forestry Code.

[25] Source: http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates. 2022

[26] Dos Santos et al. Deforestation drivers in the Brazilian Amazon: assessing new spatial predictors. Journal of Environmental Management 294 (2021) 113020.

[27] BRASIL. Lei N° 12.187, de 29 de dezembro de 2009. Institui a Política Nacional sobre Mudança do Clima - PNMC e dá outras providências.

1.14 Participation under Other GHG Programs

1.14.1 Projects Registered (or seeking registration) under Other GHG Program(s)

Mejuruá project is not registered or seeking to register in any other GHG program.

1.14.2 Projects Rejected by Other GHG Programs

Mejuruá project has not been rejected by any other GHG program.

1.15 Other Forms of Credit

1.15.1 Emissions Trading Programs and Other Binding Limits

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

If yes, provide the name of the emissions trading program or other mechanism that allows GHG allowance trading.

1.15.2 Other Forms of Environmental Credit

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

☐ Yes ☒ No

If yes, provide the name of the other program(s) under which the project has sought or received another form of GHG-related credit.

Supply Chain (Scope 3) Emissions

Have the owner(s) or retailer(s) of the impacted goods and services[28] *posted a public statement saying, "VCUs may be issued for the greenhouse gas emission reductions and removals associated with [organization name(s)] [name of good or service]" since the project's start date?*

☐ Yes ☒ No

[28] Impacted goods and services are all goods and services directly impacted by the technologies and measures specified as project activities in the project description. Please see the VCS Program document *VCS Program Definitions* for additional information.

Explain your response.

BR Arbo Forest Management has not yet defined the owners/retailers of the forest product resulting from the management activity. The orientation of the posting of the public information as described above will be carried out once the agreement is reached with the contracted company (ies).

Has the project proponent posted a public statement saying, "VCUs may be issued for the greenhouse gas emission reductions and removals associated with [name of good or service] [describe the region or location, including organization name(s), where practicable]."

☒ *Yes* ☐ *No*

Explain your response.

Yes. The proponent has published the following statement on the forest conservation project available on the brarbo.com.br website: "VCUs may be issued for the greenhouse gas emission reductions and removals associated with wood products from BR Arbo operation in Carauari, state of Amazonas."

Have the producer(s) or retailer(s) of the impacted good or service been notified of the project and the potential risk of Scope 3 emissions double claiming via email?

☐ *Yes* ☒ *No*

Explain your response.

Retailers have not yet been identified, but the following statement has been released on the BR Arbo website: "Timely, due care will be taken to communicate to the other participants of the supply chain about this project being in place, when these players are properly identified, in order to prevent any double claiming of Carbon Credits."

The Forest Conservation Project of BR Arbo Gestão Florestal with these statements is available on the website and it is also attached in appendix. On the website, the project is available in both English and Portuguese versions.

1.16 Sustainable Development Contributions

At the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change, the signatory countries agreed on a commitment to limit the temperature increase to 1.5°C above pre-industrial level. Brazil ratified the Paris Agreement with its Nationally Determined Contribution (NDC) committing to reduce greenhouse gas emissions by 37% by 2025 and by 50% by 2030 and also with the long-term goal of achieving climate neutrality[29] .

BR ARBO Forest Management has a Forestry Conservation project - BR Arbo Forest Management Forest Conservation Project, whose objective is to permanently conserve the monumental native Amazonian biome of more than 900 thousand hectares. The project foresees the implementation of the Sustainable Forest Management activity with Reduced Impact Logging (RIL) which is recognized as a sustainable practice through cutting and selective management of native wood species of commercial interest in a limited way in volume.

With the help of revenue from carbon credits, this project aims to install a new sawmill in Carauari to process certified wood harvested in sustainable management including the installation of a plant to generate renewable electricity, powered by wood residues processed in the sawmill. The thermoelectric plant will be dimensioned in order to supply the sawmill's entire demand and generate a surplus that can be sold in the city of Carauari. This plant will replace the current energy that comes from burning Diesel oil, given that the location of the city does not allow its connection to the National Interconnected Energy System, thus being an off-grid situation.

The municipality of Carauari had a population of 28,179 in 2021, according to the Brazilian Institute of Geography and Statistics (IBGE). A comparative analysis of some socially relevant indices indicates that the municipality has a very poor situation, which can be explained, among other factors, by its regional and isolated location. The GDP per capita (R$ 12,591.08) and the Municipal Human Development Index (0.549) are examples of situations below 50% in Carauari's position in relation to the national ranking [30].

The project brings important opportunities to positively influence some of the above indicators with relevant impacts for the local population as well as for the Amazon region, highlighting the creation of new direct jobs through industrial and field activities. The project will naturally bring socio-economic benefits linked to its activity, such as the general increase in the level of local economic activity through the development of additional offers of goods and services.

In the given context, Mejuruá project endeavors to actively implement social initiatives within the neighboring communities, making a significant contribution towards the realization of Brazil's 2030 Agenda. The project aims to support multiple Sustainable Development Goals (SDGs) as described in Table 5. The monitoring actions and the results

[29] Source:https://www.gov.br/casacivil/pt-br/assuntos/comite-interministerial-sobre-mudanca-do-clima/arquivos-cimv/item-de-pauta-3-paris-agreement-brazil-ndc-final-1.pdf.

[30] Source: https://cidades.ibge.gov.br/brasil/am/carauari/panorama

that has been obtained will be reported in greater detail in the monitoring plan and monitoring reports in the VCS standard.

Table 5- Project contributions to Sustainable Development Goals.

Sustainable Development Goals (SDG)	Brazilian Indicators for SDG	Project Activity
1 – No Poverty	1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day.	By creating more than 400 direct job opportunities in the forest management operation, in the logistics, in the sawmill and in the power plant, plus the engagement of local providers for contracts such as machinery, logistics, surveillance, maintenance, etc., the project will aid in supporting the local economy and generating significant indirect income for the region.
	1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.	The project aims to enhance electric power availability to the local population. When grid-connected, consumers will have access to renewable energy produced by the plant to be implemented by the project, using biomass residues as fuel. When of-grid, photovoltaic kits will be supplied by the project to homes in the local communities. Antennas and peripherals will be installed in areas where local communities reside to promote internet connectivity and facilitate communication, including emergency communication. The project also seeks to address water infrastructure needs, including the provision of drinking water through photovoltaic-

		powered ultrafiltration plants. Furthermore, the project will improve living conditions for the 150 families residing by the river by improving their home infrastructure, and installing disability-friendly toilets in homes accommodating individuals with reduced mobility.
2 – Zero Hunger	2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists, and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.	BR Arbo will establish contracts and partnerships with existing local cooperatives in order to ensure the livelihood of the Fazenda workers. By doing so local cooperatives will also benefit from the Project, due to a steady and defined demand for supply. In addition, BR Arbo will hire and train local communities, mainly women, to develop and manage the sustainable production of one of most common forest products in that region: "açaí" berries. BR Arbo intends to act as a centralized buyer for the local production of berries, in order to guarantee a stronger negotiation position for local farmers and enhance the establishment of fair-trade agreements with international buyers and exporters.
	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for	BR Arbo will support the development of sustainable agriculture Land Management (SALM) and agroforestry practices in local communities to create new job opportunities by providing technological devices for employment (such as solar panels, agricultural tools, etc.).

	adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	SALM is a methodology for farmers to adapt to the impacts of climate change and achieve increased environmental resilience.
3 – Good Health and Well-Being	3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all. 3.c: Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States	BR Arbo, in consultation with the local communities, has identified the demand for initiatives to enhance healthcare in the Project area; to better prevent diseases and injuries, a strong understanding of health conditions in the area is needed. For doing so, BR Arbo will set specific collaborations with Brazilian universities and local institutions, in order to gather a better understanding of health-related risks in the area. In addition, a program of internships for healthcare personnel in the Project area will be proposed and developed, bringing on a periodic basis doctors and nurses in the area. In addition, the Project aims to bring permanent nurses into the communities as obstetricians serving women.
4 - Quality Education	4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes. 4.a: Build and upgrade education facilities that are child, disability and gender sensitive and provide safe,	The project aims to ensure access to education for children and youth in the community by renovating and equipping existing elementary schools. This will be achieved through the renovation of the set of public schools existing in Carauari and nearby area, and the construction of perimeter walls to enhance security.

non-violent, inclusive and effective learning environments for all.	
4.3: By 2030, ensure equal access for all women and men to affordable and quality technical, vocational, and tertiary education, including university	BR Arbo is committed to provide equal opportunities for local youth and to encourage education; to this aim, scholarships for outstanding students will be provided and support programs to ensure equal opportunities will be developed. In addition, BR Arbo will collaborate with Universities and Brazilian institutions to support the teacher training and development program, including institutions outside the community, to improve the quality of education and knowledge sharing.
4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship.	In order to empower local communities and ensure that their members are effectively employed in project activities, advanced training in forest management will be provided; in particular employees will be trained in agroforestry techniques and conservation practices, fire prevention and management, use of GPS and other equipment, tree nursery management, area protection and surveillance. If additional training will be required and considered as necessary, BR Arbo will organize additional training sessions.
4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the	Considering that a number of children live along the river margins, out of town and far from school, BR Arbo will collaborate with Brazilian universities and

vulnerable, including persons with disabilities, indigenous people and children in vulnerable situations. 4.7: By 2030, ensure that all learners acquire the knowledge and skills needed 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 of culture's contribution to sustainable development	institutions to deliver online learning to the community. To this aim, a collaboration with institutions will be defined in order to provide necessary devices to local communities, enabling telematic education. BR Arbo will provide funding support for the establishment and conduction of the "Escola da Floresta" project promoted by the Government of Amazonas. The "Escola da Floresta" project will provide pedagogical and educational training to local youth favoring the construction of social value, knowledge, skills, and attitudes to foster the improvement of the quality of life, the educational upskilling and training on the values and benefits of a sustainable development. School facilities are designed to minimize environmental impact and improve local sustainability through green areas, installation of photovoltaic panels, full accessibility of spaces, a natural ventilation system, rainwater storage and utilization. The schools will be provided with robotics labs, a school garden, and other outdoor and indoor spaces dedicated to school education and sports. BR Arbo is partnering with the Government of the state of Amazonas to economically support the construction and operation of the first unit of the "Escola de

	4.b: By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programs, in developed countries and other developing countries	Floresta" project, the close to the area of the Fazenda. BR Arbo is committed to provide equal opportunities for local youth and to encourage education; to this aim, scholarships for outstanding students will be provided and support programs to ensure equal opportunities will be developed.
6 – Clean Water and Sanitation	6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	The project involves the provision of freshwater infrastructure to meet domestic needs, including the installation of ultrafiltration plants powered by photovoltaic systems and the construction of drinking water tanks.
7 – Affordable and Clean Energy	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	The project provides for the setup instalation of a thermoelectric power plant supplied exclusively with wood residues produced at the sawmill to be installed in the project area. The plant will be designed in such a way as to fulfill the energy demand of the sawmill, the excess energy being sold in Carauari, replacing the current Diesel-based power. This initiative aims to address the off-grid situation of the city, given that its location doesn't allow its

		connection to the National Interconnected Energy System.
8 – Decent Work and Economic Growth	8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity, and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services.	The project will set contractual agreements with established local cooperatives, specifically those engaged in fish and tuber cultivation to safeguard the livelihoods of Fazenda workers. In another very relevant initiative, the project will train members of the local communities, mainly women, to develop, manage and operate the sustainable production of "açaí" berries.
	8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavor to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programs on sustainable consumption and production, with developed countries taking the lead.	The project considers the sustainable forest management activity using the best techniques that guarantee the integrity of the native forest over time. In addition, the project includes the installation of a sawmill in Carauari to process the certified wood that will be harvested in the forest sustainable management process. Furthermore. There will take place the installation of a renewable electricity generation plant powered by the waste from the wood processed in the sawmill.
	8.6 By 2020, substantially reduce the proportion of youth not in employment, education, or training.	BR Arbo will hire and train local people to plant and protect forest areas, the Project will generate directly jobs for forest conservation and surveillance, for the sawmill and for agricultural activities, and indirectly for activities related to education, health and dining that will be enhanced thanks to the other

		initiatives and investments fund by BR Arbo.
12 – Responsible Consumption and Production	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	The Sustainable Forestry Management activities and the installation of a thermoelectric power plant will contribute to the promotion of the efficient use of natural resources foreseen in the Brazilian 2030 Agenda.
13 – Climate Action	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. 13.2 Integrate climate change measures into national policies, strategies, and planning.	The Mejuruá project for Avoided planned deforestation will be implemented in an area of 130,640 ha showing a great potential for GHG reduction.
15 – Life on Land	15.1. By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services. 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.	The different project activities, which involve monitoring illegal deforestation in the areas and the sustainable forest management, will contribute to ensuring the conservation of the Amazon Forest and, therefore, the maintenance of the different ecosystem services provided by this biome. For the activities described above, the Enterprise will obtain, over the years, a certain amount of Carbon Credits, whose revenue will make it possible to sustain the planned activities and other positive impacts to be produced.

1.17 Additional Information Relevant to the Project

Leakage Management

The planned deforestation will not lead to an increase in harvest rates on other privately-owned lands, as the landowner does not own any other land outside of the project area. The Leakage Management Area corresponds to the market-effects leakage related to extraction of wood for timber, fuelwood or charcoal in the baseline for carbon projects (VM0007 Methodology- Module LK-ME_v1.0). When REDD projects result in reductions in wood harvest, it is likely that production will shift to other regions within the country as a means of compensating for the decrease. Therefore, it is important to assess the potential market effects that may arise from REDD projects aiming to significantly reduce the amount of wood harvested.

Furthermore, besides the APD does not lead to an increase in harvest rates on other privately-owned lands, project's implementation is recognized to have a positive impact on how interventions are applied, being an example of the following technical, environmental and economic aspects:

I) Forests to be governed with environmental and social criteria, along with financial criteria, generating revenue and profit.

II) Carbon emissions trading system as a business plan employed to provide additional return to investors.

III) Other results that aligns with the conservation goals of the investments includes improving forest management projects, establishing sustainable sources of timber, enhancing carbon sequestration, and providing ecosystem services through the preservation of intact forestland.

So, this project stimulates other landowners to adhere this business plan, showing how the success of the project management can be achieved through sustainably managed areas with REDD+. For further details about the leakage management plan and monitoring, see Section 5.3 of this Project Description.

Commercially Sensitive Information

None of the information related to the determination of the baseline scenario, demonstration of additionality, and estimation and monitoring of GHG emission reductions (including operational and capital expenditures) has been excluded from the public version of the Project Description. All relevant and necessary information about the project proponent and the Mejuruá project scope has been available in Section 1.

Further Information

No further information to disclose.

2. SAFEGUARDS

2.1 No Net Harm

The BR Arbo property is situated in the Mesoregion of the Southwest Amazon and covers two micro-regions: Alto Solimões, which includes the municipality of Jutaí, and Juruá, which includes the municipalities of Carauari and Juruá[31]. Mejuruá project is committed to implementing a range of activities that will have substantial social impacts on the community. The following section provides a detailed description of the key project activities and their expected impacts.

The project will establish a Sustainable Forest Management with reduced-impact logging (RIL). The management activity will result in substantial positive environmental impacts, specifically contributing to the long-term fortification of the natural forest through the application of targeted techniques, and social environmental impact related to additional jobs and training in forestry activities offered locally, as well as logistics. Some of the negative impacts that can be identified in this activity include a temporary reduction in carbon stock in the managed plots, which returns to the previous situation after the cycle or possibly improves as mentioned earlier.

The project foresees set up a new sawmill in Carauari, along with a renewable electricity generation plant. These industrial activities will create new job opportunities and provide local training in the industrial sector. Moreover, the power plant will have a positive environmental impact by reducing emissions from the existing fossil fuel power plant as the generation shifts to renewables, resulting in additional greenhouse gas (GHG) reduction effects associated with this project. The sawmill operation entails certain negative impacts, including marginal safety risks inherent to the generation of sawdust. To address these concerns, appropriate equipment will be installed at the source to effectively reduce emissions and collect sawdust, further mitigating the associated environmental effects. In relation to the power plant a negative environmental impact is the local pollution from biomass combustion which will be mitigate with the use of proper technology (multi-filters and others).

Activities related to forest management and industrial activities can cause negative social impact related to marginal safety risks inherent to the operations. To mitigate these impacts, a sound safety policy will be implemented for the working scheme, comprising safety training, individual and collective protective equipment, supervision, emergency assistance and other elements.

To ensure the protection of the project area, dedicated monitoring teams will be deployed to patrol the property and forest management perimeter, aiming to prevent encroachments. In case agricultural or pastoral activities are conducted in the surrounding zones, the feasibility of establishing "firebreak" areas will be assessed to effectively mitigate the spread of forest fires. The implementation of these measures will yield valuable outcomes,

[31] Amazonas em Mapas. Governo do Estado do Amazonas. Manaus, 2016.

serving as a foundation for the conservation process of the entire forest. Moreover, these activities will create additional employment opportunities and provide training in image collection and interpretation, as well as surveillance activities, to the local community. While striving for these positive impacts, it is important to acknowledge a potential negative effect associated with marginal safety risks inherent to displacement and field activities in the forest. To address this concern, a robust safety policy will be established, encompassing safety training, the provision of individual and collective protective equipment, comprehensive supervision, emergency assistance, and other essential elements.

Additionally, Br Arbo has developed the “Forest Angels Program”, which focuses on implementing a land regularization plan to grant title deeds to riverside individuals who have inhabited these areas of the farm for a significant period of time. Additionally, the program will train and qualify riverside communities to identify potential threats to the biome, implement appropriate, legally compliant measures to prevent environmental degradation, and engage in sustainable small-scale fishing, agriculture, and extractivism. To enhance environmental protection efforts, the program will establish a protective belt involving these riverside communities. This belt will be interconnected through the Internet and other available means of communication. This interconnected network will facilitate efficient communication and collaboration, empowering the communities to safeguard the environment and respond effectively to environmental challenges.

Other positive impacts that the project will bring are described in sections 1.10 and 1.14. The risks will be evaluated in the monitoring report, which shall be evaluated at each verification event. The stakeholders can express their impressions about the Mejuruá project through the email contato@brarbo.com.br.

2.2 Local Stakeholder Consultation

BR Arbo considers thar it is crucial to understand the primary requirements of the communities, in order to incorporate measures into the project that aid in the social and economic development of the region.

The stakeholder consultation process has been conducted through various channels, including the BR Arbo website, formal letters, emails, public meetings, and interviews. The adopted procedures and the initial findings from this process are described below:

BR Arbo website and report

The BR Arbo website (https://www.brarbo.com.br/) is accessible to everyone, providing a comprehensive report that describes the project in detail. This report is regularly updated to ensure it remains current and relevant.

Formal letters

A number of letters were sent out to institutional stakeholders informing about the project and the availability of the resort in the BR Arbo website, and asking for contributions and comments.

E-mails

E-mails were sent out to institutional stakeholders informing about the project and the availability of the resort in the BR Arbo website, and asking for contributions and comments. The stakeholders addressed were:

- Governors of the state of Amazonas
- Secretary of the Environment from Amazonas;
- City Hall of Carauari;
- City Hall of Juruá;
- City Hall of Jutaí;
- Municipal Council of Juruá;
- Municipal Council of Jutaí;
- Amazon Environmental Protection Institute (IPAAM);
- National Indian Foundation – Alto Solimões (FUNAI);
- Sustainable Amazon Foundation;
- Extractive Reserve of Médio Juruá;
- Uacari Sustainable Development Reserve;
- Association of Agroextractivist Residents of Baixo Médio Juruá;
- Association of Agroextractivist Residents of the Uacari Sustainable Development Reserve;
- Association of Rural Producers of Carauari;
- Extractivist Residents Association of the community of São Raimundo

Public meeting in Carauari

A meeting was held in Carauari on April 4, 2023. It was open to the public. A few days before, invitations were posted at public attendance points in Carauari, in order to inform everyone about the meeting. The meeting was held in the House of Representatives of the town of Carauari. All elected representatives were present, as well as the Speaker of the House and the deputy mayor holding the office of the municipal government of Carauari, so the local population and their interests were properly represented (Figure 15). Also in attendance were the leaders of different non-governmental entities of the region, some of which were previously engaged by letter or e-mail, as well as ordinary citizens interested in the subject.

During the meeting the project owners and developers had the opportunity to explain the project in detail, also supplying the audience with a hard copy of the full report describing the project. There were various comments from the representatives, and other people in attendance, questioning about details of the project activities, as well as about the different impacts the project would cause on the local community. Clarifications were made, and several requests were noted down to be addressed during the development and implementation processes, in order to meliorate the social actions to be taken.

It was also announced that that meeting will be repeated periodically to give updates of the project and communicate relevant facts to the local community. The meeting was fully recorded, a transcription of the corresponding minutes and the list of attendees are available to the auditors.

Figure 15- Public meeting in Carauari held on 4 April, 2023.

Meetings with authorities

Besides the exchange of official letters, several meetings were held between the project owners and the deputy mayor holding the office of the municipal government of Carauari together with his staff, in a continuous dialogue on the project, its impacts, the social initiatives that are being claimed by the local communities and that are taking place, sponsored by the project.

A very important meeting was held between the project owners and the Governor of the State of Amazonas on April 03, 2023 (Figure 16). On that occasion the project was fully presented to the Governor and his staff. The Governor also had the occasion to present a model school designed by the state government to be installed it forest regions throughout the state. The project owners then committed themselves to insert a pilot unit as one of the social initiatives of the project in Carauari.

Figure 16- Public meeting in Carauari held on 4 April, 2023.

Interviews with the local communities

The interviews were conducted with traditional communities in the surrounding Gleba Santa Rosa do Tenquê (hereinafter called “surrounding communities”) and Community of Riozinho which is within the property boundaries (Figures 17 and 18, respectively). The interviews were carried out by a specialized agent called JCris Ambiental-ME, in a proper level and language respecting the cultural characteristics of the target communities. The interviewer crews went out by the river, assessing each individual home or family living in the area. Due to the extractive activities and nomadic behavior of these populations, which is a normal condition in the interior of the Amazon, a given percentage of the families could not be reached, as they were not at home on the occasion. Therefore, it is the intention of the project to repeat periodically the process, to enhance its coverage in a continuous process.

Figure 17- Community of Bacaba, Carauari, AM.

Figure 18- Community of Riozinho, Carauari, AM.

The interviews have the aim of presenting the Mejuruá project and mapping the different demands of the communities. An explanatory leaflet was used so that the interviewees could better understand the objectives of the project. The interviews contained general data about each respondent, including name, marital status, identification documents, number of children, among other information. Respondents also had the opportunity to list specific actions they considered relevant to improving their living conditions.

On December 17, 2022, the interview was conducted with 39 individuals from the Surrounding communities which is composed by the communities of Vila Nova, Reforma, Lago Serrado, Ressaca, Santa Cruz, Concórdia, Marapatá, São João and Bacaba.

Each respondent listed approximately three actions that they considered most important for improving their lives, resulting in a total of 136 suggested actions. These actions were grouped into 12 different categories. Figure 19 represents the frequency with which actions were mentioned during the field interviews.

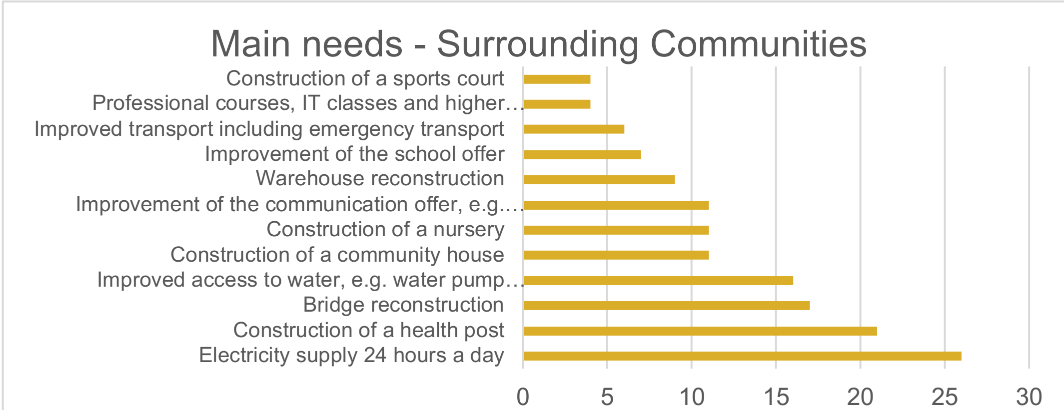

Figure 19- Community choice of relevant actions to improving life conditions.

According to the conducted questionnaire, the community's aspirations involve fulfilling their basic needs such as access to healthcare, electricity, and water. Improving the physical infrastructure, which includes enhancing the warehouse and constructing a bridge, is also a significant action that would aid the riverside communities in improving their economic capabilities, leading to an increase in their fishing income. Actions that strengthen community life, including a day care center, sports court and community house were also mentioned. Additionally, there were suggestions for actions that could help establish better connectivity with the world beyond the community, such as improving transportation, enhancing communication, especially internet access, and providing educational opportunities.

A presentation on the Mejuruá project and an interview with 21 members of the Riozinho Community took place on January 11, 2023. Each respondent listed approximately three actions that they considered most important for improving their lives, resulting in a total of 68 suggested actions. These actions were grouped into 10 different categories. Figure 20 represents the frequency with which actions were mentioned during the field interviews.

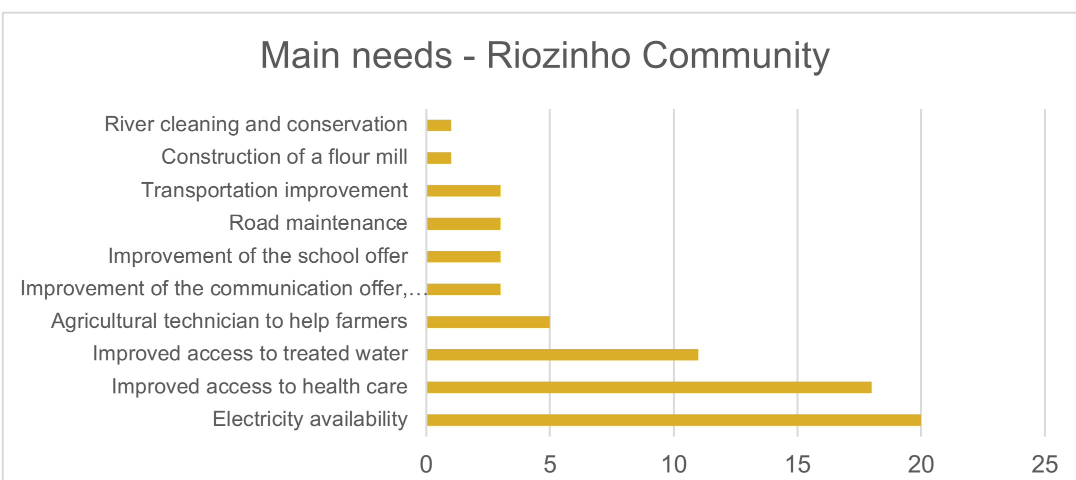

Figure 20- Community choice of relevant actions to improving life conditions.

The qualitative research conducted highlights the Riozinho community's focus on fulfilling their basic needs such as access to electricity, water, and healthcare. The improvement of physical infrastructure was also identified as a key priority, as it would enhance economic prospects and enable technical support for agriculture, road improvements, and construction of a flour mill. The study also pointed out the significance of enhancing communication channels such as internet access and educational offerings.

Feedback access channel and process

A dedicated communication channel has been established to facilitate ongoing expression of concerns by stakeholders and to effectively resolve any conflicts or grievances that may arise throughout the planning, implementation, and monitoring stages of the project. Stakeholders can provide feedback through the designated email address (contato@brarbo.com.br), which is actively monitored by the BR Arbo staff to ensure timely responses to incoming messages. Furthermore, there will be subsequent interaction phases to address specific demands raised by stakeholders, fostering continued engagement and collaboration.

In these interactions, comprehensive information regarding the project's design, implementation, associated risks, costs, and benefits to local stakeholders was shared. The concerns raised by participants were carefully considered and integrated into the project's implementation plan. Compliance with relevant laws and regulations concerning workers' rights will be ensured and communicated during the recruitment process. Regular updates on the VCS Program validation and verification process will be provided on the brarbo.com.br website. Furthermore, ongoing stakeholder engagement will be prioritized, with periodic meetings to present project progress, address concerns, and provide clarifications as needed.

The interviews, meeting minutes and emails are archived by the proponent and will be available in a data room during the audit.

2.3 Environmental Impact

With a high degree of endemism of flora and fauna, the Amazon is considered one of the most biodiverse regions on the planet. This biome covers about 40% of the Brazilian territory. However, it is estimated that approximately 91,600 km^2 of this biome's area have been deforested in the last 10 years[32]. The loss of healthy forests can lead to a reduction in ecosystem services, such as carbon storage in biomass and soils, regulation of water

[32] Source:http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/amazon/increments

balance and river flow, modulation of regional climate patterns, and decrease in the incidence of infectious diseases[33].

According to Poorter et al (2015)[34], biodiversity conservation is considered a fundamental objective for the REDD+ program, as it contributes to increasing carbon storage in forests by ensuring the proper functioning of the forest ecosystem.

The BR Arbo property plays an important role in maintaining the biodiversity of the Amazon. Covering approximately 900,000 hectares, it serves as a habitat for a wide variety of plant and animal species. The property is surrounded by conservation units and indigenous lands, contributing to the free movement of animals and gene flow in the region.

Eight conservation units (Table 6 and Figure 21) have been identified within a 300 km radius of the property.

Table 6- Conservation Units and Distance to Project Area.

CONSERVATION UNIT / INDIGENOUS LAND	DISTANCE TO PA (km)
Tefé National Forest	51
Ecological Station of Jutaí-Solimões	10
Cujubim Sustainable Development Reserve	94
Uacarí Sustainable Debelopment Reserve	84
Baixo Juruá Extrative Reserve	43
Rio Jutaí Extrative Reserve	8
Médio Juruá Extrative Reserve	12
Area of relevant ecological interest – Javari-Buriti	103

[33] Foley et al. Amazonia revealed: forest degradation and loss of ecosustem goods and services in the Amazon Basin. Front Ecol Environ 2007; 5(1): 25-32

[34] Poorter L. et al. Diversity enhances carbon storage in tropical forests. Global Ecology and Biogeography. 2015, 24: 1314-1328

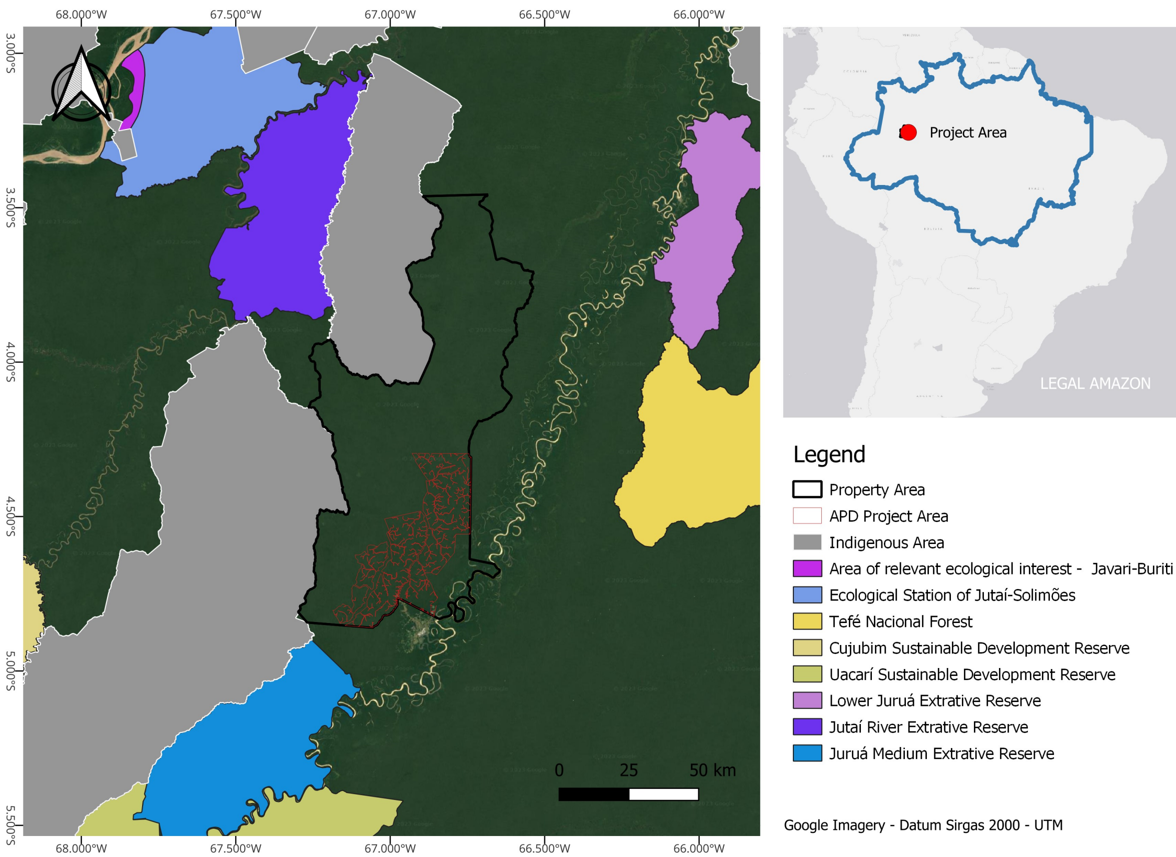

Figure 21- Conservation Units around the project area.

The National System of Conservation Units of Nature - SNUC, was established by Law No. 9,985 of July 18, 2000[35]. SNUC defines conservation unit (CU) as: "*A territorial space and its environmental resources, including jurisdictional waters, with relevant natural characteristics, legally established by the Government, with conservation objectives and defined limits, under a special administration regime, to which adequate protection guarantees apply*." The conservation units present in the vicinity of the project area are:

- Tefé National Forest;
- Ecological Station of Jutaí-Solimões (ESEC Jutaí Solimões);
- Cujubim Sustainable Development Reserve;
- Uacarí Sustainable Development Reserve;
- Baixo Juruá Extrative Reserve (RESEX Baixo Juruá);
- Rio Jutaí Extrative Reserve (RESEX Rio Jutaí);
- Médio Juruá Extrative Reserve (RESEX Baixo Juruá);
- Area de relevant ecological interest – Javari-Buriti

[35] Source: http://www.planalto.gov.br/ccivil_03/leis/L9985.htm

Studies conducted in the Rio Jutaí Extractive Reserve and Ecological Station of Jutaí-Solimões surveyed some primates in the region, contributing to the species list in the management plan for these areas[36]. Thirteen taxa were found in the Rio Jutaí Extractive Reserve and 11 taxa in the Jutaí-Solimões Ecological Station. Of the primate species found, three were identified as vulnerable according to IUCN and one as endangered, which are:

- *Cacajao calvus calvus* (RESEX Rio Jutaí) – Vulnerable
- *Cacajao calvus rubicundus* (ESEC Jutaí-Solimões) – Vulnerable
- *Lagothrix lagothricha poeppigii* (RESEX Rio Jutaí) – Vulnerable
- *Ateles chamek* (ESEC Jutaí-Solimões / RESEX Rio Jutaí) – Endangered

According to the Environmental Secretary, the Uacari Sustainable Development Reserve harbors one of the highest primate diversities in Amazonas[37]. The primate *Cacajao calvus* has also been reported in this reserve, demonstrating the important role of the surrounding native forests for the free movement of these species.

In the elaboration of the Management Plan of the Tefé National Forest [38], the occurrence of at least 14 species of primates and the occurrence of vulnerable mammal species such as *Panthera onca*, *Myrmecophaga tridactyla*, and *Priodontes maximus* were identified. The survey also indicated the possibility of endemic mammal species occurring in the region, such as *Inia geoffrensis* (endangered), *Sotalia fluviatilis* (endangered), and *Trichechus inunguis* (vulnerable). The chiropterans found in the national forest include *Noctilio leporinus*, *Artibeus obscurus*, *A. planirostris*, *Carollia perspicilata*, and *Sturnira lilium*. A total of 165 bird species, 11 snake species, and 5 lizard species were identified. According to the study, the herptofauna data may be underestimated, as a greater number of species is expected for Amazon Biome regions. Regarding the turtles found, some stand out for subsistence hunting, such as *Podocnemis expansa*, *Podocnemis unifilis*, *Podocnemis* sextuberculata, and *Peltocephalus dumerilianus*. For the region, the occurrence of alligator species such as *Caiman crocodilus*, *Melanosuchus niger*, *Paleosuchus palpebrosus*, and *Paleosuchus trigonatus* is reported. Other studies in the range of the Tefé National Forest have identified 32 species of anurans, distributed in thirteen genera and seven families [39].

The Baixo Juruá Extractive Reserve is located 43 km from the project area. The management plan for this reserve identified 32 species of mammals, including vulnerable species such as *Myrmecophaga tridactyla*, *Tapirus terrestris*, and threatened species such

[36] Silva et al. Primates in three protected areas in the Middle Solimões basin, Brazilian Amazon. Biodiversidade Brasileira, 7(2):58-70, 2017.

[37] Source: https://meioambiente.am.gov.br/reserva-de-desenvolvimento-sustentavel-de-uacari/

[38] Plano de Manejo da Floresta Nacional de Tefé. Instituto Chico Mendes de Conservação da Biodiversidade. Vol 1. Brasília Agosto, 2014

[39] Lemos, M.A de O; Nunes, J.V. Potencial Riqueza de Anuros na Comunidade Bom Jesus, Floresta Nacional de Tefé – AM. 2017. Universidade Estadual do Amapá

as *Pteronura brasiliensis* and *Inia geoffrensis*, 362 species of birds, 115 species of reptiles and amphibians, including the species *Geochelone denticulata*[40], which is listed as vulnerable according to the IUCN.

According to Ayres et al. (2005)[41], the Central Amazon Corridor, where the Mejuruá project is located, is considered a priority area for conservation, taking into account criteria such as vegetation type, phytogeographic region, and Pleistocene refuge. All of these studies emphasize the importance of preserving the native areas of the region for the maintenance of biodiversity and the ecosystem services it provides. During the project's lifetime, the Mejuruá project aims to avoid the planned deforestation of 131,647 hectares and approximately 550,000 hectares of unplanned deforestation, making a significant contribution to the preservation of this extremely important biome.

The forest management to be carried out in the project area will have FSC and/or PEFC certification. The goal of this certification is to promote responsible forest management, encouraging management practices that are environmentally friendly, socially just, and economically viable. Since the Mejuruá project does not foresee planting seedlings, it will not generate negative environmental impacts with the introduction of exotic and invasive species.

Sections 1.13 and 1.17 provide further details on the environmental aspects of the project area and the project's contribution to the UN Sustainable Development Goals.

2.4 Public Comments

2.5 AFOLU-Specific Safeguards

BR Arbo has held ownership of the land for several decades, maintaining a consistent presence in the region with a dedicated team operating at both the operational and managerial levels. Over the years, the company has fostered a robust relationship with the local government, non-governmental entities, communities, and other stakeholders. As a result, BR Arbo possesses a comprehensive understanding of the social structure in the area and how it has evolved over time.

The stakeholder engagement process was initiated by conducting interviews with local communities in December 2022 and January 2023 to address the different demands of the communities. Following that, communication with institutional agents to present the Conservation Project began on March 03, 2023, through a combination of email and face-

[40] Plano de Manejo Reserva Extrativista do Baixo Juruá. Ministério do Meio Ambiente. Instituto Chico Mendes de Conservação da Biodiversidade. Diretoria de Unidades de Conservação de Uso Sustentável e Populações Tradicionais. Juruá. 2009. 201p.

[41] Ayres et al. Os Corredores Ecológicos das Florestas Tropicais do Brasil. Sociedade Civil Mamirauá, 2005. 256p.

to-face meetings. The results of the interview and the minutes of the meeting are presented in section 2.2.

The identified categories listed below cover a wide range of connections between the project and the local society, in different aspects.

a) **People living within the project area.**

There are several families residing along the river margins, and living away from the margins, all within the property boundaries. This category was identified at the level of individual homes, or families, through the survey process initiated on January 09, 2023 under a contract with the organization called "JCris Ambiental-ME", located in Carauari. Interviews were carried out with 27 of the 36 families residing on the banks of the Igarapé Riozinho, reaching 75% of the total number of residents.

These Riozinho Community live generally from fishing, extractivism and domestic agriculture. About 45% of the people interviewed are classified as illiterate and 44% have incomplete primary education. The community reported that it does not have access to electricity supply, treated water, domestic sewage, internet access and telephony. Medical care takes place at the municipal headquarters.

Based on the initial understanding of the BR ARBO Project, it is evident from the feedback received that the participants comprehended the overall objectives conveyed by the interviewer. Furthermore, there is a shared interest among individuals in acquiring additional information about the project, with the belief that its implementation will positively impact and enhance the quality of life for the assisted families. The results of the interview conducted with the Riozinho community, which lives within the boundaries of the property, are described in section 2.2.

The Forest Angels program developed by BR Arbo aims at providing title deeds to riverside individuals occupying areas within the farm. The program initiates by identifying eligible families who will be contacted by BR Arbo to offer lending contracts, enabling them to regularize ownership in the region and sustainably utilize their land with proper legal authorizations. Furthermore, the program emphasizes the training and empowerment of riverside communities to recognize forest threats and implement legally applicable measures to prevent environmental degradation. This model aligns with the approach adopted by the state of Amazonas in the Guardians of the Forest Program (Bolsa Floresta +[42]). By participating and actively engaging in the program, riverside dwellers not only gain access to training but also pave the way towards obtaining future land titles. As a result, the lending contract will transition into an ownership title, ensuring sustainable land use within the Amazon rainforest biome.

[42]Source: https://meioambiente.am.gov.br/clique-aqui-edital-do-programa-guardioes-da-floresta-bolsa-floresta/

Additionally, these families will have access to various social benefits provided by the REDD Project as described in sections 1.10, 1.14, and 2.1.

b) **People living in the town of Carauari**

Carauari, with an estimated population of 28,719 people, exhibits an average monthly salary of formal workers (2020) amounting to 1.9 times the minimum wage. In terms of education, the schooling rate for 6- to 14-year-olds (2010) stands at 90.2%, positioning Carauari at the 5462nh spot nationwide of 5570. The municipality has a GDP per capita [2020] of R$ 12,591.08, ranking 3906 in the country[43].

Due to its proximity to the property, with only a few kilometers, the project proponent recognizes the entire population of Carauari as local stakeholders even though they do not depend on the project area. As any activities in the area can potentially affect the town, both positively and negatively, their perspectives are crucial to consider. On April 4, 2023, a public meeting was conducted in the House of Representatives of the town of Carauari with the objective of presenting the Forestry Conservation project of BR Arbo. To ensure broad participation, invitations were prominently displayed at various public locations in Carauari a few days prior to the meeting, effectively notifying the community about the event. The topics discussed at this meeting are presented in section 2.2.

The project showcases numerous positive impacts for the population of Carauari, outlined in sections 1.10, 1.14, and 2.1. These impacts are focused on enhancing the quality of life, creating new job opportunities, and providing professional training for the local community. However, it is essential to acknowledge the potential negative impacts, particularly regarding marginal security risks associated with displacement and field activities in the forest, as well as operational activities within the industries. To address and mitigate these risks effectively, a robust safety policy will be implemented for the work regime. This policy encompasses comprehensive safety training, the provision of individual and collective protective equipment, diligent supervision, emergency assistance, and other necessary measures. By prioritizing safety measures, the project aims to minimize any adverse effects and ensure the well-being of all stakeholders involved.

c) **Communities living out of town and out of the property.**

Some communities also live close to the property. The identification of these communities was carried out at the level of individual homes, or families by a survey process carried out by " JCris Ambiental-ME " on December 17, 2022. The interview covered 43% of the families in these communities. This percentage of interviewed families is due to two reasons:

[43] Source:https://cidades.ibge.gov.br/brasil/am/carauari/panorama

- End of year period: community members go to the headquarters for the festive celebrations of Christmas and New Year;
- Period of payment of social benefits: the vast majority of community heads of households went to the municipality headquarters in search of receiving the benefits of Auxílio Brasil, to complement purchases and other acquisitions at the end of the year.

The surrounding community interviewed, and its location are shown in Table 7.

Table 7- Surrounding communities interviewed.

Community	Number of resident families	Number of families interviewed	Outreach of interviews in the community	Geographic Coordinates DATUM SIRGAS 2000
Vila Nova	28	05	18%	S: -04 50' 21.52064'' W: -66 50' 49.87870''
Reforma	08	03	37%	S: -04 45' 22.20449'' W: -66 44' 18.27652''
Lago Serrado	13	03	23%	S: -04 44' 14.67237'' W: -66 44' 14.99071''
Ressaca	09	03	33%	S: -04 41' 03.21766'' W: -66 41' 45.68699''
Santa Cruz	05	05	100%	S: -04 41' 17.60288'' W: -66 39' 25.97887''
Concórdia	10	02	20%	S: -04 35' 27.91323'' W: -66 38' 34.46602''
Marapatá	04	01	25%	S: -04 34' 48.87098''

				W: -66 39' 47.66689''
São João	13	11	84%	S: -04 32' 06.19094'' W: -66 37' 00.40577''
Bacaba	55	29	53%	S: -04 30' 27.53320'' W: -66 32' 22.19756''
Total	**145**	**62**	**43%**	

The main activities carried out by these communities are fishing and agriculture. All communities reported having the government benefit "Bolsa Familia", a federal direct and indirect income transfer program that integrates social assistance, health, education and employment benefits, aimed at families in poverty[44]. Most of these families have incomplete basic education. Some communities reported having electricity only partially and only two communities reported having treated water. All communities reported not having sewage treatment and internet access. The main form of medium assistance is the municipal headquarters. A more comprehensive description of the survey findings can be found in item 2.2.

These families from the nearby communities will have the opportunity to access a range of social benefits provided by the BR Arbo REDD Project, as outlined in sections 1.10 and 1.14. These benefits will improve their well-being and contribute to their overall development.

d) **Local Entities and Regional acting entities**

There is a range of non-governmental entities operating in the region, comprising the "Médio Juruá" region where Carauari is located. As these entities represent the interests of specific segments of the local population, they are here considered as stakeholders.

Several non-governmental entities are involved in environmental issues, including the Amazon protection and conservation. They work at a wider regional scope, encompassing the entire Amazonic forest, and are identified as stakeholders to the project.

In March 2023, a series of emails were sent to institutional stakeholders, providing information about the project and highlighting the availability of the resort on the BR

[44]Source: https://bfa.saude.gov.br/

Arbo website. The purpose of these emails was to encourage stakeholders to contribute their feedback and comments. The list of stakeholders consulted, including the local and regional entities is presented in section 2.2.

e) **Local government - municipal level**

At the municipality level, as ruled by the Brazilian Constitution, the government is organized under the executive power, in this case represented by the Mayor of Carauari and his staff, and the legislative power, represented by the House of Representatives of the municipality Carauari, all freely elected by the population. In this project we are considering these legally constituted authorities as stakeholders, as the legally represent the interests of the local people, comprising all listed under (a), (b) and (c) above.

A public meeting was held on April 4, 2023, at the House of Representatives in the town of Carauari. The purpose of the meeting was to introduce the Forestry Conservation project of BR Arbo to the local community, with the presence of the vice mayor and councilors. The discussions during the meeting covered various topics, which are detailed in section 2.2.

f) **State level government**

As ruled by the Brazilian Constitution, the country is a federation of states. The state of Amazonas is where the area is located. So, we take the government of the state of Amazonas as a stakeholder to our project. There are different levels in the state government, starting from the Governor himself and going down to the environmental entities. A meet between Br Arbo team and the Governor of the State of Amazonas took place on April 03, 2023, where the project was thoroughly presented to the Governor and his team. Additionally, during the meeting, the Governor had the opportunity to showcase a model school initiative, called "Escola da Floresta" developed by the state government for installation in forest regions across the state. As a result of the meeting, the project owners made a commitment to include a pilot unit of this school as one of the social initiatives within the Carauari project.

g) **Federal government**

The federal government has a basic rule in environmental issues as most of the subject is ruled by federal laws. Federal environmental administration entities are also included as identified stakeholders to this project.

The risks mapped in project implementation and the corresponding mitigation actions are described in detail in section 2.1. The project does not interfere with the ownership rights of the interested parties, on the contrary, the ownership rights will be granted to families residing in the property illegally. On the other hand, these families will participate in the surveillance of the area, as part of the "Forest Angels project".

An open communication channel has been established to allow stakeholders to express their concerns continuously and to address any conflicts or grievances that may arise at any stage of the project, including planning, implementation, and monitoring.

The grievance redress procedure to be used in the case of conflicts or disputes with local stakeholders, will follow the steps:

- Step 1: receiving grievances

Grievances and other comments will be received openly and continuously trough the contact e-mail of the Company, regardless of who is the complaining party.

Punctual occasions as public meetings will also be a vehicle for such points.

- Step 2: process at the Company level

Once a grievance is received, it will be screened at two levels within BR ARBO: the local level, by the Carauari Manager, and the company headquarters, where it will be submitted the Board of Directors. The grievance will be submitted to the Board in the case it is not solved satisfactorily at the local level. Solutions may go through amicable negotiations and get to formal agreements between the company and the conflicting party. If not solved at these levels, the issue will undergo the following phases. Additionally, a special committee may be created to support the negotiations with the grievant party, if adequate.

- Step 3: mediation

If not solved in Step 2, grievances will go through a mediation process by means of a private independent mediation office, to be selected and hired.

- Step 4: arbitration or court

If not solved in Step 3, grievances will be submitted to arbitration or to the relevant courts, if the grievant so decides.

The management teams engaged in the project bring valuable expertise and experience from previous successful endeavors in land management projects (BR ARBO Forest Management) and carbon projects (Plant Inteligência Ambiental and ATA Consultoria). Comprehensive factsheets of these companies will be readily accessible for reference during the audit process.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Methodology

This project is based in the VM0007 – REDD+ Methodology Framework (REDD+ MF), Version 1.6, approved 8 September 2020. The REDD+ Methodology Framework document outlines the overall functionality of the method, encompassing predefined modules and tools that serve specific purposes.

The specific modules and tools applied to the Mejuruá project are listed below:

Carbon Pool Modules:

VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools (CP-AB), v1.1.

VMD0005 Estimation of carbon stocks in the long-term wood products pool (CP-W), v1.1.

Baseline Module:

VMD0006 Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation/forest degradation and planned wetland degradation (BL-PL), v1.3.

Leakage Modules:

VMD0009 Estimation of emissions from activity shifting for avoided planned deforestation/forest degradation and avoided planned wetland degradation (LK-ASP), v1.3.

VMD0011 Estimation of emissions from market-effects (LK-ME), v1.1.

Emissions Module:

VMD0013 Estimation of greenhouse gas emissions from biomass and peat burning (E-BPB), v1.2.

Monitoring Module:

VMD0015 Methods for monitoring of GHG emissions and removals in REDD and CIW projects (M-REDD), v2.2.

Miscellaneous Modules:

VMD0016 Methods for stratification of the project area (X-STR), v1.2

VMD0017 Estimation of uncertainty for REDD project activities (X-UNC), v2.2.

Tools:

VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFALOU) Project Activities, v3.0.

VCS AFOLU Non-Permanence Risk Tool", Version 4.0.

3.2 Applicability of Methodology

The project's primary objective is to decrease emissions resulting from planned deforestation, thus falling under the category of a REDD activity type, as specified in the VCS AFOLU Guidance document. By selecting the relevant modules that meet the specified conditions for each module, a project-specific methodology can be developed.

This REDD activity for the Mejuruá project is applicable due to the following conditions:
• Land in the project area has qualified as forest for at least the 10 years prior to the project start date.
• Baseline deforestation in the project area fall within the categories of Planned deforestation/degradation (VCS category APD).
• Leakage avoidance activities do not include: i) Agricultural lands that are flooded to increase production (e.g., rice paddy) ii) Intensifying livestock production through use of feed lots and/or manure lagoons.

For avoiding planned deforestation/degradation activities to be considered applicable, it is necessary that the conversion of forest lands into deforested areas is legally authorized. In the Mejuruá project, all instances of converting forest lands to deforested conditions in the baseline scenario are legally authorized, as described in Section 3.4. This compliance is aligned with the Brazilian Forest Law, which grants landowners the legal authority to clear forested areas. Consequently, the project falls into the category of planned deforestation, specifically the VCS APD category.

The following items provide a detailed overview of the selected modules, accompanied by their corresponding VCS site descriptions and applicability conditions. This information highlights how these modules align with the specific conditions of the project:

<u>VMD0001: Estimation of carbon stocks in the above-and belowground biomass in live tree and non-tree pools, v1.1.</u>

As per the REDD MF framework module, it is mandatory to include the aboveground tree biomass pool within the project boundary. This module is relevant to all types of forests, regardless of their age. This module enables the estimation of carbon stocks in both above and belowground tree biomass for the baseline scenario (before and after deforestation) and the project scenario, allowing for the assessment of carbon stock changes in aboveground and belowground tree biomass during the project phase.

<u>VMD0005: Estimation of carbon stocks in the long-term wood products pool, v1.1.</u>

Logging operations are applied in the baseline scenario of the project and this module is mandatory according to the requirements of VM0007 REDD-MF when there are deforestation processes that involve harvesting timber for commercial markets. The Mejuruá project satisfies the applicability condition of this tool due to the occurrence of logging operations in the baseline scenario before the conversion of forests into non-forest areas. This module is applicable to all situations where wood is harvested for the purpose of converting it into wood products for commercial markets, irrespective of forest types and age classes. Specifically, it applies when timber harvesting takes place before or during the deforestation process and when the timber is intended for commercial markets.

VMD0006: Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation/forest degradation and planned wetland degradation, v1.3.

The Mejuruá project includes a forested project area that can be legally deforested and therefore classified as Avoiding Planned Deforestation. This module is mandatory for use by VM0007-FM to estimate baseline GHG emissions in the project area. It is designed to estimate baseline emissions on forest lands, typically under private or government ownership, that have been legally approved and documented for conversion into non-forest areas.

VMD0009: Estimation of emissions from activity shifting for avoiding planned deforestation/forest degradation and avoiding planned wetland degradation, v1.3.

The Mejuruá project meets the applicability condition of this tool because the baseline scenario is the conversion of legally authorized and documented forest land into deforested land. This module enables the estimation of greenhouse gas (GHG) emissions resulting from the activity shifting leakage of project activities focused on avoiding planned deforestation and avoiding planned wetland degradation.

VMD0011: Estimation of emissions from market effects, v1.1.

According to methodology VM0007-FM, this module is mandatory when the deforestation process involves extracting wood for commercial markets. This module allows for the estimation of greenhouse gas (GHG) emissions caused by the market effects leakage associated with wood extraction for purposes such as timber, fuelwood, or charcoal in the baseline scenario for carbon projects. When REDD project activities lead to reductions in wood harvesting, it is probable that production may shift to other regions within the country to compensate for the decrease. This includes the possibility of activity shifting towards forested peatlands that are drained due to project implementation.

VMD0013: Estimation of greenhouse gas emissions from biomass and peat burning, v1.2.

This module is applied to estimate GHG emissions generated in the process of burning forest residues to clean up the area after deforestation, a practice commonly applied in the project region and used in the baseline of the Mejuruá project.

VMD0015: Methods for monitoring of greenhouse gas emissions and removals, v2.2.

This module is mandatory for REDD projects according to VM0007-FM. This module offers techniques for monitoring post-implementation emissions and removals of greenhouse gases (GHGs) resulting from the avoidance of deforestation and forest degradation, as well as carbon stock enhancement within the project area and leakage belt. It also accounts for carbon stock changes resulting from natural disturbances.

VMD0016: Methods for stratification of the project area, v1.2.

The requirement for this module is essential due to the presence of diverse forest types within the project are. These forests exhibit distinct characteristics that necessitate the implementation of specific strata for accurate assessment. This module offers instructions for dividing the project area into distinct, relatively uniform units, aiming to enhance the accuracy and precision of estimates related to carbon stocks, carbon stock changes, and greenhouse gas (GHG) emissions.

VMD0017: Estimation of Uncertainty for REDD project activities, v2.2.

This module is mandatory according to VM0007-FM. This module enables the estimation of uncertainties associated with the calculation of emissions and removals in REDD and WRC project activities. It is applicable for assessing the uncertainty in estimating CO_2e emissions and removals resulting from these project activities.

VT0001: Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities (T-ADD), v3.0.

The use of this tool is mandatory according to VM0007-FM. This tool was employed to identify plausible alternative land use scenarios, assess both options, and showcase the project's additionality. It offers a systematic approach to demonstrate the additionality of VCS AFOLU projects. The Mejuruá project fulfills the applicability criteria of this tool as its conservation and protection activities comply with all relevant laws, ensuring there is no violation.

3.3. Project Boundary

Geographical Boundaries

The Mejuruá project is composed of two instances, namely APD (Avoiding Planned Deforestation) and AUDD (Avoiding Unplanned Deforestation and /or degradation) (Figure 22). Both instances are situated within the same property, and their respective coordinates are provided in Table 8.

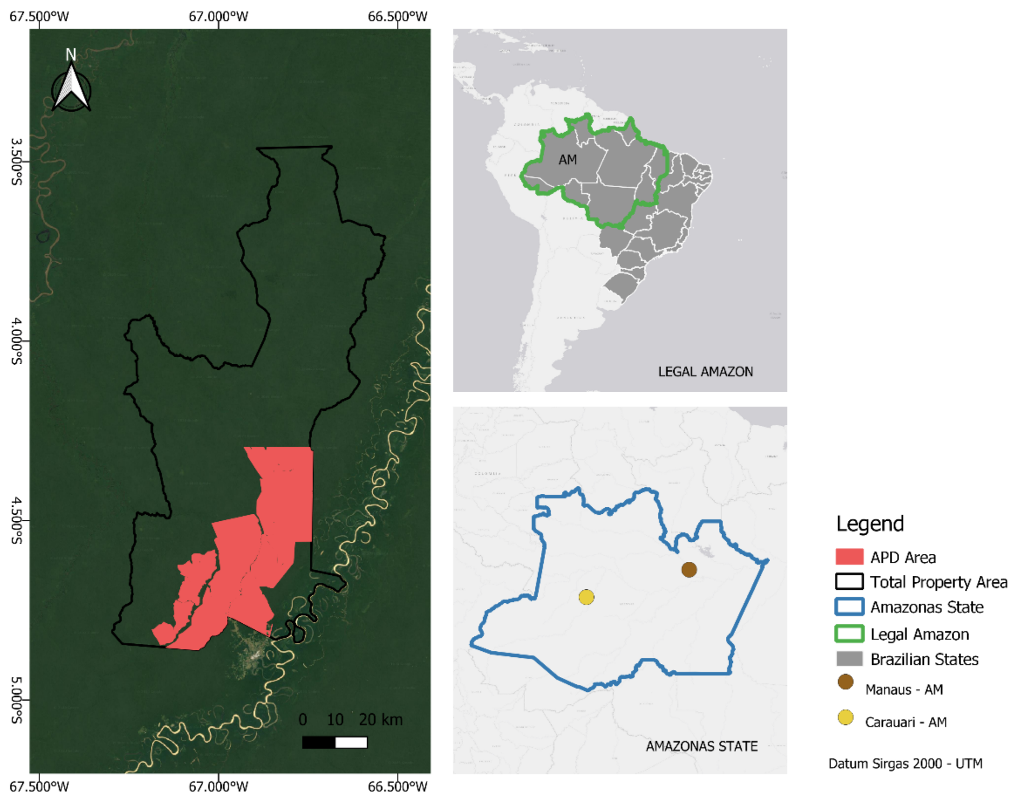

Figure 22- Mejuruá Project property and project instances boundaries.

Table 8- Project area location.

Project Activity Instance	Project Area (ha)	Coordinates	
		Longitude	Latitude
APD	130,640.540	4°34'17.0"S	66°53'33.4"W
AUD	543,720.990	4°07'09.1"S	66°56'39.5"W

Temporal Boundaries

A historical reference period from 2011 to 2021 was used to define project eligibility, and deforestation and forest degradation rates for ex-ante estimates of GHG emissions in the project scenario, following VM0007. The Mejuruá project crediting period start and end date are defined in section 1.9.

Carbon Pools

The relevant carbon pools considered by the Mejuruá project are shown in Table 9, according to the VM0007 and the modules.

Table 9- Mejuruá project carbon pools.

Carbon Pools	Included?	Justification/Explanation
Aboveground tree biomass	Included	Mandatory for REDD projects according to VM0007. Carbon stock change is always significant.
Aboveground non-tree biomass	Excluded	Conservatively omitted.
Belowground tree biomass	Included	Optional according to VMD0001. Carbon stock change is significant to the project.
Deadwood	Excluded	Conservatively omitted.
Litter	Excluded	Conservatively omitted.
Soil organic carbon	Excluded	Conservatively omitted.
Wood products	Included	Mandatory for the given project activity where the process of deforestation involves timber harvesting for commercial markets.

Sources of GHG Emissions

The relevant sources of GHG emissions considered by the Mejuruá project are shown in Table 10, according to VM0007:

Table 10- Relevant sources of GHG emissions in Mejuruá project.

Source		Gas	Included?	Justification/Explanation
Baseline	Biomass Burning	CO_2	No	Excluded as recommended by the applied methodology. Counted as carbon stock change.
		CH_4	Yes	Methane emissions from biomass burning in the baseline scenario.

Source		Gas	Included?	Justification/Explanation
		N_2O	Yes	Nitrous oxide emissions from biomass burning in the baseline scenario.
		Other	No	No other GHG gases were considered in the baseline scenario.
	Livestock emissions	CO_2	No	Not a significant source.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
		Other	No	No other GHG gases were considered in this project activity.
Project	Biomass Burning	CO_2	No	Biomass burning does not occur in the project scenario.
		CH_4	No	Biomass burning does not occur in the project scenario.
		N_2O	No	Biomass burning does not occur in the project scenario.
		Other	No	Biomass burning does not occur in the project scenario.
	Livestock emissions	CO_2	No	Livestock does not occur in the project scenario.
		CH_4	No	Livestock does not occur in the project scenario.
		N_2O	No	Livestock does not occur in the project scenario.
		Other	No	Livestock does not occur in the project scenario.

3.4. Baseline Scenario

In the baseline scenario, is anticipated that forest land will undergo a conversion to non-forest land through two distinct mechanisms or components referred to as Avoided Planned Deforestation (APD) and Avoided Unplanned Deforestation and/or degradation (AUDD).

The APD component pertains to a specific subsection of the BR Arbo property measuring about 130 thousand hectares (20% of the total area), which has documented plans for clearing the existing forest. As per the baseline scenario, 20% of the property would be subjected to complete deforestation, and the harvested wood would be sold in the timber and fuelwood markets. Subsequently, the deforested areas would be transformed into pasturelands. The baseline scenario was developed according to the VMD0006 v.1.3. (BL - PL module) and the VT0001 v.3.0 tool criteria. This module and this tool provide a stepwise approach for estimating GHG emissions related to planned deforestation and determining the most plausible baseline scenario.

On the other hand, the AUDD baseline component involves the prediction of unplanned deforestation throughout the project's lifespan. In the absence of carbon credits, the landowners are unable to afford the necessary efforts and costs required to maintain constant vigilance over the project boundaries, thus preventing uncontrolled trespassing and deforestation leading to land use change. In the event that new instances related to the AUD project activity are incorporated, the baseline scenario will be determined based on the specific methodology, taking into consideration all relevant criteria.

3.4.1 Agent of Planned Deforestation

For the project activity instance involving APD in the Mejuruá project, the company BR Arbo Forest Management is identified as the single agent of planned deforestation in the baseline.

3.4.2 Area of Deforestation in Planned Deforestation

According to Article 12 of the Brazilian Forest Code (Law No. 12.651/2012), the owner of forested lands within the Amazon Legal region must maintain at least 80% of the area with native coverage. Therefore, the legal permission for deforestation is no more than 20% of the total property area.

To define the baseline, a series of operations are performed in a GIS environment. Initial property data is obtained from the National Environmental Rural Registry System (SICAR). To define the project area, protected areas by law (Legal Reserve and Permanent Protection Area) are excluded. As the methodology determines, non-forested areas in the last 10 years prior to the start date are also excluded from the project area.

3.4.3 Assessment of the Feasibility of Converting the Project Area for Alternative Non-Forest Land Use

To assess the feasibility of converting the Mejuruá project area to alternative land uses, several important criteria were evaluated, including the accessibility of the land to relevant markets, the soil's suitability for livestock, the region's topography, slope, and climate conditions (see section 1.13). All these factors were taken into consideration to determine if the area is appropriate for alternative land use purposes beyond forest preservation.

The legal deforestation in the Amazon is driven primarily by the trade of valuable hardwoods. Afterwards, the common practice of clearing the remaining forest through fires is adopted to transform the area into agriculture and pastures. Due to its close location, the production in the project area can easily be transported to the city of Carauari, and subsequently transported by the Juruá River (Figure 23).

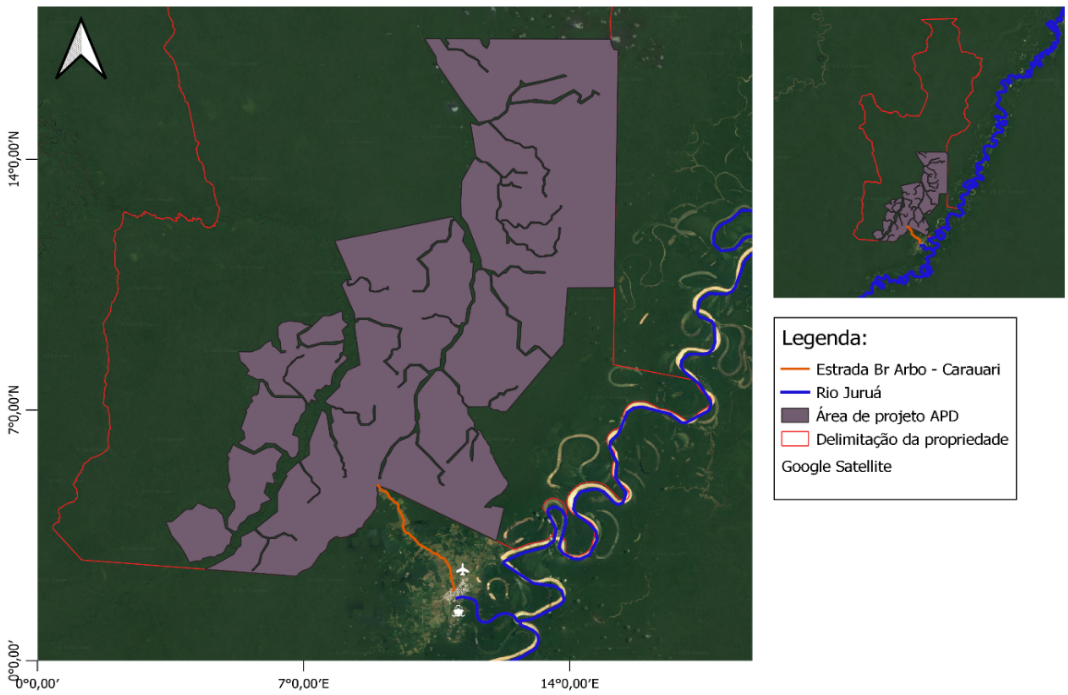

Figure 23- Mejuruá project accessibility to relevant markets.

3.4.4 Government approval for deforestation to occur.

Legal permissibility for deforestation: The application of a sustainable forest management plan is regulated in Brazil by Federal Laws Nº. 12,651/2012 and decree Nº. 5,975. In accordance with Article 12 of Law Nº. 12,651/2012, every rural property must maintain an area with native vegetation coverage, including a Legal Reserve (RL) and Permanent Preservation Area (APP), observing the minimum required according to the biome. For properties located in the Legal Amazon, the percentage is 80%. Thus, deforestation in the Legal Amazon of a maximum of 20% of the property's area is legally permitted.

The Federal Forest Code also states that the suppression of native vegetation for alternative land use, both in public and private domains, is subject to the registration of the property in the Rural Environmental Registry (CAR) and prior authorization from the competent government department of the National System for the Environment (SISNAMA), as per Article 26. Please refer to the attached document.

3.4.5 Intention to deforest.

Suitability of the project area for conversion is a technical aspect to be evidenced through the adequate and related studies, while intent to deforest, under the mentioned VM0007 and Module BL-PL, is to be shown either by a recent approval from the relevant government department for conversion of forest to an alternative land use or by documentation showing that a request for such an approval has been filed. Please refer to the attached document.

3.4.6 Rate of deforestation in Planned Deforestation

The rate of deforestation ($D\%_{planned,i,t}$) is given by the plan for the suppression of vegetation and is equal to 5.99% per year of the total area of Mejuruá project. Please refer to the attached document.

3.4.7 Likelihood of Deforestation

According to Section 1.4 criteria of VMD0006, the likelihood of deforestation (L-Di) is set to be 100%. The private areas under Mejuruá project scope are not subject to government control.

3.4.8 Risk of Abandonment

The assessment of abandonment risk relies on proxy areas categorized by the same class of deforestation agents, utilizing 10-year intervals. For the analysis of pasture areas in the last decade (2011-2021), the most recent data from Map Biomas is available. Proxy areas were carefully chosen based on similar forest types, Koppen climate classes, land use patterns, and fluvial transportation networks (refer to Figures 24, 25, and 26). All proxy areas were selected within the geographical boundaries of the Amazon biome, and the Nacional System of Environmental Rural Register was utilized to select areas with legally defined limits.

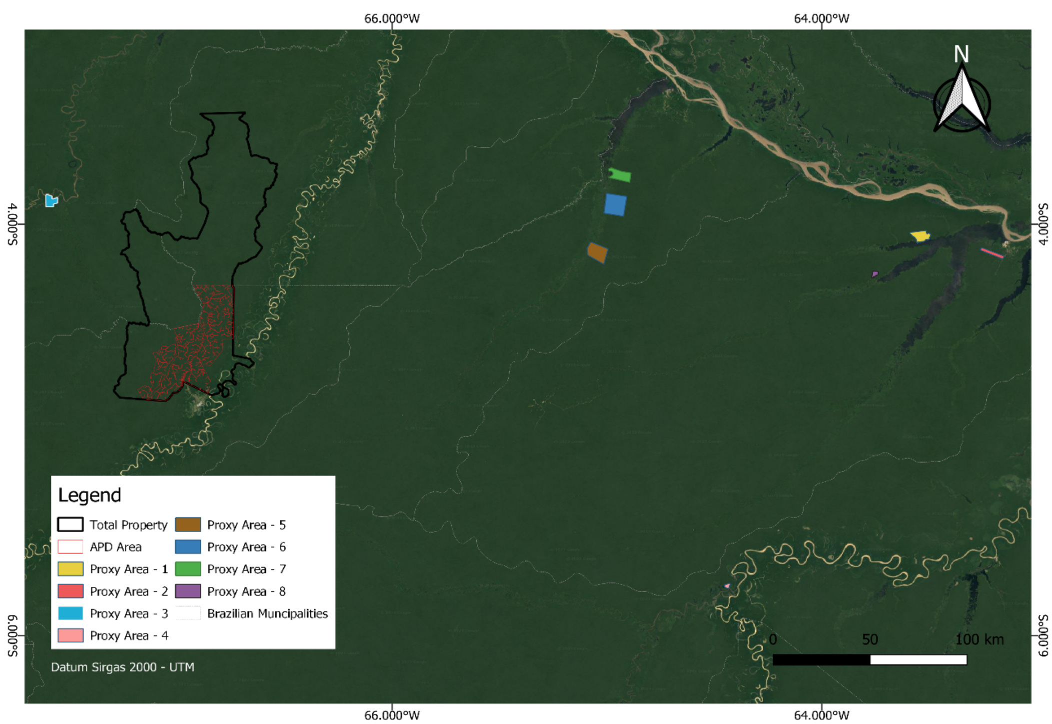

Figure 24- Proxy Areas Location.

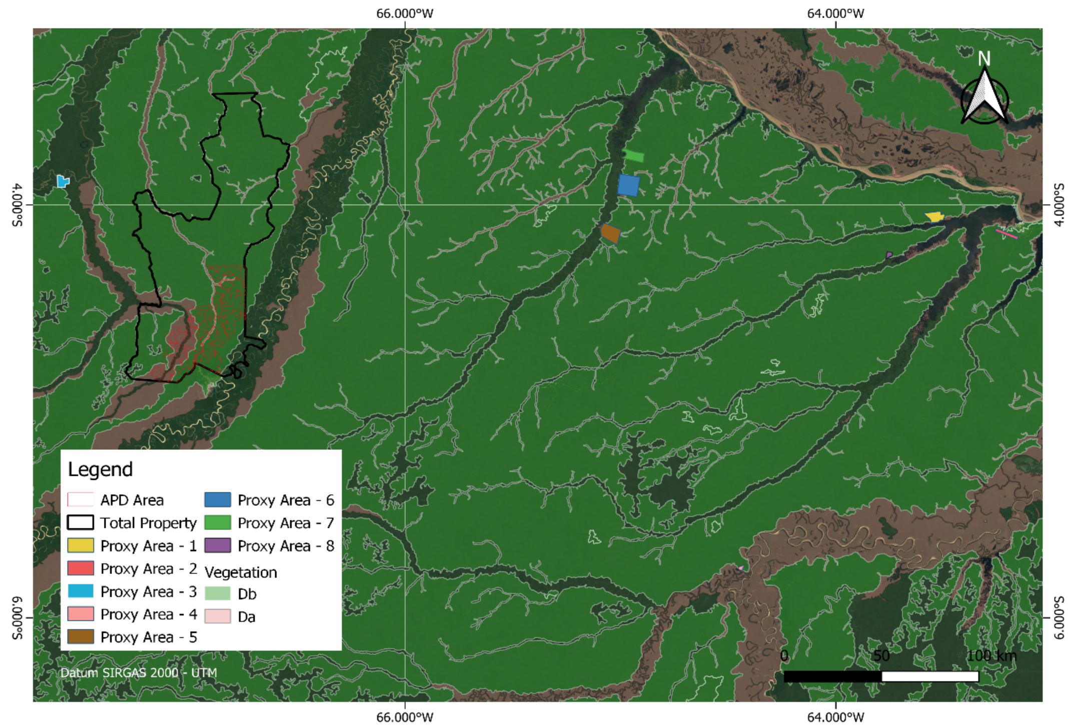

Figure 25- Proxy Areas – Dense Ombrophylous Forest (Da) and Dense Ombrophylous Forest (Db).

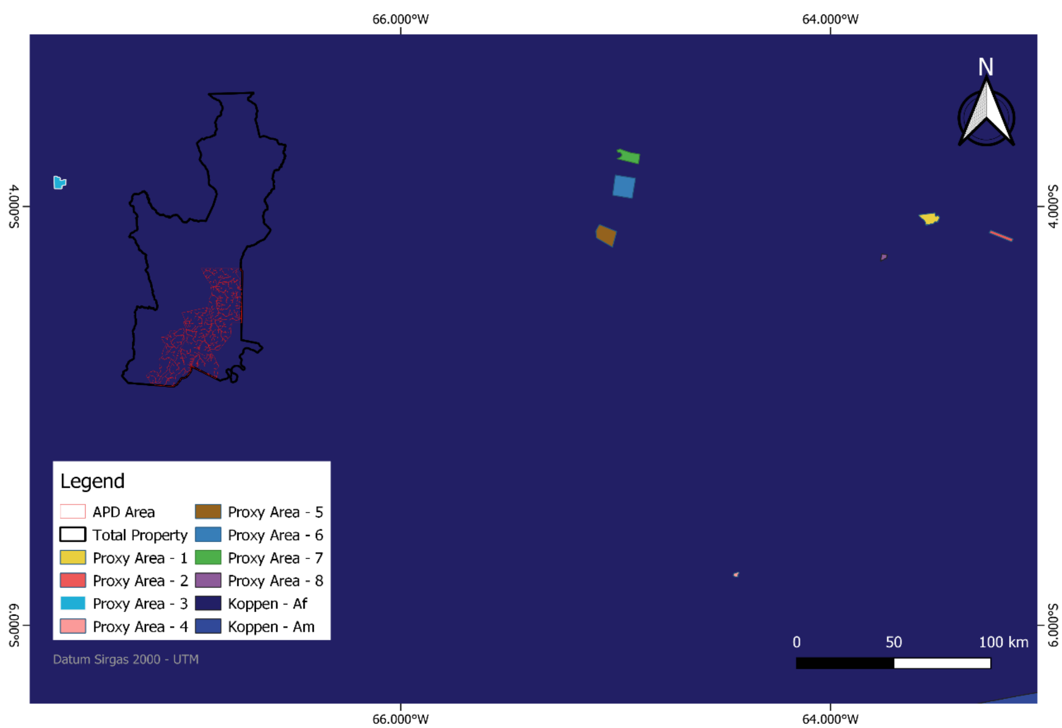

Figure 26- Proxy Areas on Koppen's Climate Classification of Af (Tropical Rainforest climate).

Based on data provided by MapBiomas, it is evident that the Amazon biome in Brazil has the largest expanse of pastureland. The rate of pasture expansion has notably intensified since 2008, as depicted in Figure 27. The data reveals that approximately 106.1 million hectares were maintained as pasture between 2000 and 2021, while 47.1 million hectares of natural areas were converted into pasture over the course of two decades.

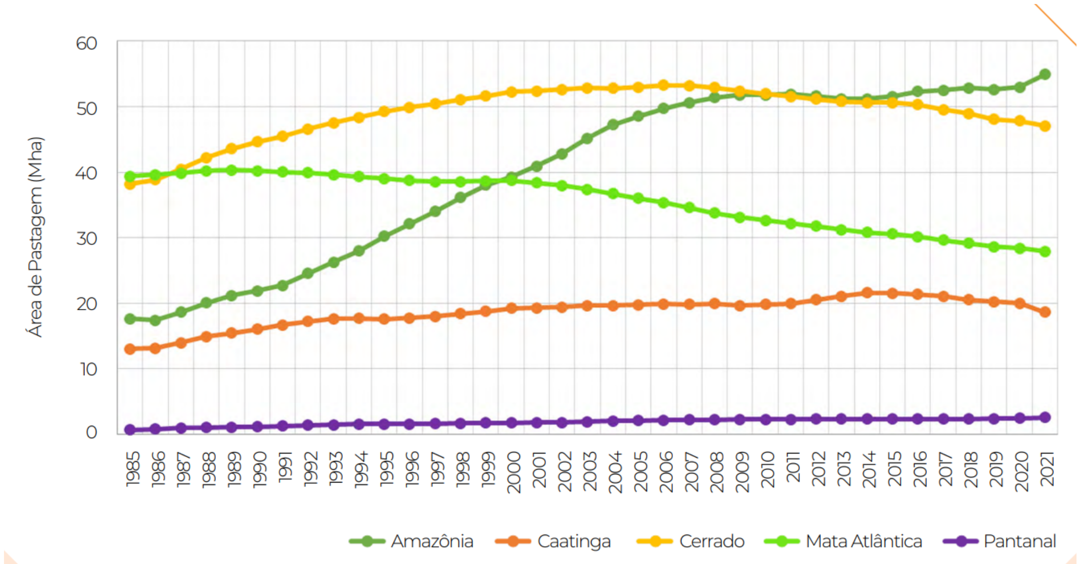

Figure 27- Area of cultivated pasture in Brazilian biomes over time.

In the selected proxy areas, the grazing areas remained stable or increased from 2011 to 2021, and the percentage of areas that experienced regeneration gains was insignificant (Table 11).

Table 11- Relation of pasture and regrowth in closely areas from project area (Data from MapBiomas-Collection 7).

Area Proxy	Area (ha)	Pasture 2011 (%)	Pasture 2021 (%)	Regrowth 2000-2021
1	4,275.12	0,31%	1,03%	0,14%
2	1,995.43	3,30%	11,49%	2,33%
3	538,87	0,27%	4,14%	0%
4	2,935.82	1,39%	3,74%	0,01%
5	7,804.58	0,09%	0,82%	0,10%
6	11,176.52	0,44%	3,82%	0,10%
7	5116,14	0,20%	4,21%	0,15%
8	801,21	0,12%	2,59%	0%
Amazonas State	264,675,03 8.8	0,94%	1,67%	0,8%

According to MapBiomas[45] the identification of deforestation pressure vectors can be attributed to agriculture, mining, urban expansion, and others, including the pressure from the construction of wind and solar power plants, particularly in the Northeast region. The numbers demonstrate the prevalence and stability of agricultural pressure over the past three years, with deforestation rates exceeding 97% attributed to this activity. However, the state of Pará stands out in some areas where mining has been a significant pressure vector. In areas near capitals and major urban centers, urban expansion has been the main source of pressure.

Based on Figure 28, it is evident that deforestation in the Legal Amazon has undergone significant changes over the past four decades, as monitored by INPE. It is crucial to delve into the reasons behind the rising deforestation rate observed in Amazonas State in recent years.

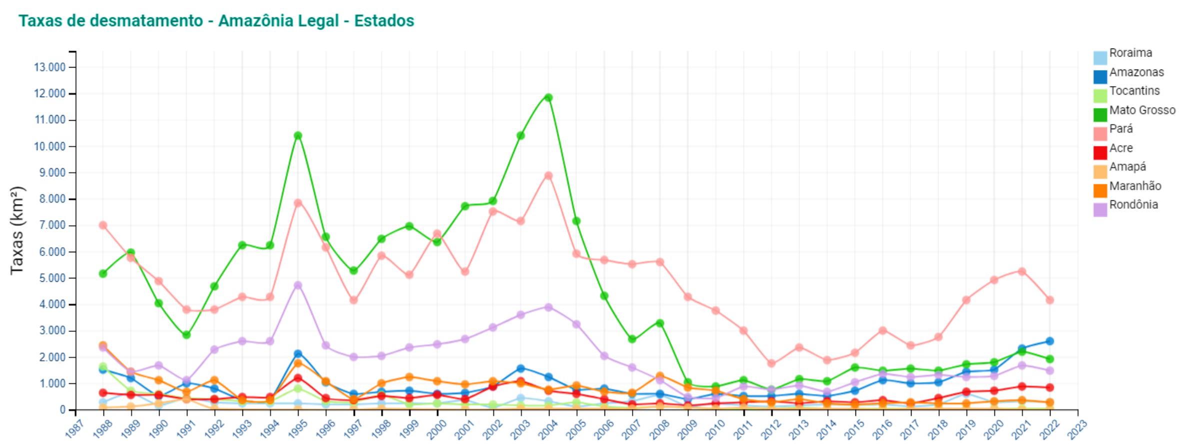

Figure 28- Deforestation of Legal Amazon (Data: Prodes/INPE).

The Figure 29 demonstrates that the percentage of regeneration for the entire Amazon region is very small during the period 2011-2021. Therefore, there is no risk of abandonment of the area for regeneration. The trends show that deforestation has been increasing more and more in the Legal Amazon, and the change in land use and land cover for grazing has been expanding in the state of Amazonas, furthering the region of the deforestation arc.

[45] Source: https://mapbiomas.org/desmatamento-em-2021-aumentou-20-com-crescimento-em-todos-os-biomas-1

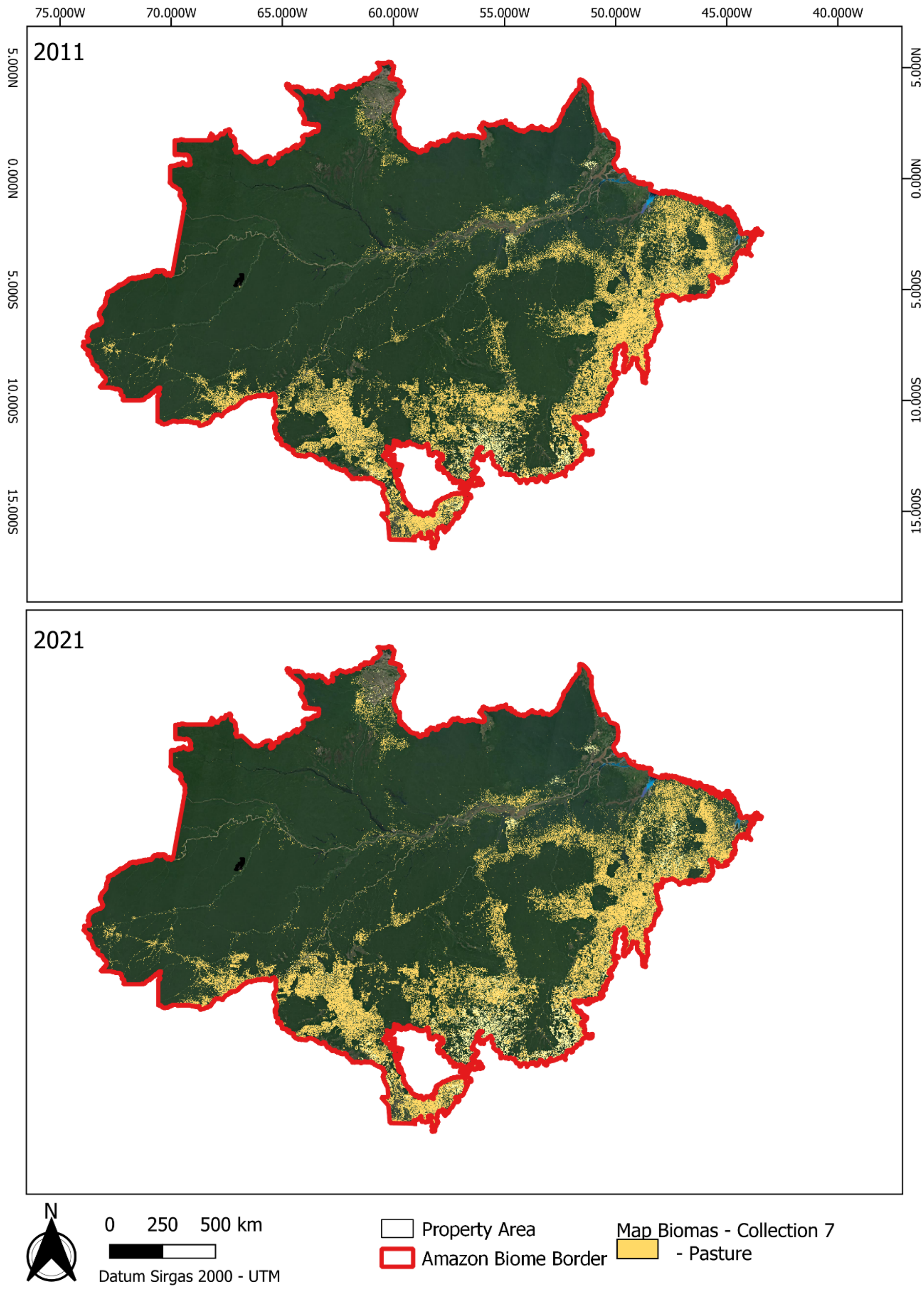

Figure 29- Difference of land use for pasture in ten years.

3.5. Additionality

The project additionality was conducted using the latest edition of the VCS tool "VT0001- Tool for the Demonstration and Assessment of Additionally in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities", version 3.0, 1 February 2012.

Both prerequisites for the tool's applicability have been met, as the AFOLU project's activity on the land within the proposed project boundary is either the same or similar to the proposed project activity, and does not violate any applicable law, regardless of whether it is registered as the VCS AFOLU project or not, even if the law is not enforced.

APD Activity analysis

3.5.1 Step 1- Identification of alternative land use scenarios to the proposed VCS AFOLU project activity

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

a) The land-use scenarios that have been identified as both realistic and credible, and that would have occurred on the land within the proposed project boundary in the absence of the AFOLU project activity under the VCS, are as follows:

SCENARIO I: Continuation of the pre-project land use

In this scenario, the landowners would be responsible for maintaining the preserved forest area while engaging in sustainable activities within the project area, without relying on any additional sources of income (without commercial exploitation). To prevent deforestation, monitoring and surveillance measures would be developed with the primary goal of protecting the legal reserve area (which comprises 80% of the property) from potential encroachment by external parties. Hence, since there are solely expenses associated with maintenance, the project does not yield an Internal Rate of Return (IRR) value, and the Net Present Value (NPV) throughout the 30-year duration of the project, considering a discount rate of 15%, amounts to ($316,000).

SCENARIO II: Logging being conducted through Sustainable Forest Management Plan

Sustainable Forest Management adopts the practices of selective cutting and reduced impact exploitation. The Brazilian legislation establishes one sole minimum logging diameter (DBH or stem diameter at 1.3 m above the ground ≥50 cm) and a harvest cycle of 25–35 years (Bonfim et al., 2022). In this scenario, the landowner would have an authorized deforestation permit and to develop and approve a Sustainable Forest Management Plan (SFMPs) under the responsibility of competent environmental agency.

Selective logging, associated with the cut intensity in volume by area and by species, requires planning based on the location of exploitable trees. To carry out exploration activities, infrastructure planning must include construction and maintenance of forest roads, construction of storage yards and logging trails. Among these infrastructures, the activity of construction and maintenance forest roads are among those with highest cost (Sessions et al., 2007; Walker et al., 2013). According to Silva (2019), the cost of constructing the infrastructure to facilitate logging in the Amazon region accounts for approximately 75% of the total cost of the operation.

SCENARIO III: Wood harvesting followed by cattle farming (Business as usual BAU)

This scenario involves the planned deforestation in the Amazon rainforest for commercial purposes. Logging in the Amazon region is a practice that occurs both legally and illegally, through or not the approval of the sustainable forest management plan. The National Forest Code allows that up to 20% of the forest area in the Legal Amazon can be cleared for economic activities, such as cattle ranching, agricultural activities, and commercial logging (Bicalho & Hoefle, 2015).

As reported by the National Institute for Space Research (INPE), approximately 75% of the total deforested area in the Amazon region since 2015 has been transformed into cattle pastures, making it the most significant land use after deforestation. In the Amazon region where Mejuruá project is being implemented, extensive beef cattle is one of the main components of the regional economy, representing more than 30% of its Gross Domestic Product (GDP) (IBGE, 2022).

b) To ensure the credibility of the proposed VCS AFOLU project's land-use scenarios, we have thoroughly examined the existing literature and conducted local observations to assess the current Business as Usual (BAU) practices within the project's boundaries.

c) Three credible alternative land-use scenarios that could have occurred within the project boundary have been identified as Scenarios I, II, and III. These scenarios have undergone a thorough evaluation and have been determined to be credible options for land use within the project area.

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

a) Considering the three credible alternative land use scenarios from sub-step 1a, a demonstration of compliance with all applicable mandatory legal and regulatory requirements is presented below.

Scenario I: Continuation of the pre-project land use

In this scenario, only additional activities are executed to protect and conserve the area, and do not imply compliance with any legislation that has not already been complied with.

Scenario II: Logging being conducted through Sustainable Forest Management Plan

Once a Sustainable Forestry Management Plan has been approved, rural landowners are authorized to carry out sustainable forestry management practices on their property. These practices involve the implementation of compatible techniques for driving, exploration, reforestation, and management that consider the various ecosystems formed by the forest cover.

Scenario III: Wood harvesting followed by cattle farming.

According to the Brazilian Forest Code, landowners are entitled to utilize 20% of their land in the manner they deem most suitable. In accordance with this provision, they intend to explore this portion of their property and will continue to do so under the current circumstances.

It has been demonstrated that SCENARIOS 1, 2 and 3 are plausible alternative land use scenarios to this VCS AFOLU project activity.

Sub-step 1c. Selection of the baseline scenario

Based on an analysis of the baseline scenario detailed in Section 3.4, as well as commonly employed practices and the business-as-usual scenario, the most credible scenario for the realization of BR Arbo business in the absence of carbon credit revenue would be Scenario (III)- Wood harvesting followed by cattle farming. This scenario is entails carrying out exploiting operations of timber resources present in the 20% of the land that corresponds to the total area of the APD project.

Scenario (i)- this scenario is easily dismissed, as it suggests that implementing certain practices would only increase costs for the landowner without offering any additional revenue.

Scenario (ii)- Forest management practices that promote sustainable logging can face significant challenges that discourage their implementation. One of the main issues is that current Sustainable Forest Management Plans are not always effective, as regulatory loopholes may allow the harvesting of timber from an entire area in the early years rather than using a sustainable, plot-by-plot approach that would ensure financial sustainability over the full 30-year cycle (Fearnside, 2018). Moreover, the fundamental issue is that financial interests can sometimes conflict with the biological growth of trees. Waiting for long periods of time to generate income from the forestland is not always feasible, making it difficult for sustainable forest management to be a financially attractive option for landowners. As a result, some landowners may decide to cut down their forest and invest in alternative ventures that offer better returns than waiting for logged forest stands to recover under a sustainable management system.

3.5.2 Step 2. Investment analysis

In this step, an investment analysis was conducted to demonstrate that the proposed project activity, without the revenue from the sales of Verified Carbon Units (VCUs), is less financially attractive than scenario III (referred to as the BAU scenario), as determined by VT0001.

Sub-step 2a. Determine appropriate analysis method.

According to VT0001, the appropriate analysis method (simple cost analysis, investment comparison analysis, or benchmark analysis) for the VCS AFOLU project depends on whether the project generates financial or economic benefits in addition to VCS-related income. As the project does generate financial benefits beyond VCS-related income, an investment comparison analysis was applied.

Sub-step 2b. Option II.

The investment comparison analysis will be carried out using the financial indicators IRR (rate of return on investment) and NPV (net present value).

Sub-step 2c. Calculation and comparison of financial indicators

In this analysis, the project scenario was exclusively compared to the baseline scenario (scenario III). The assessment of the remaining alternative land use scenarios was disregarded for the following reasons: (i) scenario I (area conservation) solely increase costs for landowners without providing any supplementary revenue; (ii) the investment of scenario II (Sustainable Forest Management Plan) bears resemblance to the project scenario, with the project line involving more associated costs.

The investment analysis for the baseline scenario considered only the costs and revenues associated with forest land conversion and did not incorporate the revenues from alternative land use, specifically the revenues generated from pasture lands. This approach can be deemed more conservative, as it does not consider the potential benefits of alternative land use and results in underestimating the potential profitability of the business.

All the most relevant costs for the development of the Project Business Plan (Forest Management) were identified and are briefly described in Tables 12, 13 and 14.

Table 12- General OPEX for the Project Business Plan.

Project OPEX	Total Cost (R$k)
Forest inventory	47,016
Forest exploration	24,745
Transport by river	260,993
Transport by container	54,630
Monitoring	21,564
Forklift (up to 2.5 ton)	21,820
Crane (up to 50 ton)	47,732
Deposit for containers	51,142
Spare parts	135,682
General and administrative expense	319,921

Project OPEX	Total Cost (R$k)
PEFC certification	778
Forest management certification process	4,828
Satellite connection	2,932
Road cost, transport and maintenance	1,007,771
Other costs	226,455

Table 13- General Staff OPEX for the Project Business Plan.

Staff OPEX by sectoral activity	Total Annual Cost (R$k)
Patio organization and feeding production lines	9,243
Panels	6,942
Flooring	2,522
Decking	2,301
Maintenance	1,170
Operational licensing offices	1,170
Forestry exploration	1,950
Deposits	1,092
Transport from deposit to port	260
Loading bales	390
Headquarters team	1,917
Middle management team	1,646
Top management team	46,776
Thermoelectric business	2,691

Table 14- General CAPEX for the Project Business Plan.

Project CAPEX	Total Cost (R$k)
Sawmills	16,014
Floor and decking lines	11,127
Panels line	2,027
Buildings & infrastructure	111,652
Plant facilities & systems	14,337
Patio Machines	13,794
Forest trucks & machines	22,077
Timber transport	3,080

Project CAPEX	Total Cost (R$k)
Road construction	16,650
Other Investment	16,200
Thermoelectric	76,773

As such, Table 15 presents the calculations for IRR and NPV for both the baseline scenario and the proposed VCS AFOLU project, without incorporating any financial benefits derived from VCS.

Table 15- Net present value and internal rate of return of baseline and project scenarios.

Financial Indicator	Baseline Scenario	Project Scenario *W/O carbon credits*
NPV ($k), discount rate 10%	334,218	(38,424)
IRR (%)	24.88%	7.13%

a) The internal rate of return was obtained as the discount rate that would result in a zero-net present value for the project within the considered planning horizon. According to the estimates, the net present value (NPV) for the baseline scenario is $ 334 million while the internal rate of return (IRR) is 25%. In contrast, the project scenario has an estimated negative NPV of R$ 38 million and an IRR of 7%.

b) When comparing the two scenarios, the data accumulated on revenue and EBITDA are approximately three times greater in the baseline scenario than in the project scenario. Additionally, in the event of deforestation, this data is concentrated in the initial phase. The spreadsheet used for these calculations is accessible to both the audit team and any stakeholder interested in replicating the analysis.

c) The analysis of the investment comparison indicates that the deforestation scenario for alternative land uses demonstrates superior indicators, specifically higher IRR and NPV, in comparison to the project scenario. As a result, it can be concluded that the proposed VCS AFOLU project, without the financial benefits provided by the VCS, is not financially the most attractive option.

Sub-step 2d. Sensitivity analysis

The purpose of this sensitivity analysis is to determine whether the conclusion regarding the financial attractiveness of the proposed project is robust enough to withstand reasonable variations in critical assumptions. The investment analysis is only a valid argument in support of additionality if it consistently supports, across a realistic range of assumptions, the conclusion that the proposed project is unlikely to be financially attractive. Therefore, this sub-step aims to demonstrate that the Project Activity would not be more financially attractive than the baseline scenario, even if the market conditions become more favorable in different scenarios, as explored through sensitivity analysis.

To perform the sensitivity analysis, the net present value (NPV) of the project activity was estimated using various discount rates. The results indicated financial indicators that were less favorable compared to the baseline scenario, as depicted in the table below (Table 16). For detailed calculations, please refer to the available calculation worksheet.

Table 16- Net present value sensitivity calculation.

		Current scenario	Project scenario	Baseline scenario
	Discount rate (%)	*IRR n.a*	*IRR 7,1%*	*IRR 25,0%*
NPV ($k)	15	(316)	(75,204)	154,128
	18	(263)	(85,277)	98,134
	20	(222)	(92,200)	55,998
	23	(189)	(96,949)	23,824
	25	(163)	(100,163)	(1049)

3.5.3 Step 3. Common practice analysis

The VT0001 necessitates either an investment analysis or a barrier analysis. In this instance, the decision was made to proceed with the investment analysis, which was previously outlined in Step 2.

3.5.4 Step 4. Common practice analysis

The Common Practice analysis represents a supplementary stage to the preceding investment and barrier analyses. Its purpose is to ascertain the degree to which comparable activities to the proposed VCS AFOLU project activity have already proliferated in the geographical area of the activity's conceptualization. It is important to note that this analysis should exclude any registered VCS AFOLU project activities.

In this analysis, activities similar to the proposed project were assessed in the project region, encompassing the municipalities of Carauari, Jutaí, and Juruá. Specifically, sustainable forest management was examined as a regulated activity based on a management plan, as it pertains to the proposed VCS REDD+ project activity. According to information provided by the Institute for Environmental Protection of Amazonas (IPAAM), from 2018 to 2022, only four sustainable forest management projects were granted licenses in the municipality of Carauari-AM. The average area of the project sites was approximately 220 hectares. No records of sustainable forest management projects were found in the municipalities of Jutaí and Juruá.

As evidenced, sustainable forest management activities exist in the project region, albeit on a significantly smaller scale when compared to the proposed VCS REDD+ project activity. Moreover, it is essential to note that the Sustainable Forest Management Plan, regulated by law, aims to manage forests situated in Permanent Preservation Areas (APP), Legal Reserves (RL), and restricted-use areas. Conversely, in areas that are not classified as APP or RL areas, such as the proposed VCS REDD+ project site, the removal of native vegetation for alternative land use, e.g., agriculture and livestock farming, is subject to specific law authorization. Consequently, forest management activities can be deemed unappealing since the financial gains derived from this practice do not surpass the opportunity cost of deforestation via clear cutting.

In light of the aforementioned information, it can be inferred that the proposed VCS REDD+ project activity is not the baseline scenario and, as a result, is deemed additional.

3.6. Methodology Deviations

Mejuruá project has no methodology deviations at the time of audit.

4. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1. Baseline Emissions

Baseline emissions are estimated using module VM0006 v1.3 – Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation/forest degradation and planned wetland degradation (BL-PL) in accordance with VM0007 v1.6 – REDD+ Methodology Framework (REDD+ MF).

4.1.1 Deforestation in the Baseline Scenario

The annual area of baseline planned deforestation ($AA_{planned,i,t}$) is calculated according to VM0006 BL-PL v1.3 (Equation 5):

$$AA_{planned,i,t} = \left(A_{planned,i} * D\%_{planned,i,t}\right) * L - D_i$$

Where:

$AA_{planned,i,t,}$ Annual area of baseline planned deforestation for stratum i at time t; ha

$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum i during year t. If actual annual proportion is known and documented (e.g. 25% per year for 4 years), set to proportion; %
$A_{planned,i,}$	Total area of planned deforestation over the baseline period for stratum i; ha
$L\text{-}D_i$	Likelihood of deforestation for stratum i; %

The determination of the total area of planned deforestation during the baseline period ($A_{planned,i,t}$) takes into account the immediate site-specific threat of deforestation, which is influenced by the legal permissibility for deforestation, the suitability of the project area for non-forest land use conversion, government approval for deforestation, and a management plan for deforestation. The specific details for calculating $A_{planned,i,t}$ can be found in Section 3.4. In this case, $A_{planned,i,t}$ was estimated to be 130,640.59 ha. The annual proportion of land projected to be deforested in stratum i during year t ($D\%_{planned,i,t}$) is determined based on suppression plans. In this context, $D\%_{planned,i,t}$ was considered to be 5.99% per year. It is important to note that the scope of this analysis only includes private areas, as specified in the VMD0006 v1.3 requirements. Therefore, the parameter L-Di is set to 100%. Baseline planned deforestation is shown in Table 17.

Table 17- Annual baseline deforestation.

Year	$AA_{planned,i,t,}$		
	Da	Db	Total
2021	886.68	3,032.47	3,919.15
2022	1,773.37	6,064.94	7,838.30
2023	1,773.37	6,064.94	7,838.30
2024	1,773.37	6,064.94	7,838.30
2025	1,773.37	6,064.94	7,838.30
2026	1,773.37	6,064.94	7,838.30
2027	1,773.37	6,064.94	7,838.30
2028	1,773.37	6,064.94	7,838.30
2029	1,773.37	6,064.94	7,838.30
2030	1,773.37	6,064.94	7,838.30
2031	1,773.37	6,064.94	7,838.30
2032	1,773.37	6,064.94	7,838.30
2033	1,773.37	6,064.94	7,838.30
2034	1,773.37	6,064.94	7,838.30
2035	1,773.37	6,064.94	7,838.30
2036	1,773.37	6,064.94	7,838.30
2037	1,773.37	6,064.94	7,838.30

Year	$AA_{planned,i,t,}$		
	Da	Db	Total
2038	296.05	1,012.51	1,308.56
2039	0,00	0,00	0.00
2040	0,00	0,00	0.00
2041	0,00	0,00	0.00
2042	0,00	0,00	0.00
2043	0,00	0,00	0.00
2044	0,00	0,00	0.00
2045	0,00	0,00	0.00
2046	0,00	0,00	0.00
2047	0,00	0,00	0.00
2048	0,00	0,00	0.00
2049	0,00	0,00	0.00
2050	0,00	0,00	0.00
$A_{planned,i}$	**29,556.59**	**101,083.95**	**130,640.54**

4.1.2 Carbon Stock Change per pool in the Baseline Scenario

This section presents the projected changes in carbon stocks by reservoir in the baseline scenario. Initial stocks are derived from direct measurements through forest inventories, while stocks in the post-deforestation categories are sourced from peer-reviewed literature (Table 18).

Aboveground Tree Biomass

The calculation of the baseline carbon stock change in aboveground tree biomass (ΔCAB_tree,i) is based on the comparison between the forest carbon stock in aboveground tree biomass ($C_{ABtree,bsl,i}$) and the post-deforestation carbon stock in aboveground tree biomass (CAB_tree,post,i), as outlined in VMD0006 v1.3, Equation 6:

$$\Delta C_{AB_{tree},i} = C_{AB_{tree_{bsl}},i} - C_{AB_{tree_{post}},i}$$

Where:

$\Delta CABtree,$ Baseline carbon stock change in aboveground tree biomass in stratum i; t CO2- e ha-1

$CABtreebsl,$ Forest carbon stock in aboveground tree biomass in stratum i; t CO2-e ha-1

$CABtreepost,$ Post-deforestation carbon stock in aboveground tree biomass in stratum i; t CO2- e ha-1 i 1, 2, 3, … M strata

Table 18- Baseline carbon stock change in aboveground tree biomass per hectare.

Stratum (i)	$CABtreebsl,i$	$CABtreepost,i$	$\Delta CABtree,i$
Da	521.987	27.756	494.230
Db	542.051	27.756	514.294

The forest carbon stock in aboveground tree biomass (CAB_tree,bsl,i) was estimated through field measurements in fixed sample plots, using representative stratified random sampling following the requirements of VMD0001 v1.1. The post-deforestation carbon stock in aboveground tree biomass (CAB_tree,post,i) is derived from peer-reviewed literature. For further information on the sampling design, adopted allometric equations, and associated Standard Operating Procedure (SOP), please refer to the Appendix.

Belowground Tree Biomass

The calculation of the baseline carbon stock change in belowground tree biomass (ΔCAB_tree,i) is based on the comparison between the forest carbon stock in belowground tree biomass ($C_{ABtree,bsl,i}$) and the post-deforestation carbon stock in belowground tree biomass (CAB_tree,post,i), as outlined in VMD0006 v1.3 (Table 19), Equation 8:

$$\Delta C_{BB\_tree,i} = C_{BB_{tree_{bsl}},i} - C_{BB_{tree_{post}},i}$$

Table 19- Baseline carbon stock change in belowground tree biomass per hectare.

Stratum (i)	$CBBtreebsl,i$	$CBBtreepost,i$	$\Delta CBBtree,i$
Da	161.816	0	161.816
Db	168.036	0	168.036

Forest carbon stock in belowground tree biomass ($C_{ABtree,bsl,i}$) is calculated through root-to-shoot ratios taken from peer reviewed literature. Considering that the post-deforestation carbon stock in the aboveground tree biomass (CAB_tree,post,i) already accounts for the total biomass, the post-deforestation carbon stock in belowground tree biomass (CBB_tree,post,i) was set as zero.

Wood Products

The mean stock extracted biomass carbon by class of wood product (CXB,ty,i) is calculated according to VMD005 v1.1 Equation 1:

$$C_{XB,ty,i} = \frac{1}{A_i} * \sum_{j=1}^{S} (V_{ex,ty,j,i} * D_j * CF_j * \frac{44}{12})$$

Where:

CXB,ty,i Mean stock of extracted biomass carbon by class of wood product ty from stratum i; t CO2-e ha-1

Ai Total area of stratum i; ha

Vex,ty,j Volume of timber extracted from within stratum i (does not include slash left onsite) by species j and wood product class ty; m3

Dj Mean wood density of species j; t d.m.m-3

CFj Carbon fraction of biomass for tree species j; t C t-1 d.m.

j 1, 2, 3, … S tree species ty Wood product class – defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o)

44/12 Ratio of molecular weight of CO2 to carbon, t CO2-e t C-1

Baseline carbon stock in wood products ($C_{WP,i}$) is calculated through direct volume extraction estimation (Option 1), according to VMD0005 v1.1 Equation 2:

$$C_{WP,i} = \sum_{ty=s,w,oir,p,o} C_{XB,ty,i} * (1 - WW_{ty})$$

Where:

CWP,i Carbon stock entering the wood products pool from stratum i; t CO2-e ha-1

CXB,ty,i Mean stock of extracted biomass carbon by class of wood product ty from stratum i; t CO2-e ha-1

WWty Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product ty; dimensionless

ty Wood product class – defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o)

i 1, 2, 3, … M strata

The calculation of the carbon entering the wood products pool at the time of deforestation and expected to be emitted over 100 years (CWP100,i) is based on Equation 3 of VMD0005 v1.1 (Table 20):

$$C_{WP100,i} = C_{WP,i} - C_{WP,i} * (1 - SLFp) * (1 - Ofp)$$

Where:

CWP100,i Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum i; t CO2-e ha-1

CWP,i Carbon stock entering wood products pool at time of deforestation from stratum i; t CO2-e ha-1

SLFty Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product ty; dimensionless

OFty Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product ty; dimensionless

ty Wood product class – defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o)

i 1, 2, 3, … M strata

Table 20- Carbon stocks in the wood products pool in the baseline.

Stratum (i)	CWP,i	CWP100,i
Da	28.410	24.703
Db		

4.1.3. Carbon Stock Change in All Pools in the Baseline Scenario

The net carbon stock changes in all pools in the baseline (ΔCBSL,i,t) is calculated according to the following equation 13 from VMD0006 v1.3 (Table 21):

$$\Delta C_{BSL,i,t} = AA_{planned,i,t} \times (\Delta C_{AB_{tree},i} - \Delta C_{WP,i} + \Delta C_{AB_{non-tree},i} + \Delta C_{LI,i})$$
$$+(\sum_{t-10}^{t} AA_{planned,i,t}) \times (\Delta C_{BB_{tree},i} + \Delta C_{BB_{non-tree},i} + \Delta C_{DW,i}) * \left(\frac{1}{10}\right)$$
$$+(\sum_{t-20}^{t} AA_{planned,i,t}) \times \left(C_{WP100,i} + \Delta C_{SOC,i}\right) * \left(\frac{1}{20}\right)$$

Where:

ΔCBSL,i,t	Sum of the baseline carbon stock change in all terrestrial pools in stratum i in year t, t CO2-e.
AAplanned,i,t	Annual area of baseline planned deforestation for stratum i in year t; ha
CWP100,i	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum i; t CO2-e ha-1.
ΔCAB_tree,i	Baseline carbon stock change in aboveground tree biomass in stratum i; t CO2-e ha-1.
ΔCBB_tree,i	Baseline carbon stock change in belowground tree biomass in stratum i; t CO2-e ha-1.

ΔCAB_non-tree,i	Baseline carbon stock change in aboveground non-tree biomass in stratum i; tCO2-e ha-1.
ΔCBB_non-tree,i	Baseline carbon stock change in belowground non-tree biomass in stratum i; tCO2-e ha-1.
ΔCWP,i	Baseline carbon stock change in wood products in stratum i; tCO2-e ha1.
ΔCDW,i	Baseline carbon stock change in dead wood in stratum i; tCO2-e ha-1.
ΔCLI,i	Baseline carbon stock change in litter in stratum i tCO2-e ha-1.
ΔCSOC,i	Baseline carbon stock change in soil organic carbon in stratum i; tCO2-e ha-1.
i	1, 2, 3, … M strata.
t	1, 2, 3, … t* years elapsed since the projected start of the project activity

Table 21- Net carbon stock changes in all pools in the baseline period.

Year	Aaplanned,i,t (ha)	Aaplanned,i,t accumulated (ha)	ΔCBSL,i,t (tCO2-e)	ΔCBSL,i,t Accumulated (tCO2-e)
2021	3,919.15	3,919.15	1,956,609.15	1,956,609.15
2022	7,838.30	11,757.45	3,983,363.21	5,939,972.36
2023	7,838.30	19,595.75	4,123,653.02	10,063,625.38
2024	7,838.30	27,434.06	4,263,942.83	14,327,568.22
2025	7,838.30	35,272.36	4,404,232.65	18,731,800.86
2026	7,838.30	43,110.66	4,544,522.46	23,276,323.32
2027	7,838.30	50,948.96	4,684,812.27	27,961,135.59
2028	7,838.30	58,787.26	4,825,102.08	32,786,237.68
2029	7,838.30	66,625.57	4,965,391.90	37,751,629.57
2030	7,838.30	74,463.87	5,105,681.71	42,857,311.28
2031	7,838.30	82,302.17	5,180,667.27	48,037,978.55
2032	7,838.30	90,140.47	5,190,348.58	53,228,327.14
2033	7,838.30	97,978.77	5,200,029.89	58,428,357.03
2034	7,838.30	105,817.08	5,209,711.21	63,638,068.24
2035	7,838.30	113,655.38	5,219,392.52	68,857,460.75
2036	7,838.30	121,493.68	5,229,073.83	74,086,534.58
2037	7,838.30	129,331.98	5,238,755.14	79,325,289.72
2038	1,308.56	130,640.54	1,988,508.22	81,313,797.95
2039	0.00	130,640.54	1,228,030.25	82,541,828.20
2040	0.00	130,640.54	1,097,421.75	83,639,249.96

Year	Aaplanned,i,t (ha)	Aaplanned,i,t accumulated (ha)	ΔCBSL,i,t (tCO2-e)	ΔCBSL,i,t Accumulated (tCO2-e)
2041	0.00	130,640.54	961,972.60	84,601,222.55
2042	0.00	130,640.54	821,682.78	85,422,905.34
2043	0.00	130,640.54	681,392.97	86,104,298.31
2044	0.00	130,640.54	541,103.16	86,645,401.47
2045	0.00	130,640.54	400,813.35	87,046,214.82
2046	0.00	130,640.54	260,523.53	87,306,738.35
2047	0.00	130,640.54	120,233.72	87,426,972.07
2048	0.00	130,640.54	88,748.05	87,515,720.12
2049	0.00	130,640.54	79,066.73	87,594,786.85
2050	0.00	130,640.54	69,85.42	87,664,172.27

4.1.4. Non-CO2 Emissions in the Baseline Scenario

The baseline greenhouse gas emissions resulting from deforestation activities within the project area were calculated according to Equation 15 from module VMD0006 v1.3 (Table 22):

$$GHG_{BSL,E,i,t} = E_{FC,i,t} + E_{BiomassBurn,i,t} + N_2O_{direct-N,i,t}$$

Where:

GHGBSL,E Greenhouse gas emissions as a result deforestation activities within the project boundary in the stratum i in year t; t CO2-e

EFC,i,t Net CO2e emission from fossil fuel combustion in stratum i in year t; t CO2-e

EBiomassBurn,i,t Non-CO2 emissions due to biomass burning in stratum i in year t; t CO2-e

N2Odirect-N,i,t Direct N2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t; t CO2-e

i 1, 2, 3, …M strata

t 1, 2, 3, …t* years elapsed since the start of the REDD VCS project activity

Net CO2-e emissions from fossil fuel combustion (EFC,i,t) and nitrogen application (N2Odirect-N,i,t) in the baseline scenario were conservatively excluded.

Non-CO2 emissions from biomass burning (EBiomassBurn,i,t) were calculated according Equation 1 from module VMD0013 v1.2:

$$E_{biomassburn,i,t} = \sum_{g=1}^{G}\left(\left(\left(A_{burn,i,t} \times B_{i,t} \times COMF_i \times G_{g,i}\right) \times 10^{-3}\right) \times GWP_g\right)$$

Where:

Ebiomassburn,i,t Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO2, CH4, N2O) (t CO2e)

Aburn,i,t Area burnt for stratum i in year t (ha)

Bi,t Average aboveground biomass stock before burning stratum i, year (t d.m. ha-1)

COMFi Combustion factor for stratum i (unitless)

Gg,i Emission factor for stratum i for gas g (kg t-1 d.m. burnt)

GWPg Global warming potential for gas g (t CO2/t gas g)

g 1, 2, 3 … G greenhouse gases including carbon dioxide1, methane and nitrous oxide (unitless)

i 1, 2, 3 … M strata (unitless)

t 1, 2, 3, … t* time elapsed since the start of the project activity (years)

The burnt area (Aburn,i,t) corresponds to the annual area of planned deforestation in the baseline case (AAplanned,i,t). The combustion and emission factors are default values adopted from the IPCC (2006). The global warming potential is a default factor from the latest IPCC assessment report.

The average aboveground biomass stock before burning (Bi,t) is calculated according to Equation 2 from module VMD0013 v1.2:

$$B_{i,t} = (C_{AB\_tree,i,t} + C_{DWi,t} + C_{LI,i,t}) \times 12/44 \times (1/CF)$$

Where:

Bi,t Average aboveground biomass stock before burning for stratum i, year t (tonnes d.m. ha-1).

CAB_tree,i,t Carbon stock in aboveground biomass in trees in stratum i in year t (t CO2e ha-1).

CAB_non-tree,i,t Carbon stock in aboveground biomass in non-trees in stratum i in year t (t CO2e ha-1).

CDWi,t Carbon stock in dead wood for stratum i in year t (t CO2e ha-1).

CLI,i,t Carbon stock in litter for stratum i in year t (t CO2e ha-1).

12/44 Inverse ratio of molecular weight of CO2 to carbon (t CO2e t C-1).

CF Carbon fraction of biomass (t C t-1 d.m).

i 1, 2, 3 … M strata (unitless).

t 1, 2, 3, … t* time elapsed since the start of the project activity (years).

Dead wood (CDWi,t) and litter (CLI,i,t) were excluded from the baseline, and thus were not accounted for in the calculation of aboveground biomass stock before burning (Bi,t).

Table 22- Non-CO2 emissions in the baseline.

Year	Aburn,i,t	GHGBSL,E
2021	3,919.15	133,888.54
2022	7,838.30	267,777.08
2023	7,838.30	267,777.08
2024	7,838.30	267,777.08
2025	7,838.30	267,777.08
2026	7,838.30	267,777.08
2027	7,838.30	267,777.08
2028	7,838.30	267,777.08
2029	7,838.30	267,777.08
2030	7,838.30	267,777.08
2031	7,838.30	267,777.08
2032	7,838.30	267,777.08
2033	7,838.30	267,777.08
2034	7,838.30	267,777.08
2035	7,838.30	267,777.08
2036	7,838.30	267,777.08
2037	7,838.30	267,777.08
2038	1,308.56	44,703.90
2039	0.00	0.00
2040	0.00	0.00
2041	0.00	0.00
2042	0.00	0.00
2043	0.00	0.00
2044	0.00	0.00
2045	0.00	0.00
2046	0.00	0.00
2047	0.00	0.00
2048	0.00	0.00
2049	0.00	0.00

Year	Aburn,i,t	GHGBSL,E
2050	0.00	0.00
Total	**130,640.54**	**4,463,025.66**

4.1.5. Net GHG emissions in the Baseline Scenario

The baseline net GHG emissions for planned deforestation is determined according to VMD0006 v1.3 Equation 1 (Table 23):

$$\Delta C_{BSL,planned} = \sum_{t=1}^{t*} \sum_{i=1}^{M} \left(\Delta C_{BSL,i,t} + GHG_{BSL-E,i,t} \right)$$

Where:

ΔCBSL,planned — Net greenhouse gas emissions in the baseline from planned deforestation up to year t*; t CO2-e.

ΔCBSL,i,t — Net carbon stock changes in all pools in the baseline stratum i in year t; t CO2-e.

GHGBSL-E,i,t — Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i in year t; t CO2-e yr-1.

i 1, 2, 3, … — M strata.

t 1, 2, 3, … — t* years elapsed since the projected start of the project activity.

Table 23- Net GHG emissions in the baseline case from APD in the baseline.

Year	ΔCBSL,planned (tCO2-e)	ΔCBSL,planned accumulated (tCO2-e)
2021	2,090,496.95	2,090,496.95
2022	4,251,138.79	6,341,635.75
2023	4,391,428.56	10,733,064.30
2024	4,531,718.32	15,264,782.63
2025	4,672,008.09	19,936,790.72
2026	4,812,297.86	24,749,088.57
2027	4,952,587.62	29,701,676.19
2028	5,092,877.39	34,794,553.58
2029	5,233,167.15	40,027,720.74
2030	5,373,456.92	45,401,177.65
2031	5,448,442.46	50,849,620.11
2032	5,458,123.77	56,307,743.88
2033	5,467,805.08	61,775,548.96
2034	5,477,486.39	67,253,035.36

Year	ΔCBSL,planned (tCO2-e)	ΔCBSL,planned accumulated (tCO2-e)
2035	5,487,167.70	72,740,203.06
2036	5,496,849.02	78,237,052.08
2037	5,506,530.33	83,743,582.41
2038	2,033,211.46	85,776,793.86
2039	1,228,029.87	87,004,823.74
2040	1,097,421.42	88,102,245.15
2041	961,972.31	89,064,217.46
2042	821,682.54	89,885,900.01
2043	681,392.78	90,567,292.79
2044	541,103.01	91,108,395.80
2045	400,813.25	91,509,209.04
2046	260,523.48	91,769,732.52
2047	120,233.71	91,889,966.24
2048	88,748.05	91,978,714.28
2049	79,066.73	92,057,781.02
2050	69,385.42	92,127,166.44

4.2. Project Emissions

The greenhouse gas emissions from the project line will be evaluated according to VMD0015 v2.2. Ex-ante estimates will be made, considering projections of forest degradation caused in the project area by timber harvesting as well as the infrastructure involved in forest management. Ex-post estimates will be based on monitored data throughout the project's lifetime.

4.2.1 Emissions arising in the logging gap

Calculate the biomass of the total volume extracted from within each logging stratum is calculated according to VMD0015 v2.2, Equation 11 (Table 24):

$$C_{EXT,z,i,t} = \sum_{j=1}^{S}(V_{EXT,j,z,i,t} * D_j * CF_j * \frac{44}{12})$$

Where:

CEXT,z,I,t Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum I in year t; t CO2-e

VEXT,j,z,I,t The volume of timber extracted of species j for logging stratum z, in stratum I in year t; m3

Dj Basic wood density of species j; t d.m.m-3

CFj Carbon fraction of biomass for tree species j; t C t-1 d.m.

z 1, 2, 3, ...Z logging strata

j 1, 2, 3, ... SPS tree species t 1, 2, 3, ...

t years elapsed since the start of the project activity

Emissions arising in the logging gap are calculated according to VMD0015 v2.2, Equation 10:

$$C_{LG,i,t} = \sum_{z=1}^{Z} (C_{EXT,z,i,t} + (LDF_{z,i} * V_{EXT,z,i,t} * \frac{44}{12}))$$

Where:

CLG,i,t Actual net project emissions arising in the logging gap , in stratum i in year t; t CO2-e

CEXT, z,i,t Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t; t CO2-e

LDFz,i Logging damage factor for logging stratum z, in stratum i; t C m-3

VEXT,z,i,t Volume extracted from logging stratum z, in stratum i in year t; m3

Z 1, 2, 3, ...Z logging strata

i 1, 2, 3, ... M strata

t 1, 2, 3, ... t years elapsed since the start of the project activity

Table 24- Emission arising in the logging gap in the project scenario.

Year	VEXT,j,z,i,t (m3)	CEXT,z,i,t (tCO2e)	CLG,i,t (tCO2e)
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00
2023	0.00	0.00	0.00
2024	0.00	0.00	0.00
2025	109,142.00	112,852.83	324,952.12
2026	109,142.00	112,852.83	324,952.12
2027	109,142.00	112,852.83	324,952.12
2028	109,142.00	112,852.83	324,952.12
2029	109,142.00	112,852.83	324,952.12
2030	109,142.00	112,852.83	324,952.12

Year	VEXT,j,z,i,t (m3)	CEXT,z,i,t (tCO2e)	CLG,i,t (tCO2e)
2031	109,142.00	112,852.83	324,952.12
2032	109,142.00	112,852.83	324,952.12
2033	109,142.00	112,852.83	324,952.12
2034	109,142.00	112,852.83	324,952.12
2035	109,142.00	112,852.83	324,952.12
2036	109,142.00	112,852.83	324,952.12
2037	109,142.00	112,852.83	324,952.12
2038	109,142.00	112,852.83	324,952.12
2039	109,142.00	112,852.83	324,952.12
2040	109,142.00	112,852.83	324,952.12
2041	109,142.00	112,852.83	324,952.12
2042	109,142.00	112,852.83	324,952.12
2043	109,142.00	112,852.83	324,952.12
2044	109,142.00	112,852.83	324,952.12
2045	109,142.00	112,852.83	324,952.12
2046	100,000.00	103,400.00	297,733.33
2047	65,000.00	67,210.00	193,526.67
2048	65,000.00	67,210.00	193,526.67
2049	13,533.40	13,993.54	40,293.44
2050	0.00	0.00	0.00
Total	**2,535,515.43**	**2,621,722.95**	**7,549,074.60**

4.2.2. Emissions arising through logging infrastructure

Skid Trail Creation

GHG emissions from the creation of skid trails is estimated by multiplying the total length of skid trails created and a skid trail emission factor, according to VMD0015 v2.2, equation 13 (Table 25):

$$\Delta C_{SKID,i,t} = L_{SKID,i,t} * SK_i$$

Where:

ΔCSKID,i,t Change in carbon stock resulting from skid trail creation in stratum i in year t; t CO2-e

LSKID,i,t Length of skid trails in stratum i in year t; m

SKi Skid trail emissions factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum i; t CO2-e m-1 t 1, 2, 3, … t* years elapsed since the start of the project activity

Skid trail emissions factor is calculated according to VMD0015 v2.2, Equation 14:

$$SK_i = (C_{dest,i} + \Delta C_{SOC,sk,i}) * \frac{1}{10,000} * W_{SKID}$$

$$C_{dest,i} = C_{AB\_tree\_dest,i} + C_{BB\_tree\_dest,i} + C_{AB\_non-tree,i} + C_{BB\_non-tree,i}$$

Where:

SK,I Skid trail emission factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum I; t t CO2-e m-1

Cdest, I Mean live carbon stock of trees and non-tree biomass assumed to be killed per unit area in creation of skid trail in stratum I; t CO2-e ha-1

ΔCSOC_sk,I Carbon stock change in organic carbon resulting from skid trail creation in stratum I; t CO2-e ha-1

WSKID Mean width of skid trails in stratum I; m

CAB_tree_dest,I Carbon stock in aboveground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail in stratum I; t CO2-e ha-1

CBB_tree_dest,I Carbon stock in belowground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail in stratum I; t CO2-e ha-1

CAB_non-tree,I Carbon stock in aboveground non-tree biomass in stratum I; t CO2-e ha-1

CBB_non-tree,I Carbon stock in belowground non-tree biomass in stratum I; t CO2-e ha-1

1/10,000 Conversion of units from hectares to m^2

I 1, 2, 3, … M strata

Logging Roads Creation

GHG emissions resulting from the creation of roads are calculated according to VMD0015 v2.2, equation 17:

$$\Delta C_{ROAD,i,t} = A_{ROAD,i,t} * C_{BSL,i}$$

Where:

ΔCROAD,i,t Change in carbon stock resulting from logging road creation in stratum i in year t; t CO2-e

AROAD,i,t Area of roads in stratum i in year t; ha

$C_{BSL,i}$ Carbon stock in all pools in the baseline case in stratum i; t CO_2-e ha^{-1}

i 1, 2, 3, … M strata

t 1, 2, 3, … t* years elapsed since the start of the project activity

Logging Decks Creation

GHG emissions resulting from the creation of logging decks are calculated according to VMD0015 v2.2, equation 18:

$$\Delta C_{DECKS,i,t} = A_{DECKS,i,t} * C_{BSL,i}$$

Where:

$\Delta C_{DECKS,i,t}$ Change in carbon stock resulting from logging deck creation in stratum i in year t; t CO_2-e

$A_{DECKS,i,t}$ Area of logging decks in stratum i in year t; ha

$C_{BSL,i}$ Carbon stock in all pools in the baseline case in stratum i; t CO_2-e ha^{-1}

i 1, 2, 3, … M strata

t 1, 2, 3, … t* years elapsed since the start of the project activity

Emissions arising through logging infrastructure are calculated according to VMD0015 v2.2, equation 12:

$$C_{LR,i,t} = \Delta C_{SKID,i,t} + \Delta C_{ROAD,i,t} + \Delta C_{DECKS,i,t}$$

Where:

$C_{LR,i,t}$ Actual net project emissions arising from logging infrastructure in stratum i in year t; t CO_2-e

$\Delta C_{SKID,i,t}$ Change in carbon stock resulting from skid trail creation in stratum i in year t; t CO_2-e

$\Delta C_{ROAD,i,t}$ Change in carbon stock resulting from logging road creation in stratum i in year t; t CO_2-e

$\Delta C_{DECKS,i,t}$ Change in carbon stock resulting from logging deck creation in stratum i in year t; t CO_2-e

i 1, 2, 3, … M strata

t 1, 2, 3, … t years elapsed since the start of the project activity

Table 25- Emissions arising through logging infrastructure in the project scenario.

Year	ΔCSKID,i,t (tCO2e)	ΔCROAD,i,t (tCO2e)	ΔCDECKS,i,t (tCO2e)	CLR,i,t (tCO2e)
2021	0.00	0.00	0.00	0.00
2022	0.00	0.00	0.00	0.00
2023	0.00	0.00	0.00	0.00
2024	0.00	0.00	0.00	0.00
2025	63,260.06	59,828.83	27,744.72	150,833.61
2026	63,260.06	59,828.83	27,744.72	150,833.61
2027	63,260.06	59,828.83	27,744.72	150,833.61
2028	63,260.06	59,828.83	27,744.72	150,833.61
2029	63,260.06	59,828.83	27,744.72	150,833.61
2030	63,260.06	59,828.83	27,744.72	150,833.61
2031	63,260.06	59,828.83	27,744.72	150,833.61
2032	63,260.06	59,828.83	27,744.72	150,833.61
2033	63,260.06	59,828.83	27,744.72	150,833.61
2034	63,260.06	59,828.83	27,744.72	150,833.61
2035	63,260.06	59,828.83	27,744.72	150,833.61
2036	63,260.06	59,828.83	27,744.72	150,833.61
2037	63,260.06	59,828.83	27,744.72	150,833.61
2038	63,260.06	59,828.83	27,744.72	150,833.61
2039	63,260.06	59,828.83	27,744.72	150,833.61
2040	63,260.06	59,828.83	27,744.72	150,833.61
2041	63,260.06	59,828.83	27,744.72	150,833.61
2042	63,260.06	59,828.83	27,744.72	150,833.61
2043	63,260.06	59,828.83	27,744.72	150,833.61
2044	63,260.06	59,828.83	27,744.72	150,833.61
2045	63,260.06	59,828.83	27,744.72	150,833.61
2046	63,260.06	59,828.83	27,744.72	150,833.61
2047	63,260.06	59,828.83	27,744.72	150,833.61
2048	63,260.06	59,828.83	27,744.72	150,833.61
2049	7,844.13	7,418.66	3,440.29	18,703.08
2050	0.00	0.00	0.00	0.00
Total	**1,526,085.67**	**1,443,310.67**	**669,313.48**	**3,638,709.82**

4.2.3. Carbon Stock in Wood products in Project Line

Changes in carbon stock in the project scenario due to wood products have been calculated using the same equations as the baseline (Table 29).

Table 26- Carbon stocks in the wood products pool in the project scenario.

Stratum (i)	CWP,i	CWP100,i
Da	5.682	5.023
Db		

4.2.2 Forest Regeneration in the Project Scenario

In the project line, sustainable forest management is carried out, duly certified with FSC and/or PEFC. After the management activities are completed, the managed area remains untouched until the end of the project's lifetime. Therefore, it is plausible to consider the carbon sequestration achieved through the natural forest regeneration that will occur in the area. To calculate the sequestered carbon, a value of 3.03 tCO2/ha was used, sourced from peer-reviewed literature (West et al., 2014). The value of regeneration was multiplied by the managed area per year until reaching the carbon value equivalent to the net project emissions arising in the logging gap (CLG,i,t) (Table 27).

Table 27- Carbon sequestration through natural regeneration in the project scenario.

Year	Area (ha)	CLG,i,t (tCO2)	Regeneration (tCO2)
2021	0.00	0.00	0.00
2022	0.00	0.00	0.00
2023	0.00	0.00	0.00
2024	0.00	0.00	0.00
2025	5,415.38	324,952.12	16,408.59
2026	5,415.38	324,952.12	32,817.18
2027	5,415.38	324,952.12	49,225.78
2028	5,415.38	324,952.12	65,634.37
2029	5,415.38	324,952.12	82,042.96
2030	5,415.38	324,952.12	98,451.55
2031	5,415.38	324,952.12	114,860.14
2032	5,415.38	324,952.12	131,268.74
2033	5,415.38	324,952.12	147,677.33
2034	5,415.38	324,952.12	164,085.92
2035	5,415.38	324,952.12	180,494.51
2036	5,415.38	324,952.12	196,903.10
2037	5,415.38	324,952.12	213,311.70
2038	5,415.38	324,952.12	229,720.29
2039	5,415.38	324,952.12	246,128.88
2040	5,415.38	324,952.12	262,537.47
2041	5,415.38	324,952.12	278,946.06
2042	5,415.38	324,952.12	295,354.66
2043	5,415.38	324,952.12	311,763.25

Year	Area (ha)	CLG,i,t (tCO2)	Regeneration (tCO2)
2044	5,415.38	324,952.12	328,171.84
2045	5,415.38	324,952.12	344,580.43
2046	5,415.38	297,733.33	360,989.02
2047	5,415.38	193,526.67	377,397.62
2048	5,415.38	193,526.67	393,806.21
2049	671.50	40,293.44	395,840.84
2050	0.00	0.00	395,840.84
Total	**130,640.54**	**7,549,074.60**	**5,714,259.29**

4.2.5 Total Emission from Selective Logging in the Project Scenario

The greenhouse gas (GHG) emissions from logging activities in the project scenario were estimated ex-ante and will be monitored ex-post, based on post exploration reports. The ex-post estimates are based on GHG emissions resulting from the logging gap, logging infrastructure, and carbon stock in the wood product pool, in accordance with VMD0015 v2.2 equation 9 (Table 28).

$$\Delta C_{P,SelLog,i,t} = \sum_{t=1}^{t} \left(C_{LG,i,t} + C_{LR,i,t} - C_{WP,i,t} \right)$$

Where:

ΔCP,SelLog,i,t Net carbon stock change as a result of degradation through selective logging of FSC and/or PEFC certified forest management areas in the project area in the project case in stratum i in year t; t CO2-e

CLG,i,t Actual net project emissions arising in the logging gap in stratum i in year t; t CO2-e

CLR,i,t Actual net project emissions arising from logging infrastructure in stratum i in year t; t CO2-e

CWP i,t Carbon stock in wood products pool from stratum i, in year t; t CO2-e

t 1, 2, 3, … t years elapsed since the start of the project activity

In equation 9, the subtraction of carbon sequestered through natural regeneration, as explained in the previous section (4.2.4), has also been included.

Table 28- Net emissions in the project scenario.

Year	CLG,i,t (tCO2)	CLR,i,t (tCO2)	Regeneration (tCO2)	ΔCP,SelLog,i,t (tCO2)
2021	0.00	0.00	0.00	0.00
2022	0.00	0.00	0.00	0.00
2023	0.00	0.00	0.00	0.00

Year	CLG,i,t (tCO2)	CLR,i,t (tCO2)	Regeneration (tCO2)	ΔCP,SelLog,i,t (tCO2)
2024	0.00	0.00	0.00	0.00
2025	324,952.12	150,833.61	16,408.59	475,774.37
2026	324,952.12	150,833.61	32,817.18	459,365.78
2027	324,952.12	150,833.61	49,225.78	442,957.19
2028	324,952.12	150,833.61	65,634.37	426,548.59
2029	324,952.12	150,833.61	82,042.96	410,140.00
2030	324,952.12	150,833.61	98,451.55	393,731.41
2031	324,952.12	150,833.61	114,860.14	377,322.82
2032	324,952.12	150,833.61	131,268.74	360,914.23
2033	324,952.12	150,833.61	147,677.33	344,505.63
2034	324,952.12	150,833.61	164,085.92	328,097.04
2035	324,952.12	150,833.61	180,494.51	311,688.45
2036	324,952.12	150,833.61	196,903.10	295,279.86
2037	324,952.12	150,833.61	213,311.70	278,871.27
2038	324,952.12	150,833.61	229,720.29	262,462.67
2039	324,952.12	150,833.61	246,128.88	246,054.08
2040	324,952.12	150,833.61	262,537.47	229,645.49
2041	324,952.12	150,833.61	278,946.06	213,236.90
2042	324,952.12	150,833.61	295,354.66	196,828.31
2043	324,952.12	150,833.61	311,763.25	180,419.71
2044	324,952.12	150,833.61	328,171.84	164,011.12
2045	324,952.12	150,833.61	344,580.43	147,602.53
2046	297,733.33	150,833.61	360,989.02	103,975.15
2047	193,526.67	150,833.61	377,397.62	-16,640.11
2048	193,526.67	150,833.61	393,806.21	-33,048.70
2049	40,293.44	18,703.08	395,840.84	-334,821.05
2050	0.00	0.00	395,840.84	-395,840.84
Total	**7,549,074.60**	**3,638,709.82**	**5,714,259.29**	**5,869,081.89**

4.3 Leakage

4.3.1. Activity Shifting Leakage

Given the project scope, the total area of monitored deforestation caused by the baseline agent for planned deforestation, AdefLK,i,t, is always zero. This is because there are no forested areas within the lands managed by the identified deforestation agent that are legally allowed to be suppressed, regardless of the project boundary. Consequently, any greenhouse gas (GHG) emissions resulting from activity shifting to evade planned deforestation are assumed to be zero in both ex-ante and ex-post estimates.

Therefore, the newly calculated forest clearance by the baseline agent for planned deforestation, where no leakage is occurring, is simply the average number of hectares deforested per year across all concessions managed by the agent. The agent of deforestation, project owner, has no other managed land. The area has no forested wetlands within the project area. The agent of deforestation in this case has only one area predicted to this project and the proponent have the official request and the plan to deforest 20% of Santa Rosa do Tenquê property, in accordance with Brazilian Forest Code.

4.3.2 Market Effects Leakage

Since the baseline agent of deforestation does not engage in fuelwood or charcoal collection, market leakage is confined to the leakage resulting from reduced timber harvest, as determined by equation 2 from VMD0011 v1.0. Leakage caused by market effects equals the baseline emissions from logging multiplied by a leakage factor, and, if applicable, a leakage management factor (Table 29).

$$LK_{MarketEffects,timber} = \sum_{i=1}^{M} \left(LF_{ME} * AL_{T,i} \right)$$

Where:

LKMarketEffects,timber Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO2-e

LFME Leakage factor for market-effects calculations; dimensionless

ALT,i Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO2-e

i 1,2,3,...M strata

To calculate the leakage factor for market effects (LFME), we took into account the relationship between the average merchantable biomass as a percentage of the total aboveground tree biomass for each forest type (PMLFT) and the merchantable biomass as a percentage of the total aboveground tree biomass for stratum i within the project boundary (PMPi). The PMLFT was estimated based on available literature data. According to Homma (2011), out of the 45 billion m3 of Amazon wood stocks, approximately 14 billion m^3 was considered marketable. Therefore, we adopted a PMLFT of 31% for the legal Amazon region. The LF_{ME} was adopted as 0.2, as the total tree biomass above ground is considered to be 40% lower in the project area when compared to the Amazon (PML_{FT} > 15% to PMP_i).

Summed emissions from timber harvest potentially displaced through implementation of carbon project is estimated according to VMD0011 v1.0 equation 3:

$$AL_{T,i} = \sum_{t=1}^{t} \left(C_{BSL,XBT,i,t}\right)$$

Where:

ALT,i Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO2-e

CBSL,XBT,i,t Carbon emission due to displaced timber harvests in the baseline scenario in stratum i in time t; t CO2-e

i 1, 2, 3, ...M strata

t 1, 2, 3, ... t* years elapsed since the projected start of the REDD project activity

Carbon emissions due to displaced timber harvests in the baseline scenario is calculated according to VMD0011 v1.0 equation 4:

$$C_{BSL,XBT,i,t} = \left(\left[V_{BSL,XE,i,t} * D_{mn} * CF\right] + \left[V_{BSL,XE,i,t} * LDF\right] + \left[V_{BSL,XE,i,t} * LIF\right]\right) * \frac{44}{12}$$

Where:

CBSL,XBT,i,t Carbon emission due to timber harvests in the baseline scenario in stratum i at time t; t CO2-e

VBSL,EX,i,t Volume of timber projected to be extracted from within the project boundary during the baseline in stratum i at time t; m3

Dmn Mean wood density of commercially harvested species; t d.m.m-3 . The value must be the same as that used in the module CP-W if this pool is included in the baseline.

CF Carbon fraction of biomass for commercially harvested species j; t C t d.m.-1 . The value must be the same as that used in the module CP-W if this pool is included in the baseline.

LDF Logging damage factor; t C m-3 (default 0.53 t C m-3 for broadleaf and mixed forests; 0.25 t C m-3 for coniferous forests)

LIF Logging infrastructure factor; t C m-3 (default 0.29 t C m-3)

i 1, 2, 3, ... M strata

t 1, 2, 3, ... t* years elapsed since the projected start of the REDD project activity

Table 29- Net GHG emissions due to market-effects leakage.

Year	CBSL,XBT,i,t	$LKMarketEffects,Timber$	ΔCLK-ME (tCO2-e)
2021	797,912.86	159,582.57	159,582.57
2022	1,595,825.73	319,165.15	319,165.15

Year	CBSL,XBT,i,t	$LK_{MarketEffects,Timber}$	ΔCLK-ME (tCO2-e)
2023	1,595,825.73	319,165.15	319,165.15
2024	1,595,825.73	319,165.15	319,165.15
2025	1,154,819.28	230,963.86	230,963.86
2026	1,154,819.28	230,963.86	230,963.86
2027	1,154,819.28	230,963.86	230,963.86
2028	1,154,819.28	230,963.86	230,963.86
2029	1,154,819.28	230,963.86	230,963.86
2030	1,154,819.28	230,963.86	230,963.86
2031	1,154,819.28	230,963.86	230,963.86
2032	1,154,819.28	230,963.86	230,963.86
2033	1,154,819.28	230,963.86	230,963.86
2034	1,154,819.28	230,963.86	230,963.86
2035	1,154,819.28	230,963.86	230,963.86
2036	1,154,819.28	230,963.86	230,963.86
2037	1,154,819.28	230,963.86	230,963.86
2038	266,414.12	53,282.82	53,282.82
2039	0.00	0.00	0.00
2040	0.00	0.00	0.00
2041	0.00	0.00	0.00
2042	0.00	0.00	0.00
2043	0.00	0.00	0.00
2044	0.00	0.00	0.00
2045	0.00	0.00	0.00
2046	0.00	0.00	0.00
2047	0.00	0.00	0.00
2048	0.00	0.00	0.00
2049	0.00	0.00	0.00
2050	0.00	0.00	0.00
Total	**20,864,454.85**	**4,172,890.97**	**4,172,890.97**

4.4. Net GHG Emission Reductions and Removals

4.4.1 Total Net GHG Emission Reduction

Net GHG emissions reduction estimates are based in equation 2 from VM0007 v1.6 (Table 30):

$NER_{REDD} = \Delta C_{BSL\text{-}REDD} - \Delta C_{WPS\text{-}REDD} - \Delta C_{LK\text{-}REDD}$

Where:

NERREDD Total net GHG emission reductions of the REDD project activity up to year t (t CO2e)*

ΔCBSL-REDD Net GHG emissions in the REDD baseline scenario up to year t (t CO2e)*

ΔCWPS-REDD Net GHG emissions in the REDD project scenario up to year t – from Module MREDD (t CO2e)*

ΔCLK-REDD Net GHG emissions due to leakage from the REDD project activity up to year t (t CO2e)*

Table 30- Total net GHG emissions reductions of the REDD project activity.

Year	Estimated baseline emissions or removals (tCO2e) ΔCBSL-REDD	Estimated project emissions or removals (tCO2e) ΔCWPS-REDD	Estimated Leakage emissions (tCO2e) ΔCLK-REDD	Estimated net GHG emission reductions or removals (tCO2e) NERREDD
2021	2,090,496.95	0.00	159,582.57	1,930,914.38
2022	4,251,138.79	0.00	319,165.15	3,931,973.65
2023	4,391,428.56	0.00	319,165.15	4,072,263.41
2024	4,531,718.32	0.00	319,165.15	4,212,553.18
2025	4,672,008.09	475,774.37	230,963.86	3,965,269.86
2026	4,812,297.86	459,365.78	230,963.86	4,121,968.22
2027	4,952,587.62	442,957.19	230,963.86	4,278,666.58
2028	5,092,877.39	426,548.59	230,963.86	4,435,364.94
2029	5,233,167.15	410,140.00	230,963.86	4,592,063.30
2030	5,373,456.92	393,731.41	230,963.86	4,748,761.65
2031	5,448,442.46	377,322.82	230,963.86	4,840,155.78
2032	5,458,123.77	360,914.23	230,963.86	4,866,245.69
2033	5,467,805.08	344,505.63	230,963.86	4,892,335.59
2034	5,477,486.39	328,097.04	230,963.86	4,918,425.50
2035	5,487,167.70	311,688.45	230,963.86	4,944,515.40
2036	5,496,849.02	295,279.86	230,963.86	4,970,605.30
2037	5,506,530.33	278,871.27	230,963.86	4,996,695.21
2038	2,033,211.46	262,462.67	53,282.82	1,717,465.96
2039	1,228,029.87	246,054.08	0.00	981,975.79
2040	1,097,421.42	229,645.49	0.00	867,775.93
2041	961,972.31	213,236.90	0.00	748,735.41
2042	821,682.54	196,828.31	0.00	624,854.24
2043	681,392.78	180,419.71	0.00	500,973.06

Year	Estimated baseline emissions or removals (tCO2e) ΔCBSL-REDD	Estimated project emissions or removals (tCO2e) ΔCWPS-REDD	Estimated Leakage emissions (tCO2e) ΔCLK-REDD	Estimated net GHG emission reductions or removals (tCO2e) NERREDD
2044	541,103.01	164,011.12	0.00	377,091.89
2045	400,813.25	147,602.53	0.00	253,210.72
2046	260,523.48	103,975.15	0.00	156,548.33
2047	120,233.71	-16,640.11	0.00	136,873.82
2048	88,748.05	-33,048.70	0.00	121,796.74
2049	79,066.73	-334,821.05	0.00	413,887.78
2050	69,385.42	-395,840.84	0.00	465,226.26
Total	**92,127,166.44**	**5,869,081.89**	**4,172,890.97**	**82,085,193.58**

4.4.2. Calculation of AFOLU Pooled Buffer Account Contribution

The calculation of the credits to be held in the AFOLU pooled buffer account is based on a percentage of the total carbon stock benefits. In the case of this project, this percentage is determined by subtracting the net GHG emissions in the project case from the net emissions in the baseline. The buffer calculations do not consider leakage emissions. Additionally, non-CO_2 emissions from fossil fuels and fertilizer usage were intentionally excluded from the project scope as a conservative approach. The buffer calculation follows equation 8 in VM0007 v1.6:

$$Buffer_{Planned} = \left(\left(\Delta C_{BSL,Planned} - \sum_{t=1}^{t^*} \sum_{\substack{i=1 \\ BSL\ Planned}}^{M} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) - \left(\Delta C_{P,Planned} - \sum_{\substack{t=1 \\ P}}^{t^*} \sum_{\substack{i=1 \\ Planned}}^{M} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) \right) \times Buffer\%$$

Where:

BufferPlanned Buffer withholding for avoiding planned deforestation project activities; t CO2e.

ΔCBSL,planned Net greenhouse gas emissions in the baseline from planned deforestation up to year t*; t CO2-e.

EFC,i,t Net CO2e emission from fossil fuel combustion in stratum i in year t; t CO2-e.

N_2Odirect i,t Direct N2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t; t CO2-e.

Buffer% Buffer withholding percentage (percent).

The buffer value was determined using the AFOLU Non-Permanence Risk Tool v4.0. The resulting retention value was 10%, as shown in Table 31:

Table 31- Overall risk ratting.

Risk Category		Rating
a)	Internal Risk	0
b)	External Risk	5
c)	Natural Risk	2
Overall Risk Ratting (a + b + c)		10

4.4.3 Uncertainty Analysis

According to the module X-UNC (VMD0017), Estimation of Uncertainty for REDD+ Project Activities, have focus on following sources of uncertainty applicable to rates of deforestation, associated with estimation of stocks in carbon pools and carbon stock changes.

The estimated cumulative net anthropogenic greenhouse gas (GHG) emission reductions will be modified continuously to accommodate uncertainty, as outlined in Module X-UNC. Module X-UNC calculates an adapted value for the net emission reductions from anthropogenic sources (NERREDD+) at any given moment.

Uncertainty should be quantified as the half width of the 95% confidence interval, expressed as a percentage of the mean. Initially, uncertainty is propagated across pools within strata to account for variations.

According to item 5.1.1, the value can be assumed that is zero because in baseline rate of deforestation or degradation the numbers are based on actual deforestation plan (BL-PL).

UncertaintyBSL,RATE = 0

Uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline scenario

That is estimated according to VMD0017 v2.2 Equation 5:

$$Uncertainty_{REDD-BSL,SS} = \frac{\sqrt{\sum_{i=1}^{M}(U_{REDD-BSL,SS,i} \times E_{REDD-BSL,SS,i})^2}}{\sum_{i=1}^{M} E_{REDD-BSL,SS,i}}$$

Where:

UncertaintyREDD-BSL,SS Total uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline scenario (%)

UREDD-BSL,SS,i Percentage uncertainty in the combined carbon stocks and greenhouse gas sources in stratum *i* in the REDD baseline scenario (%)

EREDD-BSL,SS,t,i Sum of combined carbon stocks and GHG sources in the REDD baseline scenario (tCO2e)

i 1, 2, 3, …*M* strata (unitless)

Considering that no ex post (re)measurements of carbon pools or greenhouse gas (GHG) sources were conducted, the uncertainty of these sources is already encompassed in $UncertaintyREDD{-}BSL,*$. In addition, the uncertainty in $UncertaintyREDD{-}WPS$ is considered negligible and set to zero.

$$U_{REDD-BSL,SS,i} = \frac{\sqrt{\sum_1^n (U_{REDD-BSL,SS,i,pool\#} * E_{REDD-BSL,SS,i,pool\#})^2}}{\sum_1^n E_{REDD-BSL,SS,i,pool\#}}$$

Where:

UREDD-WPS,SS,i Percentage uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD project scenario in stratum *I* (%)

UREDD-WPS,SS,i,pool# Percentage uncertainty for carbon stocks and greenhouse gas sources in the REDD project scenario in stratum *i* (%)

EREDD-WPS,SS,i,pool# Carbon stock or GHG sources in stratum *i* in the REDD project scenario (tCO2)

i 1, 2, 3, …*M* strata (unitless)

Rate uncertainty is incorporated according to equation 6 from VMD0017 v2.2:

$$Uncertainty_{REDD-BSL,t*} = \sqrt{Uncertainty_{BSL,RATE,t*}^{\ 2} + Uncertainty_{REDD-BSL,SS}^{\ 2}}$$

Where:

*UncertaintyREDD-BSL,t** Cumulative uncertainty in REDD baseline scenario up to year *t** (%)

*UncertaintyREDD-BSL,RATE,t** Cumulative uncertainty in the baseline rate of deforestation up to year *t* (%)

UncertaintyREDD-BSL,SS Total uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline scenario (%)

t 1, 2, 3, …*t** time elapsed since the start of the project activity (years)

Uncertainty across combined strata is assessed as follows:

$$Uncertainty_{REDD-WPS} = \frac{\sqrt{\sum_{i=1}^{M}(U_{REDD-WPS,SS,i} \times E_{REDD-WPS,SS,i})^2}}{\sum_{i=1}^{M} E_{REDD-WPS,SS,i}}$$

Where:

UncertaintyREDD-WPS Total uncertainty in the REDD project scenario (%)

UREDD-WPS,SS,i Percentage uncertainty in the combined carbon stocks and greenhouse gas sources in stratum *i* in the REDD project scenario (%)

EREDD-WPS,SS,t,i Sum of combined carbon stocks and GHG sources multiplied by the area of stratum *i* (*Ai*) in the REDD project scenario (t CO2e)

i 1, 2, 3, …*M* strata (unitless)

Where no ex post (re-)measurements of carbon pools or GHG sources have been made, uncertainty from these sources is already included in UncertaintyREDD-BSL,t* and UncertaintyREDD-WPS is set to zero.

The total error in the REDD+ project activity

Is therefore calculated by VMD0017 v2.2 equation 21:

$$NER_{REDD+ERROR} = \sqrt{(Uncertainty_{REDD_{BSL},t*} * \Delta C_{BSL-REDD,t*})^2} * \left(\frac{1}{\Delta C_{BSL-REDD,t*}}\right)$$

Where:

NERREDD+_ERROR Cumulative uncertainty for the REDD+ (REDD and WRC) project activities up to year *t** (%)

*UncertaintyREDD_BSL,t** Cumulative uncertainty in REDD baseline scenario up to year *t* (%) *UncertaintyWRC_BSL,t** Cumulative uncertainty in the WRC baseline scenario up to year *t* (%) *UncertaintyREDD_WPS* Total uncertainty in the REDD project scenario (%) *UncertaintyWRC_WPS,t** Cumulative uncertainty in the WRC project scenario up to year *t* (%)

*GHGBSL-WRC,t** Net GHG emissions in the WRC baseline scenario up to year *t* (t CO2e)

*GHGWPS-WRC,t** Net GHG emissions in the WRC project scenario up to year *t* (t CO2e)

D*CBSL-REDD,t**Net GHG emissions in the REDD baseline scenario up to year *t** (t CO2e

D*CWPS-REDD,t** Net GHG emissions in the REDD project scenario up to year *t** (t CO2e) *t* 1, 2, 3, …*t** time elapsed since the project start (year)

If the total error in the REDD+ project activity exceeds 15% of NERREDD at the 95% confidence level, deductions are made according to VMD0017 v2.2. The allowable uncertainty in the REDD-MF methodology is also set at +/- 15% of NERREDD+ at the 95% confidence level. In cases where the uncertainty surpasses 15% of NERREDD+ at the 95% confidence level, the deduction will be equal to the excess amount beyond the allowable level. To account for this uncertainty, the adjusted value for NERREDD shall be calculated as described in the given equation (Table 32):

$$Adjusted\_NER_{REDD+} = NER_{REDD} * (100\% - NER_{REDD+ERROR} + 15\%)$$

Where:

Adjusted_NERREDD+ Total net GHG emission reductions of the REDD+ project activities up to year *t**

adjusted to account for uncertainty (t CO2e)

NERREDD Total net GHG emission reductions of the REDD project activity up to year *t** (t CO2e)

NERWRC Total net GHG emission reductions of the WRC project activity up to year *t** (t CO2e)

NERREDD+_ERROR Cumulative uncertainty for the REDD+ (REDD and WRC) project activities up to year *t** (%)

NGRARR Total net GHG removals of the ARR project activity up to year *t** (t CO2e)

Table 32- Total net GHG emissions reductions of the REDD project activities up to year t8 adjusted to account for uncertainty.

Year	NERREDD (tCO2e)	NERREDD+ERROR (%)	Adjusted_NERRedd (tCO2)
2021	1,930,914.38	2.49%	1,930,914.38
2022	3,931,973.65	2.49%	3,931,973.65
2023	4,072,263.41	2.49%	4,072,263.41
2024	4,212,553.18	2.49%	4,212,553.18
2025	3,965,269.86	2.49%	3,965,269.86
2026	4,121,968.22	2.49%	4,121,968.22
2027	4,278,666.58	2.49%	4,278,666.58
2028	4,435,364.94	2.49%	4,435,364.94
2029	4,592,063.30	2.49%	4,592,063.30
2030	4,748,761.65	2.49%	4,748,761.65

Year	NERREDD (tCO2e)	NERREDD+ERROR (%)	Adjusted_NERRedd (tCO2)
2031	4,840,155.78	2.49%	4,840,155.78
2032	4,866,245.69	2.49%	4,866,245.69
2033	4,892,335.59	2.49%	4,892,335.59
2034	4,918,425.50	2.49%	4,918,425.50
2035	4,944,515.40	2.49%	4,944,515.40
2036	4,970,605.30	2.49%	4,970,605.30
2037	4,996,695.21	2.49%	4,996,695.21
2038	1,717,465.96	2.48%	1,717,465.96
2039	981,975.79	2.48%	981,975.79
2040	867,775.93	2.48%	867,775.93
2041	748,735.41	2.48%	748,735.41
2042	624,854.24	2.48%	624,854.24
2043	500,973.06	2.48%	500,973.06
2044	377,091.89	2.48%	377,091.89
2045	253,210.72	2.48%	253,210.72
2046	156,548.33	2.48%	156,548.33
2047	136,873.82	2.47%	136,873.82
2048	121,796.74	2.47%	121,796.74
2049	413,887.78	2.47%	413,887.78
2050	465,226.26	2.47%	465,226.26
Total	**82,085,193.58**	2.49%	**82,085,193.58**

4.4.4. Calculation of Verified Carbon Units

Total number of Verified Carbon Units (VCU) generated by the project activity implementation is estimated (ex-ante) according to equation 19 from VM0007 v1.6 (Table 33):

$$VCU_t = \left(Adjusted\_NER_{REDD+,t_2} - Adjusted\_NER_{REDD+,t_1}\right) - Buffer_{Total}$$

Where:

VCUt Number of Verified Carbon Units at year t = t2 - t1 (VCU)

Adjusted_NERREDD+,t2 Total net GHG emission reductions of the REDD+ project activity up to year t2 and adjusted to account for uncertainty (t CO2e)

Adjusted_NERREDD+,t1 Total net GHG emission reductions of the REDD+ project activity up to year t1 and adjusted to account for uncertainty (t CO2e)

Total permanence risk buffer withholding (t CO2e)

Table 33- Number of Verified Carbon Units (VCU).

Year	Adjusted_NERREDD+ (tCO2)	BufferTotal (tCO2)	VCUt
2021	1,930,914.38	209,049.70	1,721,864.69
2022	3,931,973.65	425,113.88	3,506,859.77
2023	4,072,263.41	439,142.86	3,633,120.56
2024	4,212,553.18	453,171.83	3,759,381.35
2025	3,965,269.86	419,623.37	3,545,646.49
2026	4,121,968.22	435,293.21	3,686,675.01
2027	4,278,666.58	450,963.04	3,827,703.54
2028	4,435,364.94	466,632.88	3,968,732.06
2029	4,592,063.30	482,302.72	4,109,760.58
2030	4,748,761.65	497,972.55	4,250,789.10
2031	4,840,155.78	507,111.96	4,333,043.82
2032	4,866,245.69	509,720.95	4,356,524.73
2033	4,892,335.59	512,329.94	4,380,005.65
2034	4,918,425.50	514,938.94	4,403,486.56
2035	4,944,515.40	517,547.93	4,426,967.47
2036	4,970,605.30	520,156.92	4,450,448.39
2037	4,996,695.21	522,765.91	4,473,929.30
2038	1,717,465.96	177,074.88	1,540,391.08
2039	981,975.79	98,197.58	883,778.21
2040	867,775.93	86,777.59	780,998.34
2041	748,735.41	74,873.54	673,861.87
2042	624,854.24	62,485.42	562,368.81
2043	500,973.06	50,097.31	450,875.76
2044	377,091.89	37,709.19	339,382.70
2045	253,210.72	25,321.07	227,889.64
2046	156,548.33	15,654.83	140,893.50
2047	136,873.82	13,687.38	123,186.44
2048	121,796.74	12,179.67	109,617.07
2049	413,887.78	41,388.78	372,499.00
2050	465,226.26	46,522.63	418,703.64
Total	**82,085,193.58**	**8,625,808.45**	**73,459,385.12**

5. MONITORING

5.1. Data and Parameters Available at Validation

Data / Parameter	CF
Data unit	tC/tdm
Description	Carbon fraction of dry matter in t Ct 1 d.m
Source of data	Values from the literature (e.g IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3) shall be used if available, otherwise default value of 0.47 t C t 1 d.m. can be used
Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	The default IPCC value was used.
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	LDF
Data unit	t C m^{-3}
Description	Logging Damage Factor
Source of data	VMD0001 LK-ME[135]
Value applied	0.53
Justification of choice of data or description of measurement methods and procedures applied	Default value for broadleaf and mixed forests, according to module VMD0001 LK-ME.
Purpose of Data	• Calculation of leakage emissions

	• Calculation of project emissions
Comments	N/A

Data / Parameter	$AA_{planned,i,t}$
Data unit	ha
Description	Annual area of baseline planned deforestation for stratum i in year t.
Source of data	Calculated based on VMD0006 v1.3 equation 4.
Value applied	See the table 1
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on total area of planned deforestation over the baseline period for stratum.
Purpose of Data	Calculation of baseline emissions.
Comments	N/A

Data / Parameter	$A_{planned,i}$
Data unit	ha
Description	Total area of planned deforestation of a fixed baseline period
Source of data	Remote Sensing data
Value applied	130,640.54
Justification of choice of data or description of measurement methods and procedures applied	VMD0006 BL PL. The Mejuruá includes a forested project area that can be legally deforested and therefore classified as Avoiding Planned Deforestation.
Purpose of Data	Calculation of baseline emissions.
Comments	N/A

Data / Parameter	$C_{AB\_tree,i}$
Data unit	t $CO_2e.ha^{-1}$

Description	Carbon stock in aboveground biomass in trees in the baseline in stratum i
Source of data	Forest inventory
Value applied	Dense Alluvial rainforest (Da): 494,230 Dense lowland rainforest (Db): 514,294
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the forest carbon stock in aboveground tree biomass in stratum I ($C_{AB\_tree,bsl,i}$) and the post-deforestation carbon stock in aboveground tree biomass in stratum I ($C_{AB\_tree,post,i}$), according to VMD0006 v1.3 equation 6.
Purpose of Data	Calculation of baseline emissions.
Comments	N/A

Data / Parameter	$C_{BB\_tree,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Carbon stock in belowground biomass carbon stock in stratum i
Source of data	Calculated based on VMD0001 v1.1, equation 5.
Value applied	Dense Alluvial rainforest (Da): 161,816 Dense lowland rainforest (Db): 168,036
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the forest carbon stock in aboveground tree biomass in stratum I ($C_{BB\_tree,bsl,i}$) and the post-deforestation carbon stock in aboveground tree biomass in stratum I ($C_{AB\_tree,post,i}$)
Purpose of Data	Calculation of baseline emissions.
Comments	N/A

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;
Source of data	National Forest Inventory from INPE
Value applied	0,31

Justification of choice of data or description of measurement methods and procedures applied	National Source
Purpose of Data	Calculation of baseline emissions.
Comments	N/A

Data / Parameter	44/12
Data unit	Dimensionless
Description	Ratio converting C to CO 2 e
Source of data	IPCC 2006 Guidelines
Value applied	44/12 = 3.67
Justification of choice of data or description of measurement methods and procedures applied	Conversion of carbon to carbon dioxide
Purpose of Data	• Calculation of baseline emissions • Calculation of leakage
Comments	N/A

Data / Parameter	D%planned,i,t
Data unit	% year-1
Description	Projected annual proportion of land that will be deforested in stratum i at year t
Source of data	Forest Deforestation Plan from Mejuruá Project
Value applied	5,999900%
Justification of choice of data or description of measurement methods and procedures applied	According to VMD0006 v1.3, where a valid verifiable plan exists for rate at which deforestation is projected to occur and must be used.
Purpose of Data	Calculation of baseline emissions.

Comments	N/A

Data / Parameter	$C_{wp,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Baseline carbon stock change in in wood products in stratum i
Source of data	Calculated based on mean stock of extracted biomass carbon by class of wood product ty and wood waste. VMD0005 v1.1 equation 2.
Value applied	Dense Alluvial rainforest (Da): 28,410 Dense lowland rainforest (Db): 28,410
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on mean stock of extracted biomass carbon by class of wood product ty from stratum I ($_{CXB,ty,i}$) and the wood waste (the fraction immediately emitted through mill inefficiency by class of wood product) (WW_{ty}), according to VMD0005 v1.1 equation 2.
Purpose of Data	Calculation of baseline emissions.
Comments	N/A

Data / Parameter	$C_{AB\_tree,post,i}$
Data unit	t CO2e.ha-1
Description	Post-deforestation carbon stock in aboveground tree biomass in stratum i.
Source of data	National Inventory from INPE
Value applied	27,756
Justification of choice of data or description of measurement methods and procedures applied	National Source
Purpose of Data	Calculation of baseline emissions
Comments	

Data / Parameter	$C_{BB\_tree,post,i}$
Data unit	t CO2e.ha-1
Description	Post-deforestation carbon stock in belowground tree biomass in stratum i.
Source of data	-
Value applied	0.0
Justification of choice of data or description of measurement methods and procedures applied	Considering that the post-deforestation carbon stock in the aboveground tree biomass (CAB_tree,post,i) already accounts for the total biomass, the post-deforestation carbon stock in belowground tree biomass (CBB_tree,post,i) was set to be zero.
Purpose of Data	Calculation of baseline emissions
Comments	

Data / Parameter	$C_{XB,ty,i}$
Data unit	t CO_2e.ha^{-1}
Description	Mean stock of extracted biomass carbon by class of wood product *ty* from stratum *i*.
Source of data	Calculated based on VMD0005 v1.1 equation 1.
Value applied	37.381
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on wood product class (V ex,ty,i), volume of timber extracted from stratum I by species j, mean of wood density j (Dj), carbon fraction (CF) and the area of stratum.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	D_j
Data unit	t.d.m.m^3
Description	Mean wood density of species j

Source of data	Reyes, Gisel; Brown, Sandra; Chapman, Jonathan; Lugo, Ariel E. 1992. Wood densities of tropical tree species. Gen. Tech. Rep. SO-89 New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station.
Value applied	0,6
Justification of choice of data or description of measurement methods and procedures applied	Study reference in tropical species.
Purpose of Data	Calculation of baseline emissions.
Comments	N/A

Data / Parameter	OF_{ty}
Data unit	Dimensionless
Description	Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product ty
Source of data	Winjun et al., 1998.
Value applied	0.8
Justification of choice of data or description of measurement methods and procedures applied	Data suggested by Winjun et al., 1998.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$V_{ex,ty,i}$
Data unit	m^3/ha
Description	Volume of timber in m^3 extracted from within the stratum (does not include slash left onsite), reported by wood product class and preferably species.
Source of data	Forest Management Plan

Value applied	50
Justification of choice of data or description of measurement methods and procedures applied	Deforestation plan data.
Purpose of Data	Calculation of baseline emissions.
Comments	N/A

Data / Parameter	$GHG_{BSL\text{-}E,i,t}$
Data unit	t $CO_2e.yr^{-1}$
Description	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i in year t.
Source of data	Calculated based on VMD0006 v1.3 equation 15.
Value applied	See the table 22
Justification of choice of data or description of measurement methods and procedures applied	Calculated based on the non-CO2 emissions due to biomass burning in stratum i in year t (EBiomassBurn,i,t), according to VMD0006 v1.3 equation 15.
Purpose of Data	Calculation of baseline emissions
Comments	Net CO2e emission from fossil fuel combustion in stratum i in year t ($E_{FC,i,t}$) and direct N_2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t ($N_2O_{direct\text{-}N,i,t}$) are conservatively excluded from the project scope and the calculation of the baseline estimates following VM0007 v1.6 in section 5.4.

Data / Parameter	$E_{BiomassBurn,i,t}$
Data unit	t CO_2e
Description	Greenhouse gas emissions due to biomass burning in stratum I in year t of each GHG (CO2, CH4 , N2O)
Source of data	Calculated based on data from area burnt and combustion factors, according to VMD0013 v1.3 equation 1
Value applied	See the table 22

Justification of choice of data or description of measurement methods and procedures applied	Calculated based on Area burnt, Average aboveground biomass stock before burning stratum i, year, Combustion factor for stratum I,Emission factor for stratum i for gas g
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$A_{burn,i.t}$
Data unit	ha
Description	Area burnt for stratum i in year t.
Source of data	Equal to $AA_{planned,i,t}$ in the baseline case
Value applied	See the table 22
Justification of choice of data or description of measurement methods and procedures applied	The burned area is considered equivalent to the annual deforested area $AA_{planned,i,t}$ considering that all deforestation is preceded by a fire to clear the land in the baseline case.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$COMF_i$
Data unit	Dimensionless
Description	Combustion factor for stratum i
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0,45
Justification of choice of data or description of measurement methods and procedures applied	Combustion factor for stratum i
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	Bi,t
Data unit	t d.m/ha
Description	Average aboveground biomass stock before burning stratum i, year
Source of data	Calculated based on carbon stock according to VMD0013 v1.3 equation 2
Value applied	Dense Alluvial rainforest (Da): 302,893617 Dense lowland rainforest (Db): 314,5361702
Justification of choice of data or description of measurement methods and procedures applied	Calculated based on carbon stock in aboveground biomass in trees in stratum i in year t ($C_{AB\_tree,i,t}$), Carbon stock in dead wood for stratum i in year t ($C_{DWi,t}$), Carbon stock in litter for stratum i in year t ($C_{LI,i,t}$) and Carbon fraction of biomass (CF), according to VMD0013 v1.3 equation 2.
Purpose of Data	Calculated of baseline emissions
Comments	

Data / Parameter	$G_{g,i}$
Data unit	kg t $^{-1}$ d.m. burnt
Description	Emission factor for stratum i for gas g
Source of data	IPCC (2006)
Value applied	G_{N2O} 0.2 G_{CH4} 6.8
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculations of baseline emissions
Comments	N/A

Data / Parameter	GWP_g
Data unit	Dimensionless

Description	Global warming potential for gas g
Source of data	Fifth Assessment Report (AR5), IPCC
Value applied	GWP_{N2O} 265 GWP_{CH4} 28
Justification of choice of data or description of measurement methods and procedures applied	Default factor from Global Warming Potentials (GWP)
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$\Delta C_{BSL,i,t}$
Data unit	T CO_2e
Description	Net carbon stock changes in all pools in the baseline stratum i in year t.
Source of data	Calculated based on VMD0006 v1.3 equation 4.
Value applied	See table 30.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the annual area of baseline planned deforestation for stratum i in year t ($AA_{planned,i,t}$), the baseline carbon stock change in aboveground tree biomass in stratum I ($\Delta C_{AB\_tree,i}$), the baseline carbon stock change in belowground tree biomass in stratum I ($\Delta C_{BB\_tree,i}$), the baseline carbon stock change in aboveground non-tree biomass in stratum ($\Delta C_{AB\_non-tree,i}$), the baseline carbon stock change in belowground non-tree biomass in stratum I ($\Delta_{CBB\_non-tree,i}$), the baseline carbon stock change in wood products in stratum I ($\Delta C_{WP,i}$), the baseline carbon stock change in dead wood in stratum I ($\Delta C_{DW,i}$), the baseline carbon stock change in litter in stratum I ($\Delta C_{LI,i}$) and the baseline carbon stock change in soil organic carbon in stratum I, according to VMD0006 v1.3.
Purpose of Data	Calculation of baseline emissions
Comments	This project did not consider carbon stock change values in dead wood, litter and soil organic carbon.

Data / Parameter	$\Delta C_{BSL,planned}$
Data unit	T CO_2e

Description	Net greenhouse gas emissions in the baseline from planned deforestation up to year *t*
Source of data	Calculated based on VMD0006 v1.3 equation 1.
Value applied	See table 23.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the net carbon stock changes in all pools in the baseline ($\Delta C_{BSL,i,t}$) and GHG emissions as a result of deforestation activities within the project boundary in the baseline stratum i in year t ($GHG_{BSL\ E,i,t}$).
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	ΔC_{LK-ME}
Data unit	T CO_2e
Description	Net greenhouse gas emissions due to market effects leakage
Source of data	Calculated based on VMD0011 v1.1 Equation 1
Value applied	See table 29
Justification of choice of data or description of measurement methods and procedures applied	Total leakage due to market effects is equal to the sum of market effects leakage through decreased timber harvest and decreased harvest for fuelwood / charcoal production
Purpose of Data	Calculation of leakage
Comments	N/A

Data / Parameter	$LK_{MarketEffects,timber}$
Data unit	T CO_2e
Description	Total GHG emissions due to market effects leakage through decreased timber harvest
Source of data	Calculated based on VMD0011 v1.1 Equation 2
Value applied	See table 29

Justification of choice of data or description of measurement methods and procedures applied	Leakage due to market effects i s equal to the baseline emissions from logging multiplied by a leakage factor and, where applicable, by a leakage management factor
Purpose of Data	Calculation of leakage
Comments	-

Data / Parameter	LK_{ME}
Data unit	Dimensionless
Description	Leakage factor for market effects calculations
Source of data	VMD0011 LK ME v1.1
Value applied	See table 29.
Justification of choice of data or description of measurement methods and procedures applied	
Purpose of Data	Calculation of leakage
Comments	

Data / Parameter	L-Di
Data unit	%
Description	Likelihood of deforestation in stratum i
Source of data	Analysis of land tenure
Value applied	100%
Justification of choice of data or description of measurement methods and procedures applied	For all other planned deforestation areas (i.e. areas not both under government control and zoned for deforestation), L-Di must be equal to 100%, according to VMD0006 v1.3, section 1.4.
Purpose of Data	Determination of baseline scenario
Comments	N/A

Data / Parameter	SLFty
Data unit	Dimensionless
Description	Fraction of wood products that will be emitted to the atmosphere within 5 years of production by class of wood product ty
Source of data	Winjun et al., 1998
Value applied	0.2
Justification of choice of data or description of measurement methods and procedures applied	Default value suggested by VMD0005 v1.1.
Purpose of Data	Calculation of baseline emission
Comments	N/A

Data / Parameter	WW_{ty}
Data unit	Dimensionless
Description	Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product ty
Source of data	Pearson et al. (2012), page 8
Value applied	0,24
Justification of choice of data or description of measurement methods and procedures applied	Waste wood gives the proportion emitted immediately due to factory inefficiency which is 0.19 in developed countries, 0.24 in developing countries.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	LIF
Data unit	$t\ C\ m^{-3}$
Description	Logging infrastructure factor
Source of data	VMD0011 LK ME v1.1

Value applied	0,29
Justification of choice of data or description of measurement methods and procedures applied	According to module VMD0011 LK ME v1.1
Purpose of Data	Calculation of leakage
Comments	N/A

5.2. Data and Parameters Monitored

Data / Parameter	Project Forest Cover Monitoring Map
Data unit	N/A
Description	Map showing the location of forest land within the project area at the beginning of each monitoring period. If within the Project Area some forest land is cleared, the benchmark map must show the deforested areas at each monitoring event.
Source of data	Remote sensing in combination with GPS data collected during ground truthing
Description of measurement methods and procedures to be applied	The measurement methods and procedures applied are described in Approved VCS Module VMD0015 M REDD v2.2
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	Remote sensing and GPS
QA/QC procedures to be applied	-
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	$Aburn,i,t$

Data unit	ha
Description	Area burnt for stratum *i* in year t
Source of data	Remote sensing data
Description of measurement methods and procedures to be applied	This value varies annually, as a function of deforested area.
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	Remote sensing
QA/QC procedures to be applied	Best practices in remote sensing. Land Use/Land Change Map biomas and INPE BDQueimadas[46]
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions
Calculation method	N/A
Comments	Considering that the burning of biomass is a common practice in the region, it was assumed that all deforested areas were also subjected to burning, as burning is a part of the deforestation cycle.

Data / Parameter	$A_{Aplanned,i,t}$
Data unit	ha
Description	Annual area of baseline planned deforestation for stratum i at time t
Source of data	Calculated according to VMD00 0 6 v1. 3, Equation 5
Description of measurement methods and procedures to be applied	Calculated based on the Projected annual proportion of land that will be deforested in stratum *i*during year *t*, Total area of planned deforestation over the baseline period for stratum *i*and Likelihood of deforestation for stratum *i*
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.

[46] https://queimadas.dgi.inpe.br/queimadas/bdqueimadas

Value applied	See table 17.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	• Calculation of baseline emissions
Calculation method	VMD0006 v1.3, Equation 5
Comments	N/A

Data / Parameter	$A_{Aplanned,i}$
Data unit	ha
Description	Projected annual proportion of land that will be deforested in stratum i during year t
Source of data	Forest suppression plan
Description of measurement methods and procedures to be applied	Forest suppression plan
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	130,640.54
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	• Calculation of baseline emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	$A_{DefPA,i,u,t}$
Data unit	ha

Description	Area of recorded deforestation in the project area in stratum I converted to land use u in year t.
Source of data	Remote sensing data from PRODES.
Description of measurement methods and procedures to be applied	The yearly deforestation rate is quantified using remote sensing techniques in GIS, and then reported with spatially explicit data through raster and shapefile formats.
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	Ex-Ante: Ex-Post: N/A
Monitoring equipment	Remote sensing
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	$A_{DistPA,q,I,t}$
Data unit	ha
Description	Area impacted by natural disturbance in the project stratum i converted to natural disturbance stratum q in year t; ha
Source of data	Remote Sensing imagery combined with ground verification
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	0
Monitoring equipment	Remote sensing and GIS tools

QA/QC procedures to be applied	MapBiomas is a Brazilian multi-institutional initiative that aims to map and monitor the land use and land cover dynamics of Brazil. The project is composed of a network of institutions from different sectors, such as academia, non-governmental organizations, and private companies. The project uses satellite imagery and other remote sensing data to map and monitor land use changes in Brazil, including deforestation, urbanization, and agricultural expansion. The evaluation of areas affected by natural disturbances in this project will be conducted using MapBiomas.
Purpose of data	Calculation of project emissions
Calculation method	Estimates of emissions resulting from natural disturbances will be based on the historical incidence of those events in the project region, prior to their occurrence.
Comments	N/A

Data / Parameter	A_{BSLPAt}
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	Periodic assessments of classified satellite imagery covering the project area provided by the MapBiomas Project will be used to monitor forest cover changes resulting from deforestation.
Frequency of monitoring/recording	Annually
Value applied	The value will be calculated ex post, prior to every verification period.
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	MapBiomas is a Brazilian multi-institutional initiative that aims to map and monitor the land use and land cover dynamics of Brazil. The project is composed of a network of institutions from different sectors, such as academia, non-governmental organizations, and private companies. The project uses satellite imagery and other remote sensing data to map and monitor land use changes in Brazil, including deforestation, urbanization, and agricultural expansion. The evaluation of BSL_{Pat} in this project will be conducted using MapBiomas and following the criteria of the VM0007 Methodology
Purpose of data	• Calculation of project emissions • Calculation of baseline emissions

Calculation method	Analysis of satellite images and maps
Comments	N/A

Data / Parameter	$C_{EXT,z,i,t}$
Data unit	t CO_2-e
Description	Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t.
Source of data	Calculated according to VMD0015 v2.2, equation 11.
Description of measurement methods and procedures to be applied	Calculated based on the volume of timber extracted of species j for logging stratum z, in stratum i in year t (VEXT,j,z,i,t), the basic wood density of species j (Dj) and the carbon fraction of biomass (CF), according to VMD0015 v2.2, equation 11.
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 24.
Monitoring equipment	The logged trees are previously inventoried.
QA/QC procedures to be applied	-
Purpose of data	Calculation of project emissions.
Calculation method	
Comments	

Data / Parameter	$C_{LG,i,t}$
Data unit	t CO_2-e
Description	Actual net project emissions arising in the logging gap, in stratum i in year t;
Source of data	
Description of measurement methods and procedures to be applied	Biomass carbon stock of timber extracted within the project boundary($C_{EXT\ z\ i\ t}$) is summed to volume oflogsin sustainable forest management ($V_{EXT\ z\ i\ t}$)multiplied by LDF (Logging damage factor), to estimate both amounts of emissions of timber extracted and emissions caused for logging damage.

Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 24.
Monitoring equipment	N/A
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions.
Calculation method	Biomass carbon stock of timber extracted within the project boundary($C_{EXT\ z\ i\ t}$) is summed to volume oflogsin sustainable forest management ($V_{EXT\ z\ i\ t}$)multiplied by LDF (Logging damage factor), to estimate both amounts of emissions of timber extracted and emissions caused for logging damage.
Comments	

Data / Parameter	$C_{WP,i}$
Data unit	t CO_2-e ha^{-1}
Description	Carbon stock sequestered in wood products from harvests in stratum i
Source of data	
Description of measurement methods and procedures to be applied	Calculated based on biomass carbon of the commercial volume extracted by wood product type ty from within the project boundary
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 26
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 05.
Comments	N/A

Data / Parameter	$\Delta C_{WPS-REDD}$
Data unit	t CO_2-e
Description	Net GHG emissions in the REDD project scenario up to year t.
Source of data	According to VMD0015 v2.2, equation 01.
Description of measurement methods and procedures to be applied	Calculated based on net carbon stock change as a result of deforestation in the project area in the project case in stratum i in year t ($\Delta C_{P,DefPA,i,t}$), Net carbon stock change as a result of degradation in the project area in the project case in stratum i in year t ($\Delta C_{P,Deg,i,t}$), Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum i in year t ($\Delta C_{P,DistPA,i,t}$) and Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum i in year t ($GHG_{P-E,i,t}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 28.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	VMD0015 v2.2, Equation 1
Comments	N/A

Data / Parameter	$\Delta C_{LK-AS,planned}$
Data unit	t CO_2-e
Description	Net GHG emissions due to activity shifting leakage for projects preventing planned deforestation up to year t*
Source of data	According to VMD0009 v1.3, equation 01.
Description of measurement methods and procedures to be applied	Calculated based on the area of activity shifting leakage in stratum i in year t (LKAplanned,i,t), the net carbon stock changes in all pre-deforestation pools in baseline stratum I, (ΔCBSL,i) and the Greenhouse gas emissions as a result of leakage of avoiding deforestation activities in stratum i in year t (GHGLK,E,i,t).

Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	-
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	VMD0009 v1.3, Equation 1
Comments	N/A

Data / Parameter	$LK_{Aplanned,i,t}$
Data unit	ha
Description	The area of activity shifting leakage in stratum i in year t.
Source of data	According to VMD0009 v1.3, E quation 6
Description of measurement methods and procedures to be applied	Calculated according to the total area of monitored deforestation by the baseline agent of the planned deforestation in stratum i in year t ($AdefLK_{,i,t}$), and the New calculated forest clearance by the baseline agent of the planned deforestation in stratum i in year t where no leakage is occurring ($NewR_{i,t}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	Ex-Ante: 0 Ex-post: N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	VMD0009 v1.3, equation 06.
Comments	N/A

Data / Parameter	$A_{defLK,i,t}$
Data unit	ha
Description	The total area of monitored deforestation by the baseline agent of the planned deforestation in stratum i in year t.
Source of data	Remote sensing data
Description of measurement methods and procedures to be applied	Annual deforestation is measured using remote sensing techniques in GIS, and reported as spatially explicit data through raster and shapefile formats.
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	Remote sensing and GIS tools
QA/QC procedures to be applied	MapBiomas and PRODES
Purpose of data	Calculation of leakage.
Calculation method	N/A
Comments	N/A

Data / Parameter	$NewR_{i,t}$
Data unit	ha
Description	New calculated forest clearance by the baseline agent of the planned deforestation in stratum i in year t where no leakage is occurring.
Source of data	According to VMD0009 v1.3, equation 04 or 05.
Description of measurement methods and procedures to be applied	Calculated based on projected annual proportion of land that will be deforested outside the project boundary in stratum i in year t, and Total area of planned deforestation outside the project boundary over the baseline period for stratum i according to equation 04 or based on Deforestation by the baseline agent of the planned deforestation in stratum i in year t in the absence of the project, projected annual proportion of land that will be deforested in project stratum i in year t , and Total area of

	planned deforestation over the baseline period for project stratum i
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	VMD0009 v1.3, Equation 4 or 5
Comments	Equation 4 is used when the identified deforestation agent has made public a business plan or similar documentation containing data suited for estimating a conversion rate over the baseline period. Equation 5 is used when the conversion rate must be estimated. In this case, the projected annual proportion of land that will be deforested is the same used to set the baseline, while the deforestation provoked by the identified deforestation agent is calculated by VMD0009 v1.3, Equation 1 or 2

Data / Parameter	$D\%_{planned,i,t,OP}$
Data unit	%
Description	Projected annual proportion of land that will be deforested outside the project boundary in stratum i in year t.
Source of data	Deforestation permits for areas outside the project boundary.
Description of measurement methods and procedures to be applied	Defined in deforestation permits.
Frequency of monitoring/recording	Must be revisited at the time of baseline revision
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A

Purpose of data	Calculation of leakage
Calculation method	N/A
Comments	N/A

Data / Parameter	$WOPR_{i,t}$
Data unit	ha
Description	Deforestation by the baseline agent of the planned deforestation in the absence of the project in stratum i in year t.
Source of data	According to VMD0009 v1.3, equation 01 or 02.
Description of measurement methods and procedures to be applied	Projected based on linear regression according to VMD0009 v1.3 equation 01 or based on number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years prior to project implementation in stratum i by agent ag within the country ($HistHa_{i,ag}$), according to VMD0009 v1.3 equation 02.
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	Equation 01 is used when the results of the analysis must produce a statistically significant regression with a $p \leq 0.05$ and an adjusted r2 of ≥ 0.75. The regression is calculated based on the deforested by the deforestation agent each year over the previous five years within the country. Where no statistically significant regression can be found, equation 02 is used
Comments	N/A

Data / Parameter	HistHai,ag
Data unit	ha

Description	Number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years prior to project implementation in stratum i by agent ag within the country
Source of data	Remote sensing data
Description of measurement methods and procedures to be applied	Annual deforestation is measured using remote sensing techniques in GIS and reported as spatially explicit data through raster and shapefile formats.
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	Remote sensing tools
QA/QC procedures to be applied	
Purpose of data	Calculation of leakage
Calculation method	
Comments	N/A

Data / Parameter	GHGLK,E,i,t
Data unit	t CO_2e
Description	Greenhouse gas emissions because of leakage of avoiding deforestation activities in stratum i in year t.
Source of data	According to VMD0009 v1.3, equation 07
Description of measurement methods and procedures to be applied	Calculated based on Non-CO2 emissions due to biomass burning in stratum i in year t ($E_{biomassburn,i,t}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	N/A

QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	VMD0009 v1.3, Equation 7
Comments	-

Data / Parameter	ΔC_{LK-ME}
Data unit	t CO_2e
Description	Net greenhouse gas emissions due to market effects leakage
Source of data	According to VMD0011 v1.1 Equation 1
Description of measurement methods and procedures to be applied	Calculated based on Total GHG emissions due to market- effects leakage through decreased timber harvest ($LK_{MarketEffects,timber}$), and Total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets ($LK_{MarketEffects,FW/C}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 29.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	VMD0011 v1.1 Equation 1
Comments	N/A

Data / Parameter	$AL_{T,i}$
Data unit	T CO_2-e
Description	Summed emissions from timber harvest in stratum i in the baseline case laced through implementation of carbon project
Source of data	According to VMD0011 v1.1, Equation 4

Description of measurement methods and procedures to be applied	Calculated based on Carbon emission due to displaced timber harvests in the baseline scenario in stratum i in time t ($C_{BSL,XBT,i,t}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	Ex-Ante: 30 years = 20.864.454,85 Ex-Post: 2021 = 797.912,86
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	VMD0011 v1.1, Equation 4
Comments	N/A

Data / Parameter	$V_{BSL,EX,i,t}$
Data unit	m³
Description	Volume of timber projected to be extracted from within the project boundary during the baseline in stratum i in year t
Source of data	Forest Exploration Plans/Pre-exploratory inventories
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 24.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage emissions

Calculation method	N/A
Comments	N/A

Data / Parameter	LDF
Data unit	t C m^{-3}
Description	Logging damage factor
Source of data	Default value provided by VMD0011 v1.0.
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value applied	0.53
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	N/A
Comments	VMD0011 v1.0 equation 4.

Data / Parameter	LIF
Data unit	t C m^{-3}
Description	Logging infrastructure factor
Source of data	Default value provided by VMD0011 v1. 1
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A

Value applied	0.29
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	N/A
Comments	N/A

Data / Parameter	$\Delta C_{pools,Def,u,i,t}$
Data unit	t CO_2-e
Description	Net carbon stock changes in all pools as a result of deforestation in the project case in land use u in stratum i at time t.
Source of data	According to VMD0015 v2.2, equation 05
Description of measurement methods and procedures to be applied	Calculated based on carbon stock in all pools in the baseline case in stratum I (CBSL,i), carbon stock in all pools in post-deforestation land use u in stratum I ($C_{P,post,u,i}$) and carbon stock sequestered in wood products from harvests in stratum I ($C_{WP,i}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 05
Comments	N/A

Data / Parameter	$\Delta C_{P,DefPA,i,t}$
Data unit	t CO_2-e

Description	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t.
Source of data	According to VMD0015 v2.2, equation 03
Description of measurement methods and procedures to be applied	Calculated based on the area of recorded deforestation in the project area stratum i converted to land use u at time t ($A_{DefPA,u,i,t}$) and the net carbon stock changes in all pools in the project case in land use u in stratum i at time t ($\Delta_{Cpools,Def,u,i,t}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 03
Comments	N/A

Data / Parameter	$\Delta C_{P,SelLog,i,t}$
Data unit	t CO_2-e
Description	Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum i in year t.
Source of data	According to VMD0015 v2.2, equation 09
Description of measurement methods and procedures to be applied	Calculated based on actual net project emissions arising in the logging gap in stratum i in year t ($C_{LG,i,t}$), actual net project emissions arising from logging infrastructure in stratum i in year t ($C_{LR,i,t}$) and the carbon stock in wood products pool from stratum i, in year t ($C_{WPi,t}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	Ex-Ante:0 Ex-Post: N/A

Monitoring equipment	N/A
QA/QC procedures to be applied	-
Purpose of data	Calculation of project emissions
Calculation method	According to VMD0015 v2.2, equation 09
Comments	N/A

Data / Parameter	$V_{EXT,Z,I,t}$
Data unit	m^3
Description	Volume extracted from logging stratum z, in stratum i in year t.
Source of data	Reports post exploration
Description of measurement methods and procedures to be applied	All logged trees are previously inventoried.
Frequency of monitoring/recording	Minimum of five years in each verification.
Value applied	Ex-ante:0 EX-post:N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions.
Calculation method	N/A
Comments	N/A

Data / Parameter	$A_{ROAD,i,t}$
Data unit	dimensionless
Description	Area of roads in stratum I in year t

Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Measured in GIS
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	0,01569
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	$A_{decks,i,t}$
Data unit	dimensionless
Description	Area of logging decks in stratum i in year t.
Source of data	Field measurements, reported measurements, and post-harvest maps using remote sensing data and GIS
Description of measurement methods and procedures to be applied	The logging deck area is obtained from post-exploration reports and post-harvest maps that are derived from field measurements.
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	0,007276
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions.

Calculation method	N/A
Comments	N/A

Data / Parameter	$GHG_{P,E,i,t}$
Data unit	t CO_2e.yr^{-1}
Description	Greenhouse gas emissions as a result of deforestation activities within the within the project area in the project case stratum i in year t.
Source of data	Calculated based on VMD00 15 v 2.2 Equation 30
Description of measurement methods and procedures to be applied	Calculated based on the non-CO2 emissions due to biomass burning in stratum i in year t ($E_{BiomassBurn,i,t}$)
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	Ex-Ante: 0 Ex-Post: N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	Calculated based on VMD0006 v1.3 equation 30
Comments	

Data / Parameter	$E_{BiomassBurn,i,t}$
Data unit	T CO_2e
Description	Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO_2, CH_4, N_2O)
Source of data	Calculated based on VMD0013 v1.3 equation 1
Description of measurement methods	Calculated based on area burnt for stratum i in year t ($A_{burn,i,t}$), average aboveground biomass stock before burning stratum i, in

and procedures to be applied	year t ($B_{i,t}$), combustion factor for stratum i (unitless) ($COMF_i$), emission factor for stratum i for gas g ($G_{g,i}$) and the Global warming potential for gas g (GWP_g).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	Calculated based on VMD0013 v1.3 equation 1.
Comments	N/A

Data / Parameter	$\Delta C_{LK-REDD}$
Data unit	t CO_2e
Description	Net GHG emissions due to leakage from the REDD project activity up to year t*
Source of data	Calculated according to VMD0007 v1.6 equation 4.
Description of measurement methods and procedures to be applied	Calculated based on net GHG emissions due to activity shifting leakage for projects preventing planned deforestation up to year t ($\Delta_{CLK-AS,planned}$), and the Net GHG emissions due to market-effects leakage up to year t*(ΔCLK-ME).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 30.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	Calculated according to VMD0007 v1.6 equation 4.
Comments	N/A

Data / Parameter	LF_{ME}
Data unit	Dimensionless
Description	Leakage factor for market effects calculations
Source of data	VMD0011 (LK ME)
Description of measurement methods and procedures to be applied	Calculated based on Total GHG emissions due to market- effects leakage through decreased timber harvest (LKMarketEffects,timber), and Total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets (LKMarketEffects,FW/C).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 29.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	N/A
Comments	N/A

Data / Parameter	$LK_{MarketEffects,timber}$
Data unit	t CO_{2-e}
Description	Total GHG emissions due to market effects leakage through decreased timber harvest
Source of data	Calculated according to VMD0011 v1. 1, E quation 2
Description of measurement methods and procedures to be applied	Calculated according to leakage factor for market-effects calculations (LF_{ME}) and summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project ($ALT_{,i}$).
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 29.

Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage
Calculation method	VMD0011 v1. 1, Equation 2
Comments	N/A

Data / Parameter	$C_{BSL,XBT,i,t}$
Data unit	t CO_{2-e}
Description	Carbon emission due to timber harvests in the baseline scenario in stratum i in year t
Source of data	Calculated according to VMD0011 v1. 1, Equation 5
Description of measurement methods and procedures to be applied	Calculated based on the volume of timber projected to be extracted from within the project boundary during the baseline in stratum i at time t ($V_{BSL,EX,i,t}$), the mean wood density of commercially harvested species (same as that used in the module CP-W) (D_{mn}), the carbon fraction of biomass for commercially harvested species j (CF), the logging damage factor (LDF), and the logging infrastructure factor (LIF)
Frequency of monitoring/recording	Annual monitoring
Value applied	See table 21
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Prior to each verification event, with a minimum frequency of 5 years.
Calculation method	
Comments	N/A

Data / Parameter	NER_{REDD}
Data unit	t CO_{2-e}

Description	Total net GHG emission reductions of the REDD project activity up to year t (t CO2e).
Source of data	Calculated according to VM0007 v1.6 equation 2
Description of measurement methods and procedures to be applied	Calculated based on the net GHG emissions in the REDD baseline scenario up to year t ($\Delta_{CBSL-REDD}$), the net GHG emissions in the REDD project scenario up to year t ($\Delta C_{WPS-REDD}$) and the net GHG emissions due to leakage from the REDD project activity up to year t ($\Delta C_{LK-REDD}$), according to VM0007 v1.6 equation 2.
Frequency of monitoring/recording	Prior to each verification event, with a minimum frequency of 5 years.
Value applied	See table 30
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of VCUs
Calculation method	Based on VM0007 v1.6 equation 2
Comments	N/A

5.3. Monitoring Plan

The monitoring plan was developed according to Methodology VM0007 "REDD+ Methodology Framework (REDD+ MF)" version 1.6, section 9.3.1. The specific module for GHG emissions used was VMD0015 (M-REDD) version 2.2.

The monitoring plan was developed following the aspects below for the following tasks (Figure 30): monitoring of project implementation, monitoring of actual carbon stock changes and greenhouse gas emissions, monitoring of leakage carbon stock changes and greenhouse gas emissions, and estimation of ex-post net carbon stock changes and greenhouse gas emissions.

a. Technical description of the monitoring task.

b. Data to be collected (the list of data and parameters to be collected must be given in PD).

c. Overview of data collection procedures.

d. Quality control and quality assurance procedure.

e. Data archiving.

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

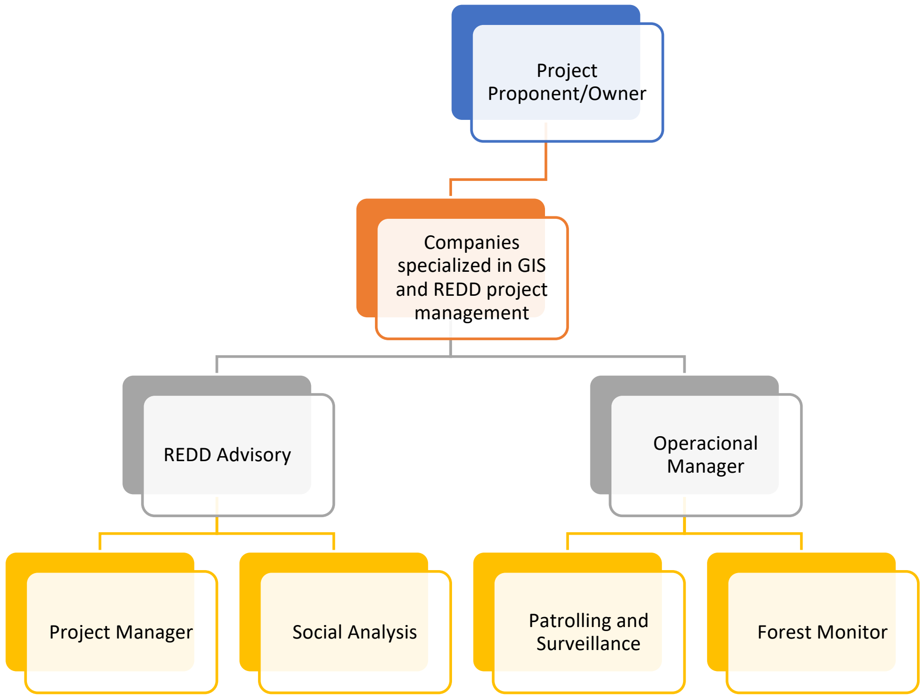

Figure 30- Overview of the tasks and responsibilities of the project.

The same procedure will be applied with safeguards for necessary adjustments if new instances are added.

The objective of this text is to clarify the roles and responsibilities of the parties involved in the project, describing each general function. The project proponent is responsible for strategic planning, verification, instructions, accounting, PD development, and monitoring document reports, and is accountable to the REDD+ activity assessor. The quality control and quality assurance procedures of Plant Environmental Intelligence are described in an attached document. The landowner is responsible for executing and reporting information through tactical planning, patrolling, surveillance, local infrastructure, and on-site project management. Thus, this collaborative framework allows for efficient monitoring activities to be carried out.

The proponent is responsible for the central system of information and GHG (greenhouse gas) controls associated with the project and its monitoring. The backup of this system is kept in a cloud unit as well as on the project proponent's hard drives for security. To ensure effective monitoring, the proponent is accountable for monitoring controls, including providing timely updates based on pre-determined monitoring frequencies and incorporating new instances. Meanwhile, owners must carry out on-site monitoring and promptly execute action plans in the event of occurrences. Additionally, they are required to furnish evidence of their actions to the support team, which will analyze and record occurrences for audit purposes.

5.3.1 Monitoring of project implementation

a. Technical description of the monitoring task

The activities of the project that take place within the designated area will be monitored to ensure that they are in compliance with the project management and project design plans.

b. Data to be collected (the list of data and parameters to be collected must be given in PD)

The monitoring of deforestation prevention activities will be carried out through regular surveillance rounds and satellite imagery to ensure continuous monitoring of the forest's status within the project area. All images, maps, and records generated during project implementation must be kept and made available to VCS verifiers during verification inspections to demonstrate the actual implementation of AUD and APD project activities. Monitoring of social and biodiversity parameters will be based on data generated from inventories and activities planned for area protection. To record data on costs and investments related to the activity's implementation, a system will be implemented using invoices, receipts, contracts, and signed attendance list.

All materials generated, including images, maps, records, drafts, spreadsheets, and remote monitoring data, will be made available.

c. Overview of data collection procedures

For the activities implemented in this REDD project, all invoices, receipts, and contracts will be preserved as hard copies. To promote accessibility and redundancy, it is recommended to also maintain electronic copies of the documentation, when feasible.

d. Quality control and quality assurance procedure

The project proponent will be responsible for training the personnel who will be in charge of collecting and safely storing all documentation generated in the project. Additionally, electronic documentation will be properly archived and sent to both Plant and ATA to ensure greater security and verification.

e. Data archiving

All maps and records generated during project implementation will be preserved and made available to VCS verifiers. Backup copies of the files should be kept with the project proponent, as well as with Plant - Environmental Intelligence and ATA Consulting. All records and documents will be securely stored, in both electronic and physical media, for at least two years after the end of the project credit period.

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

The project proponent is responsible for implementing this monitoring item and ensuring proper archiving, as well as necessary quality controls and procedures.

5.3.2 Monitoring of actual carbon stock changes and greenhouse gas emissions

a. Technical description of the monitoring task

The responsible for implementing the project activities is the instance owner. The monitoring of the sustainable management plan is conducted by municipal and state secretariats. The information from the sustainable forest management plan and post-exploration reports will be used to update parameters related to planned deforestation and will be verified during the validation and verification of the carbon project. The current stock data will be presented in the project design.

b. Data to be collected (the list of data and parameters to be collected must be given in PD)

About carbon stock change estimate, if new and more accurate carbon stock data becomes available, they can be utilized to estimate the net anthropogenic GHG emission reduction, provided that they conform to the requirements established by the applied methodologies. New data on carbon stocks will be used only if they are validated by an accredited VVB.

c. Overview of data collection procedures

All maps and records generated during project implementation will be preserved and made available to VCS verifiers. Backup copies of the files should be kept with the project proponent, as well as with Plant - Environmental Intelligence and ATA Consulting. All records and documents will be securely stored, in both electronic and physical media, for at least two years after the end of the project credit period.

d. Quality control and quality assurance procedure

The monitoring of land use will be carried out through remote sensing, using images generated by sources accepted by the methodology, such as Mapbiomas, INPE (PRODES) and LANDSAT satellite images, subject to digital processing for interpretation and classification of the studied land use classes. The local community will also participate in the management structure to help monitor the area. All monitored parameters will be checked frequently according to the VCS Methodologies for the two project areas. To ensure consistency and quality of results, spatial analysts will strictly follow the detailed steps in the methodology for image processing, interpretation, and change detection. All reliable data collected and documented will be used as a support tool for decision-making and project adaptation to current needs and realities. All implemented activities must comply with the

DP management plan and will be continuously monitored through remote sensing techniques and field studies.

e. Data archiving

All maps and records generated during project implementation will be preserved and made available to VCS verifiers. Backup copies of the files should be kept with the project proponent, as well as with Plant - Environmental Intelligence and ATA Consulting. All records and documents will be securely stored, in both electronic and physical media, for at least two years after the end of the project credit period.

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

Plant Environmental Intelligence is responsible for generating maps, conducting GIS analysis, carrying out remote monitoring of the project area, and archiving data. The operational part of the project will be executed by the owner/proponent and their team. All activities will be monitored by the owner.

5.3.3 Estimation of ex post net carbon stock changes and greenhouse gas emissions

a. Technical description of the monitoring task

If new and more accurate carbon stock data are available, they can be used to estimate anthropogenic greenhouse gas emission reductions, provided that these data meet the requirements established by the VM0007 v1.6 Methodology. The calculation of ex-post net anthropogenic greenhouse gas emission reductions is similar to the ex-ante calculation.

b. Data to be collected (the list of data and parameters to be collected must be given in PD)

For the preparation of the report on net anthropogenic greenhouse gas emissions estimated after the implementation of actions, as well as for the Verified Carbon calculation, units must use the same table format used for the ex-ante assessment, as provided in the VM0007 v1.6 Methodology.

c. Overview of data collection procedures

The data collection procedures involve compiling data from previous procedures to calculate the ex-post reduction of anthropogenic net GHG emissions.

d. Quality control and quality assurance procedure

All relevant quality control/quality assurance (QC/QA) procedures must be applied in the ex-post calculation of net greenhouse gas (GHG) emissions reduction. The map of cumulative credited areas within the project area must be updated and presented to the Verified Carbon Standard (VCS) verifiers at each verification event. The cumulative area cannot generate verified carbon credit units (VCUs) in future periods.

e. Data archiving

All maps and records generated during project implementation will be preserved and made available to VCS verifiers. Backup copies of the files should be kept with the project proponent, as well as with Plant - Environmental Intelligence and ATA Consulting. All records and documents will be securely stored, in both electronic and physical media, for at least two years after the end of the project credit period.

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

Plant is responsible for calculating and reporting the ex-post estimated net anthropogenic greenhouse gas (GHG) emissions, archiving data, and providing support and clarification during verification audits.

5.3.4 Uncertainty and Quality Management

Data from the DETER services will be used monthly to assess deforestation alerts and forest degradation. These alerts and degradation will be cross-verified on-site through drone oversight and direct observation. In case deforestation is corroborated by PRODES data, it will be employed to estimate greenhouse gas (GHG) emissions stemming from deforestation within the project area or potential leakage caused by activity shifting in the project scenario. If PRODES does not confirm the DETER data but it is validated through drone oversight or direct observation, it will be employed to revise the forest cover benchmark maps. This ensures accurate tracking of deforestation in the project area or potential activity shifting leakage in the project scenario. DETER data, although having a higher temporal resolution, has a relatively lower spatial resolution compared to PRODES data. However, this characteristic makes it well-suited for generating deforestation alerts, enabling prompt responses from BR Arbo.

The PRODES project data will be utilized on an annual basis to monitor land use changes across all lands managed by the identified deforestation agents, encompassing both the project area and lands beyond its boundaries. Forest cover benchmark maps will be created and regularly updated as soon as the data is released by INPE. To assess deforestation, the project utilizes classified orbital images from the PRODES project, provided by INPE (Space Research Institute). These images are compatible with those generated by NASA/USGS's Landsat series satellites, often known as "Landsat-class" images. These images have a spatial resolution of approximately 30 meters and a minimum of three spectral bands. Additionally, satellite images from sources like Landsat-8, SENTINEL-2 (European Union), or CBERS-4 from INPE/CRESDA (Brazil/China) can also be employed.

To ensure accuracy, assessments are conducted using the SENTINEL satellite series from the European Space Agency (ESA), which offers a spatial resolution of 10x10 meters. For evaluating deforestation alerts and forest degradation, classified orbital images from the DETER service by INPE are utilized. The DETER service utilizes images from WFI sensors on the Sino-Brazilian Earth Resources Satellite (CBERS-4) and AWiFS on the Indian Remote Sensing Satellite (IRS), which have spatial resolutions of 64 meters and 56 meters, respectively.

5.3.5 Monitoring of key baseline variables

REDD Information required to periodically reassess the project baseline must be collected during the entire project crediting period. Key variables to be measured are:

· Changes in forest cover in the Reference Regions for Deforestation (RRD) (at a minimum of every 10 years), as specified in Module M-REDD and where relevant in Module BL-UP.

· Spatial variable datasets used to model the location of deforestation, as specified in Module BL-UP. As a minimum, the variables used in the first baseline assessment must be monitored at the time of the re-assessment to determine if they have changed.

· Where required, carbon stock data, as specified in Module M-REDD.

The leakage area was demonstrated in section 3.3 of the project and will be monitored whenever a verification of validation process needs to be done.

5.3.6 Revising the baseline for future project crediting periods (Under development)

Baseline will be updated considering the methodological procedures described in section 3.4 after 10 years of the project start date. A summary of the emission monitoring frequency is presented in Table 34.

Table 34- Overview of monitoring plan and responsible part.

To be monitored	Responsible	Frequency/Date
Revaluation of the baseline	Project Proponent	6 years
Monitoring of Deforestation and Project Emissions	Project Proponent/ATA/PLANT -	Before each

	external institutions qualified to monitoring the area with GIS analysis.	Check/verification
Monitoring of non-CO_2 emissions from forest fire	Project Proponent/ ATA/PLANT - external institutions qualified to monitoring the area with GIS analysis.	Before each Check/verification
Monitoring Leakage emissions	Project Proponent/ ATA/PLANT - external institutions qualified to monitoring the area with GIS analysis.	Before each Check/verification
Monitoring of natural catastrophic events	Project Proponent	Only when occur natural events
Updating Forest Carbon Stock Changes	Project proponent	Every ten years, if necessary

APPENDIX

APPENDIX 1: BIBLIOGRAPHY

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