JURUÁ REDD+ PROJECT

Document Prepared by

Biofílica Ambipar Environment S/A and Ambiental Amazônia - Engenharia & Consultoria

Project Title	*Juruá REDD+ Project*
Version	*v.1*
Date of Issue	*June 16, 2022*
Prepared By	*Biofílica Ambipar Environment e Ambiental Amazônia - Engenharia & Consultoria*
Contact	*Rua Vieira de Morais, 420 – Cj. 43/44 – Campo Belo* *Zip Code 04617-000, São Paulo/SP – Brazil* *Plínio Ribeiro – Executive Director – plinio@biofilica.com.br* *Caio Gallego –Operations Manager– caio@biofilica.com.br*

CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Project

Juruá REDD+ Project is a partnership between Biofílica Ambipar Environment and Amazônia Agroindústria EIRELI, in order to foster forest conservation and the reduction of potential greenhouse gas (GHG) emissions based on a local economic development model that values the "standing" forest through the integration of non-timber forest product management and trading of environmental services.

Juruá REDD+ Project is located at Seringal Valparaíso property, in the Alto Juruá region, between the municipalities of Cruzeiro do Sul and Porto Walter, including an area of 24,076 hectares, in relation to the total property that represents 24,976,3199 hectares. Juruá River basin is formed by four micro-basins: the micro-basin of Igarapé do Meio, the micro-basin of Igarapé Primeiro de Março and the Igarapé Grande micro-basin, in addition to the Valparaiso River Basin (micro-basin) itself, which is the main drainage network of the rubber plantation region.

The purpose of the project is to reduce GHG emissions from activities regarding to conserve the forest and its natural resources, as well as to maintain carbon stocks, through activities that promote the reduction of deforestation in the region, such as the improvement of patrimonial vigilance, the monitoring of land use change and land cover using satellite images and strengthening the management of non-timber forest products. The performance of activities allied to a good project management, with continuous monitoring and evaluation of activities and results, will allow the Project to reach the expected goals and effects.

Considering the socio-economic context of the region, it was identified that the main drivers of deforestation and degradation affecting the Reference Region during the historical period are: creation of settlement projects opening new tracks, conversion of areas for cattle ranching, opening of primary forest areas to implement annual crops, and opening roads for selective timber collection.

Therefore, it is expected that Juruá REDD+ Project prevents, by curbing deforestation, about 1,937,742 tCO_2e by reducing GHG emissions throughout 20 years of the project. All the proposed activities to curb deforestation will become economically feasible if the management of non-timber forest products is combined with the trading of carbon credits through REDD+ carbon crediting mechanisms.

1.2 Sectoral Scope and Project Type

- Sectoral scope: 14 - Agriculture, Forestry and Other Land Use (AFOLU);
- Reducing Emissions from Deforestation and Degradation (REDD);
- Methodology to Avoid Unplanned Deforestation (AUD);
- This is not a grouped project.

1.3 Project Eligibility

Under the parameters of the VCS Methodology Requirements, v 4.1, the scope of avoided unplanned deforestation and/or degradation (AUDD) has the Project eligibility as a premise and must include activities to reduce greenhouse gas (GHG) emissions by avoiding deforestation and/or forest degradation. Therefore, Juruá REDD+ Project proposes actions in order to reduce (GHG) emissions with activities to contain unplanned deforestation and forest degradation (section 1.11).

Furthermore, according to decision 11/CP.7 of the Marrakesh Agreement, forests are defined as: " area of at least 0.05-1.0 ha with canopy cover (or equivalent density) of more than 10-30%, with trees with possibility to reach a minimum height of 2-5 meters at maturity *in situ*. A forest may consist of both closed (dense) forest formations, where trees of various strata and shelterwood cover a high proportion of the ground, and open forests. Recent natural population settlements and all plantations that have yet to reach a density of 10-30% and a height between 2 and 5 meters are included as forest, as well as areas that are normally part of the forest area and are temporarily deforested as a result of human intervention, such as harvesting, or natural causes, but where forest reversion is expected (UNFCCC, 2002)". As such, the Project Area meets the UNFCCC definition of forests and qualifies as forest for at least 10 years prior to the Project start date.

Other VCS eligibility requirements that the project meets relate to:

- The project applies a methodology within the VCS Program (section 1.2);
- The implementation of the project activities does not violate any applicable law (section 1.14);
- The project is not covered by a REDD+ jurisdictional program (section 1.11);
- The project will not be implemented in wetlands and does not drain native ecosystems or degrade hydrological functions;
- The risk of non-permanence will be analyzed according to the VCS Program (AFOLU Non-Permanence Risk Tool).

1.4 Project Design

Juruá REDD+ Project is an AFOLU project comprising only one scope of activity consisting of emissions reductions from unplanned deforestation and forest degradation (REDD-AUD), according to VM0015 methodology, version 1.1. Furthermore, the project is not qualified as a grouped project.

1.5 Project Proponent

Organization name	Biofílica Ambipar Environment
Contact person	Plínio Ribeiro
Title	Executive Director

Address	Rua Vieira de Morais, 420 – Cj. 43/44 – Campo Belo Zip Code: 04617-000, São Paulo/SP – Brasil
Telephone	+55 11 3073-0430
Email	plinio@biofilica.com.br

Organization name	Amazônia Agroindústria EIRELI
Contact person	James Castro Cameli
Title	Managing Partner
Address	Estrada do Canela Fina, bairro Boca da Alemanha, nº 1226 Zip Code: 69.980-000, Cruzeiro do Sul - Acre
Telephone	+55 68 99926-1691
Email	jamescameli@yahoo.com.br

1.6 Other Entities Involved in the Project

Organization name	AMBIENTAL AMAZÔNIA - Engenharia & Consultoria
Role in the project	Project Developer In accordance with the contract with the owner, Ambiental Amazônia was responsible for developing this Project Document.
Contact person	Emanuel Ferreira do Amaral
Title	Agronomist Engineer - Technician
Address	Ramal da Piçarreira, n. 1210, Bairro Rural - Rio Branco-AC - Zip Code: 69.923-899 - Brasil
Telephone	+55 68 9 9900-1716
Email	emanuel.ambientalamazonia@gmail.com

Organization name	LAVRADO SOLUÇÕES AMBIENTAIS
Role in the project	Geographic Information Systems and mapping services
Contact person	Maola Monique Faria

Title	Geographer/PhD in Soils and Plant Nutrition - Post-Doctorate in Biodiversity and Sustainability of the Amazon
Address	Avenida Benjamin Constant, 433, sala 2, Bairro São Pedro
Telephone	Boa Vista-RR - Brasil
Email	+55 95 9 8105-0514

Organization name	GESTAO E RESULTADOS CONSULTORES ASSOCIADOS
Role in the project	Local and Regional Development and Monitoring
Contact person	Gilberto do Carmo Lopes Siqueira
Title	Civil Engineer / Specialist in Planning and Regional Development
Address	Rua Copacabana n° 392, Bairro: Vilage Wilde Maciel, Rio Branco- AC, Brazil
Telephone	
Email	+55 68 98121-0505

Organization name	IMPACTO PLUS CONSULTORIA E PRODUÇÕES LTDA
Role in the project	Safeguards and environmental legal analysis
Contact person	Carolina Jambo Gama
Title	Lawyer - Specialist in Environmental Law
Address	Av. Bartolomeu Mitre, 335, APTO 502, no Bairro LEBLON, Cidade do Rio de Janeiro, Estado do Rio de Janeiro, Zip Code: 22.431-001
Telephone	+55 21 9 8051 - 7744
Email	jambogm_2000@hotmail.com

Organization name	CARBONO FÁCIL — PROJETOS E SISTEMAS DE CERTIFICAÇÃO AMBIENTAL LTDA. (“CARBONO FÁCIL”)
Role in the project	Validation, financial strategy, safeguards, and environmental legal analysis

Contact person	Ludovino Lopes
Title	Specialized Lawyer in Environmental Law
Address	Rua Doutor Chibata Miyakoshi, no 350, conjunto 141, Vila Andrade, Zip Code: 05705-170, São Paulo-SP
Telephone	+55 11 98961-3088
Email	ludovino@infrapar.com

1.7 Ownership

Amazônia Agroindústria is the legal owner of the property where the Juruá REDD+ Project is being implemented and developed. The use and ownership rights are demonstrated by the following documents, which were forwarded to the audit team:

- Full Certificate containing the description of the Enrollment;
- Environmental Rural Registry (CAR);
- Certificate of Registration of Rural Property (CCIR);
- Descriptive memorial and plan (part I and II) linked to the Land Management System (SIGEF);
- Term of Administrative Agreement – donation INCRA (24,942.61 hectares).

Gleba Seringal Valparaíso is composed of 2 parts certified and registered in the real estate registry office, in which both present the descriptive memorial and geo-referencing in accordance with the Law 10.267/01. Below, the Table 1 with information related to lots of Amazônia Agroindústria registered in the INCRA - SIGEF land information system

Table 1. - Parts of Amazônia Agroindústria property, with respective sizes and links in SIGEF.

Name	Ownership registration	Area (ha)	SIGEF link
Seringal Valparaíso - Part 1	5,197	21,110.51	https://sigef.incra.gov.br/geo/parcela/detalhe/541cb795-9eb0-4b2a-9290-e87d4c6d5d8c/
Seringal Valparaíso - Part 2	5,197	3,865.81	https://sigef.incra.gov.br/geo/parcela/detalhe/714a6031-ac10-4119-ab77-c37a600a02cd/

To define the final boundaries of the two parts of the property, the owner made a term of agreement with INCRA, as part of the land title regularization process in 2014, relinquishing an area of 24,942.61 hectares, which was subsequently incorporated into the property of the Federal Government, directly benefiting indigenous people and settlers in the region.

Based on these information and documents, it is demonstrated that the right to use the Project Area is observed according to the criteria of VCS Standard v4.2 (page 24):

"1) Right to use resulting from or granted under statute, regulation or decree by a relevant authority.

2) Right to use arising from law.

...

4) Right to use arising from a statutory, property, or contractual right to land, vegetation, or conservation process, or management allowing reduction of GHG emissions and/or removals (where such right includes the right to use such reductions or removals and the project proponent has not been divested of such right to use)."

In a supplementary manner, by signing a contract between the two bidders, responsibilities and rights over the Project were set out, as well as the percentage of carbon credits addressed to each party.

1.8 Project Start Date

The initial coordination occurred with the purpose to create the Project in the beginning of the second semester of 2020, with preliminary meetings between the owner and the technical team to plan the Project's activities and, consequently, with the initial allocation of resources for the Project's construction. Based on this historical context, the proponents have chosen August 1, 2020 as the starting date, representing the milestone to start planning to implement the activities of Juruá REDD+ Project, coinciding with the day after the end date of the Project's reference period.

1.9 Project Crediting Period

The accreditation period of Juruá REDD+ Project will occur from August 1, 2020 to July 31, 2050, comprising a period of 30 years.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	x
Mega Project	

Year	Estimated GHG emission reductions or removals (tCO2e)
2021	35,348
2022	73,169
2023	68,669

2024	106,375
2025	48,478
2026	81,120
2027	93,521
2028	87,636
2029	124,978
2030	102,680
2031	152,152
2032	129,123
2033	130,055
2034	70,291
2035	191,843
2036	52,280
2037	85,650
2038	97,093
2039	99,468
2040	107,812
Estimated total ERs	1,937,742
Total number of years of credit	30
Average annual ERs	96,887

1.11 Description of the Project Activity

The purpose of the Juruá REDD+ Project is to promote joint actions to reduce greenhouse gas emissions (REDD+) resulting from unplanned deforestation and forest degradation, acting through activities such as improving surveillance, remote monitoring of changes in land use and land cover, and strengthening the management of non-timber forest products. Through this set of interconnected actions, the Project will seek to promote the forest conservation and associated natural resources through rational and sustainable use.

Initial studies and coordination

The activities related to the Project's initial coordination extend to the first meetings held with the landowner, the signing of the contract, which defined the terms of a long partnership aimed at the region's environmental conservation and socioeconomic development, hiring experts and meetings with technical partners to proceed with the initial studies of the Project. These studies provided the technical input for the project's concept and design, and included baseline studies, project feasibility studies considering financial indicators, and studies to characterize the area considering socioeconomic aspects, vegetation, biodiversity, climate, and geomorphology, among others. It is understood that the activities related to the initial coordination processes are part of the Project's management, in which they contributed for generating results such as the development of initial studies, allowing a better understanding of the socioeconomic and environmental context, and that they contributed for outlining the actions to be developed by the Project and, consequently, to the reduction of greenhouse gas emissions since the beginning.

Improved property surveillance

The property surveillance activity seeks to mitigate and prevent the occurrence of unplanned deforestation in the Project Area, as well as a consequent reduction of greenhouse gas emissions, through on-field physical presence. Currently, surveillance actions are performed in the area by the property's own employees, but without very well defined procedures and conducts. The proposal of this activity is to improve and adapt the surveillance actions and tatics within the Project Area, through the continuous improvement and revision of the procedures of conduct, establishing clear and well-defined protocols and procedures and promoting training for workers so that they take appropriate action in cases of illegal activities in the area. In this way, through this activity, it promotes the conduction of surveillance actions that are more effective in mitigating and preventing illegal deforestation and, consequently, reducing emissions. In addition, if necessary, the Project will seek to strengthen local partnerships, especially with law enforcement agencies, to assist in combating illegal activities within the area and to allow communication for reporting complaints.

Within this scope, the Project proposes to assist the field activities of property surveillance through interconnection by remote monitoring activities related to deforestation (described below). Therefore, products of satellite image monitoring activity will be used by the surveillance team for assessing areas detected in the field monitoring, understanding the context of deforestation pressure, allowing the refinement to prevent and combat illegal activities and, as a result, greater assertiveness, and efficacy.

Deforestation monitoring using satellite images

Regular monitoring of deforestation will be done using satellite images, tracking changes in land use and land cover within the Project's boundaries. This monitoring will result in reports with locations of deforestation, which will allow a greater understanding of the dynamics of deforestation, serving as input for the improvement of on-field interventions, allowing them to be more effective and assertive. By supporting the strategic plan for field patrols, this action is directly related to the restrain deforestation and invasions and, consequently, the maintenance of forest cover and associated natural resources, for serving as a basis for understanding the dynamics of deforestation in the region and better detailing the areas of greatest pressure from illegal deforestation and risk.

Strengthening the management of non-timber forest products

The actions focused on management of non-timber forest products will seek to strengthen the existing practice in the Project Area by identifying improvements and other opportunities to be worked on, development of actions and training within the potential mapped lines, for sustainable production, as well as the implementation of partnerships to develop the selected actions. In addition, the activity proposes to map the stakeholders with the potential to adhere to the management of non-timber forest products, promoting the engagement of all for the sustainable development of the practice. In this sense, the objective of the activity is to promote the valorization of forest conservation aligned with sustainable production. Among the non-timber forest products found in the Project Area, cat's claw (*Uncaria tomentosa*) is until now the main product managed and consists of a woody climbing vine.

Cat's claw is most abundant in the Vale de Juruá (Miranda et al., 2001), and is used by traditional populations for medicinal treatment of diseases such as dysentery, rheumatism and diabetes (Cabiesis, 1997; Jong et al., 1999). It is noteworthy that the phytotherapeutic products based on cat's claw extract are one of the 12 registered by the Ministry of Health for distribution by the Brazilian Unified Health System. Cat's claw extract base has a recommendation grade B III by the Ministry of Health for knee osteoarthritis (1) and active rheumatoid arthritis (2). According to chemical, biological and pharmacological studies, this species has immunostimulant, antiflammatory, antiviral, and cancer cell growth inhibitory effects, and so on (Williams, 2001; Sandoval et al., 2002; Souza & Cimerman, 2010).

Due to the management strengthening activity of non-timber forest products, it is expected to enhance the development of a forest-based and sustainable economy in the Amazon in order to promote the valuation of environmental assets from a conserved forest, increasing production with sustainable practices. The valuation of the standing forest is an expected impact, along with the conservation of the area, which emerges as a positive measure influencing new dynamics and sustainable productive models for the region, allowing to combat illegal deforestation.

Implementation, monitoring, and assessment of the activities developed

The reach of the expected impacts when carrying out the Project's activities is directly related to its good management throughout its life cycle. Therefore, through "implementation, monitoring and assessment of activities carried out", the Project will seek to follow up the status and execution of each activity, as well as its results through the strategies defined in the monitoring plan. In this sense, reports will be produced to accompany the implementation of the activities and the monitoring and evaluation of the indicators and results achieved by the Project, allowing for a greater understanding of the impacts generated. This follow-up will allow the continuous monitoring of the Project, accompanied by assessment processes, allowing to incorporate learning and improvements. In addition, the activity proposes, through the monitoring of the activities, to define the planning of the activities for each year, allowing a greater targeting of the activities and refinement of the data collection methods.

Another relevant point for good Project management that will be applied consists in the implementation and consolidation of communication channels for stakeholders to have access to Project information, as well as to have the possibility of exchanging and acting on planned activities. As explained in section 2.2, during the interviews with the rural communities that live around the Project Area, their interest was expressed in carrying out some activities that would have synergy with the Project, such as the strengthening of sustainable practices. Therefore, the Project will seek to strengthen relationships with these stakeholders through the CCB (Climate, Community and Biodiversity) certification procedures and guidelines.

As a starting point to build these future relationships, the Project will first implement and consolidate a communication plan containing guidelines on communication channels available and on necessary steps to be taken in cases where suggestions and complaints are received from stakeholders. In addition to the communication plan, the coordination of activities for "implementation, monitoring and assessment of activities being carried out" will involve the production of reports presenting descriptions of activities that have been carried out, as well as the follow-up of the respective indicators and expected results, and the actions planned for the following years regarding to continuous assessment.

The strategies mentioned in this activity will allow the good management and efficient implementation of the Project, reaching the expected goals of containment of deforestation and reduction of emissions from deforestation and forest degradation, thus generating positive net impacts and benefits.

Updating and complementary studies

As presented in the activity above, the Project has plans to promote closer ties with local rural communities and other stakeholders that may have synergy to carry out the Project's activities, which it is intended to be accomplished through the CCB certification guidelines. The application of this certification will enable the Project to address the intended benefits in a clearer and more transparent way regarding to climate, community and biodiversity aspects, through criteria such as the identification of all possible stakeholders, ensuring full and effective participation, and the identification and maintenance of high conservation values.

Therefore, in order to meet CCB certification, which will require the completion of natural resources and socioeconomic studies, and to maintain VCS requirements, which, for example, requires the reassessment of the baseline every six years, it will be necessary to develop other technical studies throughout the Project's life cycle.

The main activities of Juruá REDD+ Project are described in the following table, and include the initial coordination, planning, project concept, and development activities.

Activity	Description	Status
1. Initial coordination and planning		
1.1 Technical meetings with the owner and his representatives to plan and design the Project, as well as define the hiring of companies for all the following stages	Meetings between owner, technical team, developers, managers to plan the Project activities from conception to validation and first verification.	Completed in 2021

1.2 Survey of potential partners and identification of strategic institutions	Identification of local, national, and international partners such as consultants, researchers, and institutions that could contribute to the Project development.	This is an ongoing activity of the project
1.3 Resource allocation for project construction and financing the initial stages	Project financing using its own resources, including the use of the property's infrastructure such as vehicles and a single-engine Cessna Skylane 182 airplane, used in the natural resource assessment actions.	Completed in 2020
1.4 Signing the contract	Signing the contract between the bidders.	Completed in 2022
2. Project design and concept, with initial studies		
2.1 Construction of the feasibility study	Initial assessment of financial indicators such as Net Present Value, Internal Rate of Return, Benefit-Cost Indicator (B/C), and Project Pay-Back.	Completed in 2021
3.1 Cartographic base structuring and construction in the Project's geographic information system	Development of a geographic database adjusted to the official cartographic base of the State of Acre, allowing analyses at more detailed scales at the property level, through the partnership with Lavrado.	Completed in 2021
3.2 Socioeconomic Assessment and Evaluation of Natural Resources	Development of studies by Ambiental Amazônia, Lavrado e Impacto Plus, involving 10 specialized technicians, enabling the characterization of the Project Area and the surrounding areas regarding to socioeconomic aspects, vegetation, biodiversity and climate, hydrology, geology, geomorphology and soils.	Completed in 2021
3.3 Estimation of forest and soil carbon stocks	Development of studies in partnership with Lavrado regarding to estimate the forest carbon stock for the Project Area based on data from forest inventories already carried out in the area. As well as estimation of soil carbon stock (up to 100 cm) by collecting soil profile samples within the scope of the project construction.	Completed in 2021
3.4 Determination of baseline and potential for carbon credit generation	Initial assessment of baseline and crediting potential of the Project through partnership with Impacto Plus, Carbono Fácil and Lavrado.	Completed in 2021
3.5 Stakeholder consultation	6 meetings with interested parties for presentation and discussion about the Project	Completed in 2021
3.6 Preparation of the Project Description document	Development of the Project Description document according to the criteria set out by VCS	Completed in 2022
4. Management and Development		
4.1 Property Surveillance Improvement	Development of actions to improve property surveillance in order to mitigate and prevent the occurrence of unplanned deforestation in the Project Area, as well as the consequent reduction of greenhouse gas emissions, through on-field physical presence.	Expected to start in 2022, and be continuous throughout the Project
4.2 Monitoring deforestation using satellite images	Promoting the remote monitoring of deforestation, contributing to understand the deforestation dynamics and, consequently, to the improvement of field interventions.	Expected to start in 2022, and to be continued throughout the Project

4.3 Strengthening the management of non-timber forest products	Development of improvements and other opportunities to be worked on, based on actions and training within the potential lines mapped, as well as the implementation of partnerships for the development of the selected actions	Expected to start in 2022, and to be continued throughout the Project
4.4 Implementation, monitoring and assessment of the activities carried out	Monitoring the status and execution of each activity, as well as its results through the strategies defined in the monitoring plan, in order to allow a continuous assessment of what will be carried out, enabling the incorporation of learning and improvements.	Expected to start in 2022, and to be continued throughout the Project
4.5 Updating and complementation of studies	Execution of required technical studies to develop the Project's activities throughout its duration and subsequent verification, such as: review of the baseline study, complementation of the natural resources and socioeconomic studies using secondary and/or primary data, among other actions whenever necessary	Ongoing throughout the duration of the Project, whenever necessary

Jurisdictional status

Biofílica Ambipar Environment has been willing to accompany the advances that have been occurring in relation to discussions about jurisdictional regulations, both in Brazil and internationally. This follow-up has been done through Aliança Brasil NBS, where Biofílica Ambipar Environment is founding partner, and has expanded to a collaborative approach in contributing with the states any policy development at the jurisdictional level.

Aliança has members the carbon project developers in Brazil and other entities related to voluntary market that can prove their experience track-record. In terms of developments at the jurisdictional level, Aliança's approach is collaborative, aiming to contribute and collaborate with states in any policy development at the jurisdictional level.

a) Nationwide level

In nationwide level, the country has some initiatives regarding to the construction and negotiation of REDD+ concept. In this sense, the National Strategy for REDD+ in Brazil (ENREDD+), instituted in 2015, formally sets out how the Brazilian government has structured its efforts and intends to improve them by 2020, contributing to climate change mitigation by controlling deforestation and forest degradation, promoting forest recovery, and fostering sustainable development. Under the decree no. 10.144 (dated 11/28/2019), the National Commission for REDD+ (CONAREDD+) was established, responsible for coordinating, following up, monitoring and reviewing the ENREDD+, in addition to guiding the elaboration of requirements for accessing payments by results of policies and actions of REDD+ in the country (section 1.14).

Also, the purpose of the Forest Emission Reference Level (FREL) is to technically assess the payment for REDD+ activities. For this purpose, the emission levels at the national scope were measured for the Amazon biome (FREL Amazônia), allowing the evaluation of the real effects of policies and measures to reduce greenhouse gas emissions. O FREL is a requirement for developing countries that wish to obtain recognition by the UNFCCC regarding their national forest mitigation efforts for the purpose of payments for results of REDD+ activities.

b) Acre's State System of Incentives for Environmental Services (SISA)

On October 22, 2010, it was established by State Law no. 2.308, the Acre's Incentive System for Environmental Services (SISA), which establishes incentives for a range of environmental services, including forest carbon, water resources, scenic beauty, climate regulation, among others. SISA is regulated by the Climate Change Institute (Instituto de Mudanças Climáticas - IMC), a public company that is financially and administratively independent, but supervised by the State Secretary for the Environment (SEMA).

SISA explicitly allows flexibility for harmonization and linkages with other future incentive systems for ecosystem services at the national, sub-national, or international level, and was based on the policies set forth in the Brazilian Federal Law of 2009 which set out the National Policy on Climate Change, the State Law on Ecological-Economic Zoning of the Acre State (ZEE/AC) of 2007 and Acre's State Policy directions for valuation of forestry and environmental activities.

According to SISA Law, the beneficiaries are the providers of environmental services, i.e., the stakeholders that are conserving, preserving, and recovering forest assets or using natural resources in a sustainable way. The law defines "environmental service providers" as those who promote legitimate actions for the preservation, conservation, or recovery and sustainable use of natural resources, according to the law's guidelines.

SISA Law establishes programs for each environmental service, among them the Incentives Program for Environmental Carbon Services (ISA Carbon Program) is regulated. With its nested approac, the ISA Carbon Program and its sub-programs enables the integration of the incentive policy for environmental services in Acre State as a future REDD National Strategy. Thus, it can be said that the Acre's ISA Carbon Program was designed from a jurisdictional perspective, at the subnational scale, in order to have the direct emissions of carbon credits at both the state (jurisdictional) and individual project scale.

Incentives related to Acre's ISA Carbon Program include:

- Promoting the transition of agricultural and livestock production to more productive systems, reducing the need for their expansion and, therefore, preventing new deforestation;
- Increasing the economic value of standing forest, regarding to improve the quality of life of forest-dependent people and enhancing forest conservation; and
- Distribution of benefits for environmental services, based on trading carbon credits from avoided deforestation and carbon sequestration through forest regeneration and restoration.
- Evaluating the incentives related to Acre's ISA-C Carbon Program, it can be seen that the Juruá REDD+ Project is aligned with these parameters.

The development of Acre's ISA Carbon Program was subdivided in two periods: 2006-2010, using as reference level the period from 1996-2005 for calculation of the average deforestation rate (602 km²/year); and 2011-2015, using as reference level the period from 2001-2010 for calculation of the average deforestation rate (496 km²/year). The basis used for carbon accounting in Acre has been the Action Plan for Prevention and Control of Deforestation in the Amazon PPCDAm, Acre's State Plan for Prevention and Control of Deforestation do PPCD/AC and the study on forest biomass in Acre, by SALIMON et al. (2011). For emission estimation, the average value of 123 tC/ha is used for the biomass carbon density of the forest typologies in Acre.

After Brazil has submitted to UNFCCC, the reference level of forestry emissions (FREL) of Amazon biome in 2014, and the creation of National Strategy for REDD+ (ENREDD+) in 2015, Acre State sought the alignment of ISA Carbon Program, in subnational level, with national FREL and within the limits established in the Resolution no. 6 of National Commission for REDD+ (CONAREDD+).

ISA Carbon Program, under any circumstances, does not limit or forbit REDD+ Projects to be developed by private entities, and does not oblige them to be incorporated into the Program by SISA. Aiming at a better alignment with the entities responsible for the ISA Carbon Program, Juruá REDD+ Project has applied for category registration of Special Projects, considering the Normative Instruction – IN/IMC no. 01 dated 10/19/2015 which regulates the subsection IV of Article 7 of State Law no. 2.308 dated 10/22/2010 which established the SISA. The Special Projects, according to these laws, are those prepared by private parties and intended to implement actions not included in the subprograms, to be submitted to the Institute of Regulation, Control and Registration. These assigned procedures enable an alignment between the parties, mitigating risks such as double counting.

1.12 Project Location

Juruá REDD+ Project is located at the Seringal Valparaíso property, in the region of Alto Juruá, between the municipalities of Cruzeiro do Sul and Porto Walter, in the Acre State in Brazil, comprising an area of 24,076 hectares, regarding the total property area which represents 24,976.3199 hectares. The access to the area is made through the national highway BR 364 and branch 03 of Santa Luzia Settlement Project (70 km far from the City Municipal Office of Cruzeiro do Sul). The vertices of the Project Area can be found in Table 2 and area location in the Figure 1.

Table 2. Geographic coordinates of the property vertices of Seringal Valparaíso (in meters).

Vertex	X	Y
P - A3	782,523.3	9,100,013.2
2	775,785.8	9,108,579.6
3	782,923.2	9,106,803.7
4	783,418.9	9,101,909.7
5	773,989.3	9,105,222.0
6	775,360.3	9,101,962.6
7	774,344.2	9,095,515.5
8	784,352.3	9,092,144.1
9	795,792.1	9,095,813.2
10	795,155.6	9,083,581.7

11	786,432.2	9,084,685.9

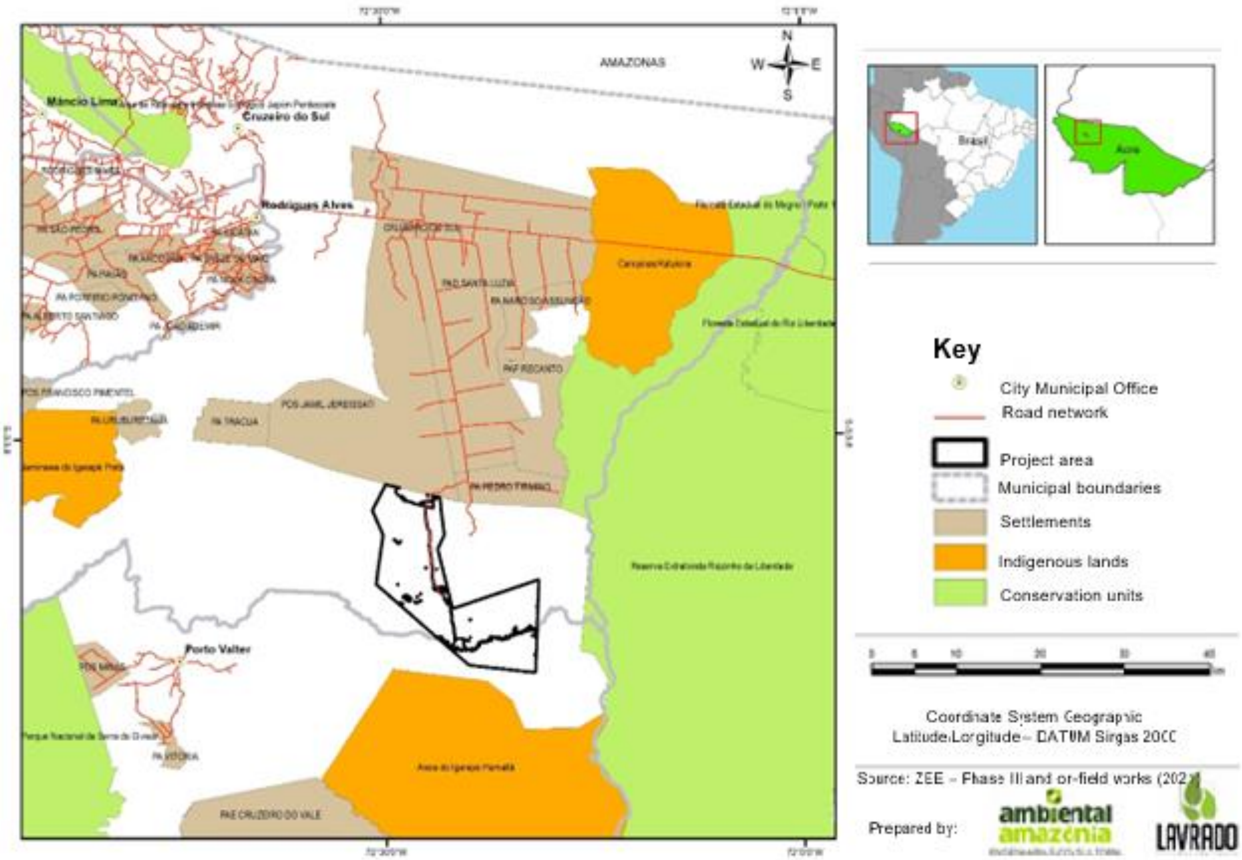

Figure 1. Location of Juruá REDD+ Project, South East Amazon, Acre State, Cruzeiro do Sul and Porto Walter municipalities, Brazil.

1.13 Conditions Prior to Project Initiation

Relevant historical conditions

Alto Juruá was previously occupied by dozens of indigenous ethnic groups and, around 1870, became an object of interest to non-indigenous populations because of its gum territories, as well as being the epicenter of diplomatic issues involving Peru and Brazil (CASTELO BRANCO, 1959). The conflict stems from the occupation by a Brazilian rubber company and the migrant workers, mainly from the Northeast, who later became rubber tappers. The ethnic combination of indigenous, migrants and Peruvians constitutes, in part, the current population of Acre (MARTINI, 2019).

At the beginning of the occupation by the non-indigenous population, the land was divided into productive units that included the rubber roads (paths through the forest that connected the scattered syringes), the equipment necessary for rubber production, and also the rubber tapper's house. This occupation model prevailed for about a century. Throughout this time, the migrants who worked in the rubber plantations and their descendants developed their own way of life, which was based on several activities, and the settlements came to comprise cultivation areas and plantations, livestock and hunting areas (REZENDE,2010).

However, the land under the placements were owned by rubber tappers' bosses, who established a lessor/lessee relationship with the rubber tappers, who paid him a fixed rate in rubber for each year of exploitation of each rubber road and had a monopoly on the buying and selling of rubber and merchandise in the rubber tappers (REZENDE,2010). Tied to this system of exploitation, the rubber tappers began to organize a struggle for eviction of bosses and ownership right of lands where they had worked for decades (ALMEIDA, 2004).

In this scenario, culminated, in the early 1990s, in the creation of the first Extractive Reserves (RESEX) in Brazil. In the region of Alto Juruá, the creation of RESEX meant the expulsion of bosses and sharing the territory management between the relevant federal agency (IBAMA), and the neighborhood association (in portuguese, Associação dos Seringueiros e Agricultores da Reserva Extrativista do Alto Juruá - ASAREAJ) (REZENDE,2010).

However, in the late 1990s, rubber production began to decline, leading to the growth of agricultural activities and breeding as a source of income for rubber tappers. Thus, the occupation along the riverbanks began, because the products flow became easier. Therefore, the rubber tappers began to occupy the land in a system distinct from the placements model, gaining strength then, the notion of a community (REZENDE,2010).

Due to the new economic activities, especially animal husbandry, the environmental impacts have become greater, increasing the deforested areas over the years.

Socioeconomic conditions in the municipalities

Cruzeiro do Sul is the second most populous municipality in the state, with a population of 89,760 inhabitants according to estimates for 2021 by Brazilian Institute of Geography and Statistics (IBGE), approximately 10% of the population in the State and in 33rd place in the Brazilian North region in terms of population size. The population density is 8.94 inhabitants per km².

Cruzeiro do Sul Municipal Human Development Index (IDH-M) is considered as “MEDIUM” by United Nations Development Programme (UNDP), with a score of 0.664. The Gini coefficient, which measures social inequality, is 0.64 (2010), being 1.00 the worst score and 0,00, the best. There was an increase since 2000 of 0.02.

The Gross Domestic Product (GDP) per capita values recorded, in 2010 and 2018, show that there has been income growth in the municipality. The GDP per capita in the Municipality was BRL 9,829.18, in 2010, and BRL 16,261.39, in 2018. The employed population is practically stagnant, since in 2014 it corresponded to 11.2% of the population and in 2019, it reached 11.8% (IBGE). The municipality has 8,877 formal jobs, 7% of the state's formal jobs. 4,835 companies in operation, corresponding to 11.8% of companies in the State (SEBRAE, 2020) and the average monthly remuneration of the workers in

Cruzeiro do Sul is BRL 1,851.47, representing 63.6% of the average wage in the State, which is BRL 2,908.19 (Ministry of Labor and Social Security-MTP/Annual Social Information Report-RAIS, Sep/2019).

Among the main economic activities, besides the natural inclination for ecotourism, the municipality also presents a strong economic activity with emphasis on livestock breeding, artisanal production of tobacco rolls, guarana powder and syrup, and manioc flour, which is the main product of the region's economy (AMAC, 2016). Regarding to basic education, Cruzeiro do Sul municipality presented, in 10 years, and increase of 32.5% for Basic Education Development Index (IDEB) in the Municipal Education Network for 4th /5th Grades, in 2009, it scored 4.3, and in 2019 it scored 5.7 (National Institute for Educational Research and Studies-INEP, 2019).

Porto Walter is the 16th most populous city in the State, with a population of 12,497 inhabitants according to estimation in 2021 by IBGE, with approximately 1.4% of population in the State, and population density of 1.42 inhabitants per km².

IDH-M of Porto Walter is considered "LOW" according to PNUD, scored 0.532. Gini coefficient, which measures social inequality, is 0.61 (2010), increased since 2000 in 0.10.

The Gross Domestic Product (GDP) per capita values recorded, in 2010 and 2018, show that there has been income growth in the municipality. The GDP per capita in the Municipality was BRL 6,576.28, in 2010, and BRL 9,569.61, in 2018. The working population has decreased, as in 2014 it was only 6.31% of the population and in 2019, it became 5.51% (IBGE). The municipality has 643 formal jobs, 0.5% of the formal jobs in the State (MTP/RAIS, Sep/2019). Porto Walter has 281 companies in operation, corresponding to 0.7% of companies in the State (SEBRAE, May/2020) and the average wage in Porto Walter is BRL 1,626.02, which represents 55.9% of the average compensation in the State, of BRL 2,908.19 (MTP/RAIS, Sep/2019).

The municipality's economy is based on vegetal extraction, mainly of latex and wood, besides the practice of subsistence agriculture and cattle raising. Regarding to basic education, Porto Walter municipality presented, in 10 years, a 31.2% increase in the Basic Education Development Index (IDEB) of Municipal Education Network 4th /5th Grades, in 2009 it had a score of 3.2 and in 2019, it received a score of 4.2 (National Institute for Educational Research and Studies-INEP, 2019).

Weather

The Project Area falls within the tropical monsoon (AM) climate, according to the Koppen classification. It is characterized by high temperatures and rainfall with an average temperature of the coldest month always above 18ºC, presenting a dry season of short duration as a consequence of the high rainfall in the region.

In the Amazon, the average rainfall is approximately 2,300mm/year. The rainy months of high convective activity correspond to the period between November and March, while the months related to dry periods are between May and September, with April and October as transition months from one regime to another (FISCH et al., 1998).

Considering a 43-year historical series, the high rainfall recorded in the municipality of Cruzeiro do Sul (AC), is one of the characteristic factors of this region, presenting an annual average of 2,115 mm. The rainy season starts in September and lasts until May. The first quarter of the year has the largest accumulation of rainfall. The average annual temperature is around 25,4ºC. The average maximum temperature is 27.7ºC and the average minimum temperature is around 22.2ºC (INMET, 2020) (According to Figure 2).

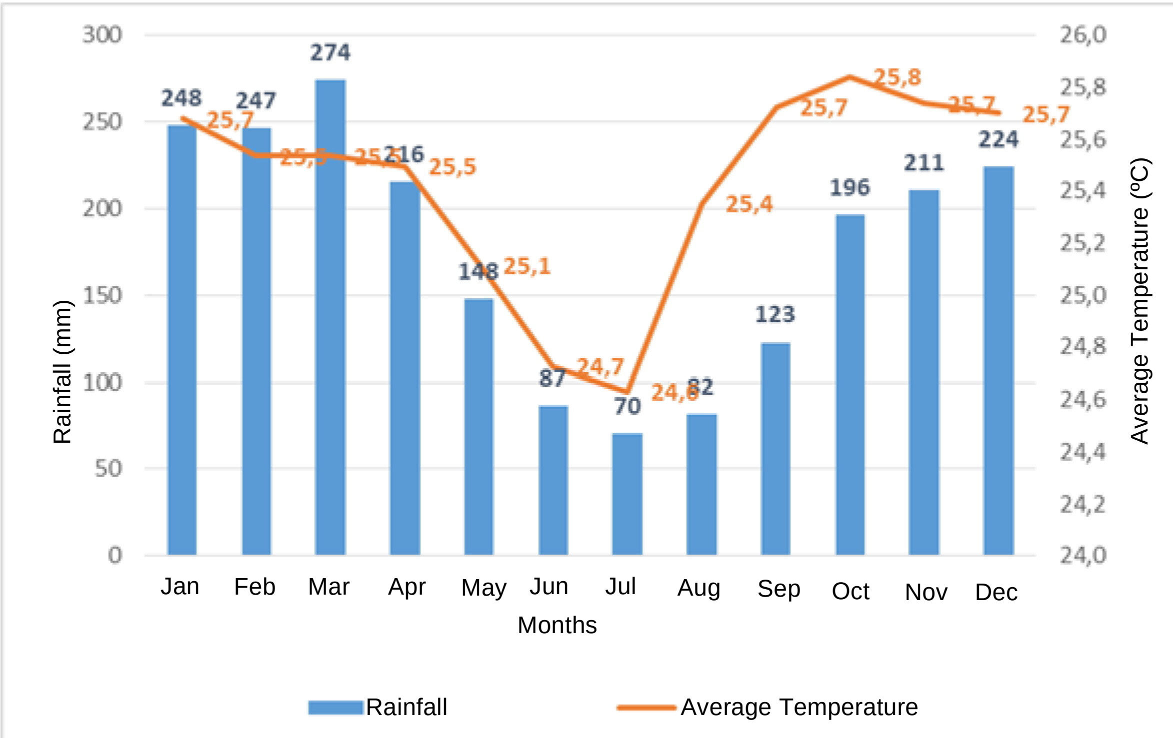

Figure 2. Variation of temperature and rainfall during 43 years (1962;1970-1990 and 1993-2005) in the Cruzeiro do Sul municipality, Acre State, Brazil. Source: Adapted from INMET (2020).

Therefore, the region is characterized by a nine-month rainy period that occurs from October to May, with the months of December through March being the wettest. The wettest quarter (January, February and March) has a rainfall of 769 mm and accounts for about 36% of the total annual precipitation. The reduced rainfall period lasts for three months, from June to August, with an average rainfall that varies from 82 mm to 87 mm per month, in which we have a total rainfall of 239 mm, which corresponds to 11% of the annual total. It is worth noting that the favorable conditions of sunshine, temperature and high humidity, causes the forest to have high rates of organic matter production, which benefits its development (ARTAXO et al., 2014).

Hydrography

The Project Area is within the Juruá River Basin, more precisely in four micro watersheds: micro watershed of the igarapé do meio, micro watershed of the igarapé primeiro de março and micro watershed of the igarapé grande, besides the basin itself (microbasin) do rio Val Paraiso which is the main drainage network of the rubber plantation region.

The Juruá River has its source in the Mercês mountain range (Serra da Contamana) in Peru and runs through the northwest of the state of Acre flowing into the Solimões River (AM), southwest-northeast direction) (Sousa & Oliveira, 2016). The Juruá river stream is divided in low, medium and high Juruá (Acre, 2012). Jointly with Purus River, Tarauacá-Envira river and Acre River, the Juruá river make up the main drainage systems of Acre State, forming the so-called Acre Basin (Sousa & Oliveira, 2016).

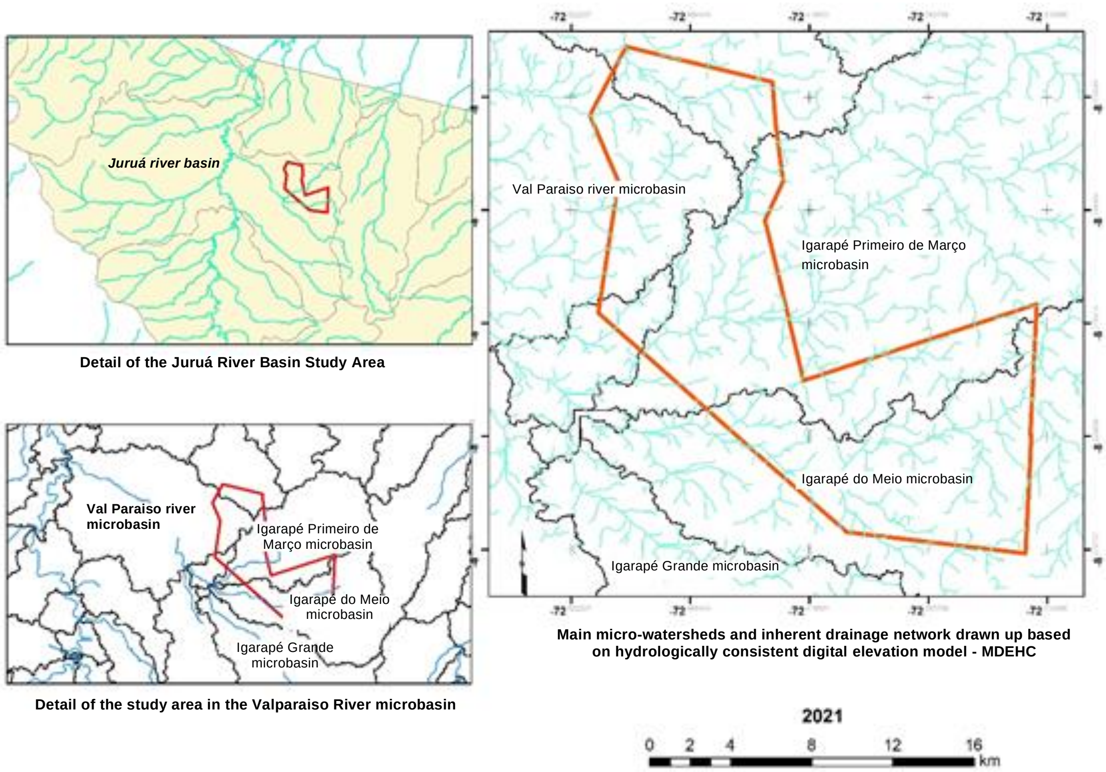

Figure 3. Main microbasins that drain the Seringal Valparaíso area (Juruá REDD+ Project), South East Amazon, Acre State, in Cruzeiro do Sul and Porto Walter municipalities, Brazil.

Soils

The taxonomic classification, which supported the definition for mapping units, preparation of the final keys and soil maps (scale 1:75,000), in high intensity recognition level (Figure 5) was based on the information from on-field studies (mainly soil morphology), interpretations of the analytical results, and norms and criteria of the current Brazilian Soil Classification System (SANTOS et al., 2018).

According to obtained data, 3 soil classes were found in terms of first category level (Figure 4). There was a predominance of the Acrisols class with 75% of the total area of the property where the Project is located (Table 3), followed by Plinthossols (24%). The sub-order of Red-Yellow Acrisols with plinthic character, which has as a remarkable characteristic the shallow effective depth and poor drainage of this type of soil. One can highlight the presence of Gleysols, a soil class common on the banks of the larger rivers and in areas that are flooded most of the year. Dystrophic soil is the specific aspect of the region's soils.

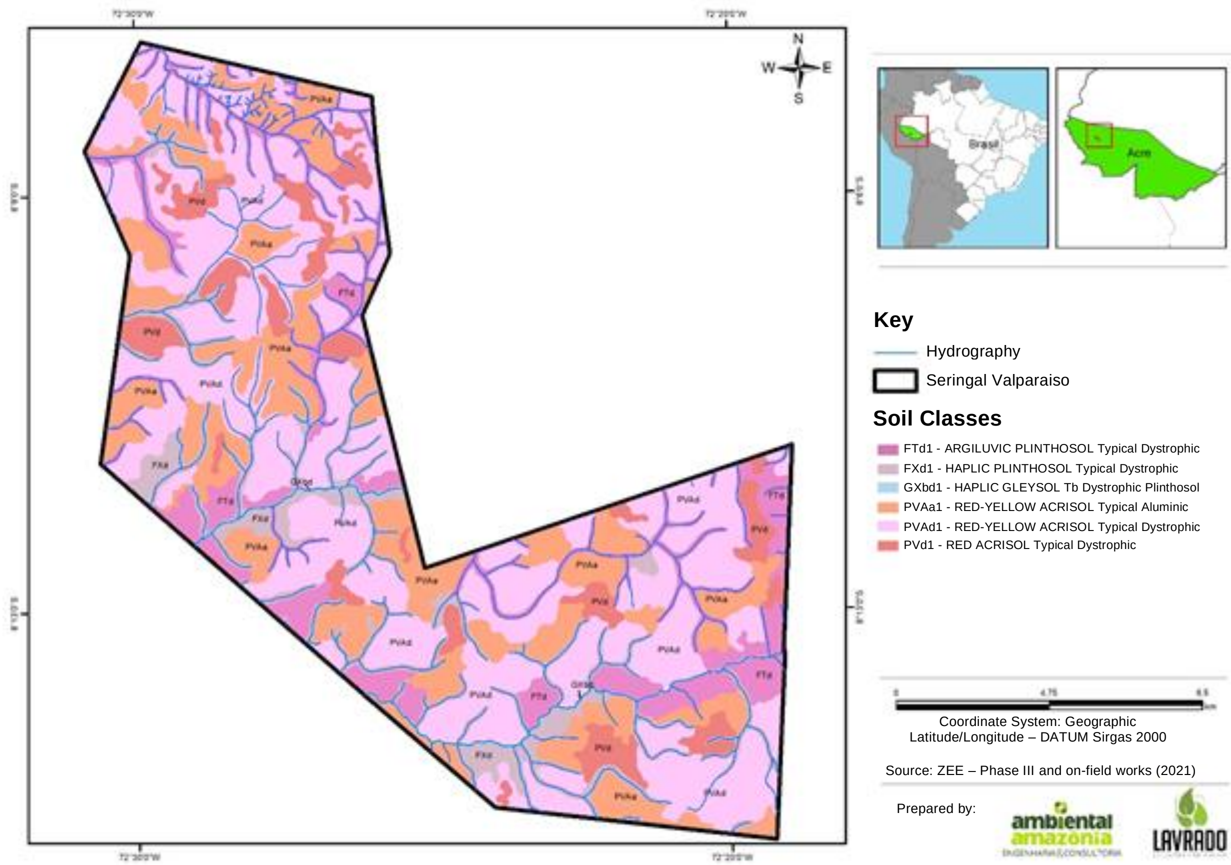

Figure 4. Distribution of soil classes in Seringal Valparaíso (Juruá REDD+ Project), South-Western Amazon, Acre State, Cruzeiro do Sul and Porto Walter municipalities, Brazil. Source: Ambiental Amazônia, 2021.

Table 3. Description and distribution of soil classes in Seringal Valparaíso (Juruá REDD+ Project), South-Western Amazon, Acre State, Cruzeiro do Sul and Porto Walter municipalities, Brazil.

Soils	%
ACRISOLS	75.1
RED ACRISOLS	11.4
RED-YELLOW ACRISOS	63.7
GLEYSOLS	0.8
HAPLIC GLEYSOLS	0.8
PLINTHOSOLS	24.0

ARGILUVIC PLINTHOSOLS	6.9
HAPLIC PLINTHOSOLS	17.2
TOTAL	**100**

Source: Ambiental Amazônia, 2021.

Geology

In the region subject of this study where Juruá REDD+ Project is located, geological units that cover the Juruá region were identified, such as: Solimões, Divisor, Rio Azul and Cruzeiro do Sul Formations; Pleistocene terraces, Holocene Alluvium and Quartz Sand. (CAVALCANTE, 2010).

Solimões formation presents various lithologies, mostly argillites with carbonate concretions (limestone) and veins of gypsum (gypsum), occasionally with carbonized material (peat and lignite), sparse concentrations of pyrite and a large amount of vertebrate and invertebrate fossils (ACRE, 2010).

In the total area of the property in which the Project is located, there is a predominance of more than 90% of lower Solimões Formation (Table 4), with lithology composed of sandy pelite from the Pleistocene, moderately developed material, and low soil fertility (BARDALES, et al., 2021).

Table 4. Geological classes and area distribution in the Seringal Valparaíso (Juruá REDD+ Project), South-Western Amazon, Acre State, Cruzeiro do Sul and Porto Walter municipalities, Brazil.

Symbols	Geological Units	Area %
TNsi	Lower Solimões Formation	95
QHt	Holocene Terraces	2
QHa	Holocene Alluvium	3
TOTAL	-	100

It is worth mentioning for the region surrounding the Project Area the Cruzeiro do Sul Formation, which presents sediments deposited by river currents, river-lake, and in alluvial fans, composed of fine, friable, massive, clayey sandstones, with lenticular argillite intercalations and cross stratification (CAVALCANTE, 2010). This formation was previously inserted in the Solimões Formation, however, with the work of IBGE in the region, in the mid ‘90s, it was excluded, and is now called Cruzeiro do Sul Formation (ARAÚJO et al., 2019).

The other important geological formations are the Holocene Alluvium and Terrace. These formations consist of former floodplains (old floodplains), represented today by flattened and possibly terraced surfaces (BAHIA, 2015). Whereas the Alluvium is a lithostratigraphic unit comprising unconsolidated sediments from deposits interspersed between two distinct environments, represented by the river channel and the floodplain, constituting recent and current deposits (BAHIA, 2015).

Geomorphology

According to CAVALCANTE, (2010) & BRASIL, (1977) the characteristics of geomorphic units occurring in the Project Area are as follows:

Amazon Plains: A unit with altitudes varying between 110 and 270m, situated along the main rivers, is characterized by several terrace levels and the recent floodplains contain dikes and paleochannels, meander and barrage lakes, settling basins, boreholes, braided channels, and stretches of talweg straightened by structural factors (increased sediment load and flow energy).

Juruá Depression – Iaco: This unit presents variable altitude between 150 to 440 m. Its main characteristic is to present itself as a dissected surface with high first order drainage density and dendritic pattern.

Table 5. Geomorphologic Classes and distribution of areas comprising Seringal Valparaíso (Juruá REDD+ Project), South-Western Amazon, Acre State, Cruzeiro do Sul and Porto Walter municipalities, Brazil.

Symbols	Geological Units	Area
		%
Dc	Juruá-Iaco depression, cross dissection model	95
Aptf	Amazon Plains - accumulation model in plains and river terrace	5
TOTAL		**100**

Regarding to relief classes, there is a predominance of flat and gently undulated, these classes occur both in lowland areas (predominance) and in higher areas (upper third), with better drainage. The relief class mild to wavy may represent erosive risk, especially due to the predominant soil class (Acrisols) with textural change of the surface horizon in relation to the subsurface (ARAÚJO et al., 2018).

Vegetation

The project region is inserted in the Amazon biome, consisting of exuberant forest formations with great diversity in relation to structural characteristics of vegetation such as canopy closure or openness level and predominance of life forms such as palms, lianas or bamboos. The main characteristic of the Amazon is the presence of forests that are located in regions with abundant water and are called Ombrophilous.

Therefore, from this diversity of physiognomies, the main formations for predominant biome in the Acre State (ACRE, 2010) are: i- Dense Ombrophilous Forest (FOD), which is characterized by a compact forest cover, with a dense canopy that intercepts much solar radiation, making the light that reaches the lower stratum of the forest scarce; and ii- Open Ombrophilous Forest (FOA), which has a less closed canopy, allowing more light penetration into the lower forest stratum. The greater solar radiation allows the proliferation of some life forms, which, when found in abundance, give the name to the subdivisions of this formation, called FOA with Palms, FOA with Bamboos, FOA with Liana, and FOA with Sororoca (a plant type). The ombrophilous forests can be further categorized according to the altitude at which they occur into alluvial, lowland, submontane, montane and high montane (IBGE, 2012).

Four forest typologies are identified in the Project Area: Open Forest with Palm and Open Forest with Bamboo (FAP+FAB), Open Forest with Palm, Open Forest with Bamboo and Dense Forest (FAP+FAB+FD), Open Forest with Palm, Dense Forest and Open Forest with Bamboo (FAP+FD+FAB), and Open Forest with Palm-Alluvial (FAP-Alluvial) (ACRE, 2010). For a better understanding about their peculiarities, descriptions of these forest typologies taken from the Ecological-Economic Zoning do Estado do Acre (ACRE, 2010) are presented below.

FAP+FAB: "Typology named for Open Forest with Palm Trees, in which several species of palm trees can be found with patches of forest with bamboo understory"

FAP+FAB+FD:” Open Forest with Palms is dominant in this forest, as well as patches of Open Forest with Bamboo and patches of Dense Forest."

FAP+FD+FAB: “Forest typology occurring in Assis Brasil, Feijó, Marechal Thaumaturgo, Jordão e Tarauacá municipalities.”

FAP-Aluvial: "The Open Forest with Palm Trees in alluvial areas occurs along the main rivers and some of their tributaries and is distributed throughout the State. In some areas, this forest may occur associated with patches of Dense Forest with emergent trees and in other areas associated with patches of Dense Forest with uniform canopy."

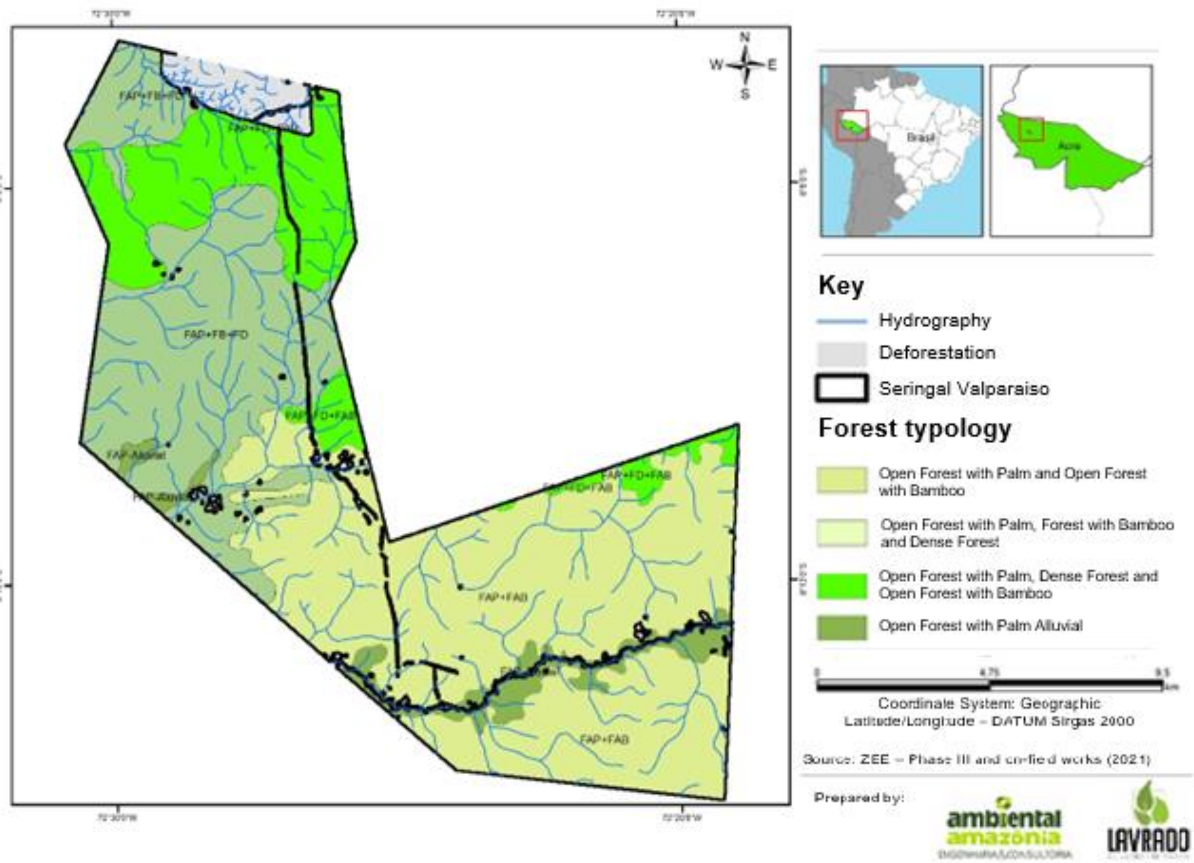

Figure 5. Seringal Valparaíso Forest Typologies (Juruá REDD+ Project).

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Compliance with Laws, Statutes and other significant regulatory instances for Juruá REDD+ Project is related to the activity of Non-Timber Forest Products Management. In Acre State, the enterprise's activities are being licensed by the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), therefore, federal legislation should be applied. Subordinate to the federal legislation, the legislation at the state level is applied.

Regarding to REDD+ activities, one can notice a history of initiatives despite the construction and negotiation of this concept through agreements and meetings at the United Nations Framework Convention on Climate Change – UNFCCC). In December 2015, the National Strategy for REDD+ in Brazil (ENREDD+) was established by Ordinance MMA no.370, a document that formalizes to the Brazilian society and to the signatory countries of UNFCCC how the Brazilian government has structured its efforts and intends to improve them by 2020, contributing to climate change mitigation by controlling deforestation and forest degradation, promoting forest recovery, and fostering sustainable development. In this context, in Brazil, the Decree no. 10.144 (dated 11/28/2019) established the National Commission for REDD+ (CONAREDD+) in order to coordinate, follow up, monitor and review the National Strategy for REDD+ and guide the development of requirements for accessing payments by results of policies and REDD+ actions in the country. The following year, the CONAREDD+ internal regulations were published, according to Ordinance (no. 544, dated 10/26/2020).

In addition, in broadly relevant nature, the draft Bill No. 572/2020 is currently under analysis, which "Establishes the national system for reducing emissions from deforestation and degradation, conservation, sustainable forest management, maintenance and enhancement of forest carbon stocks (REDD+) and makes other provisions". The text is in progress at the House of Representatives.

For the carbon market, there is a draft Bill (PL no. 528 of 2021) in progress at the House of Representatives, which aims to establish the Brazilian Market for Emissions Reduction (MBRE) and regulate the buying and selling of carbon credits in the country for instance, resulting from Reducing Emissions from Deforestation and Forest Degradation activities. The development of this voluntary carbon market is provided in the Law that established the National Policy on Climate Change (Law no. 12.187, dated 12/29/2009).

After years of discussion and stagnation of the draft Bill (PL) no. 528 of 2021 in the National Congress, most recently the Decree no. 11.075 dated 05/19/2022 which addresses the implementation of a regulated carbon credit market in Brazil through the creation of the National System for Greenhouse Gas Emission Reduction (Sinare) and establishes procedures for the preparation of Sectoral Plans for Climate Change Mitigation. In addition to these measures, the document also provides new concepts regarding to methane credit, carbon footprint registration for processes and activities, carbon from native vegetation, soil carbon and blue carbon.

Below, the main relevant legislation and regulations at federal and state levels are listed and detailed. Also, a brief analysis of the international climate agreements that have been driving the worldwide creation and development of REDD+ climate initiatives is provided

Federal Legislation

- **Law no. 14.119, dated 1/13/2021**: Establishes the National Policy for Payment for Environmental Services; and changes the Law no. 8.212, dated July 24, 1991, Law no. 8.629, dated February 25, 1993, and Law no. 6.015, dated December 31, 1973, in order to adapt them to the new policy.

- **Law no. 12.727, dated 12/17/2012**: Provides for the protection of native vegetation; amends the Law no. 6.938, dated August 31, 1981, Law 9.393, dated December 19, 1996, and Law no. 11.428, dated December 22, 2006; and superseded the Law no. 4.771, dated September 15, 1965, and Law no. 7.754, dated April 14, 1989, the Provisional Decree no. 2.166-67, dated August 24, 2001, item 22 of subsection II of Art. 167 of Law no 6.015, dated December 31, 1973, and Paragraph 2 of Art. 4 of Law no. 12.651, dated May 25, 2012.

- **Law no. 12.651, dated 05/25/2012**: Provides for the protection of native vegetation; amends the Law no. 6.938, dated August 31, 1981, Law no. 9.393, dated December 19, 1996, and Law no. 11.428, dated December 22, 2006; superseded the Law no, 4.771, dated September 15, 1965, and Law no. 7.754, dated April 14, 1989, and Provisional Decree no. 2.166-67, dated August 24, 2001; and makes other provisions.

- **Law no. 12.187, dated 12/29/2009**: Establishes the National policy on Climate Change – PNMC and other provisions.

- **Decree no. 11.075, dated 05/19/2022**: Establishes the procedures for the preparation of Sectoral Plans for Climate Change Mitigation, creates the National System for the Reduction of Greenhouse Gas Emissions and amends the Decree no. 11.003, dated March 21, 2022.

- **Decree no. 10.144, dated 11/28/2019**: Establishes the National Commission for Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Forest Management and Enhancement of Forest Carbon Stocks – REDD+.

- **Decree no. 58.054, dated 03/23/1966**: Enacts the Convention for the protection of flora, fauna and the scenic beauties of the countries of the Americas.

- **Decree no. 2.661, dated 07/08/1998**: Regulates the sole paragraph of Art. 27 of Law no. 4.771, dated September 15, 1965 (Forest Code), by establishing precautionary norms regarding the use of fire in agricultural and forestry practices, and makes other provisions.

- **Decree no. 5.975, dated 11/30/2006**: Regulates the Art. 12, final part, 15, 16, 19, 20 and 21 of Law no 4.771, dated September 15, 1965, the art. 4, subsection III, of Law no. 6.938, dated August 31, 1981, the art. 2 of Law no 10.650, dated April 16, 2003, amends and adds provisions to Decrees nos. 6.514/08 and 3.420/00, and makes other provisions.

- **Resolution CONAMA no. 16, dated 12/07/1989**: Establishes the Integrated Assessment Program and Environmental Control of Brazilian Legal Amazon

- **Resolution CONAMA no. 378, dated 10/19/2006**: Defines the enterprises that potentially cause national or regional environmental impact for the purposes of the provision in the subsection III, Paragraph 1, Art. 19 of Law no. 4.771, dated September 15, 1965, and makes other provisions.

- **Resolution CONAMA no. 379, dated 10/19/2006**: Creates and regulates a data and information system on forest management within the National Environmental System - SISNAMA.

- **Ordinance IBAMA no. 218, dated 05/04/1989**: Provides for the felling and extraction of native forests and native successor forest formations of the Atlantic Forest, and makes other provisions.

- **Ordinance IBAMA no. 438, dated 08/09/1989**: Amends the writing of Article 4 of Ordinance no. 218, dated May 4, 1989.

- **Ordinance MMA no. 103, dated 04/05/2006**: Provides on implementation of Forest Origin Document (Documento de Origem Florestal - DOF), and makes other provisions.

- **Ordinance MMA no. 253, dated 08/18/2006**: Establishes, as of September 1, 2006, within the scope of the Brazilian Institute of the Environment and Renewable Natural Resources - IBAMA, the Forest Origin Document - DOF to replace the Authorization for Transport of Forest Products - ATPF.

- **Ordinance no. 1.896, dated 12/09/2013**: Amends the Regulatory Standard no. 31.

- **Normative Instruction MMA no. 1, dated 09/05/1996**: Provides on Mandatory Forest Replacement and the Integrated Forest Plan.

- **Normative Instruction MMA no. 07, dated 04/27/1999**: Provides on authorization for deforestation in States of Brazilian Legal Amazon.

- **Normative Instruction MMA no. 02, dated 05/10/2001**: Provides on economic exploitation of forests in rural properties located in the Legal Amazon, including Legal Reserve areas, except permanent preservation areas established in the legislation in force, which will be carried out through multiple-use sustainable forest management practices.

- **Normative Instruction MMA no. 06, dated 12/15/2006**: Provides on forest replacement and consumption of forest raw material, and makes other provisions.

- **Normative Instruction IBAMA no. 178, dated 06/23/2008**: Defines the guidelines and procedures, by IBAMA, for appreciation and consent related to the issue of authorizations for suppressing forests and other forms of native vegetation in an area larger than two thousand hectares on rural properties located in the Legal Amazon and one thousand hectares on rural properties located in the other regions of the country.

- **Regulatory Standard no. 31, dated 03/03/2005**: Approves the Regulatory Standard for Occupational Safety and Health in Agriculture, Livestock, Forestation, Forest Exploration and Aquaculture.

State Legislation

- **State Law no. 2.308, dated October 22, 2010**: "The State System of Incentives for Environmental Services - SISA is created, the Program of Incentives for Environmental Services - ISA Carbon and other Programs for Environmental Services and Ecosystem Products of the State of Acre and makes other provisions."

- **State Law no. 1.426 dated 12/27/2001**: "Provides for the preservation and conservation of the forests of the state, establishes the State System of Protected Natural Areas, creates the State Forest Council and the State Forest Fund, and makes other provisions."

- **State Law no. 3.883, dated December 17, 2021**: Provides on State System for Protected Natural Areas – SEANP.

- **State Law no. 1.548, dated January 29, 2004**: Amends the Art. 9 of Law no. 1.426, dated December 27, 2001.

- **State Law no. 2.836, dated December 30, 2013**: Amends Law 1.426, dated December 27, 2001, which provides on preservation and conservation of the state's forests, creates the State System of Protected Natural Areas, creates the State Forest Council and the State Forest Fund, and makes other provisions.

- **State Law no. 3.595, dated December 20, 2019**: Amends provisions of Laws no. 1.022, dated January 21, 1992, of Law no. 1.117, dated January 26, 1994 and Law no. 1.426, dated December 27, 2001.

- **Supplementary State Law no. 300, dated July 9, 2015**: Amends Supplementary Law no. 247, dated February 17, 2012, which provides on administrative structure of the Executive Branch; Law no. 2.308, dated October 22, 2010, which creates the State System of Incentives for Environmental Services -SISA, the Program of Incentives for Environmental Services - ISA Carbon and other Programs of Environmental Services and Ecosystem Products of the State of Acre; Law no. 1.426, dated December 27, 2001, which provides for the preservation and conservation of the state's forests, creates the State System of Protected Natural Areas, creates the State Forest Council and the State Forest Fund, and makes other provisions.

- **State Law no. 1.460, dated May 3, 2002**. “Establishes the Support Program for Traditional Populations and Small Producers–PRÓ-FLORESTANIA, and makes other provisions.

- **State Law no. 1.904, dated June 5, 2007**. “Establishes the Ecological-Economic Zoning of Acre State – ZEE.

- **State Law no. 1.963, dated December 4, 2007**. “Provides on Sanitary Vegetation Defense in Acre State.

- **State Law no. 2.024, dated October 20, 2008**. “Creates the State Incentive Program for Forest and Familiar Agroforest Production.

- **Decree no 503, dated April 6, 1999.** “Establishes the State Program for Ecological-Economic Zoning of Acre State, and makes other provisions.

- **Decree no. 8.452, dated August 14, 2003.** "Sets forth the structure and composition of the State Forest Council and regulates the Forest Fund.

- **Decree no. 3.414, dated September 12, 2008.** "Provides on forest replacement in the State of Acre due to the consumption of forest raw material.

- **Decree no. 3.415, dated September 12, 2008.** "Provides on creation of the State Commission for Environmental Risk Management in Acre.

- **Decree no. 5.507, dated July 15, 2010**. "Provides on State Council for Rural Development and Sustainable Forestry -CDRFS.

- **Resolution/CEMACT no. 001, dated June 22, 2005.** “Approves the terms of Inter-institutional Ordinance IMAC/IBAMA No. 001 dated 06/04/2005, concerning to the definition of minimum standards for sustainable use of the cat's claw vine.

Municipal Legislation – Cruzeiro do Sul

- **Municipal Law no. 453, dated October 7, 2006:** Provides on Participative Master Plan of Cruzeiro do Sul municipality and makes other provisions”

- **Municipal Law no. 457, dated December 7, 2006**: Provides on Municipal Environmental Policy of Cruzeiro do Sul municipality, its purposes and formulation and application mechanisms, establishing the Municipal Environmental System and amending the competencies of SEMMA and COMDEMA, and sets forth other provisions.

International Agreements

- **FCCC/CP/2005/Misc.1:** Reducing emissions from deforestation in developing countries: approaches to stimulate action. Submission from Parties. (COP 11, Montreal, 2005.)

- **FCCC/CP/2007/6/add.1:** Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007. Addendum. Part two: Action taken by the Conference of the Parties at its thirteenth session. (COP 13, Bali, 2007.)

- **FCCC/CP/2009/Add.1:** Report of the Conference of the Parties on its fifteenth session, held in Copenhagem from 7 to 19 December 2009. Addendum. Part Two: Action taken by the Conference of the Parties at its fifteenth session. (COP 15, Copenhagen, 2009.)

- **FCCC/CP/2010/7/Add.1**: Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010. Addendum. Part Two: Action taken by the Conference of the Parties at its sixteenth session. (COP 16, Cancun, 2010.)

- **FCCC/CP/2011/9/Add. 1:** Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011. Addendum. Part Two: Action taken by the Conference of the Parties at its seventeenth session. (COP 17, Durban, 2011.)

- **FCCC/CP/2012/8/Add.1**: Report of the Conference of the Parties on its eighteenth session, held in Doha from 26 November to 8 December 2012. Addendum. Part two: Action taken by the Conference of the Parties at its eighteenth session.

- **FCCC/CP/2013/Add.1:** Warsaw Framework for REDD-plus, held in Warsaw, Poland, from 11 to 22 November 2013, in particular the following decisions:

- **Decision9/CP.19:** Work programme on results-based finance to progress the full implementation of the activities referred to in decision 1/CP. 16, paragraph 70.

- **Decision10/CP.19:** Coordination of support for the implementation of activities in relation to mitigation actions in the forest sector by developing countries, including institutional arrangements.

- **Decision12/CP.19:** The timing and the frequency of presentations of the summary of information on how all the safeguards referred to in decision1/CP.16, appendix I, are being addressed and respected.

- **Decision13/CP.19:** Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels and/or forest reference levels.

- **Decision14/CP.19:** Modalities for measuring, reporting and verifying.

- **Decision15/CP.19:** Addressing the drivers of deforestation and forest degradation. (Approach of deforestation drives and forest degradation.)

- **FCCC/CP/2015/Add.1**: Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015. Addendum. Part two: Action taken by the Conference of the Parties at its twenty-first session.

- **FCCC/CP/2015 Paris Agreement:** Global, legally-binding agreement that sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. Entry into force on 4 November 2016.

- **FCCC/CP/2016 Decisions adopted by the Conference of the Parties (COP):** Especially decisions 1 (preparation into force of the Paris Agreement), 3 (Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts), 6 (National adaptation plans) and 7 (Long-term climate finance).

- **FCCC/CP/2017, FCCC/CP/2018, FCCC/CP/2019 Decisions adopted by the COP:** Especially decision 1 reporting on developments of the implementation of the Paris Agreement.

- **Nationally Determined Contribution** – Brazilian NDC submitted in September 2015 to the United Nations Framework Convention on Climate Change for mitigation, adaptation and means of implementation, in a consistent manner with the purpose to contribute for achieving the ultimate objective of the Convention, pursuant to decision 1/CP.20, paragraph 9.

- **CITES, dated 03/03/1973**: "Convention on International Trade in Endangered Species of Wild Fauna and Flora", signed in Washington D.C. On March 3, 1973, amended in Bonn on June 22, 1979.

- **Article 6 of the Paris Agreement (2021):** Decision 1/CP.21 mandated the SBSTA to operationalize the provisions of this Article through recommending a set of decisions to the COP serving as the meeting of the Parties to the Paris Agreement at its first session. At COP26, the Parties to the Paris Agreement at its third session (CMA 3) adopted three main decisions related to Article 6: decision 2 (on Article 6.2), decision 3 (on Article 6.4) and decision 4 (on Article 6.8).

- **Glasgow Leaders' Declaration on Forests and Land Use (2021)**: Signatories (including Brazil) promise to reverse and end deforestation by 2030.

- **Brazilian Nationally Determined Contribution (NDC):** First Brazilian NDC submitted in in September 2015 to the UN Framework Convention on Climate Change for mitigation, adaptation and means of implementation, in a manner consistent with the purpose of contributions to achieve the ultimate objective of the Convention, pursuant to Decision 1/CP.20, paragraph 9. The updated Brazilian NDC was presented at the COP26 on December 8th, 2022.

1.15 Participation under Other GHG Programs

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

Juruá REDD+ Project has not received or sought to be registered in any other GHG program and has submitted the Project for validation and verification in VCS (Verified Carbon Standard).

1.15.2 Projects Rejected by Other GHG Programs

Juruá REDD+ Project has not undergone validation and verification by any other GHG program and is therefore not rejected by any other GHG program.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Not applicable

1.16.2 Other Forms of Environmental Credit

Not applicable

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

Juruá REDD+ Project will carry out activities that will actively contribute with at least 5 (five) Sustainable Development Goals (SDGs) of the United Nations (UN), as detailed below:

SDG 4 – ENSURE INCLUSIVE, QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL

United Nation's Goals (UN): 4.4 Until 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship.

4.7 Until 2030, ensure that all learners acquire the knowledge and skills necessary to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and nonviolence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development.

National goal (Brazil): 4.4 Until 2030, substantially increase the number of youth and adults who have the necessary skills, especially technical and vocational skills, for employment, decent work, and entrepreneurship.

4.7 Target kept without changes, in relation to the official text of target 4.7, due to the fact that it is very comprehensive and, therefore, comprises the specificities of the Brazilian reality.

Rationale of the application in the project: The families that manifest interest in establishing a partnership to carry out the management of non-timber forest products in the Project Area will receive training to acquire the required knowledge and skills to adopt good practices for extraction of forest resources to be exploited in a sustainable way. In addition, training will be provided for workers to take appropriate action in cases where illegal activities are identified in the area.

SDG 6 - ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

United Nation's Goals (UN): 6.6 Until 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes.

National goal (Brazil): 6.6 Until 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes, reducing the impacts of human action.

Application rationale in the project : As the main purpose of the Juruá REDD+ Project, the conservation of forest cover and containment of deforestation and forest degradation. An important activity in this project is the management of non-timber forest products, which, as a scope of the project's activities, provides the strengthening of this practice by providing subsidies to be developed in a sustainable way, ensuring the sustainable use of forest resources and, as a result, the protection of the forest cover. The maintenance of forests is essential for the provision of water ecosystem services and, consequently, water availability for all. The forests contribute to the hydrological cycle regulating process, by influencing some factors such as rainfall, availability and purification of water, protection of the soil, lakes, and waterways.

SDG 12 – ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

United Nations targets (UN): 12.2 Until 2030, achieve sustainable management and efficient use of natural resources.

12.8 Until 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature.

National goal (Brazil): 12.2 Target kept unchanged from the official global target text 12.2

12.8 Until 2030, ensure that people everywhere have relevant information and awareness about sustainable development and lifestyles in harmony with nature, in accordance with the National Environmental Education Program (PRONEA).

Application rationale in the project : The Project provides the responsible exploitation of forest resources, through the management of non-timber forest products in the Project Area, focusing on cat's claw (*Uncaria tomentosa*); comprising the implementation of partnerships with the surrounding communities to carry out the management, in order to enhance the activities of a sustainable forest-based economy in the Amazon, adding value to environmental assets from a conserved forest.

SDG 13 – TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

United Nations Goals (UN): 13.3 Improve education, increase awareness, and human and institutional capacity on global climate mitigation, adaptation, impact reduction, and early warning for climate change.

National goal (Brazil): 13.3 Improve education, increase awareness and human and institutional capacity on climate change, its risks, mitigation, adaptation, impacts, and early warning.

Application rationale in the project : The activities developed by the project are focused on sustainable practices, which contribute to the reduction of unplanned deforestation and forest degradation, and as a result, reducing greenhouse gas emissions. The Project has the potential to reduce 1,937,742 of $tCO2$ from GHG emissions in 20 years, preventing the deforestation of native forest. The property surveillance activity will be carried out through the presence of workers in the area, in an integrated manner with remote monitoring activities of deforestation, allowing a refinement of prevention measures and combating illegal activities and maintenance of the forest.

SDG 15 – PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS

United Nations Goals (UN): 15.1 Until 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and barren lands, in accordance with obligations under international agreements.

15.2 Until 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, and substantially increase afforestation and reforestation.

National goal (Brazil): 15.1.1br Until 2020, at least 30% of the Amazon will be conserved, by conservation unit systems as provided in the National System of Conservation Units Law (SNUC), and other categories of officially protected areas such as Permanent Preservation Areas (APPs), Legal Reserves (RLs) and indigenous lands with native vegetation, at least 30% of the Amazon, 17% of each of the other terrestrial biomes and 10% of marine and coastal areas, mainly areas of special importance for biodiversity and ecosystem services, ensuring and respecting the demarcation, regularization and effective and equitable management, in order to ensure interconnection, integration and ecological representation in larger terrestrial and marine landscapes.

15.2 Until 2030, zeroing the illegal deforestation in all Brazilian biomes, expanding the area of forests under sustainable environmental management and to recover 12 million hectares of degraded forests and other forms of native vegetation, in all biomes and preferably in Permanent Preservation Areas (APPs) and Legal Reserves (RLs) and, in areas of alternative land use, to expand by 1.4 million hectares the area of planted forests.

Application rationale in the project The main purpose of Juruá REDD+ Project is the conservation of forest cover and restraining deforestation and forest degradation. The Project is within and protects a region classified by the Ministry of the Environment (Administrative Rule no. 463, of 12/18/2018) as a Priority Area for Conservation, Sustainable Use, and Sharing of Benefits of Brazilian Biodiversity and serves as an ecological corridor for preserved areas in the region, protecting endangered fauna and flora species. The natural resource and socio-economic studies already carried out, as well as the supplementary studies to be carried out, required to meet CCB certification, and other technical studies to maintain VCS requirements, will also contribute to integrating ecosystem and biodiversity values into national and local planning, development processes, and poverty reduction and biodiversity conservation strategies.

1.17.2 Sustainable Development Contributions Activity Monitoring

The Project activities since its development stage and during the monitoring period are aligned with several SDGs, based on the assumption that interventions in one area contribute to the outcome of another.

The Project contributed to the purpose **(6) Water supply and sustainable management**, more specifically to the target **(6.6)**; the Project has protected the areas under management, thus contributing to the protection of the forest ecosystems that are part of the water-related ecosystems.

There was contribution with the purpose **(12) Responsible production and consumption**, goal **(12.2)**, through the cat's claw management activities carried out in the Project Area during the monitored period, in order to achieve an economic benefit through sustainable management without compromising the long-term availability and quality of the natural resource used.

The Project contributed to the purpose **(13) Action Against Global Climate Change,** ensuring the preservation of 102 hectares of a forest coverage preventing the emission of 43,594 tCO_2 and GHG emissions during the monitored period, reducing the vulnerability of ecosystems and communities to climate change.

At last, the activities performed during the monitored period included **the SDG (15) Sustainable use of natural resources**, through targets **(15.1)** and **(15.2),** through the conservation of 102 hectares of forest during the monitoring period that would have been deforested in a scenario if the project was not carried out, and through the development of non-timber forest product management activities in the Project Area, respectively.

Juruá REDD+ Project is committed to social and environmental sustainability, which can be evidenced through its quantifiable contributions to the SDGs, as described in Table 6, as follows.

Table 6. Sustainable Development Contributions

Line number	SDG goal	SDG indicator	Net impact for SDG indicator	Current contributions to the project	Contributions throughout the Project's life cycle
1)	6.6	Forest area under sustainable forest management as percentage of forest area	Activities implemented to increase	Through the management of non-timber forest products, 0.88 % (212/24032) of the forest area (Project Area) were under sustainable forest management	0.88% of the forest area (Project Area), a sustainable forest management was carried out
2)	12.2	Number of years approved for sustainable management of natural resources	Activities implemented to increase	In applying sustainable management practices, the management of non-timber forest products was implemented once, which was granted by a license to exploit these resources.	The management of non-timber forest products was carried out once
3)	13.0	Tons of greenhouse gas emissions avoided or removed	Activities implemented to increase	When preserving 102 ha of rain forest, the Juruá REDD+ Project prevented the release of 43,594 tCO2e to the atmosphere during the monitoring period.	Prevented the release of 43,594 tCO2e to the atmosphere

4)	15.1	Number of hectares of reduced forest loss in the project area measured in comparison to a without-project scenario	Activities implemented to increase	Juruá REDD+ Project has achieved conservation of the Project Area by avoiding deforestation of 102 ha of humid tropical rainforest.	Preserved 102 ha of rainforest that would have been deforested in a without-project scenario
5)	15.2	Forest area under sustainable forest management as percentage of forest area1	Activities implemented to increase	Through the management of non-timber forest products, 0.88 % (212/24032) of the forest area (Project Area) were under sustainable forest management	0.88% of the forest area (Project Area), a sustainable forest management was carried out

1.18 Additional Information Relevant to the Project

Leakage Management

One of the Project's main goals is to avoid unplanned deforestation, therefore, achieving reductions in greenhouse gas emissions. Through the activities listed in section 1.11, as monitoring deforestation by satellite images, it may achieve the expected goal. Among the activities proposed by the Project, two of them will contribute as management measures to the leakage: "strengthening the management of non-timber forest products" and "updating and supplementary studies".

The activity of strengthening the management of non-timber forest products seeks to identify improvements and other opportunities to be developed in order to strengthen the practice in the region. Through the valuation of the standing forest it is expected to influence new dynamics and sustainable productive models for the region, providing a positive model of a forest-based and sustainable economy in the Amazon. Furthermore, within the potential lines mapped by the Project, training is planned to be provided for rural communities involved in the management of non-timber forest products in the Project Area. Therefore, they will receive training to acquire the required knowledge and skills to adopt good practices for extraction of forest resources to be exploited in a sustainable way, with potential repeatability on their properties.

The updating activities and supplementary studies are related to the Project's plans to promote a closer relationship with local rural communities and other stakeholders which have synergies for carrying out the Project's activities. The inclusion of this activity in the project was based on conversations held with the stakeholders, in which a potential for carrying out activities with them was identified, starting with improvements in family farming with technical assistance, as well as the strengthening of sustainable practices, and which, by the way, are expressed as interests of the community. This involvement with these stakeholders will be carried out through procedures and guidelines by CCB (Climate, Community and Biodiversity) certification, as explained in the section 1.11.

The follow-up of activities carried out for leakage management will be monitored as indicated in section 5.3, and reported in all the Project's verification events.

Commercially Sensitive Information

Some information required by the VCS standard is considered confidential or commercially sensitive and cannot be publicly disclosed by the Project proponents. This information was fully provided to the audit team during the validation process attached to this document but was not included in the public version. Below is a list of provided information:

- Land documents and legal status;
- Financial statements of the proponents;
- Project's financial performance spreadsheet (budget) and other related documents;
- Agreements and contracts signed between the related parties;

- Inventories and other diagnostics.

Further Information

No more information to disclose.

2 SAFEGUARDS

2.1 No Net Harm

Environmental aspect

Although the purpose of the Project's actions is to promote positive impacts, conservatively evaluated, the management of non-timber forest products is an activity that could cause some negative impact, but with low probability.

In the New Forest Code (Law 12.651 dated May 2012), the practice of managing non-timber forest products is provided for as an eventual activity or one of low environmental impact, as long as it does not de-characterize the native vegetation cover or harm the area's ecosystem function. Also, the normative does not provide authorization or licensing by relevant environmental agency, and the collection of non-timber forest products such as lianas, fruits, leaves and seeds is free, provided that the maturation periods of the fruits and seeds and volumes set in specific regulations are respected, if any, as well as the use of techniques that do not endanger the survival of individuals and the managed species (BRASIL, 2012).

Even if there is little probability, mitigating measures are already applied to mitigate possible negative impacts in the management of non-timber forest products, and one of them is the existence of a management plan, given a past context in which this plan was not required of the owner because he already had the operating license for exploitation in hand. Even in a favorable situation, the owner sought to develop a management plan for the cat's claw in order to promote the sustainable management of the non-timber forest product and thus minimize all possible risks.

As presented in the cat's claw management plan, whose elaboration occurred in 2019, a characterization was made as to the type of appropriate exploitation to be carried out within the property. It is recommended that the exploration be done manually, cutting the liana at a height of no less than 100cm from the ground, reducing the effort of the operator to make the cut, besides favoring the regrowth of the mother plant. According to Machado (2008), developer of the manual with suggestions for management in the Amazon, this guideline is characterized as a low-impact technique, allowing to preserve the life of liana.

Furthermore, as explained in section 1.11, the "strengthening of non-timber forest products management" activity itself will seek to identify development opportunities that would improve the current management method, contributing to positive impacts such as the mitigation of eventual risks and damage to the forest and its natural resources. Another relevant activity for mitigation consists in the "implementation, monitoring and assessment of carried out activities" in the Project, which will seek to follow the status and execution of the Project's activities, as well as its results through the strategies defined in the monitoring plan, as shown in section 1.11. Through this follow-up it will be possible to identify deviations that may lead to some negative impact, allowing the Project to react quickly to respond to these unforeseen changes.

Socio-economic aspect

The Project activities do not cause any negative impact on stakeholders. Since the beginning of the Project's conception, contacts were made with stakeholders, as shown in section 2.2, in order to present the Project's activities and expected impacts, allowing the alignment of expectations and to obtain recommendations and suggestions to the Project. Through the communication channels, the Project will seek to continue this process of exchange between the proponents and stakeholders. Furthermore, as presented in section 1.1, the Project will seek to implement and consolidate a communication plan that will have guidelines on required steps to be taken in cases where suggestions and complaints are received from stakeholders.

2.2 Local Stakeholder Consultation

Communication

The communication of Juruá REDD+ Project with stakeholders will be done through three main means: verbal, written and face-to-face. The main objective is to ensure that there are different opportunities for exchange between stakeholders and proponents for discussion and participation throughout the project development.

Virtual communication: the project design document and/or links to access it, as well as relevant stakeholder information, monitoring reports, and other relevant documents, will be available through virtual media on websites of Biofílica Ambipar Environment and Verra. News and updates about the Project will also be posted on social media (LinkedIn and Instagram).

Written communication: a printed version of the Project design document summary will be provided at Seringal Valparaíso property's headquarters for consultation to all stakeholders, as well as monitoring reports.

On-site and verbal communication: Project information, news, and updates will be provided through meetings, events, and other face-to-face meetings.

Through these communication channels, the Project will be communicated about its development and implementation, including the results of monitoring and the VCS Program validation and verification processes, therefore, providing all documents and information related to the Project.

Stakeholder Consultations

Six stakeholder meetings were held in order to:

i) Ensure that they were informed and aware about the Project and its goals;

ii) Provide opportunities for them to discuss and participate in the Project validation process; and

iii) Identify potential themes to be worked on with the local rural communities.

The meetings were held on November 25, 28 and 29, 2021, in Cruzeiro do Sul city, at the headquarters of the visited institutions, as listed below, and with the surrounding community, at Municipal School of Basic Education Maria José Bezerra Fontes. The Project activities and expected impacts were presented, allowing the alignment of expectations and obtaining recommendations and suggestions to the Project.

Day 11/25/2021:

1. Project Owner-Proponent;

2. Proponent Company's Technicians;

Day 11/28/2021:

3. Local community, residents in the surrounding area of Seringal Valparaíso;

Day 11/29/2021:

4. National Indian Foundation (FUNAI-CZS);

5. Brazilian Micro and Small Business Support Service (SEBRAE-CZS);

6. State Secretariat of Production and Agribusiness (SEPA) and Acre's Technical Assistance and Rural Extension Company (EMATER-AC).

The meetings were documented in photographic record (Figure 6) and by an attendance list with the participants' signatures.

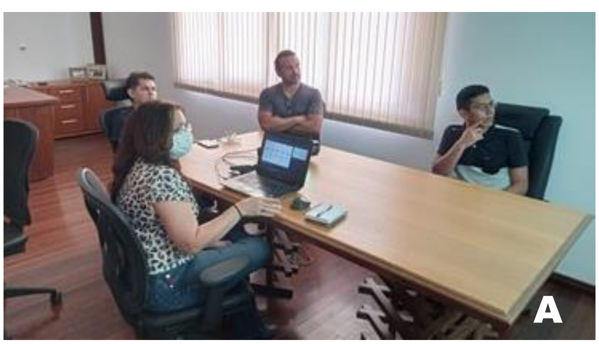

Figure 6. Stakeholder meeting. A) Project's owner-proponent On 11/25/2021 at the headquarters of AMAZÔNIA AGROINDUSTRIA EIRELI company. B) Meeting/training with a technician from the Company proposing the Project. On 11/25/2021 at the headquarters of AMAZÔNIA AGROINDUSTRIA EIRELI company. C) Meeting with the local community, residents of the surroundings of Seringal Valparaíso. On 11/28/2021 at Municipal School of Basic Education Maria José Bezerra Fontes. D) Meeting with technician from National Indian Foundation (FUNAI) and Indigenous Land (TI) leadership Arara do Igarapé Humaitá. On 11/29/2021 at FUNAI office. E) Meeting with regional manager of the Brazilian Micro and Small Business Support Service (SEBRAE-CZS). On 11/29/2021 at SEBRAE headquarters. F) Meeting with technicians from State Secretariat of Production and Agribusiness (SEPA) and Technical Support and Rural Extension Company-Acre (EMATER-AC). On 11/29/2021 at SEPA headquarters.

Among the main contributions provided at the meetings, one of the most prominent is the possibility of working together with communities living around the Project Area, whose subsistence is based on family farming and exploitation of products collected by extractivism. Therefore, during the conversations, the potential for developing activities with these stakeholders was identified, to promote improvements in family farming through technical assistance, as well as strengthening sustainable practices, both by the opportunity for development and the interest expressed by the community. Thus, the project design incorporated a future closer relationship with these stakeholders in order to contribute to the improvement of socio-economic conditions and the practices applied, consequently promoting forest conservation. This involvement with these stakeholders and others that may be deemed appropriate by the project will be conducted through the procedures and guidelines of CCB (Climate, Community and Biodiversity) certification, as explained in the section 1.11.

2.3 Environmental Impact

The impacts to the environment are related to restrain deforestation and, consequently, the reduction of emissions in the long term, along with forest preservation and by spreading sustainable practices, ensuring the valuation of the maintenance of the forest cover.

Project initiatives such as REDD+ are one of the few alternatives for preserving the biome and the biodiversity associated with it (PAVAN; CENAMO, 2012). Therefore, measures to reduce the deforestation rate are urgent (LAURANCE; VASCONCELOS, 2009), and regional systems of protected areas are fundamental to neutralize and buffer impacts in the Amazon region.

The advance of deforestation causes a structural and functional connectivity loss between forest remnants, which reduces the gene flow between populations, affecting the movement of fauna and dispersal of propagules. According to Silva et al. (2005), connectivity among fragments constitutes a large and resilient conservation system to mitigate future global changes, realize significant improvement in the living standards of local populations, and provide global communities with ecological services.

Therefore, the permanence of natural environments in the Project Area is of extreme importance for conservation, because besides promoting the conservation of biodiversity, it ensures the maintenance of ecosystem services such as pest and disease control, pollination, water quality, climate regulation and obtaining resources for traditional communities, as well as High Conservation Value Areas. (AAVC).

The implementation of the Project activities produce a direct and positive impact for biodiversity as the maintenance of vegetation cover and the conservation of biodiversity, acting directly against habitat loss and against the fragmentation of local vegetation cover. The Project expects to avoid 4,657 hectares of deforestation within the Project Area in 20 years.

The valuation of the maintenance of forest cover is another positive impact expected by the Project by spreading sustainable practices due to the activity of strengthening the management of non-timber forest products. The management, if well conducted, becomes a great ally for the conservation of natural resources and the recovery of ecosystem conditions (Shackleton et al., 2011; MAPA, 2019). In this sense, the management of non-timber forest products is intended to produce a proper method due to the maximum use of the forest's regenerative capacity, for the conservation of carbon stocks and the forest's ecological attributes managed in the long term.

According to Machado (2008), management is important because:

- It promotes the maintenance of the "standing" forest with few changes, because it does not involve the death of its components, as well as its ecological functions;
- It is a good development alternative with bases that are truly sustainable, bringing a counterpoint to the model of expansion of the agricultural frontier and other activities that emit greenhouse gases and, consequently, promote global warming;
- It values the forest and makes it profitable, showing that it is capable to generate monetary wealth;
- It values and ensures the continuity of cultural patterns of Amazonian people and communities;

- It generates quality and exotic products, and some of them with unique properties and good market acceptance;
- It is an opportunity to create more knowledge about the forest and its species, among other more important ones.

To a large extent, the negative impacts of this activity are unlikely, as pointed out in section 2.1, not leading to risks to the conservation of species. Even if in low probability, the Project will continue to implement the adopted mitigation measures, as well as seek to supplement them whenever opportunities for improvement are identified.

2.4 Public Comments

The potential impact of public consultation is directly related to the reach of the Project's communication channels with stakeholders. Therefore, to allow a better contribution from participation of different stakeholders in the evaluation of Juruá REDD+ Project, it will use its communication channels in advance of the public consultation period to disclose the process, inviting everyone to participate.

After receiving comments, the proponents will assess notes and include them in the Project design, if pertinent, as previously applied in the local consultations as shown in section 2.2.

2.5 AFOLU-Specific Safeguards

The Project does not impact local stakeholders. As explained in section 1.11, at first, the Project activities will focus on the Project Area and, therefore, will not involve any local rural community. However, given the interest expressed by these stakeholders in carrying out some activities that would have synergies with the Project, such as strengthening sustainable practices, the Project will seek to strengthen the relationship with these communities through the procedures and guidelines of CCB (Climate, Community and Biodiversity) certification. Therefore, in order to meet CCB certification, it will be necessary to complement the natural resources and socioeconomic studies, which will be the next actions to be developed within the Project planning.

Identification of local stakeholders

Juruá REDD+ Project is located at Seringal Valparaíso, in an area of 24,976.3199 hectares, in the Cruzeiro do Sul and Porto Walter municipalities, Acre State, Brazil. In its surroundings, there is a land mosaic of traditional and differentiated settlement projects, protected natural areas, areas without breakdown studies (land vacancy) and other private properties.

Considering a buffer of 20 km surrounding the Project Area (Figure 1), there are the Santa Luzia Directed Settlement Project (PAD), Jamil Jereissati Sustainable Development Project (PDS), Recanto Forest Settlement Project (PAF), Tracuá Settlement Project (PA) and Pedro Firmino Settlement Project PA; 2 private properties; Riozinho da Liberdade Extraction Reserve (Resex); and Arara do Igarapé Humaitá Indigenous Land (TI).

The settled families are partially assisted by the National Institute of Colonization and Agrarian Reform (INCRA) and the State Secretariat of Production and Agribusiness (SEPA) with regard to rural technical assistance; the indigenous people of TI Arara do Igarapé Humaitá belongs to a single Indigenous People, the Arara Shawãdawa, and are distributed in 9 villages, are represented by Shawãdawa do Igarapé Humaitá People Association (APSIH), founded in 1998, and institutionally, by the National Indian Foundation (FUNAI); the only family living in the RESEX Riozinho da Liberdade who is member of this polygon is represented by the Chico Mendes Institute for Biodiversity Conservation (ICMBio); the rest of the families are in land vacancy, and therefore, without institutional representation, as are the 2 private properties. The families living in the land voids are not organized, either in associations, cooperatives or any other type of grassroots organization.

Meetings were held with representatives of the federal, state and local governments, and representatives of the communities affected by the Project. The communities living around the Project Area are organized into associations or other types of grassroots organizations that represent them. In this sense, although the communities were not consulted directly, the consultations at the institution level confirm the meetings held.

Considering the representation of these communities, concerning to federal and state public agencies, responsible for the promotion, development, and protection of the communities that reside in the land categories of their competencies, the families settled by the State Secretariat of Production and Agribusiness (SEPA), and the indigenous people at TI with the President of APSIH and the National Indian Foundation (FUNAI-CZS). In addition, a direct consultation was carried out with residents at “James’ (Figure 7) “branch” with representatives of 18 families.

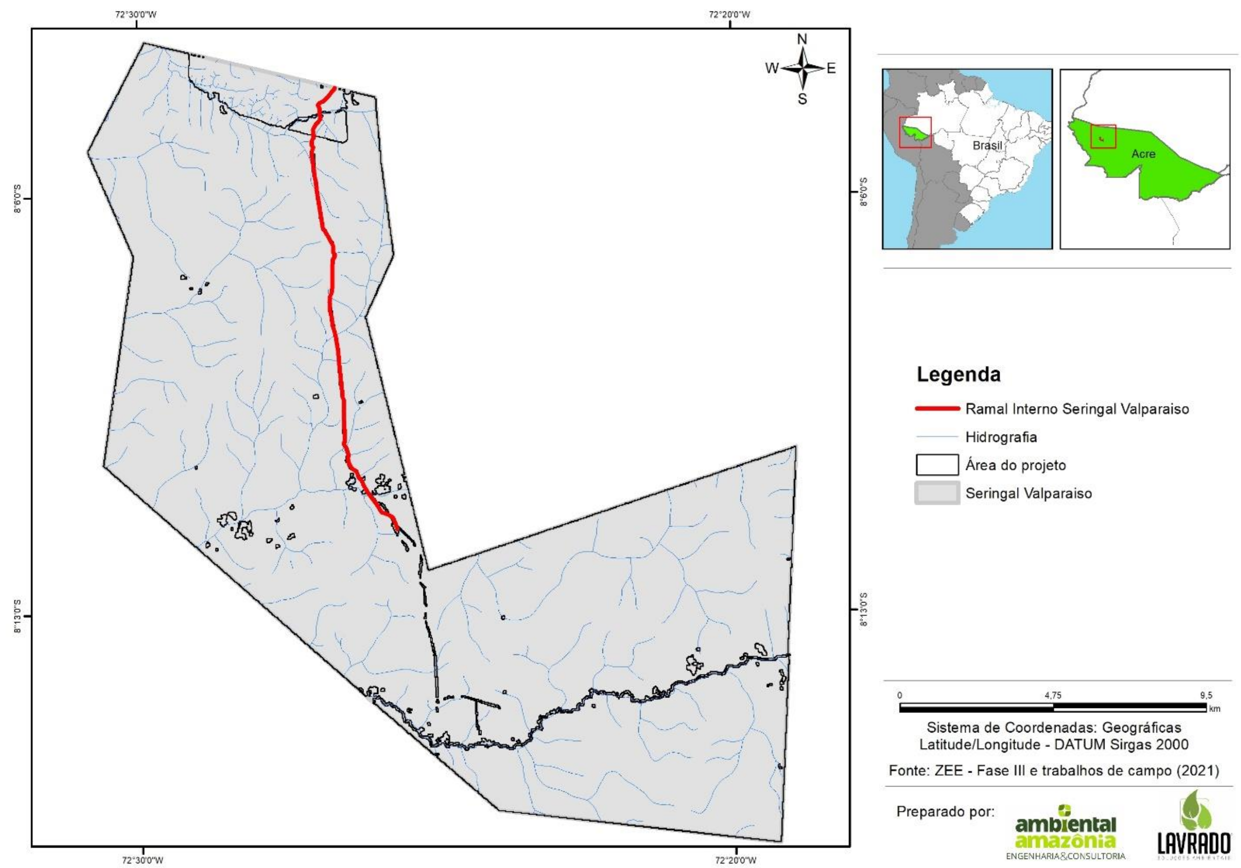

Figure 7. Location map of the "James Branch".

Figure 8. Photos of "James' Branch

Also, during the consultation with the interested parties, there was mutual interest in participating in the potential activities of the project, referring to the social and environmental scopes, especially related to communities that practice family farming as a basis for subsistence and the exploitation of products from extractivism (section 2.2). Therefore, the Project provides, through CCB standard guidelines, a closer relationship with stakeholders, also proposing to update the socioeconomic and environmental studies (section 1.11).

Respect for the resources of local stakeholders

The activities of Juruá REDD+ Project are developed according to the use and ownership rights of Amazônia Agroindústria as described in section 1.7. The Project provides the execution of activities only within the boundaries of the property belonging to Amazônia Agroindústria, i.e., no activities will be carried out in other areas such as private properties, areas belonging to indigenous communities and traditional communities or other public areas. Furthermore, it is important to highlight that there are no indigenous people or traditional communities in the Project Area, only around the Fazenda Seringal Valparaíso, and they do not depend directly on the area for their subsistence or for any other activity.

As described in section 1.7, in 2014, the land regularization process was started, in which it was agreed with INCRA to give up part of the area initially bought by the owner. The process was successfully concluded, resulting in the registration of the property with INCRA after the area georeferencing works. Regarding to the donated area, this was later incorporated into the Federal Government property, directly benefiting indigenous people and settlers in the region, avoiding possible conflicts with these local communities living around the Project Area.

Risks to local stakeholders

The risk assessment was carried out by applying a tool approved by VCS "AFOLU Non-Permanence Risk Tool, v. 4.0". The result of the risk tool was presented as an attachment to the PDD and will be reported through the Risk Report and the Risk Calculation Tool. In the assessment, the project risk resulted in 10%.

Regarding to the failure to reach the consultation with at least 20% of the residents within 20 km of the Project boundaries, as presented in the risk report, the proponents will seek a closer relationship with the stakeholders in order to reach the percentage required by the tool VCS “AFOLU Non-Permanence Risk Tool, v4.0”, in line with the studies to be carried out for CCB standard, targeted by the project for future incorporation.

In addition, other risks to the project benefits have been identified, as well as their respective mitigating measures. These risks are listed below:

Risk: Non-timber forest product management activities have a low risk of negative impacts.

Mitigation: The Project will maintain the mitigation measures already in place to mitigate potential negative impacts (section 2.1), as well as seeking to identify development opportunities that would bring improvements to the current management method, contributing to positive impacts such as mitigation of possible risks and damage to the forest and its natural resources. Therefore, it is intended to promote the development of a forest-based economy, in a sustainable way, increasing the value of natural resources from a conserved forest (section 1.11).

Another relevant activity for mitigation consists in the "implementation, monitoring and assessment of carried out activities" in the Project, which will seek to follow the status and execution of the Project's activities, as well as its results through the strategies defined in the monitoring plan, as shown in section 1.11. Through this follow-up it will be possible to identify deviations that may lead to some negative impact, allowing the Project to react quickly to respond to these unforeseen changes.

Communication and consultation

As presented in section 2.2, the Project will use three main means of communication (verbal, written, and face-to-face) with stakeholders in order to promote opportunities for discussion and participation throughout the Project development, as well as to ensure that its development and implementation, including the results of monitoring and the VCS Program validation and verification processes, are communicated to all stakeholders, including access to all documents and information concerning to the Project.

Furthermore, in order to achieve a good communication quality and exchange process between the interested parties and the Project, the Project will seek to implement and consolidate a communication plan including guidelines on communication channels available and on required steps to be taken in cases where suggestions and complaints are received from interested parties, as explained in section 1.11.

3 APPLICATION OF METHODOLOGY

3.1 Title and Methodology Reference

Approved methodology of Verified Carbon Standard (VCS) VM0015 – Methodology for Unplanned Avoided Deforestation, version 1.1.

3.2 Applicability of Methodology

The approved VCS VM0015 methodology is applicable for Juruá REDD+ Project because the applicability criteria are met, as specified in the table below (Table 7).

Table 7. Juruá REDD+ Project methodology applicability criteria and support

Applicability criteria	Description of how the project meets these criteria
a) Baseline activities may include planned and unplanned logging, fuelwood collection, charcoal production, farming and grazing activities, provided that the category is unplanned deforestation, according to the most recent version of VCS AFOLU Requirements.	Baseline activities include unplanned deforestation in accordance with the recent version of VCS AFOLU requirements as a result of agriculture and livestock activities.
b) Project activities may be included in a category or a combination of categories defined in the methodology's scope description.	The Project's activity is "Protection without cutting trees, using firewood or producing charcoal", in accordance with the description of methodology scope (details on page 11 of VM0015, Scope A of Table 1 and Figure 2).
c) The Project Area may include different types of forests, including but not limited to primary forests, degraded forests, secondary forests, planted forests, and agroforestry systems, complying with the definition of "forest".	Different forest types are found in the Project Area, mainly old growth forests that meet the Brazilian Designated National Agency's definition of "forest (SNIF, 2018), which is also used by PRODES Project of INPE - National Institute for Space Research, as it is a Brazilian governmental body, and also accepted by the VCS VM0015 methodology - APPENDIX 1. Section 1.13 presents a description of existing forest typologies.
d) At the start of the Project, the Project Area shall include only areas qualified as "forest" for at least 10 years prior to the Project start date.	Only areas qualified as "forest" for at least 10 years prior to the Project start date have been included in the Project Area.
e) The Project Area may include floodplain areas (such as lowland forests, floodplain forests, mangroves), provided that they do not grow on peat. Peat should be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm. If the Project Area comprises peat swamp forests (e.g. peat swamp forests), this methodology is not applicable.	The forest types found in the Project Area do not include peatlands.

3.3 Project Boundary

Step 1 of VM0015 – Definition of Boundaries

Spacial Limits (1.1 VM0015)

Reference Region

The Reference Region of Juruá REDD+ Project comprises an area of 631,841 hectares (500,051 hectares of forest in August 2020) and presents a historical deforestation rate (from 2010 to 2020) of 2,453 hectares per year (0.49% a year in the Reference Region converted into another uses on yearly basis).

To define the spatial limits of the Reference Region, the characteristics of the natural resources (soils, relief, hydrographic network and the limits of hydrographic basins) and the main drivers of deforestation were considered. The definition of the Reference Region limit follows the guidelines described in the methodology approved by VCS version VM0015 1.1, as well as dimensions suggested by Brown et al. (2007)[1].

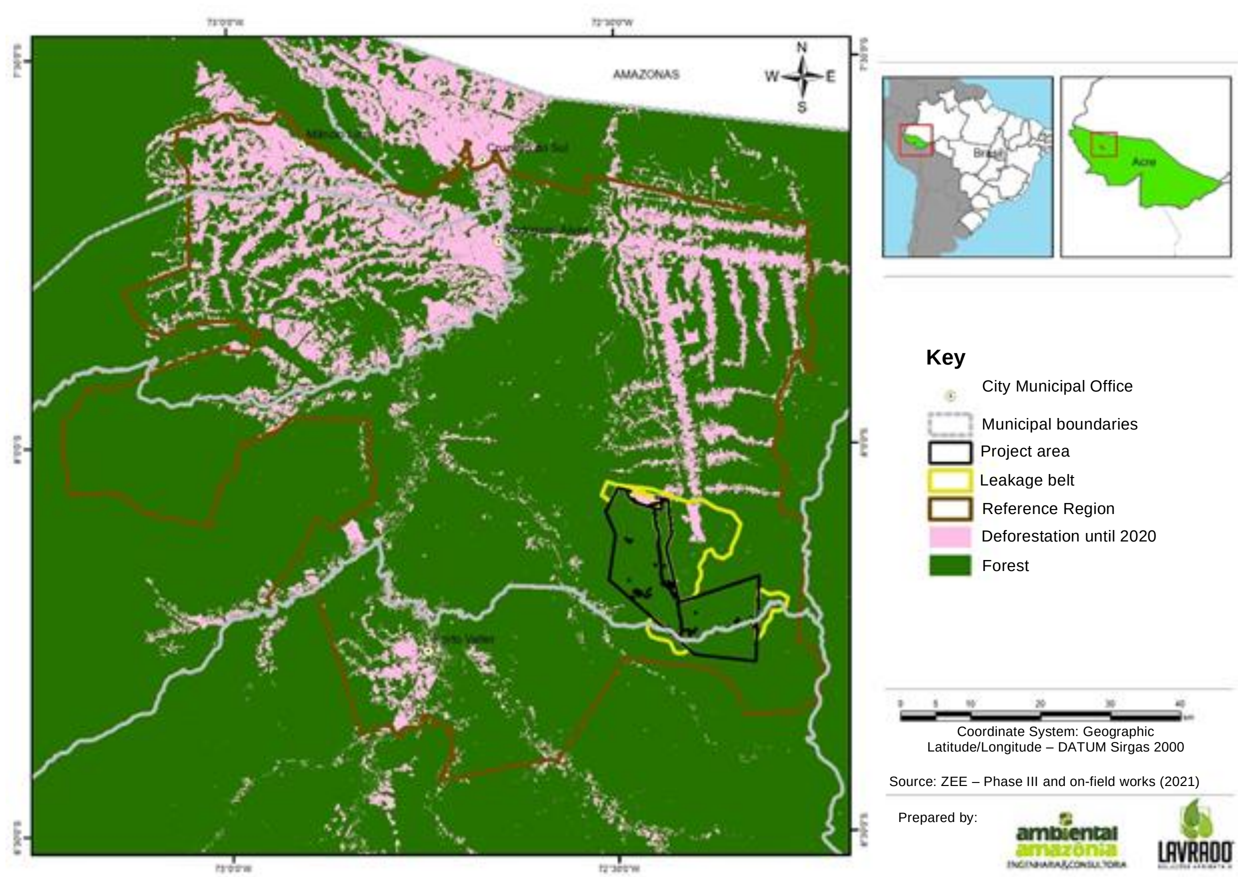

Figure 9. Location of the Reference Region, Project Area, Leakage Management Area and Leakage Belt of Juruá REDD+ Project.

The Reference Region follows at a higher deforestation rate than occurs in Acre (annual average of 0.22%). When analyzed by land tenure category, settlements account for 38% of Acre's forest clearing in recent years. The private lands, mapped by the State when drawing up the Economic-Ecological Zoning (Acre, 2007), registered in the CAR and belonging to the official base of INCRA and the Legal Land Program, represent the second land category with the greatest contribution to deforestation (33%). Areas without registration information ("land voids"), public or private, have accumulated about 15% of the total, followed by Conservation Units (11%), not-assigned public lands (2.5%), and Indigenous Lands (0.5%) (Acre, 2018).

There is a mosaic of land units in the Reference Region, in descending order of occurrence: Settlement Projects (37.3%), Land Void (32.7%), Private Properties (17.1%), Federal Public Land (12.8%), Urban Areas (<1%), and Indigenous Land (<1%). The settlements contribute with 36.9% of the deforested area in the Reference Region and already have a conversion rate of 27.3% of their territory. In second place are the occupations of the land voids that contribute 34.5% of the total deforestation by 2020 of the Reference Region and have 29.0% of their territory altered. Federal Public Lands contribute 19.6% of the deforested area of the Reference Region and have a conversion rate of 42.2%. Private properties contribute 8.7% of the deforested area of the Reference Region until 2020 and have already converted 14.1% of their boundaries. Urban city areas (Porto Walter, Mâncio Lima e Rodrigues Alves) contribute less than 1% of the total deforestation in the Reference Region and already have 76.5% of their boundaries with exposed soil.

The characteristics of the Reference Region meet all the similarity requirements for the Project Area according to the approved VCS VM0015 methodology version 1.1 presenting the following characteristics:

a) **Deforestation agents and drives:**

Agents: deforestation agents are **family producers** who are located in settlements or occupying areas without land title regularization (legal reserve of large properties or margins of rivers and streams), with a greater diversity of use in open areas that also include pastures. The **medium and large producers** whose main activity is beef cattle raising with large extensions of pastures. And, as part of the mosaic of use and deforestation agents, there are **traditional populations** (extractivists and indigenous people) that have a low conversion rate and occupation based on small plantations.

Infrastructure drives: the main deforestation drives are the **roads** (BR 364 and secondary roads) and the **occupations on the margins of Juruá river and its tributaries.** Due to the completion of the BR 364 highway paving, the traffic flow has increased on the highway and, as a result, it influenced the land mosaic that presents different pressure intensity on the forest. All these drives were considered to define the baseline and deforestation dynamics for Juruá REDD+ Project, provided for the validation/verification body.

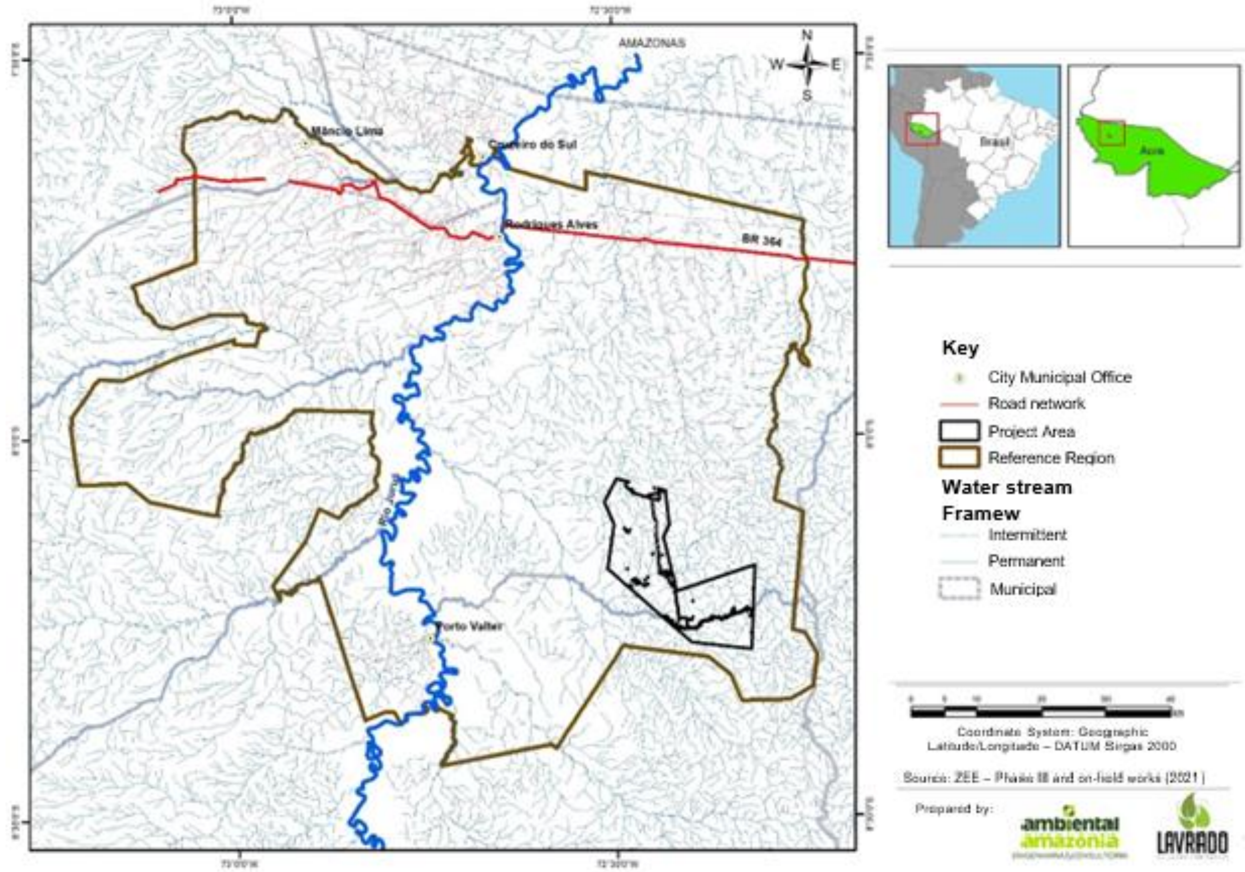

Figure 10. Location and distribution of deforestation drives in the Reference Region of Juruá REDD+ Project.

b) Landscape and ecological conditions:

Forest typologies: The dominant forest typology in the region is the Open Ombrophilous Forest with Palm. They occur in the Project Area and occupy 67% of the Reference Region.

Typology	Reference Region		Project Area	
	Area %	Cumulative Area %	Area %	Cumulative Area %
Open Ombrophilous Forest	67.1%	67.1%	100.0%	100.0%
Dense Ombrophilous Forest	32.9%	100.0%		

Source: Geographic data of forest cover from IBGE

Altitude: The average altitude in the Reference Region is 218 m above sea level, with variations from 151 to 291 m. The Project Area has an average altitude of 227 m and altitude range of 193 to 267 m, with more than 85% of the Reference Region under these conditions.

Slope: In the Project Area the slope varies from less than 3 to 20% across the entire territory and in the Reference Region these slope classes occupy more than 90% of the Reference Region.

Rainfall: In the Project Area, the average annual rainfall in the historical reference period was 2,022 to 2593 mm and in the Reference Region it is 1954 to 2614 mm, the two regions being in similar climatic conditions.

Table 8. Spatial landscape attributes and ecological conditions in the Reference Region of the Project Area.

Attribute	Reference Region	Project Area
Forest Typology		
Open forest with alluvial bamboo	Yes	No
Open forest with bamboo + Open forest with palm	Yes	No
Open forest with dominant bamboo	Yes	No
Open forest with alluvial palm	Yes	Yes
Open forest with alluvial palm + Open forest with bamboo	Yes	No
Open forest with palm + Open forest with bamboo	Yes	Yes
Open forest with palm + Open forest with bamboo + Dense forest	Yes	Yes
Open forest with palm + Dense forest	Yes	No
Open forest with palm + Dense forest + Open forest with bamboo	Yes	Yes
Dense forest + Open forest with palm tree	Yes	No
Altimetric amplitude (m)	151-291	193-267
Average slope (%)	6.8	6.5
Annual Rainfall (mm)	2,135	2,079

c) **Socio-economic and cultural conditions:**

Legal status: The land category of the Project Area is private property. The Reference Region is composed of a land mosaic of Settlement Projects (small and medium-sized owners), private properties (medium and large), Public tract of land and Indigenous Land, and other private properties (small, medium and large) with 32.7 % of the area still without land title regularization (land void).

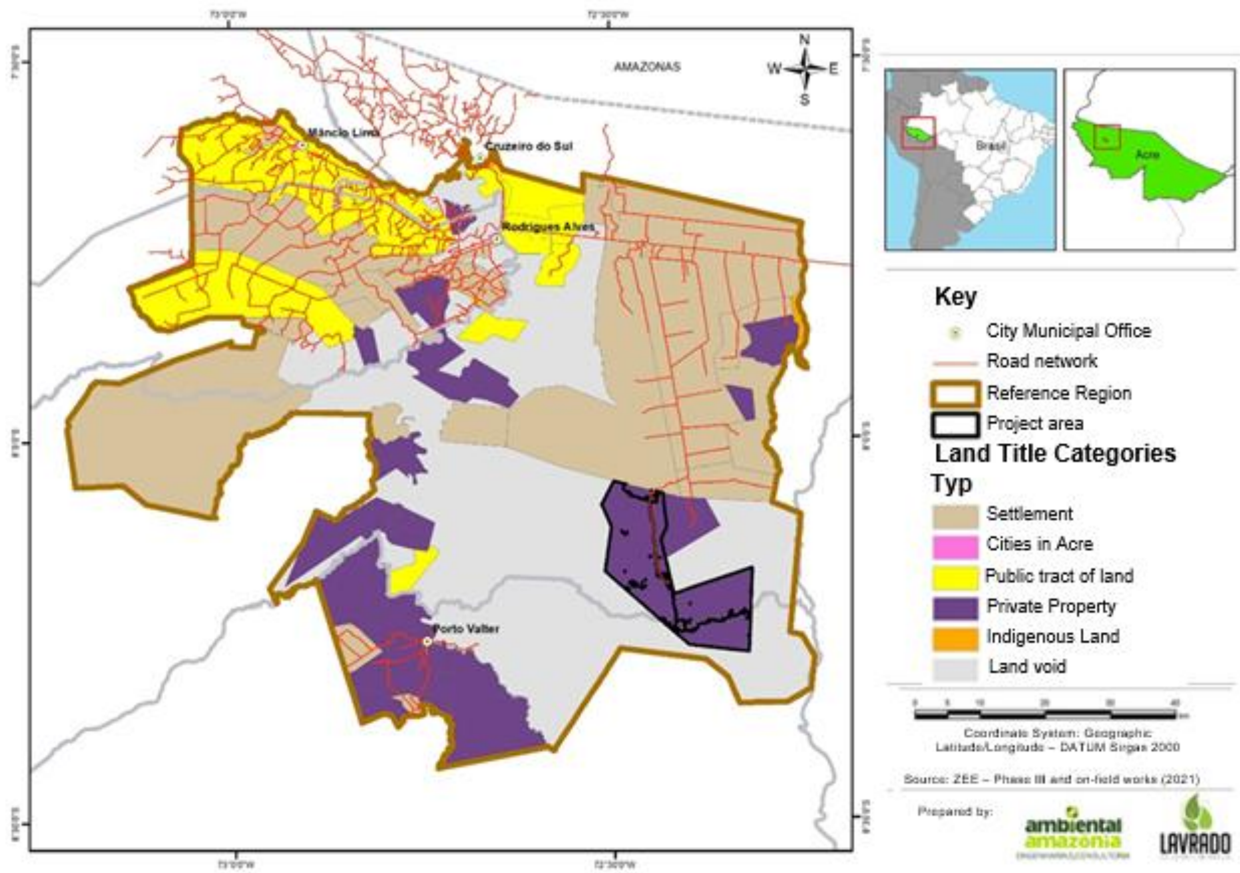

Figure 11. Juruá REDD+ Project Area Location in the Reference Region.

Land tenure: Land tenure in the Project Area (private title deeds) is found on other properties in the Reference Region, under which the same rules and regulation of ownership procedures, access and land use and its resources apply, since they are located in the same federative unit as the Project Area and in the Amazon biome.

Land use: the current and planned Project Area land use classes (forest and anthropogenic vegetation) are the same throughout the Reference Region.

Related Policies and legislation: the Project Area is under the same policies and legislations applicable to other areas in the Reference Region **Leakage Management Area**, because they all belong to the same federation (Brazil), and also because every Reference Region is located in the same federative unit as the Project Area (Cruzeiro do Sul and Porto Walter municipalities in Acre state).

Project Area

Juruá REDD+ Project relates to an area of 24,076 hectares, which is the forested area of Seringal Valparaíso, located mostly in the municipality of Cruzeiro do Sul. In this area, activities such as monitoring deforestation by satellite images, patrimonial vigilance, management of non-timber forest products, and so on, will be developed as described in the section 1.11. The boundaries of the Project Area were defined as follows:

- Name: Project Area;
- Physical limit: limit of the property's perimeter, excluding areas where there has been deforestation until 2020 (Figure 12);
- Description of land tenure and current tenure are presented in section 1.7;
- List of Project participants and brief description of their roles in the Project are presented in sections 1.5 and 1.6.

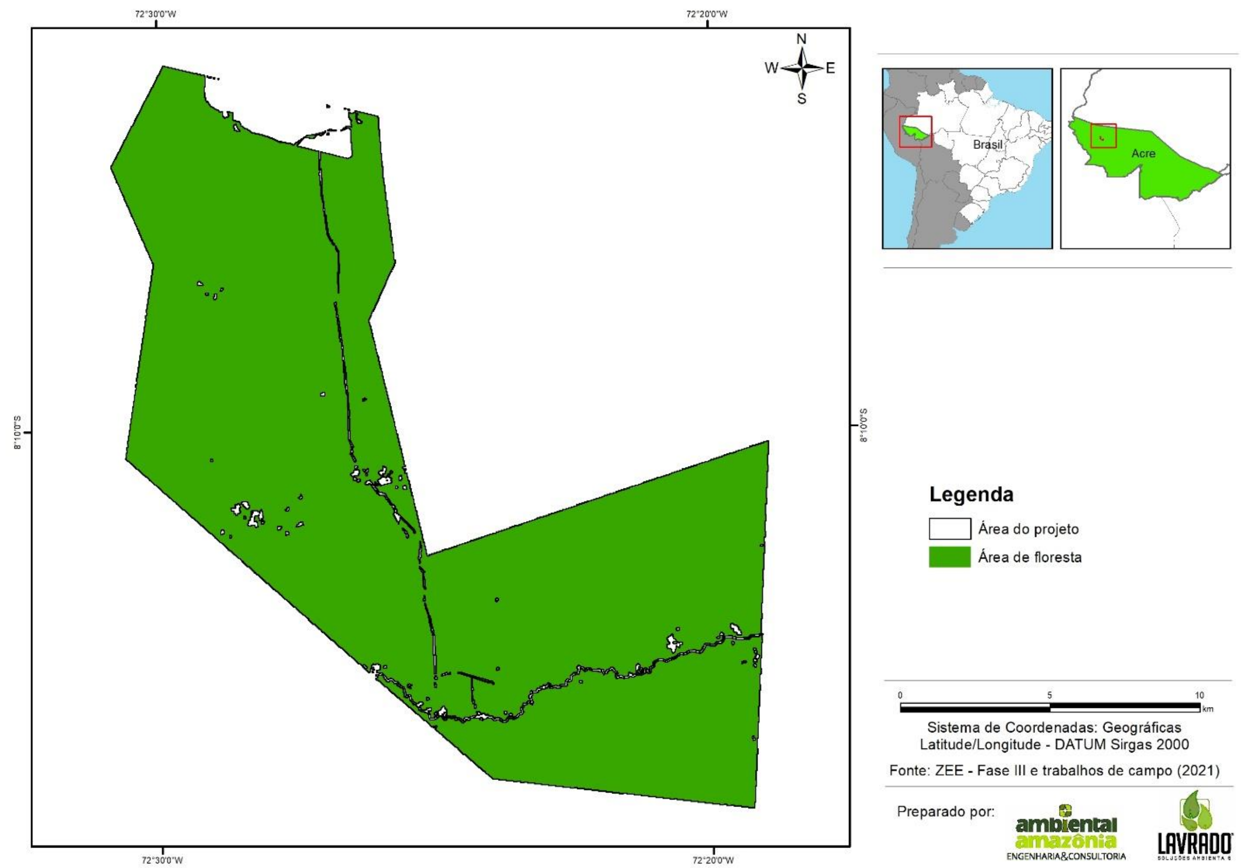

Figure 12. Physical boundary of the Project Area.

Leakage Belt

There are no data or studies available in the Reference Region presenting cost-effectiveness as an important driver of deforestation and occupation in the Reference Region has occurred from the branches and the hydrographic network. Therefore, the Leakage Belt was defined using the mobility approach (option II offered by the approved methodology VCS VM0015 version 1.1). A multi-criteria approach comprising deforestation risk map, with data from Project Area, road network and hydrographic network was used to define the spatial boundaries of the Leakage Belt. Based on this approach, the Leakage Belt was assumed to be located in regions at high risk of deforestation near the Project Area. The Leak Belt corresponds to an area of 12,710 hectares.

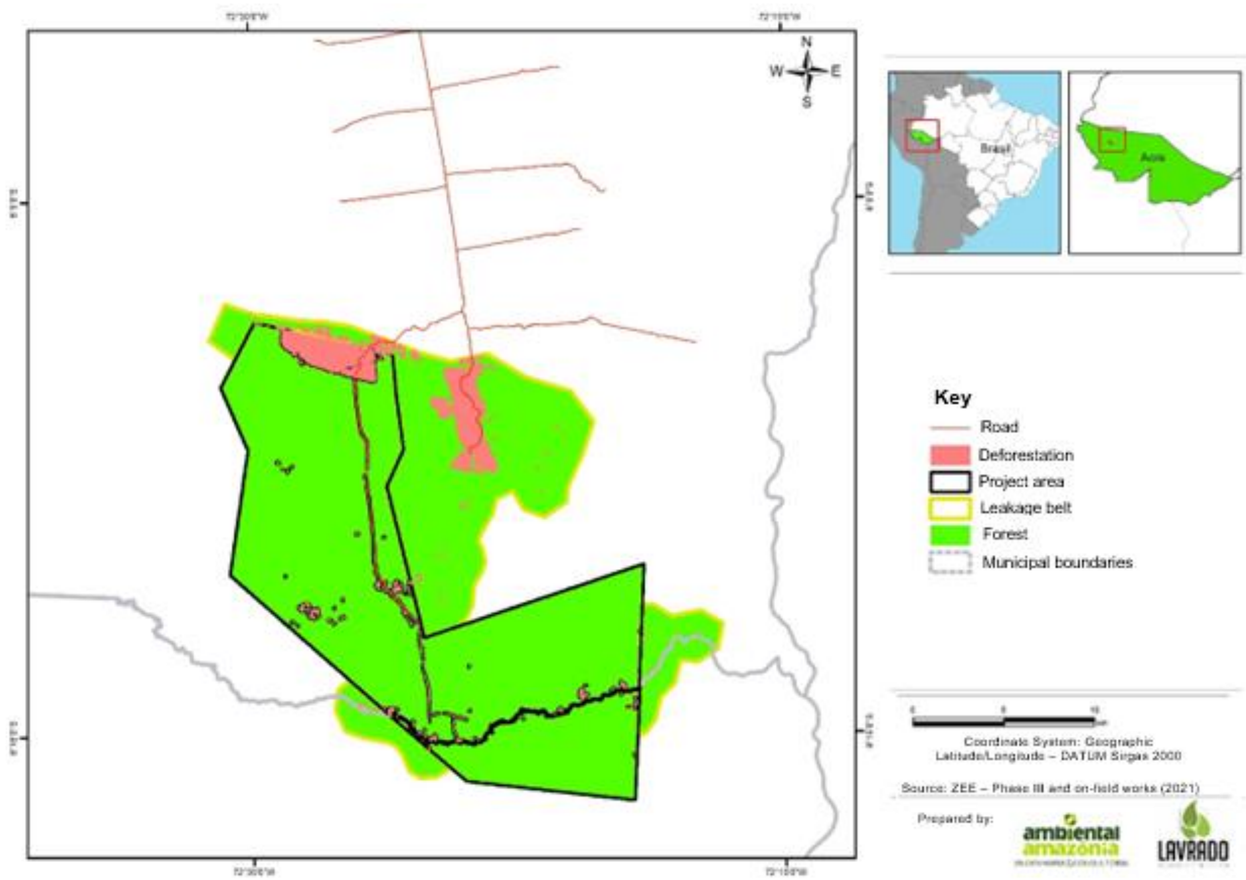

Figure 13. Leakage Belt in Juruá REDD+ Project, Cruzeiro do Sul and Porto Walter municipalities, Acre State.

Leakage Management Areas

The leakage management areas were defined considering the following criteria: areas that were cleared by 2020 within the Seringal Valparaiso property boundary.

The boundary of the Leakage Management Area covers 721 hectares, consisting of planned pasture and infrastructure areas. Land use prior to the Project consists of pasture and areas of secondary vegetation regeneration. The activities to be developed in these areas are described in section 1.18.

Forest

The definition of forest is in accordance with resolution number 2 of the Interministerial Commission on Global Climate Change (CIMGC). There are several definitions, created to meet specific goals. The Brazilian Forest Service uses this same definition, adopted by FAO (Food and Agriculture Organization of the United Nations), which takes into account aspects of land use and occupation, and the UNFCC (United Nations Framework Convention on Climate Change), which deals with forests concerning to climate change:

Forest - an area measuring more than 0.5 ha with trees greater than 5 m in height and canopy cover greater than 10%, or trees capable of achieving these parameters in situ. This does not include land that is predominantly under agricultural or urban use.

Regarding the production of the forest cover reference map (Figure 14), initially we evaluated two possible references to be used: the Forest Satellite Monitoring Project data (PRODES) of the National Institute for Space Research (INPE) and the data from the Central Geoprocessing Unit (UCEGEO) of the Acre State Technology Foundation - which was chosen by the Project. In order to have a model that better fits the dynamics of use in the Reference Region, due to its scale and the size of the Project Area, we chose to use the historical series (1988-2020) of the Central Geoprocessing Unit of the State of Acre that has a spatial resolution of 0.54 hectares, because it has a better resolution when compared to the Minimum Mapping Unit (MMU) in PRODES digital data corresponding to 1 hectare.

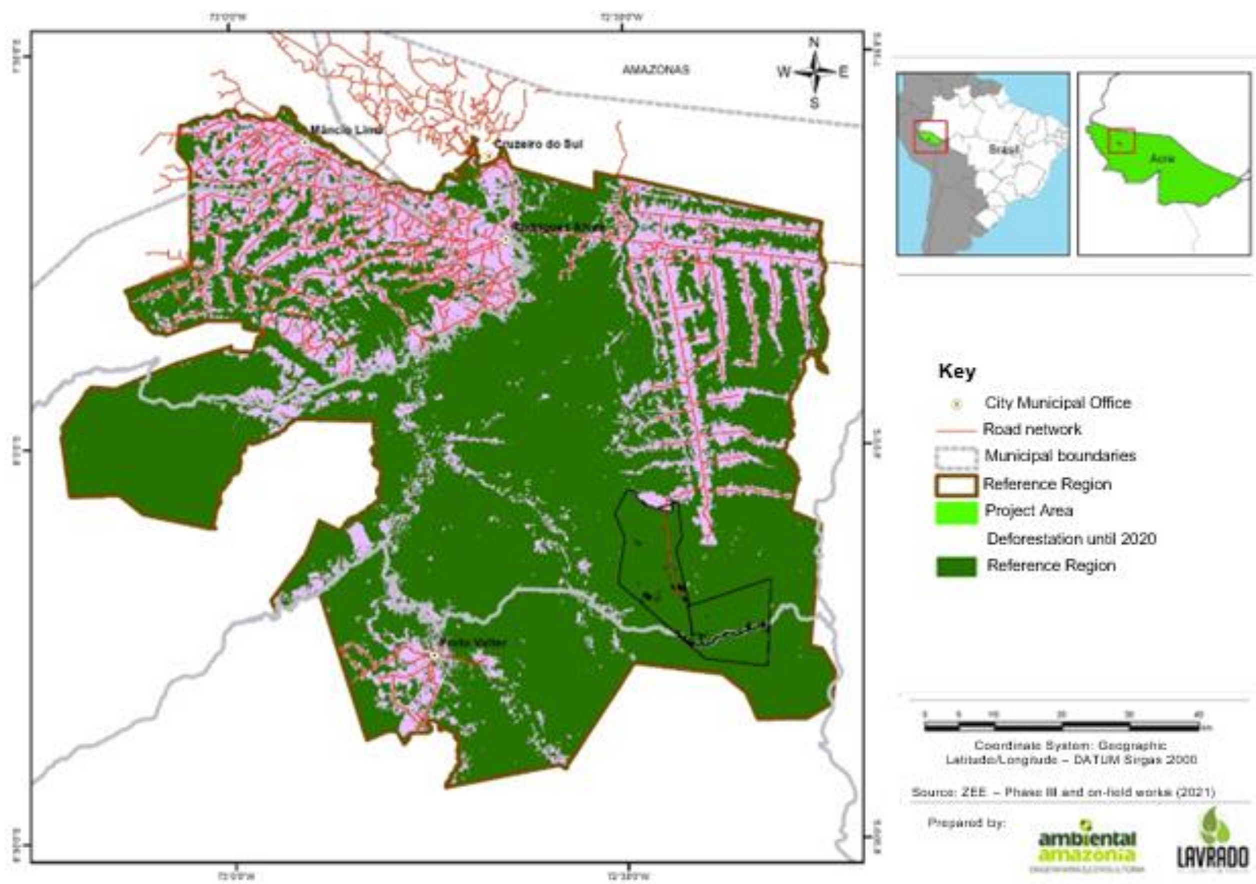

Figure 14. Reference map of forest cover until 2020 in the Reference Region of Juruá REDD+ Project.

Temporal Limits (1.2 VM0015).

Start date and end date of the historical reference period: historical reference period for Juruá REDD+ Project is limited to years 2010 to 2020 (Figure 15). These dates were set especially taking into account the availability of UCEGEO data used to generate land cover maps in accordance with the methodology (start date up to 10-15 years in the past and end date as close as possible to the Project start date).

AUD Project credit term start date: a Start date of credit term is 08/01/2020. Deforestation in the baseline scenario in this document was forecast until 2040.

Start date and end date of the first fixed period of the baseline: the fixed period of the baseline is 6 years as maintained in version 4.2 of VCS Standard. In the approved VM0015 methodology version 1.1, the baseline period is still stated as 10 years, the Project proponents understand that it will be updated according to the new limit defined by VCS Standard document version 4.2.

Monitoring period: The monitoring period of land use change and land use will start from the Project start date, complying with the requirement to be at least 1 year.

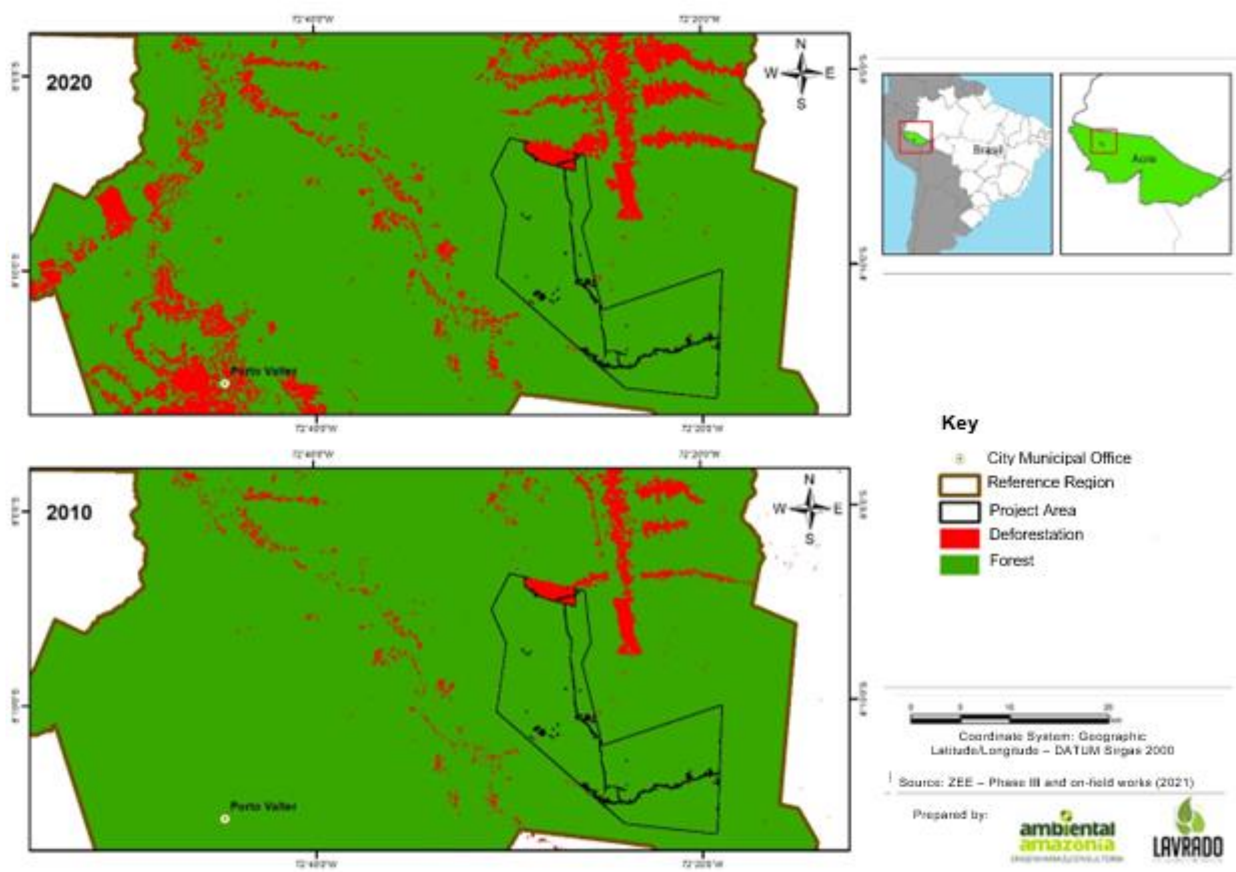

Figure 15. Maps of land use and land cover from 2010 to 2020.

Carbon Stocks and Sources of GHG Emission (1.3 and 1.4 VM0015)

The carbon stocks considered in the Project are presented in Table 9 and Table 10. Methodology details of forest carbon stocks estimation in the Project Area can be found in the inventory field sheets, the statistics report, the Forest Carbon Stock Estimation in the Project Area spreadsheet, and in section 4 of this document.

Table 9 - Carbon stocks included or excluded in the limit of Juruá REDD+ Project (Table 23 of VM0015 Methodology).

Carbon stocks	Included/excluded	Choice Rationale
Aboveground	Tree: included	The carbon stock change included in this compartment is always significant.
	Non-tree: included	Compartment included in the forest class used in the baseline scenario.
Underground	Included	Significant stock included representing 11.63% of the total carbon stock.
Dead Wood	Included	Significant stock included representing 10.65% of the total carbon stock.
Harvested wood products	Excluded	As wood products harvested in the baseline scenario is less than in the Project scenario.
Litter	Excluded	Recommended only when significant, in which case it is residual in the forest compartment as a whole.
Soil organic carbon	Excluded	Recommended when forests are converted to agricultural land. Not to be measured in conversions to pasture and perennial crops under the VCS Program.

Table 10. GHG sources, carbon sinks and stocks in the baseline scenario

Source		Gas	Included?	Rationale
Baseline	Biomass Burning	CO_2	Excluded	Accounted as carbon stock changes.
		CH_4	Excluded	According to VM0015 methodology, non-CO2 emissions can be conservatively omitted since, as demonstrated by scientific research, in the Amazon region the occurrence of natural fires is rare, what occurs is the predominance of anthropogenic fires related to human occupation (SCHROEDER et al, 2009). The project does not include or encourage these activities but promotes actions that mitigate actions of these deforestation agents by strengthening asset surveillance and monitoring deforested areas, so it is conservative to exclude these emissions.
		N_2O	Excluded	Considered negligible according to the VCS Program.

Source		Gas	Included?	Rationale
	Cattle Emission	CO_2	Excluded	Insignificant source.
		CH_4	Excluded	The project does not include livestock activities, so it is conservative to exclude such emissions once they are present in the baseline scenario.
		N_2O	Excluded	The project does not include livestock activities, so it is conservative to exclude such emissions once they are present in the baseline scenario.

3.4 Baseline Scenario

Step 2 of VM0015 - Analysis of Historical Land-Use and Land-Cover Change

Collection of appropriate data sources (2.1 VM0015).

Data from the deforestation classification in the state of Acre, performed by the Central Geoprocessing Unit-UCEGEO, with a temporal analysis of 23 years, from 1988 to 2020, available in shapefile and raster formats were used to map land use and land cover classes. UCEGEO used images from Landsat (Table 11) to map forest typologies, hydrography, and anthropic vegetation (deforestation). These images comprehend the historical reference period (2010 to 2020) and can be located through two Landsat scenes, with the following orbits/points: (i) 005/65; (ii) 005/66. The evaluation of the UCEGEO data classification was performed using medium resolution SENTINEL satellite images, complemented with high resolution Google Earth images for the same date (Figure 17).

Table 11. Satellite images used to identify and map land cover in the Reference Region of Juruá REDD+ Project (Table 5 of VM0015 Methodology).

Vector (satellite or aerial photography)	Sensor	Resolution		Coverage (km²)	Acquisition date (DD/MM/AA)	Identifier	
		Spacial (m)	Spectral			Orbit	Point
Satellite	Landsat	30	0.45-2.35 µm	34,225	07/28/2010	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	07/28/2010	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	09/15/2011	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	09/15/2011	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	08/05/2012	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	08/05/2012	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	08/12/2013	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	08/12/2013	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	07/08/2014	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	07/08/2014	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	10/05/2015	005	065

Satellite	Landsat	30	0.45-2.35 µm	34,225	10/05/2015	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	08/27/2016	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	08/27/2016	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	09/01/2017	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	09/01/2017	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	09/18/2018	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	09/18/2018	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	07/15/2019	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	07/15/2019	005	066
Satellite	Landsat	30	0.45-2.35 µm	34,225	08/10/2020	005	065
Satellite	Landsat	30	0.45-2.35 µm	34,225	08/10/2020	005	066
Satellite	Sentinel-2	10	0.48-0.71 µm	10,000	09/17/2020	18LYR	
Satellite	Sentinel-2	10	0.48-0.71 µm	10,000	09/17/2020	18MYS	

Definition of land use and land cover classes (2.2 VM0015)

The land cover classes used in this Project are represented in Table 12. The description of classes used in the Project and their area, within the Reference Region, at the beginning of the historical period (2010) are presented below:

- **Forest** (492,957 ha): area of remaining forest belonging to different open forest phytophysiognomies.
- **Anthropic vegetation in balance** (140,948 ha): an area with original forest vegetation, but which has been cleared by clear cutting (removal of all forest cover). These areas are converted to other land uses, different from forest areas (a mosaic of different vegetation types that includes pastures, plantations, and secondary vegetation, according to Fearnside, 1994);

Table 12. Land use and land cover classes existing in the Juruá REDD+ Project on the start date within the Reference Region (Table 6 of VM0015 Methodology).

Class		Carbon stock trend	Present in	Baseline activities			Description (Including criteria for unambiguous boundary definition)
ID_{cl}	Name			LG	FW	CP	
1	Forest	Constant	RR, LK, LM, PA	Yes	Yes	No	Remaining forest in the area
4	Anthropic vegetation	Constant	RR, LK, LM	Yes	Yes	No	Area deforested through clear cutting and with vegetation different from the Ombrophilous Forest

1. RR = Reference Region, LK = Leakage Belt, LM = Leakage Management Areas, PA = Project Area.

2. LG = Logging, FW = Wood Harvesting for Energy Generation, CP = Charcoal Production.

Definition of land use categories and change of land coverage (2.3. VM0015)

Transition of two land use categories was designed in this Project: the change from forest cover areas to anthropic vegetation in equilibrium areas (Table 13).

Table 13. Definition of land use and land cover change categories (Table 7b of VM0015 Methodology).

ID_{cl}	Name	Carbon stock trend	Present in	Baseline activity			Name	Carbon stock standard	Present in	Activities in the Project Area		
				LG	FW	CP				LG	FW	CP
I1/F1	Forest	Decreasing	PA	No	No	No	Anthropic vegetation	Constant	LM	Yes	Yes	No
I1/F1	Forest	Decreasing	LK	Yes	Yes	No	Anthropic vegetation	Constant	LM	Yes	Yes	No

1. RR = Reference Region, LK = Leakage Belt, LM = Leakage Management Areas, PA = Project Area.

2. LG = Logging, FW = Wood Harvesting for Energy Generation, CP = Charcoal Production.

Analysis of historical land use and land cover change (2.4 VM0015)

The main activities carried out by the Central Geoprocessing Unit in Acre State to monitor forests are presented below.

Pre-processing

The image preprocessing procedures performed by PRODES comprise the following steps (Acre, 2013):

In this stage, images from TM sensor of the Landsat satellite, from 1987 to 2020 were acquired for temporal dynamics analysis, through INPE and USGS websites, at the following addresses: http://www.dgi.inpe.br/CDSR/ e http://landsat.usgs.gov/, respectively. The images from 14 orbits/points that cover the State of Acre (Figure 16), where we sought to obtain the images with the least cloud coverage and with an acquisition date as close as possible to the reference date (August 1), to calculate the deforestation rate and its dynamics over 32 years.

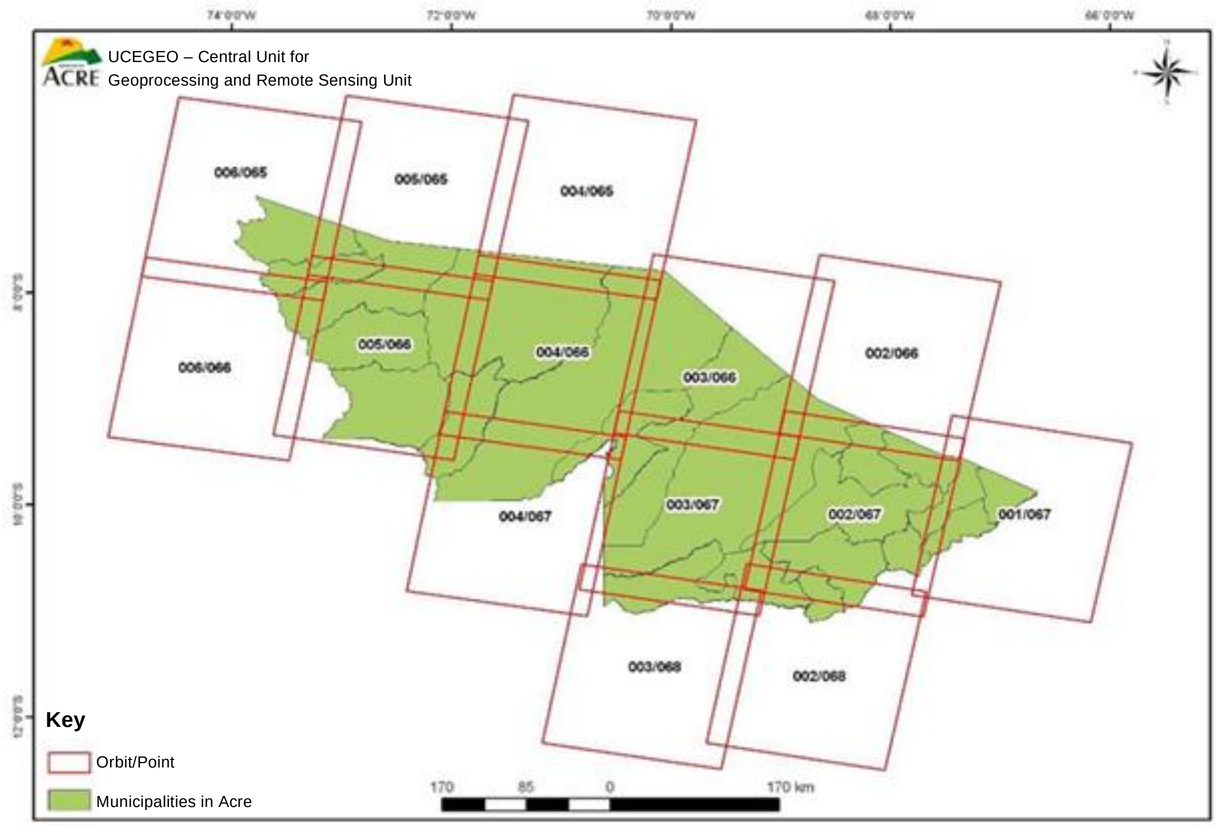

Figure 16. Landsat 5TM scenes (orbit/point) covering the State of Acre.

Interpretation and classification

The application of HAZE filter, algorithm developed by Carlotto (1999) was carried out to improve the visibility of features in fog and smoke effect images, implemented in the ENVI/IDL environment.

Image processing was performed to adjust enhancement, eliminate noise, and perform atmospheric interference correction. At first, the highlight adjustment was performed in the ENVI software application version 4.6, and finally, it was filtered for atmospheric correction, using the Haze filter.

For the geometric correction we used GeoCover 2000 images, available at website: https://zulu.ssc.nasa.gov/mrsid/. The images from this mosaic were provided as orthorectified and georeferenced images, with 30m resolution, compatible with the image resolution to be classified.

In this stage the images (orbit/point) covering the entire Acre territory were registered/georeferenced. It included the identification of base image coordinates (line and column) of several clearly identifiable points, called control points on the terrain, and matching their positions in the registered image.

So we first used the software ENVI + IDL 4.6 for grouping the bands, then we used ERDAS IMAGINE 9.1 software for registration/georeferencing, assuming a spot collection of not less than 20 and the resampling method adopted was the nearest neighbor with an error (RMS) of less than 1 pixel for Landsat image.

For image segmentation, it was necessary to group the bands in R(5), G(4) and B(3) channels generating color images to be saved in Geotiff format. The composition is linked to spectral responses to highlight the variety of objects/target in the images, a necessary procedure to start segmentation.

Image segmentation, performed in ENVI Zoom 4.6, comprises the following steps:

- Image file selection;
- Step 1: Object identification (Find Objects) using a scale level;
- Step 2: Merge close targets in cluster level;
- Step 3: Data entry using Program Default;
- Step 4: Band composition definition (shifts vegetation to the R - red channel: band 4).

These steps are related to the first phase of classification/segmentation. The next steps were related to choosing samples from samples segmented by coverage type, i.e. to use a supervised classification, where the training samples are defined for the classifier.

The chosen algorithm was SVW (Support Vector Machine) and Sigmoid Kernel type, and the choice of training sample categories (Deforestation, Forest, Water, Cloud and Shadow). When collecting training samples. Samples were distributed throughout the image, with representativeness in different forms presented by each category to be classified. The classification was performed with collected samples, and when it was not satisfactory, the previous steps could be repeated with new parameters and, when the classification was satisfactory, the next step was matrix editing.

Matrix editing consists in a visual inspection process and manual editing of the classified image, in order to correct small errors and confusions in the digital classification process. It also cleaned the deforestation class in polygons smaller than 0.54 hectares or 6 pixels, which set the minimum mappable area. When the edition was completed, the raster data was transformed into drives. Matrix edition was carried out in IDL (Interactive Data Language) application of ENVI software version 4.6.

Map Accuracy Assessment (2.5. VM0015)

UCEGEO mapping assessment was performed by comparing each of the most recent classes of land use and land cover map (2020) with a set of 88 spots randomly distributed over the Reference Region. The reference data used in this step comes from spots obtained by visual interpretation of SENTINEL Satellite, jointly with the high resolution spatial images available in Google Earth.

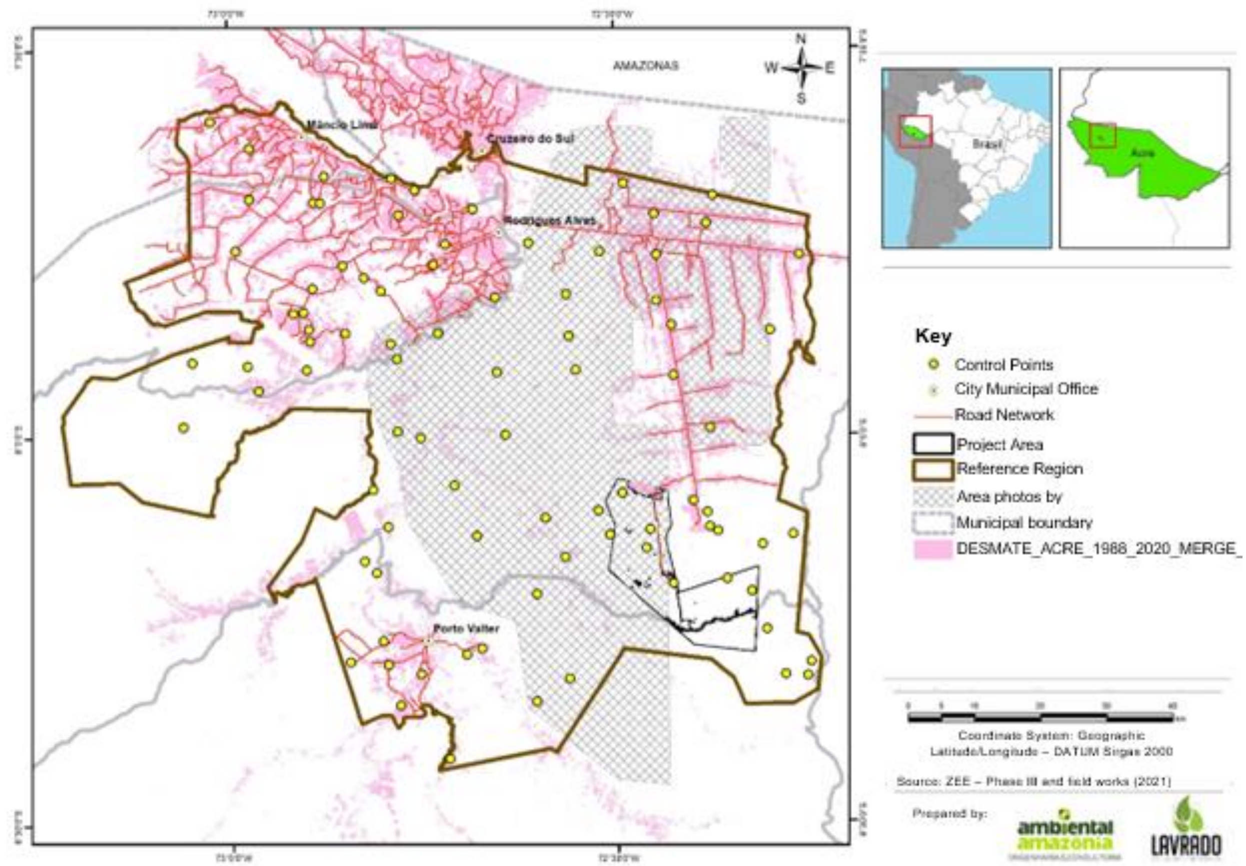

Figure 17. Distribution of reference spots used to assess the deforestation map accuracy.

Having the reference spots and the 2020 land use and land cover map, it was possible to assess the mapping performance by analyzing the confusion matrix (Table 14) according to Congalton (1999). The overall mapping accuracy for different land use classes presented values above 90%.

Table 14. Confusion matrix for data assessment from UCEGEO 2020.

		Reference			
Land use		Forest	Anthropic Vegetation	TOTAL	User Accuracy (%)
Classification	Forest	51	3	54	94
	Anthropic Vegetation	1	33	34	97
	TOTAL	52	36	88	
	Producer Accuracy (%)	98	92		**Overall accuracy: 95**

Results of historical land use and land cover change analysis

Using data obtained in previous steps, an analysis of historical change in forest cover between 2010 and 2020 in the Project Reference Region was carried out. The map subtraction analysis resulted in an area of approximately 24,535 hectares of deforested area (4.6% of the remaining forest cover in 2010) between 2010 and 2020. The Table 15 shows that changes have occurred between the forest and anthropic vegetation classes. The graph in Figura 18 presents cumulative deforestation between 2010 and 2020 in the Reference Region where it is possible to observe an upward trend in deforestation of approximately 0.46% per year.

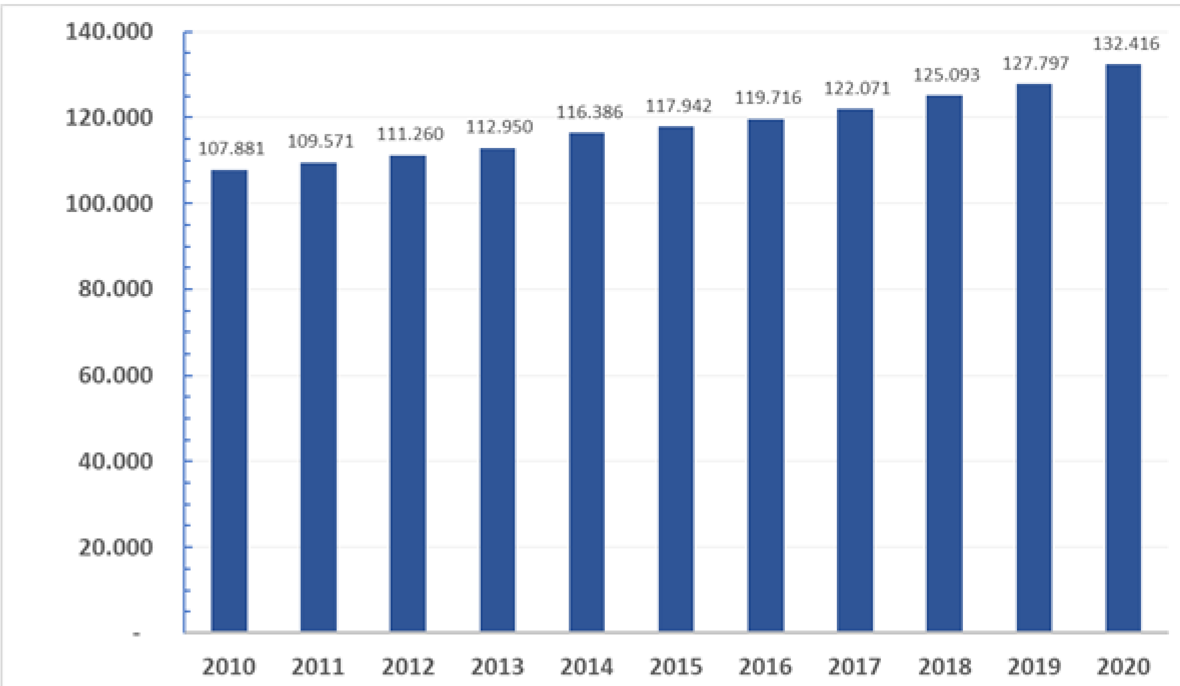

Figura 18. Accumulated deforestation in Reference Region between 2010 and 2020.

Table 15. Matrix of land use change in the Reference Region from 2010 to 2020. (Table 7a of VM0015 Methodology).

ID$_{cl}$		Name	Initial Class (2010)		Total (ha)
			Forest	Anthropic vegetation	
			I1	I2	
Final Class (2020)	F1	Forest	500,051	0	500,051
	F2	Anthropic vegetation	24,535	107,881	132,416
Total (ha)			524,736	107,912	524,586

CUMULATIVE DEFORESTATION (HA)

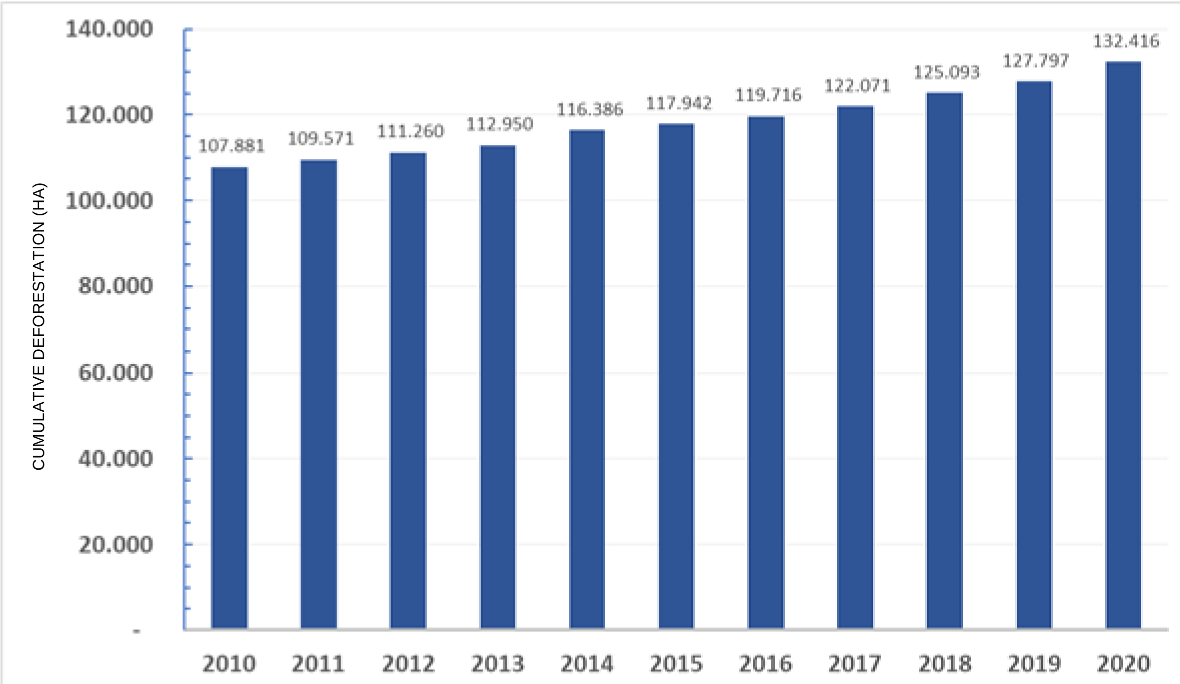

Figure 19. Cumulative deforestation in the Reference Region from 2010 to 2020.

Methodology attachment draw up for PDD (2.6 VM0015)

a. Data acquisition:

Satellite images from optical or radar sensors should be used. Optical images should be multispectral with spectral resolution between 0.45 and 2.35 m, and radar images should be acquired in the X (3 cm), C (5 cm) or L (23 cm) bands. For forest cover mapping and images with a spatial resolution of 30 meters or more should be used. The acquisition date should be during the lowest cloud and rainfall incidence in the region, between the months of August and November. For monitoring the forest cover in the Project Area and Leakage Belt, the satellite image should cover the area between the following coordinates: 72º50'00" W, 8º30'0" S and 71º50'00" W, 7º40'00" S. Monitoring data from the Central Geoprocessing Unit of the Acre State Technology Foundation will be used to carry out the monitoring. The available data include maps in Shapefile and Geotiff format of land use and land cover in Acre State for the base year 1988 through 2020. The UCEGEO data are available until December of each year.

b. Pre-processing:

The images must be geometrically corrected through georeferencing in the ArcGIS 11.5 Software or later using as reference the cartographic base of Ecological-Economic Zoning of Acre at a scale of 1:100,000. The RMS error should be less than one pixel for optical image and approximately 1.5 pixels for radar image. All data must be in the UTM coordinate system, Zone 19S and Datum SIRGAS 2000. The database must be converted into raster with a pixel size of 0.54 ha.

c. Classification:

Using multispectral images to transform digital number values into component scene (vegetation, soil and shade) through the spectral mixture algorithm, the component images the soil and shade will be selected, then apply the segmentation technique using the increasing algorithm with the following parameters: similarity threshold 8 and area threshold 4. It is classified by using unsupervised ISOSEG algorithm with threshold acceptance of 90% for classes: forest, deforestation, non-forest vegetation, hydrography and cloud. These segmentation and classification algorithms may be applied using ARC GIS, Quantum GIS and TerraView programs.

d. Post-processing:

The classification results are submitted to the audit performed by GIS analyst. During analysis of areas with cloud cover, it is used visual interpretation of radar image and/or on-field data collection.

e. Classification accuracy assessment:

Performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix according to Congalton (1999). At least 50 randomly distributed points from high spatial resolution satellite imagery (≤10 meters) and/or field collected data will be used. The minimum mapping classification accuracy is 80%.

Step 3 of VM0015 – Identification of deforestation agents

A population of about 19,265 people live in the Project's Reference Region, distributed in placements, possessions, family properties, and medium and large properties. This population (IBGE, 2017) is more concentrated along the BR-364 highway, in the tributaries, and along the banks of the main rivers in the region (Figure 20).

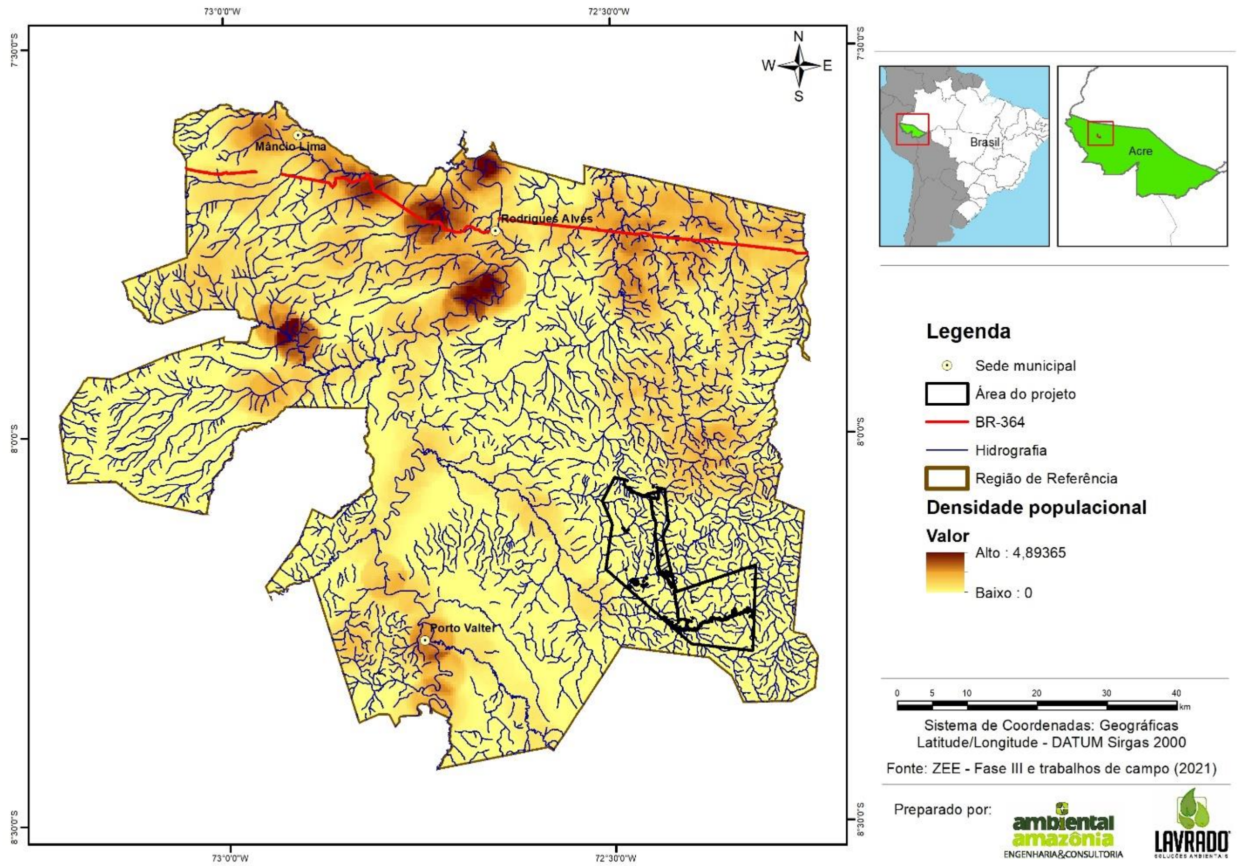

Figure 20. Population density in the Reference Region.

The actors found within this boundaries are family producers living in settlements or occupying areas without land title regularization (legal reserve of large properties or margins of rivers and streams), with a greater diversity of use in open areas that also include pastures; medium and large producers whose main activity is beef cattle ranching with large extensions of pastures and; as part of the mosaic of use and deforestation agents, the presence of traditional populations occur in the region (extractivists in unregulated areas and indigenous people) that have a low rate of conversion and occupation based on small plantations.

a) Agent name: **family producers in settlement projects**

B) Relative importance: family farmers in settlements are responsible for 37% of deforestation in the Reference Region, until 2020.

c) Brief description: There are 25 settlements in the Reference Region, 17 of which are traditional settlements (PA ARCO ÍRIS, PA SÃO PEDRO, PA ALBERTO SANTIAGO, PA PAVÃO, PA TREZE DE MAIO, PA IUCATAN, PA NARCISO ASSUNÇÃO, PA PEDRO FIRMINO, PA PORFIRIO PONCIANO, PA JOAO ADEMIR, PA URUBURETAMA, PA URUBURETAMA, PA TRACUA, PAD SANTA LUZIA, PA VITORIA, PA SAO DOMINGOS and PA NOVA CINTRA), 5 of them are differentiated settlements (PDS FRANCISCO PIMENTEL, PDS MINAS, PAF RECANTO, PDS JAMIL JEREISSATI and PAE CRUZEIRO DO VALE) and 3 Agroforest poles (RODRIGUES

ALVES, MANCIO LIMA and CRUZEIRO DO SUL). It has one of the three oldest settlements in the state (PAD Santa Luzia) and more recent settlements, all with the same occupation dynamics, in case of traditional ones, deforestation occurs from the lot front to back of the property, using the slash and burn technique, where in the first years annual crops are planted (corn, manioc, beans and rice) and then pasture is introduced. More than 80% of deforested area is pasture. These practices are responsible for most of the deforestation in the Reference Region, conditioned by thousands of small polygons every year. There are 1,861 properties in settlement projects in the Reference Region.

d) Brief assessment of the most likely development of population size: According to IBGE (2017) data, there has been an increase in population size of approximately 15% in the last two years over the last 10 years.

e) Statistics on historical deforestation attributable to the agent: from 2010 to 2020, 17,312.1 hectares were deforested in the Reference Region representing an annual average of 1,731 hectares, which were attributed to actions of family producers in the settlement.

a) Agent name: **Settlers**

b) Relative importance: the squatters in the Reference Region are primarily in areas of land void, and are responsible for 34.5% of the deforestation that occurs in the region, by year 2020.

c) Brief description: The land voids that constitute areas without regularized land tenure corresponds to 32.7% and have about 690 possessions comprising deforested areas of various sizes. In these areas, the conversion process is similar to family properties in settlements, since the labor force is almost always family-based.

These areas are often composed of small plantations and old agro-forestry backyards. At least 30% is composed of secondary forest.

d) Brief assessment of the most likely development of population size: According to IBGE data (2017), there has been an increase in population size of approximately 10% in the last 10 years.

e) Statistics on historical deforestation attributable to the agent: between 2010 and 2020, 6,643.5 hectares were deforested in the Reference Region representing an annual average of 664 hectares, which were attributed in squatters in areas of land void.

a) Agent name: **Medium and large producers**

b) Relative importance: medium and large cattle ranchers contribute with 8.7% of deforestation in the Reference Region that has already occurred until 2020 and are made up of medium and large properties, such as Juruá REDD+ Project.

c) Brief description: Private properties occupy 17.1% of the Reference Region and count 21 properties that have cattle ranching and extractivism as their economic exploitation base, since 5 properties are farms and 16 are rubber plantations...

d) Brief assessment of the most likely development of population size: According to IBGE (2017) data, there has been an increase in population size of approximately 2% in the last two years over the last 10 years.

e) Statistics on historical deforestation attributable to the agent: between 2010 and 2020 4,074 hectares were deforested in the Reference Region representing an annual average of 407 hectares, which were attributed to these private properties.

In the Reference Region there are still 889 squatters on public tract of lands (Glebas), contributing 12.8% of deforestation until 2020. An increasing trend of deforestation can be observed in the region, in the last 6 years, as a result of the population growth, the dynamics of land use, and synergistically with the selective wood collection in the region, related to the opening of new tracks and creation of new settlements.

Identification of deforestation drives (3.2 VM0015)

Infrastructure drives: the main deforestation drives in the region are the roads (BR 364 and secondary roads) and occupations along the banks of Juruá River and its tributaries; since the BR 364 highway paving was completed, there is an increase in highway traffic flow; and the land mosaic that presents different intensity of pressure on the forest. All these drives were considered to define the baseline and deforestation dynamics for Juruá REDD+ Project, provided for the validation/verification body.

The main factors affecting the amount of deforestation in the Reference Region are:

1. Demand for new agricultural and small-scale pasture areas: from 2010 to 2020, 31,531 hectares were deforested in the Reference Region representing an annual average of 3,531 Hectares, of which more than 70% come from family properties. According to data from IBGE (2017), 1,861 rural families live in settlement projects and deforest an average of 1.0 ha per year for the implementation of small plantations, which are then converted into pastures, which can cause an impact on the forest of more than 1,000 hectares per year. This same strategy is applied to squatters in areas without land tenure regularization and on public tract of lands.
2. The existing pasture expansion front associated with timber harvesting in the region.
3. Integration between Vale do Acre and Vale do Juruá by BR 364 which cuts through the Reference Region in the northern sector.

Variables explaining the geographic location of deforestation

The definition of the input data followed high-impact studies conducted in the Amazon according to Alencar et al. (2004), Soares-Filho et al. (2006), Fearnside and Graça (2006), Perz et al. (2008), Fearnside et al. (2009), Davidson et al. (2012), Yanai et al. (2012), Silva Junior et al. (2018) e Andrade et al. (2021). The data represent the current moment in time, used for defining the average rate of transition from forest to deforestation, defining the coefficients of evidence weights, and simulating deforestation.

The input data was rasterized with 30 m pixel and for Reference Region, to be used for modeling. The following is a data description and information source:

- Deforestation base data were acquired from Acre State Central Geoprocessing Unit (UCEGEO) using cumulative deforestation data until 2010 and until 2020. The temporal deforestation dynamics oscillate based on public policy issues, financial markets, land value, and others. Analyzing the historical process for Valparaiso Property region, the last 5 years show a new increase in deforestation rate;
- Types of forest phytophysiognomies at cartographic scale of 1:250,000 produced by Acre State's Ecological Economic Zoning provided by Acre State Secretariat of Environment;
- Soil types using the First Order Classification according to the Brazilian Soil Classification System at cartographic scale 1:250,000 produced by Acre State Ecological Economic Zoning provided by Acre State Secretariat of Environment;
- Land tenure classes (settlement projects, conservation units, indigenous lands, private properties and union lands) on a cartographic scale of 1:250,000 produced by Acre State Ecological Economic Zoning provided by Acre State Secretariat of Environment;
- Proximity to the hydrographic network of permanent courses at cartographic scale of 1:250,000 produced by Acre State Ecological Economic Zoning provided by Acre State Secretariat of Environment;
- Proximity to rural communities produced by Acre State Ecological Economic Zoning provided by Acre State Secretariat of Environment;
- Proximity to deforestation produced by UCEGEO using as reference date 2015 for variables calibration and as reference date 2020 to start the deforestation simulation process;
- Proximity of roads and branches produced by the Federal University of Acre - Laboratory of Geoprocessing Applied to the Environment using as reference date 2015 for the variables calibration and as reference date 2020 to start the deforestation simulation process;
- Proximity to municipal headquarters using 2015 IBGE data.

Identifying of underlying causes of deforestation (3.3 VM0015)

In order to prepare the PPCD-AC - Phase I (ACRE, 2010), an analysis of the main problems and factors influencing deforestation in Acre State was carried out. Jointly with society, it was found that the problems of land-use planning related to road paving, land title regularization and lack of technical assistance were among the main problems. According to analyses by the Amazon Environmental Research Institute (IPAM, 2017), today the change from large to medium and small deforestation patterns complement this picture, especially for family production, where more than 85% of the rural population has livestock as the dominant land use.

Small producers are found, for the most part, in settlement projects and in conservation units, especially those of sustainable use. These two land categories occupy about 11% and 35% of the territorial extension of the state, respectively. Indigenous lands (15%), private properties and not assigned public lands complete the list of state land categories (ACRE, 2018).

The most important drivers of deforestation and fires known in the Amazon and some of their specificities observed in Acre state are shown in Table 16, whose order reflects the occurrence in temporal sequence and relevance according to intensity, frequency, and impact. For definition, adjustment and success of public policies for reducing deforestation, the separation of drives into two groups can be useful. The first group represents the drives that directly cause deforestation, while the second group brings together drives that act indirectly but contribute to or accelerate deforestation.

Table 16. Drives related to deforestation and fires in the Amazon and Acre.

Drives	Typical situations in the Amazon	Situations observed in Acre
Direct drives or drives causing deforestation	Illegal extraction of wood	Weaknesses in the inspection of management plans
	Uncontrolled fire, forest fires	Use of fire for unlicensed food production
	Ranching practices with low technology level	Pastures for extensive cattle ranching in 70-90% of deforested areas
	Development of low-tech agriculture	Migratory agriculture in 10-20% of deforested areas; agricultural activities in less than 4%
	Human settlement projects	Weak infrastructure and technical follow-up for producers
	Extreme climatic conditions	Droughts in 2005, 2010, and 2016
Indirect drives or catalyzing deforestation drives	Weakness in the enforcement of protected areas	Weak infrastructure and technical staff to monitor and supervise the protected areas
	Construction and paving of roads	Deforestation along highways BR 317, BR 364, AC 040 and AC 090; spreading deforestation inside the forest
	Land speculation	Speculation faster than jurisdiction
	Fiscal and financial incentives	Adaptation to local needs should replace centralized management
	Slow land-use planning process	Low social and political acceptance
	Delay in regularizing georeferenced registration and land allocation	Historical omission, process standardization Slow land allocation process

Source: Acre, 2018

Analysis of chain of events leading to deforestation (3.4 VM0015)

Historically, Acre State had a heterogeneous territorial occupation influenced by the accessibility of highways, the concentration of settlement projects and occurrence of soils with favorable characteristics to implement agricultural and cattle raising activities (ACRE, 2009).

The dynamics of deforestation in Acre, similarly to the rest of the Legal Amazon, shows changes in time and space dimensions, with variations in the dynamics and patterns of land cover change. Although the agents of deforestation have been the large and medium-sized cattle ranchers, the analyses results indicate that small producers - around 49,000, according to CAR data (SEMA, 2017) have contributed to deforestation in recent years, mainly due to family production. Most of small and medium deforestation occurs associated with settlement projects, in addition to medium and small production in other landholding classes.

From 2011 to 2017, the analyses confirm this trend, a reflection of traditional management for natural resources, where drilling small areas of forest is carried out to renew the production areas, through family agriculture and pasture formation. About 80% of deforested polygons are in a size class of up to 10 hectares, equivalent to 60-75% of the deforested area in the period, supporting analyses carried out on the basis of CAR data, indicating that 90% of deforestation after 2008 occurred on rural properties with up to four fiscal modules (SEMA, 2017).

The evolution of deforestation rate in the state shows peaks in the years 1995 and 2003 and a significant reduction from 2004 to 2009. In general, the annual averages in Acre have accompanied the decline in deforestation that has been observed in the Legal Amazon since 2004, culminating in a 65% reduction in deforestation until 2017 and 31% from 2016 to 2017, with a significant increase in the last 4 years.

Extensive cattle ranching, logging, and traditional slash-and-burn agriculture based on the use of fire as a practice for soil preparation is still culturally used by family producers in settlement projects and small and medium-sized rural properties. In the period from 1997 to 2017, settlement projects were responsible for 35.1% of deforestation in the State.

The private lands mapped by the State during the Ecological-Economic Zoning (Phase I), recently registered in the Rural Environmental Registry or from official base of the National Institute for Colonization and Agrarian Reform (Incra) and the Legal Land Program, represent the second territorial category with the highest occurrence of deforestation (30.8%), in the period from 1997 to 2017. Areas with no breakdown study account for 4.3% and collected areas for 1.8%. Protected natural areas together - Conservation Units and Indigenous Lands, accounted for 8.1% of the state's deforestation by 2017. Twelve of the settlement projects located in the eastern portion of the state, along the BR-364 e BR-317 in the municipalities of Brasileia, Capixaba, Sena Madureira, Senador Guiomard, Rio Branco, Plácido de Castro, Acrelândia and Manoel Urbano, presented 51% of deforestation analyzed in 131 officially registered projects in Incra's database, in the period from 2014 to 2016, namely: PAE Santa Quitéria, PAD Quixadá, PAE Remanso, PA Gal. Moreno Maia, PDS Porto Luiz I, PAD Pedro Peixoto, PA Figueira, PAF Providência Capital, PA Tocantins, PAD Boa Esperança, PAR Mário Lobão and PA Liberdade (IPAM, 2017).

Conclusion (3.5 VM0015)

Based on historical deforestation and its environmental and economic characteristics, it is possible to find conclusive evidence that the relationship between agents, drivers and underlying causes of deforestation can explain the pressure on forest cover in the Reference Region of Juruá REDD+ Project. The main hypothesis is that the deforestation agents and drivers may increase as a result of a possible population increase in the Reference Region, due to increased road density, selective timber harvesting, land speculation, and encroachments, intensifying the demand for forest areas in the region. Therefore, future trend for the baseline estimate is that the deforestation rate in the Reference Region will increase. Therefore, the Project will play a decisive role in curbing deforestation in the area and to serve as a reference for other synergistic projects in the region.

Step 4 of VM0015 – Projection of the quantity of future deforestation

The Reference Region has several land units with deforestation characteristics, drives, and causes of deforestation also diversified for the entire analyzed area.

Selection of the baseline approach (4.1.1 VM0015)

Deforestation rates measured over the historical period revealed a clear trend of deforestation increase over the last 6 years.

The deforestation dynamics in the Reference Region occurs in a similar way to the rest of Acre State, showing changes in time and space dimensions, with variations in the dynamics and patterns of land cover change. Although the agents of deforestation have been the large and medium-sized cattle ranchers, the analyses results indicate that small producers - around 1,800, according to ZEE data (ACRE, 2021) have contributed to deforestation in recent years, mainly due to family production. Most of small and medium deforestation occurs associated with settlement projects, in addition to medium and small production in other landholding classes.

From 2010 to 2020, the analyses confirm this trend, a reflection of the traditional management of natural resources, where small areas of forest are drilled down to renew production areas, through plantations and the formation of pastures.

The deforestation in the Reference Region already had a reduction trend, in the first years of the analysis, and now follows an increase trend, indicating that efforts of public policies for reducing deforestation have generated few results. However, it is important to remember that these also depend on and are linked to a larger process of interference from public policies and regional, state and national economic context that influence the Amazon region as a whole.

In general, deforestation is related to the territorial occupation structure and continues to be concentrated in the northern portion of the Reference Region, along the areas of direct influence of the main highways - BR-364, around the urban centers and along the hydrographic networks, especially large rivers. This is the second pole of deforestation in Acre, the region of Cruzeiro do Sul (Juruá Regional), due to the paving of the BR 364 highway, economic conditions and, currently, the perspective of road interconnection of Cruzeiro do Sul with Pucalpa, in Peru.

Therefore, conclusive evidence emerges from the analysis of agents and drives explaining the different historical deforestation rates in the analyzed historical period. Thus, approach "c" (modeling) was selected

Quantitative projection of future deforestation (4.1.2 VM0015)

a) Projection of the annual areas of baseline deforestation in the reference region (4.1.2.1 VM0015)

Approach "b" (time function) of VM0015 methodology sub-step 4.1.1 was selected to forecast the deforestation baseline. In this approach the annual baseline deforestation in year t for the Reference Region was calculated by extrapolating the historical trend of forest cover reduction observed in the Reference Region. Deforestation rate forecasts were calculated by double exponential smoothing over the annual forest cover data in the Reference Region using the "holt" function of the "forecast" package (Hyndman (2008) e Hyndman (2022)) in the R programming environment. Automatic parameter adjustment was used and damping of the estimated trend was enabled. The adjusted parameters were α (autocorrelation) = 0.5925, β (trend) = 0.5925 and φ (trend damping) = 0.98. The Mean Absolute Error (MAE) was 905.8 ha. Forest area projection estimates were converted into annual deforestation rates. The projected deforestation for the 10-year period (2021-2030) in the Reference Region was 64,635 hectares.

The deforestation forecast values for the period from 2021 to 2040 are presented in Table 17.

Table 17. Annual and cumulative deforestation for the Reference Region until 2040.

Project Year	$ABSLRR_{i,t}$	Cumulative ABSLRR	$ARR_{i,t-1}$
	(ha)	(ha)	(ha)
2021	3,435.05	3,435.05	492,957.22
2022	3,425.74	6,860.79	489,531.48
2023	3,402.08	10,262.87	486,129.40
2024	3,378.60	13,641.47	482,750.79
2025	3,355.31	16,996.78	479,395.49
2026	3,332.19	20,328.97	476,063.30
2027	3,309.16	23,638.13	472,754.14
2028	3,286.31	26,924.44	469,467.83
2029	3,263.64	30,188.08	466,204.18
2030	3,241.16	33,429.24	462,963.03
2031	3,218.76	36,648.00	459,744.27
2032	3,196.54	39,844.54	456,547.73
2033	3,174.50	43,019.04	453,373.23
2034	3,152.64	46,171.68	450,220.58
2035	3,130.79	49,302.47	447,089.80

2036	3,109.20	52,411.67	443,980.60
2037	3,087.79	55,499.45	440,892.81
2038	3,066.47	58,565.92	437,826.34
2039	3,045.33	61,611.26	434,781.01
2040	3,024.28	64,635,54	431,756.73

b) Projection of the annual areas of baseline deforestation in the Project Area and Leakage Belt (4.1.2.2.VM0015)

For baseline estimation in the Project Area and the Leakage Belt, a spatially projected deforestation was used for the entire Reference Region produced in step 4.2.4 of VM0015 Methodology.

c) Summary of step 4.1.2 (4.1.2.3 VM0015)

In this section, the projection of future deforestation values for the period 2011-2040 in the Reference Region (Table 18) are presented for the Project Area (Table 19) and Leakage Belt (Table 20).

Table 18. Baseline of annual deforestation in the Reference Region. (Table 9.a of VM0015 Methodology)

Project Year	ABSLRR $_{i,t}$	Cumulative ABSLRR
	(ha)	(ha)
2021	3,435.05	3,435.05
2022	3,425.74	6,860.79
2023	3,402.08	10,262.87
2024	3,378.60	13,641.47
2025	3,355.31	16,996.78
2026	3,332.19	20,328.97
2027	3,309.16	23,638.13
2028	3,286.31	26,924.44
2029	3,263.64	30,188.08
2030	3,241.16	33,429.24
2031	3,218.76	36,648.00
2032	3,196.54	39,844.54
2033	3,174.50	43,019.04
2034	3,152.64	46,171.68

2035	3,130.79	49,302.47
2036	3,109.20	52,411.67
2037	3,087.79	55,499.45
2038	3,066.47	58,565.92
2039	3,045.33	61,611.26
2040	3,024.28	64,635.54

Table 19. Baseline of annual deforestation in the Project Area. (Table 9.b of VM0015 Methodology).

Project year (t)	Strata i in Project Area 1 ABSLPA $_{i,t}$	Total	
	(ha)	Annual	Cumulative
		ABSLPA $_{i,t}$ (ha)	ABSLPA (ha)
2021	102	102	102
2022	210	210	313
2023	194	194	507
2024	301	301	808
2025	129	129	937
2026	210	210	1,147
2027	242	242	1,389
2028	216	216	1,605
2029	314	314	1,919
2030	243	243	2,162
2031	373	373	2,535
2032	304	304	2,838
2033	304	304	3,143
2034	148	148	3,291
2035	451	451	3,742

2036	95	95	3,837
2037	180	180	4,017
2038	203	203	4,220
2039	212	212	4,431
2040	226	226	4,657

Table 20. Baseline of annual deforestation in the Leakage Belt. (Table 9.c of VM0015 Methodology)

Project year (t)	Strata i of Reference Region in the Leakage Belt 1 ABSLLK $_{i,t}$ (ha)	Total	
		Annual ABSLLK $_{i,t}$ (ha)	Cumulative ABSLLK (ha)
2021	123	123	123
2022	38	38	161
2023	50	50	211
2024	35	35	246
2025	22	22	268
2026	30	30	298
2027	59	59	358
2028	148	148	506
2029	77	77	583
2030	80	80	663
2031	80	80	743
2032	142	142	885
2033	59	59	944
2034	30	30	974
2035	122	122	1,096
2036	63	63	1,159
2037	209	209	1,368
2038	156	156	1,525
2039	84	84	1,609
2040	333	333	1,942

Projection of the location of future deforestation (4.2 VM0015)

The simulation of deforestation was performed using functions the Dinamica EGO Program that expand existing deforestation and generate new deforestation until 2050 in regions of higher probability according to the weights of evidence. The construction of the model was carried out in three stages: model input data systematization, calibration of variables, and modeling the future deforestation.

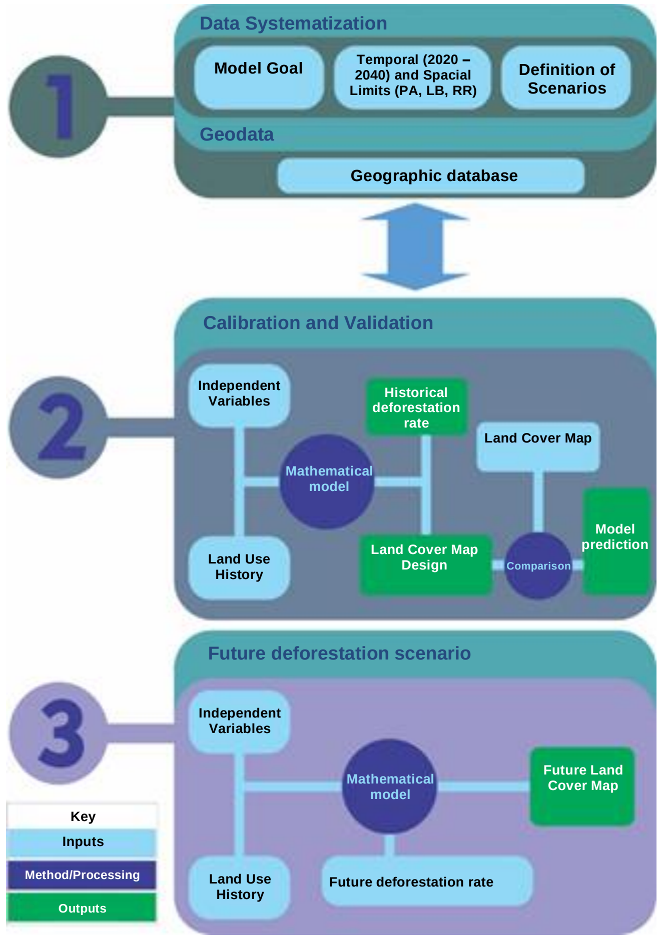

Figure 21. Projection model flowchart for future deforestation in the project's Reference Region.

Preparation of factor maps (4.2.1 VM0015)

Eight drives were selected (land tenure, soils, vegetation, distance to deforestation, distance to permanent hydrographic network, distance to rural communities, distance to roads and branches, and distance to city municipal office). The choice of variables was based on studies by Alencar et al. (2004), Davidson et al. (2012), Fearnside and Graça (2006), Fearnside et al. (2009), Perz et al. (2008), Silva Junior et al. (2018), Soares-Filho et al. (2006) and Yanai et al. (2012) in order to test and assess the influence on occurrence probability of new deforestation. The data were organized in the Dinamica EGO program's standard Format.

Table 21. List of maps, variables and factor map. (Table 10 of VM0015 Methodology)

Factor Map		Source	Represented Variable		Meaning of categories or pixel values			Algorithm or equation used
ID	File name		Unit	Description	Interval		Meaning	
1	Accessibility of all roads	UFAC/ CAR	meters	Accessibility from all roads	0.0	73,104.2	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
2	River accessibility	ZEE Acre	meters	River accessibility with permanent water regime	0.0	105,11.9	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
3	Accessibility to rural communities	ZEE Acre	meters	Accessibility to rural communities	0.0	33,873.3	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
4	Accessibility to deforested area	UCEG EO Acre	meters	Accessibility to deforested area	0.0	11,786.0	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
5	Accessibility to municipal settlements	IBGE	meters	Accessibility to municipal settlements	0.0	110,420.0	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
6	Land tenure status	ZEE Acre	meters	Land tenure status	1	11	Each value indicates a class or category	Raster polygon by identification (ArcGis)
7	Classes of soil types	ZEE Acre	meters	Classes of soil types	1	8	Each value indicates a class or category	Raster polygon by identification (ArcGis)
8	Classes of forest types	ZEE Acre	meters	Classes of forest types	1	8	Each value indicates a class or category	Raster polygon by identification (ArcGis)

a. Preparation of deforestation risk maps (4.2.2 VM0015)

The simulation of deforestation risk was performed using functions in the EGO Dinamica Program that expand existing deforestation and generate new deforestation by 2040 in regions of higher probability according to weights of evidence. The "expander" function is a routine to expand the deforestation patches, and the "patcher", which is another routine, creates new deforestation patches (SOARES-FILHO; RODRIGUES; COSTA, 2009). These routines expand the deforested area and produce new deforestation spots with each interaction depending on how many future simulation is desired from the calculated transition rates.

The settings used for the "expander" was: isometry = 1.5, average size of simulated deforestation patches = 10 ha, and variance of size of simulated deforestation patches = 20 ha. For the "patcher" it was: isometry = 1.5, mean size of simulated deforestation patches = 4 ha, and variance of the size of simulated deforestation patches = 8 ha.

Deforestation risk maps show the regions with the minimum (risk = 1) or maximum (risk = 0) conditions for deforestation to occur. The algorithm called SimWeight was used to calibrate the model (SANGERMANO et al. 2010). SimWeight stands for Similarity Weight and uses the nearest neighbor K logic to identify the relevance of each variable considered as a vector to predict the sites with the potential to change from forest to anthropic vegetation classes. The logic used by SimWeight initially consists of a relevance analysis of each variable to the occurrence of deforestation by calculating the weight of importance of the variable using the formula below:

$$PI = 1 - \left(\frac{SDc}{SDsa}\right)$$

Where:

PI = Importance Weight (Peso de importância)

SDc = Standard deviation of the vector variable in the change cells/pixels

SDsa = Standard deviation of the vector variable in cells/pixels of the entire study area

After that, SimWeight calculates the deforestation risk combined with cell change and persistence. For this, only information about variables above 0.1 was used. This information was combined to the following formula adapted from Sangermano et al. (2010):

$$Rd = \frac{\sum_{i=1}^{c}\left(1.0 - \frac{1}{1+e^{1/d_i}}\right)}{K} \quad (C \leq k)$$

Where:

Rd = change occurrence risk value ranging from 0 (low) to 1 (high)

c = number of cells/pixels change

d = distance in cells/pixels between change pixels

i = change pixel identifier

k = distance in cells/pixels of the nearest neighbors to the change pixel

The result of applying the equation to calculate deforestation risk is a potential transition map that identifies areas that present favorable conditions for deforestation in areas classified as forest (Figure 22). This map is the starting point for allocating future deforestation rates from which annual rates are allocated along with some dynamic variables. An example of a dynamic variable is the map of accessibility by branches.

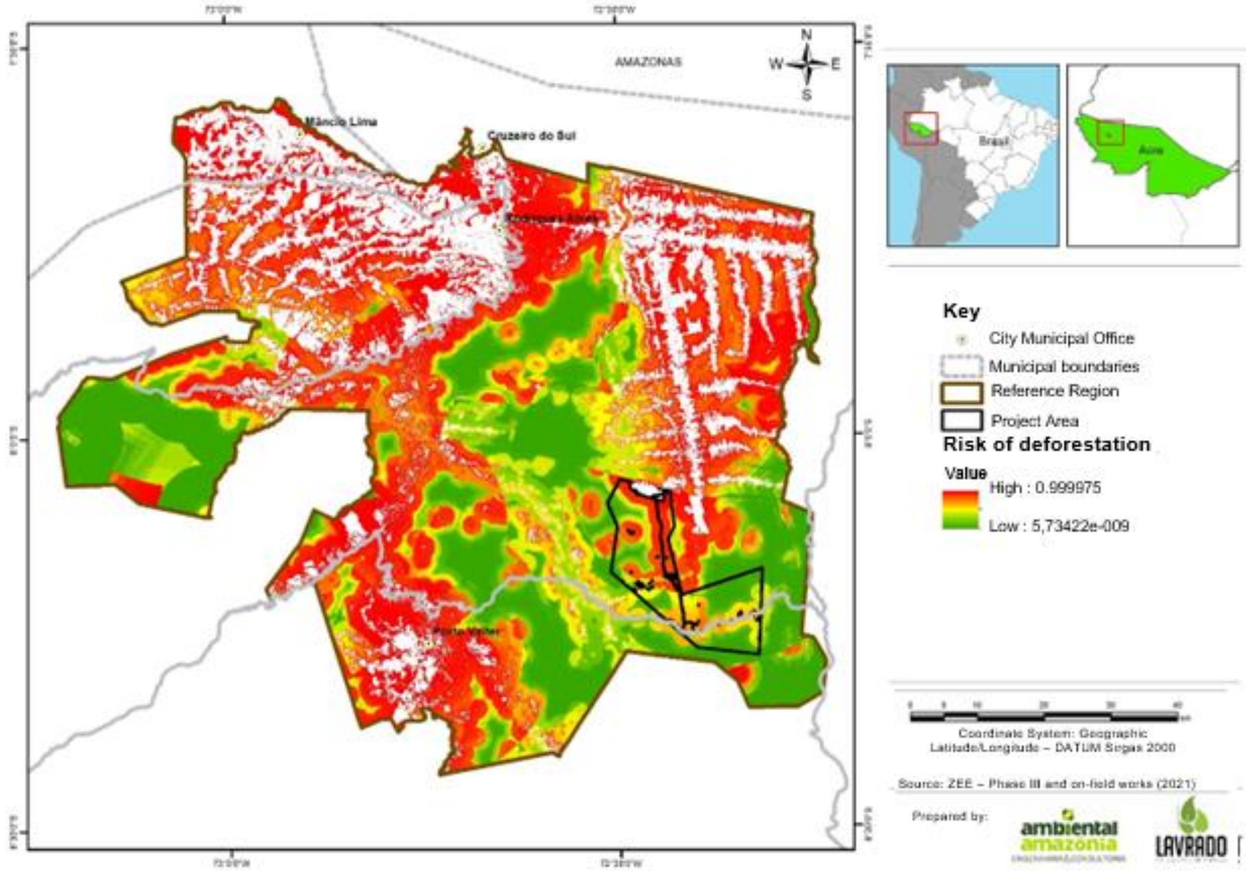

Figure 22. Map of potential for change from forest to anthropogenic vegetation (deforestation risk) in the Reference Region.

b. Selection of the most accurate deforestation risk map (4.2.3 VM0015)

To confirm the quality of the generated model, Option A was selected - calibration and confirmation using two historical sub-periods - available in the methodology approved by the VCS VM0015 version 1.1. Historical deforestation data from the period from 2010 to 2015 were used to calibrate the model, while 2020 was used for confirmation. In this process, a 2020 map was simulated from historical data from the period 2010 to 2015. Two simulated 2020 maps were generated: a hard and soft map. The hard map consisted of a model estimate for cells in the project area most likely to be converted into anthropogenic vegetation at equilibrium class in 2020 (deforestation). The values in this map are categorical, where each represents a class (e.g., 1 = forest, 2=anthropic vegetation at equilibrium).

The soft map is a deforestation risk map with continuous values indicating the areas at highest or lowest risk of deforestation in the period, values ranging from 0 (lowest risk) to 1 (highest risk).

The technical evaluation (Figure of Merit-FOM) was applied to assess the accuracy of the simulated map in 2020. The intersection ratio of the observed change (change between the reference map at time 1 and time 2) and the predicted change (change between the reference map at time 1 and simulated map at time 2) was used for the union of the observed change and the predicted change, as defined in equation 9 of VM0015 version 1.1.

VM0015 version 1.1 states that the lower threshold for the best fit measured by the FOM should be defined by the observed net change in the Reference Region for the model calibration period. The net observed change should be calculated as the total area of change being modeled in reference region during the calibration period as a percentage of the total area of the Reference Region, and such value should be at least equivalent to this value. If the FOM value is below this threshold, the project proponent should demonstrate that at least three models have been tested (resulting in at least three risk maps), and that the one with the best FOM has been used.

The threshold value of the net change observed in the Reference Region was 0.02, and FOM obtained by applying equation 9 of VM0015 version 1.1 was 0.06. As FOM for first risk map produced is above the minimum threshold, two other models were not created to perform the mapping of future deforestation locations (Step 4.2.4).

The deforestation risk model developed presented a statistically acceptable overall accuracy for deforestation allocation project until 2040 in the Reference Region of Juruá REDD+ Project. This result indicates that projected deforestation occurred in the high-risk areas.

c. Mapping of the locations of future deforestation (4.2.4 VM0015)

The procedure for selecting pixels at highest deforestation risk and respective maps of future deforestation from baseline was automatically performed by Ego Dinamica Program, the location of future deforestation until 2040 was estimated for the entire Reference Region (Figure 24). After completion of Step 4.2.4, the maps of future deforestation in the Reference Region were overlaid with the boundaries of the Project Area and Leakage Belt to quantify deforestation (Tables 9b and 9c of VM0015). The Figure 23 and Figure 24Figure 24 show the cumulative deforestation in the Project Area until 2040.

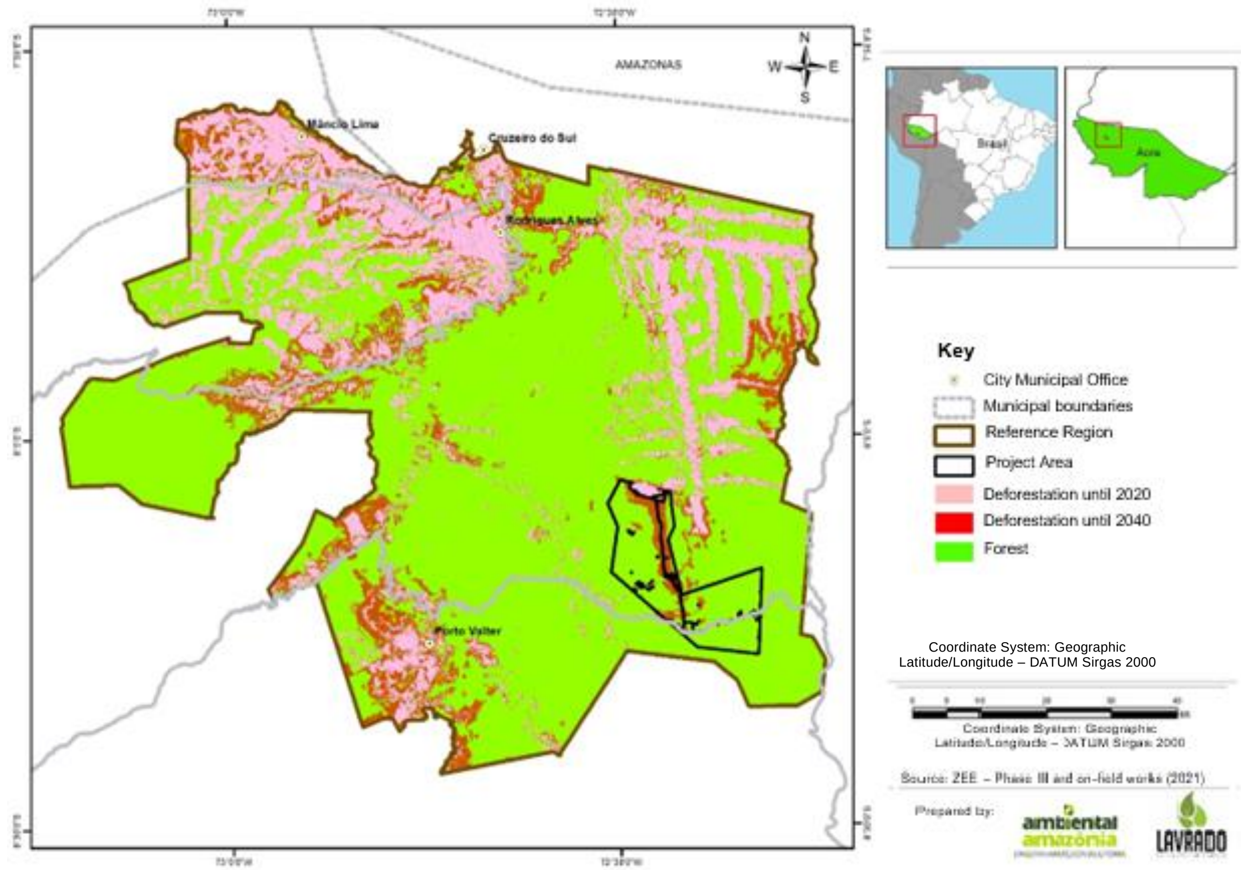

Figure 23. Deforestation projection map in the Reference Region of Juruá REDD+ Project for 2040.

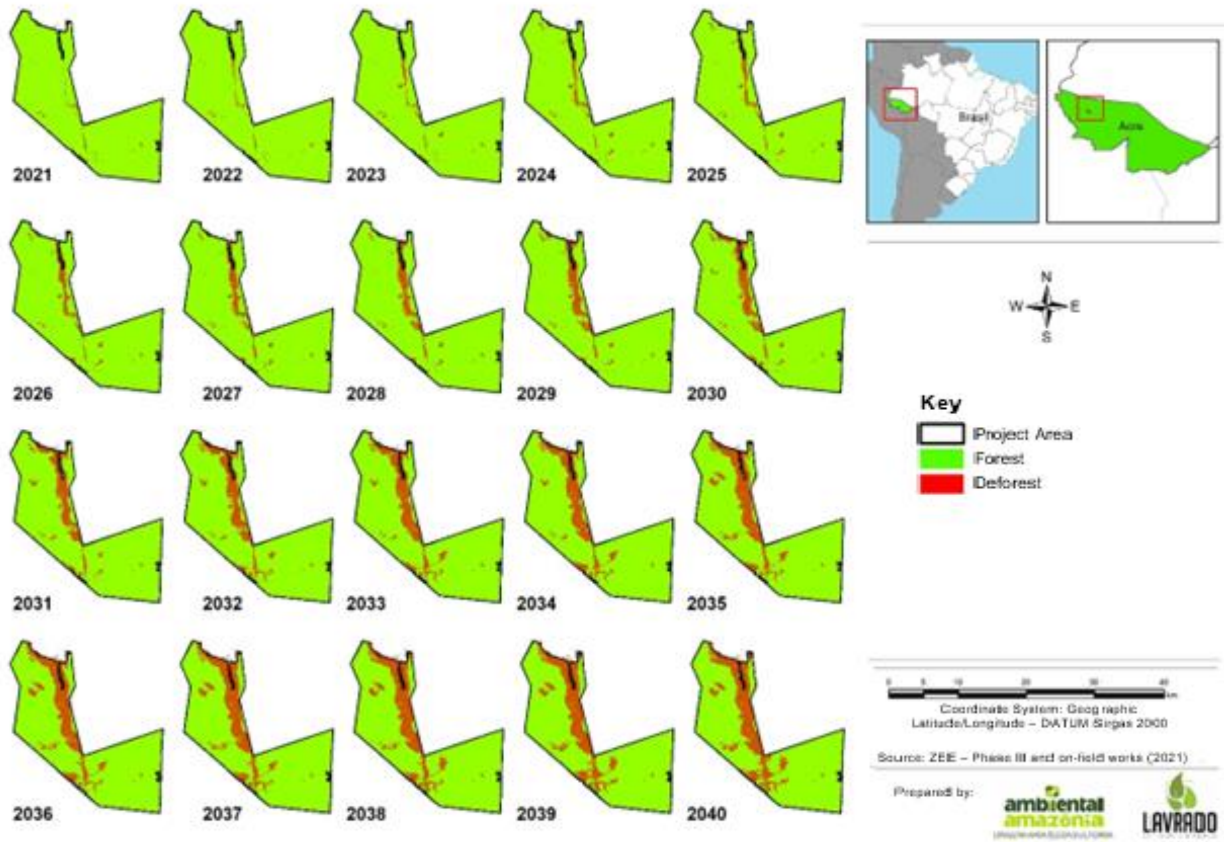

Figure 24. Annual projection map of cumulative deforestation in Juruá REDD+ Project until 2040.

3.5 Additionality

Project Additionality was analyzed according to "VT0001 - Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities", version 3.0, dated February 1, 2012.

The tool's applicability conditions have been met:

- AFOLU activities, the same or similar activities proposed in the Project, within its boundaries, certified or not as AFOLU VCS Project, are not in violation of any applicable law, even if the law is not enforced; and
- The VM0015 baseline methodology provides a step by step approach to justify the most probable scenario definition for the baseline.

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

Sub-step 1a. Identify alternative land use scenarios credible in proposals for AFOLU VCS project activities

Among the realistic and credible scenarios for land use to occur within the Project boundaries in the absence of AFOLU Project activity recorded in the VCS, the following were considered:

i) Continued land use activities prior to the Project (baseline scenario)

Deforestation caused by squatters, family farmers (subsistence agriculture, small-scale agricultural crops, grazing and property boundary demarcation) and cattle ranchers and loggers. Between 2010 and 2020, the Project Reference Region had a historical deforestation rate of 2,463 hectares per year (0.49% p.a.) to implement these activities (see section 0). Over the next 20 years, a loss of 24,535 hectares is projected in this scenario.

ii) Management of non-timber forest products, with other complementary REDD+ activities without registration as an AFOLU VCS Project.

Implementation of non-timber forest product management activities and complementary activities to contain and monitor deforestation caused by the agents of scenario (i), described above. For the Project to be effective in relation to the containment of deforestation with the management of non-timber forest products in the region and local socioeconomic development, some actions will be necessary, as well as some investments (capacity building and training in the potential lines mapped by the Project, establishment of partnerships for the development of activities and improvement of practices, among other activities described in section 1.11). These are investments that are generally not made by forest management. Therefore, the economic viability of management is reduced without the additional revenue from trading credits registered in the VCS.

Despite the contribution of forest management to forest conservation and maintenance of carbon stock, the area is subject to unplanned deforestation and loss of carbon stock due to external agents. The occupation and opening of areas for the implementation of low productivity farming practices becomes more advantageous, since inspection is inefficient and the expenses for implementation and maintenance of the area in general are substantially lower.

Because of so many adversities and obstacles, the legitimate owner of forest areas, most of the time, opts to sell the property, since he cannot afford the management activities and much less deal with the uncertainty of the market, moments of financial crisis can lead to fragility in the security of the property that would certainly result in situations of illegal deforestation and invasion of property. Thus, management activity, which is not the most attractive economic activity in the context of the region, and already undergoes financial difficulties (as in other situations throughout the Amazon), becomes even more unviable without the addition of additional revenues from the commercialization of credits registered in the VCS.

Sub-step 1b. Credible land use scenarios consistent with applicable laws and regulations

Practices in scenario (i) are not in compliance with applicable mandatory laws and Regulations. Such practices occur systematically and widely in the Project region.

The cumulative deforestation in Acre until 2020 was 25,524 km², or 2.5 million hectares, representing 15.5% of area in the State (ACRE, 2021). The average annual deforestation in the period from 1988 to 2020 was 478.2 ± 178.2 km² (Figure 25), or 47,820 hectares and average rates of 0.29 ± 0.11% (INPE, 2021).

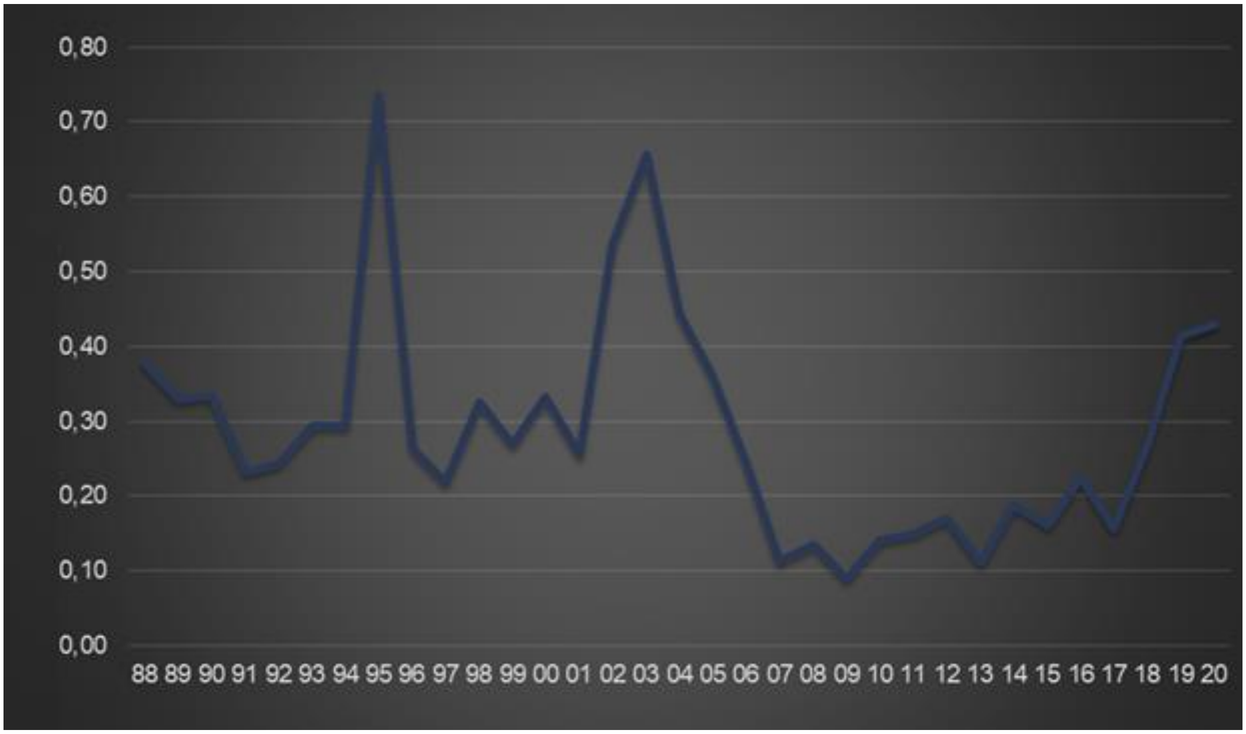

Figure 25. Deforestation dynamics in Acre State (INPE, 2021).

The data regarding the authorizations for vegetal suppression (ASV) in the state of Acre are not so clear, which can make it difficult to control the illegality of deforestation in the territory, which can reach 95.5% of the total (VALDIONES, 2021).

In order to prevent illegal land tenure and, at the same time, occupy unallocated public lands, the Brazilian state created the so-called Land Law (Federal Law 601/1850), the first of several other regulations created with the same purpose of privatizing lands or transforming them into protected areas. However, no different from other Brazilian states, where conflicts related to land concentration, poverty and rural exodus occur. Even today the insecurity of land tenure has become a major problem, since squatters would invade private lands, claiming that they belong to the state, a situation commonly found in the Brazilian Amazon to this day.

The causes of deforestation in the Amazon can be attributed to a wide range of social and economic factors. The land ownership situation is one of those factors that explain more than 80% of the deforestation rates in the Brazilian Amazon (OMETTO; AGUIAR; MARTINELLI, 2011). In Acre, the highest rates of deforestation occur in land categories related to land tenure such as settlements and private lots to the detriment of indigenous lands and conservation units where land tenure is indirect and follows differentiated cultural patterns

The Project Area is located in a private property. These areas contribute to 32% of Acre's deforestation and have already had 18% of their boundaries changed (Acre, 2021).

Government agencies at the state and federal levels have limited options for enforcing laws and regulations that have been issued to prevent deforestation. According to a report by the Federal Court of

Accounts (TCU), of all the fines issued by IBAMA for environmental crimes only 0.6% were effectively enforced.

Scenario (ii) is in compliance with all applicable legal and regulatory requirements.

Sub-step 1c. Baseline Scenario Selection

Described in Section 2 - Application of the Methodology, Item 2.4 Baseline Scenario.

Step 2 - Investment Analysis

Sub-step 2a. Defining the Appropriate Analysis Method

Since the Project generates financial benefits beyond the revenue related to credits recorded in the VCS through trade in non-timber forest products, a comparative investment analysis (Option II) of alternative scenarios was used to determine the additionality of the Project. Scenarios (ii) and (iii) were analyzed since this analysis does not apply to scenario (i).

Evaluations and comparisons of the results of scenarios (i) and (ii) were carried out, in which scenario (i) as already described in this document in substep 1a, refers to: Continuation of land use activities prior to the Project (baseline scenario), which there are no financial benefits or any type of income from the trade of forest products in the region, only deforestation caused by squatters, family farmers and ranchers in the region. Scenario (ii) also as described in substep 1a of this document refers to the Management of non-timber forest products with other complementary REDD+ activities without registration as an AFOLU VCS Project, so it was compared scenarios (i) and (ii) described.

Sub-step 2b. Option II. Applying Comparative Investment Analysis

Net Present Value (NPV) was selected as the financial indicator for the comparative analysis of alternate scenarios. NPV is one of the most widely used methods by companies to evaluate projects and has the following advantages over other indicators: (i) it takes into account the time value of money; (ii) NPV can be added; and (iii) it depends only on cash flow and cost of capital (KUHN e LAMPERT, 2012).

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

A summary of the revenue sources and expenses considered in the analysis is presented in Table 22 and Table 23. Refer to section 1.11 for description of forest management operation activities and additional activities that enhance the effectiveness of containing deforestation in the Project Area (REDD+ activities).

Table 22. Summary of revenue sources and expenses considered in the comparative analysis of the Project's investments.

Scenario	Expenses	Revenues
(i) Continuation of pre-Project land use activities (baseline scenario)	Not applied to the scenario	Not applied to the scenario

(ii) Management of non-timber forest products with other complementary REDD+ activities without registration as an AFOLU VCS Project	Forest management, with complementary activities to contain and monitor deforestation	Trading of non-timber forest products

Table 23. Variables and values considered to determine the Project's cash flows.

Activity	Cash flow	Item	Amount	Value	Period	Remarks
Forest Management	Revenues	Unha-de-gato (t)	1	R$ 1.400,00	2022-2049	Forest management activity licensed by the Environmental Institute of Acre
Forest Management	Costs	Unha-de-gato (t)	1	R$ 861,86	2022-2049	Forest management activity licensed by the Environmental Institute of Acre
Forest Management	Expenses	General and Administrative Expenses (annual)	1	R$ 8.000,00	2022-2049	Forest management activity licensed by the Environmental Institute of Acre

Each cash flow scenario is composed considering the sources described in Table 23. The premises provided in Table 24 are valid for all scenarios, including a 20% real discount rate. This discount rate reflects the critical management parameter for determining the feasibility of investing with a new project.

The analysis has revealed a negative NPV of BRL 3.593.146,19 for scenario (ii). Therefore, it becomes evident that curbing deforestation and monitoring additional forest management activities hinders the Project's financial feasibility if there is no additional revenue such as that resulting from negotiation of credits registered in the VCS.

The conclusion, therefore, is that scenario (ii) shows the best financial index and VCS AFOLU Project without the financial benefit of credits registered in the VCS are not an attractive financial scenario.

Sub-step 2d. Sensitivity Analysis

Table 24 shows critical assumptions of scenario (ii) as well as its variations that are considered reasonable and used here in this sensitivity analysis (Perspective 1: pessimistic variations and Perspective 2: optimistic variations). The base values are those considered for NPV found in Sub-step 2c.

Table 24. Critical assumptions for scenarios (ii) and (iii) and their variations used in the sensitivity analysis.

Scenario	Previous conditions	Perspective	
		1 - Pessimist	2 - Optimist
(ii) Forest management, **with** supplementary activities to contain and monitor deforestation	a. Harvest Volume	60% of base value	100% of base value
	b. average price per ton	80% of base value	120% of base value
	c. REDD+ activities cost	120% of base value	80% of base value

For Perspective 1, all scenarios presented negative VPL of BRL 3.814.284,01 for condition a, and BRL 3.703.715,10 for condition b and BRL 4.340.555,03 for condition c. For Perspective 2, all scenarios presented negative VPL of BRL 3.537.861,14 for condition a, and BRL 3.482.577,28 for condition b and BRL 2.845.737,35 for condition c.

Then, the conclusion is that the VCS AFOLU Project without the financial benefits of the credits recorded in the VCS cannot be considered the most financially attractive scenario, even with reasonable variations in critical assumptions.

Step 3 – Common practice analysis

The fourth step of additionality analysis consists of analyzing areas similar to the proposed REDD+ project model to identify common practices. This analysis was conducted considering the territorial scope of the Reference Region. The similarity analysis applied had the basic premises of land tenure category and situation, size of area, main economic activities, environmental context and action of deforestation drives.

Juruá region represents the end of the arc of deforestation in Acre State and has a high potential for forest exploitation, due to the low degree of conversion of the region. Ten (10) private properties were identified (Table 25) with environmental conditions similar to the Project Area and all certified by INCRA, that is, with regularized status by the National Institute for Colonization and Agrarian Reform. These properties have an average of 3,794.1 hectares and occupy 8.9% of the Reference Region.

Table 25. Certified private properties located in the Reference Region.

Subtype	Name	Onwer	Source	Status	Zones	Area (ha)
Private Property	GLEBA BURITIRANA	ASSOCIAÇAO AGRICOLA DA COLONIA BURITIRANA	INCRA	CERTIFIED	Zone 1	1,311.4
Private Property	FAZ SÃO FRANCISCO	FRANCISCO CLEBER DA COSTA PEDROSA	INCRA	CERTIFIED	Zone 1	2,588.8

Private Property	BOA VISTA REAL ESTATE	MARIO MACIEL DA ROCHA FILHO	INCRA	CERTIFIED	Zone 1	1,508.3
Private Property	FAZENDA CINCO IRMÃOS	CORREIA IRMÃOS	INCRA	CERTIFIED	Zone 1	1,323.8
Private Property	FAZENDA VAL PARAÍSO	EPITÁCIO TOMÉ DE MELO JUNIOR	INCRA	CERTIFIED	Zone 1	4,958.9
Rubber Plantation (Seringal)	SERINGAL ROSA AMÉLIA	FRANCISCO TOMÉ DE OLIVEIRA	INCRA	CERTIFIED	Zone 1	1,289.5
Rubber Plantation (Seringal)	SERINGAL PUCALPA II	ESTATE OF MANOEL BEZERRA CORREIA	INCRA	CERTIFIED	Zone 1	3,860.1
Rubber Plantation (Seringal)	SERINGAL LUCÂNIA PART A	CORREIA IRMÃOS	INCRA	CERTIFIED	Zone 1	7,694.6
Rubber Plantation (Seringal)	SERINGAL LUCÂNIA	CORREIA IRMÃOS	INCRA	CERTIFIED	Zone 1	9,138.8
Rubber Plantation (Seringal)	SERINGAL PORTO ALEGRE	MARIA ODETE ALVES BEZERRA	INCRA	CERTIFIED	Zone 1	4,266.6

By assessing the Reference Region, the Project Area represents a unique context when considering the basic premises already listed above, since the private areas observed in the surrounding area are considerably smaller in scale (the largest area is 9,138.8 hectares, less than 50% of the Project Area) and have no record of management of non-timber forest products, as proposed by the Juruá REDD+ Project, constituting an innovative initiative for the region.

Therefore, the compared properties have identical land tenure situations to the land tenure situation in the Project Area, but have essential distinctions making them not characterized as similar activities by the following points:

1. Scale and scope of activities

The Project Area is more than twice the size of the second largest private property in the reference area.

2. Management of non-timber forest products

The murumuru and cat's claw products are pioneers in exploitation and have no processing base in the region. The project will seek to strengthen the practice, looking for improvements and activity valuation to encourage the practice in the region.

3. Territory focus

The owner of Juruá REDD+ Project is committed to promoting social and economic development in the Juruá Valley for the past 30 years. In order to proceed with issues related to environmental services, it defined Seringal Valparaíso which has in its surroundings a number of communities, including those with low social status that allows a synergistic approach to the project as a catalyst for other initiatives in the Reference Region.

In this context, the private areas listed do not compare to the scale of the Project Area. None of them have registered forest management activities for exploitation of cat's claw and murmuru. They are restricted to selective logging and do not correspond to the model proposed by the Project both in scale and in the proposed socio-environmental activities. Thus, these analyzed areas do not represent the "trend" scenario of the Reference Region, and as a conclusion of this geographical analysis, it is verified that there is no common practice for REDD+ Project in the analyzed geographic region

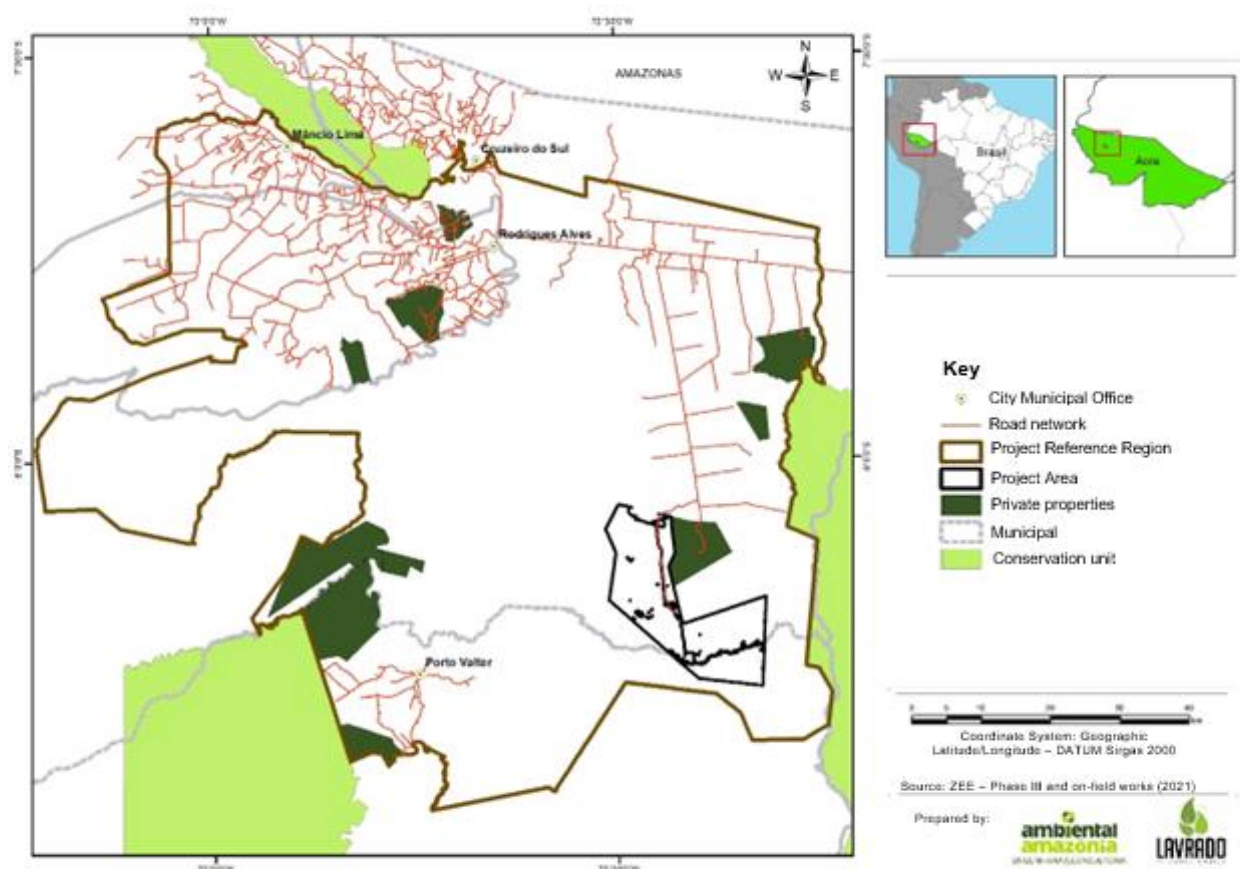

Figure 26. Reference Region map with private properties and conservation units analyzed

3.6 Methodology Deviations

Baseline modeling is conservative because it does not include the environmental impacts associated with the construction of the highway linking Cruzeiro do Sul to Pucalpa, Peru. The impacts on environment from highway construction on forest cover in the Reference Region will be verified when reviewing the baseline projections for future baseline period.

Categorical variables such as forest type, soils and others were entered into the model using the respective empirical probability (probability of evidence). This set of factor maps was entered into processing as continuous data and during the generation of risk maps (Step 4.2.2) model uses this continuous data set to automatically create classes based on the correlations between occurred deforestation and the factor maps. This methodology deviation results in higher deforestation prediction accuracy because the maps created by the Project are more accurate than using predefined classes.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Step 5 of VM0015 - Definition of the land-use and land-cover change component of the baseline

Calculation of baseline activity data per forest class (Step 5.1 VM0015)

Project baseline projections results indicate deforestation of approximately 4,657 hectares for the Project Area from 2021 to 2040 (Table 26) and 1,942 hectares for Leakage Belt (Table 27).

Table 26. Annual cleared areas by forest class icl within the Project Area in case of baseline (baseline activity data by forest class) (Table 11b of VM0015 Methodology).

Deforested area by forest class icl within the Project Area		Total deforestation from baseline in the Project Area	
ID*icl*>	icl1	$ABSLPA_t$	ABSLPA
Name>	Forest	Annual	Cumulative
Project Year	ha	ha	ha
2021	102	102	102
2022	210	210	312
2023	194	194	506
2024	301	301	807

2025	129	129	936
2026	210	210	1,146
2027	242	242	1,388
2028	216	216	1,604
2029	314	314	1,918
2030	243	243	2,161
2031	373	373	2,534
2032	304	304	2,838
2033	304	304	3,142
2034	148	148	3,290
2035	451	451	3,741
2036	95	95	3,836
2037	180	180	4,016
2038	203	203	4,219
2039	212	212	4,431
2040	226	226	4,657

Table 27. Annual areas cleared by forest class icl within the Leakage Belt area in the baseline case (baseline activity data by forest class) (VM0015 Methodology Table 11c).

Project Year (t)	Strata i of Reference Region in the Leakage Belt 1 ABSLLK $_{i,t}$	Total	
	(ha)	Annual	Cumulative
		ABSLLK $_{i,t}$ (ha)	ABSLLK (ha)
2021	116	116	116
2022	27	27	144
2023	48	48	192
2024	35	35	227
2025	22	22	249

2026	30	30	278
2027	59	59	338
2028	144	144	481
2029	77	77	558
2030	80	80	638
2031	80	80	718
2032	142	142	860
2033	59	59	919
2034	30	30	949
2035	122	122	1,071
2036	60	60	1,131
2037	209	209	1,341
2038	156	156	1,497
2039	84	84	1,581
2040	333	333	1,914

Calculation of baseline activity data per post-deforestation forest class (Step 5.2 VM0015)

Method 1 available in the VM0015 methodology was used to define the class that will replace the forest cover in the Project baseline (anthropic vegetation in equilibrium). Table 28 shows the area of zone 1, which covers the Project Area, leakage belt and leakage management areas, and the corresponding areas of each land use/post-deforestation land use change class.

Table 28. Reference Region Zone comprising potential post-deforestation LU/LC class.

Zone		Name		Total of other LU/LC classes present in the zone		Total area of each zone	
		ID_{fcl}	1				
IDz	Name	Area (ha)	% Zone (%)	Area (ha)	% Zone (%)	Area (ha)	% Zone (%)
1	Zone 1	37,493	100	6,599	17.60%	37,493	100
Total area of each class fcl		**37,493**	**100**	**6,599**	**17.60%**	**37,493**	**100**

The projected area to be deforested is reported in Table 29 (for Project Area) and Table 30 (for leakage belt).

Table 29. Annual deforested areas in each zone within the Project Area in the baseline case. (Table 13b of VM0015 Methodology)

Area established after deforestation by area within the project area		Total deforestation from baseline in the Project Area	
IDz	1		
Name	Zone 1	$ABSLPA_t$	ABSLPA
Project Year$_t$	ha	ha	ha
2021	102	102	102
2022	210	210	312
2023	194	194	506
2024	301	301	807
2025	129	129	936
2026	210	210	1,146
2027	242	242	1,388
2028	216	216	1,604
2029	314	314	1,918
2030	243	243	2,161
2031	373	373	2,534
2032	304	304	2,838
2033	304	304	3,142
2034	148	148	3,290
2035	451	451	3,741
2036	95	95	3,836
2037	180	180	4,016
2038	203	203	4,219

2039	212	212	4,431
2040	226	226	4,657

Table 30. Annual deforested areas in each zone within the Leakage Belt in the baseline box (Table 13c of VM0015 Methodology)

Area set after deforestation by zone within Leakage Belt area		Total deforestation baseline in the Leakage Belt area	
IDz	1		
Name	Zone 1	$ABSLLK_t$	ABSLLK
Project $Year_t$	ha	ha	ha
2021	116	116	116
2022	27	27	144
2023	48	48	192
2024	35	35	227
2025	22	22	249
2026	30	30	278
2027	59	59	338
2028	144	144	481
2029	77	77	558
2030	80	80	638
2031	80	80	718
2032	142	142	860
2033	59	59	919
2034	30	30	949
2035	122	122	1,071
2036	60	60	1,131
2037	209	209	1,341

2038	156	156	1,497
2039	84	84	1,581
2040	333	333	1,914

Calculation of baseline activity data per LU/LC change category (Step 5.3 VM0015)

Not applicable because method 2 was not performed.

Step 6 of VM0015: Estimation of baseline carbon stock changes and non-CO_2

Estimation of baseline carbon stock changes (Step 6.1 VM0015)

Forest class carbon stock estimate was obtained from data from 192 plots using three information bases:

- Forest inventory in the UPAS of the management plan: UPA 2 (70 plots), UPA 3 (39 plots) and UPA 9 (73 plots) which were inventoried in 100% of intensity in years 2012, 2011 and 2010, respectively;
- Sampling in 7 plots for the purpose of regeneration studies, conducted in 2012 in different UPAS of the management plan;
- Sampling carried out in 2020, where a standardized sampling system was installed that favors rapid surveys. The sampling system consists of a 15 km long line, along which, three plots (P) were installed, subdivided into 3 plots, perpendicular to this line, in order to contemplate various forest typologies.

The following is a summary of the estimates of carbon stocks in the Seringal Valparaíso area.

Estimation of the average carbon stocks of each LU/LC class (Step 6.1.1 VM0015)

a) Existing forest typologies within the Project Area and Leakage Belt:

The plot sampling method was used to collect forest inventory data. The inventory was conducted in 192 plots distributed over the Project Area (Figure 27).

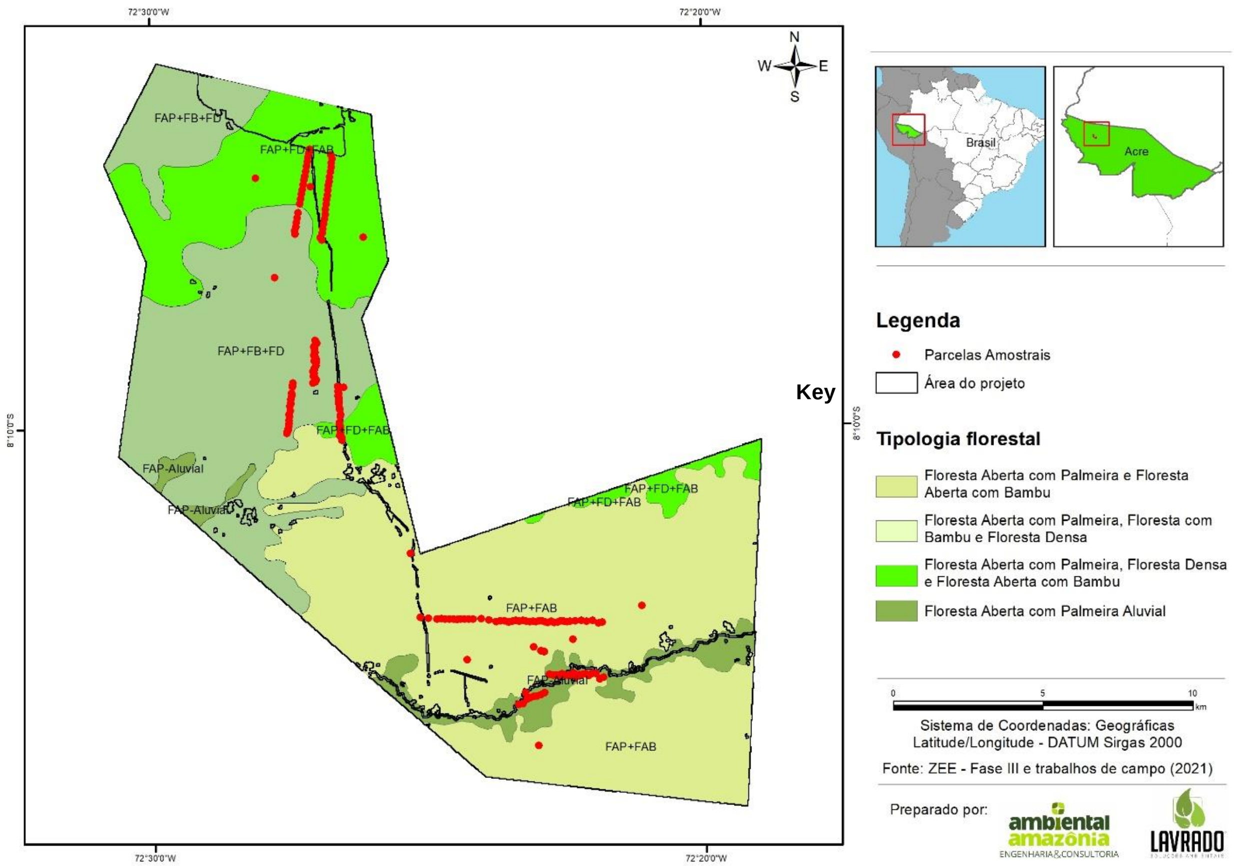

Figure 27. Distribution of forest inventory sampling points.

Each plot has a rectangular shape and variable size according to the information source, for UPAS, the plots, had an average of 12 hectares, in samples for regeneration, the plots had 0.2 hectares and for floristic assessment samples had 0.5 hectares. Samples of 1,113.7 hectares located in conditions of higher risk of deforestation were provided. This sampled area represents 4.6 % of the assessed universe, therefore a rate above the normal standards for statistical modeling.

All individuals with diameter at breast height (DBH) greater than or equal to 15 cm were measured in each plot. For each individual recorded the following variables were identified: common name of the species, DBH (circumference at breast height - 1.3 m from the ground) and height and quality class of the trunk.

Allometric equation for $BST=0,073D^{2,673}$ (Mello, 2017) was applied to convert DAP of individual trees into dry biomass aboveground, where:

TDB = Total dry biomass (kg)

D = Diameter at breast height (in cm, collected at 1.3 m)

Results obtained by MELLO (2017) suggest that open forests in the South-Western Amazon (SWA) are significantly different from forests in other regions of the Amazon in terms of D:H ratio, water and carbon content in biomass, above- and below-ground biomass ratio, and allometric patterns of trees and bamboo (Guadua sp.).

Trees with diameter ≤ 40 cm are on average 17% smaller in SWA than in eastern (EA), central (CA) and northwestern Amazonia (NWA). The differences found in water and carbon contents may result in forest carbon stock estimates in SWA that are 17% smaller than in CA.

A first set of allometric equations was fitted to estimate belowground, aboveground, total dry biomass and carbon stock in the South-Western Amazon. The bamboo biomass was found to represent a significant portion of the forest biomass and evidence was found that it presents distinct allometric patterns than the different populations existing in the SWA. The distinct patterns found in SWA can cause uncertainties of up to ±27% in the estimated forest biomass and consequently in the carbon stocks and fluxes between forests and the atmosphere.

The belowground biomass was obtained by using the following allometric equation $BSAbS=0.009D^{2,685}$ (Mello, 2017), to convert DBH of individual trees into dry belowground biomass, where:

BSAbS = Dry belowground Biomass (kg)

D = Diameter at breast height (in cm, collected at 1.3 m)

The allometric equations developed by Mello (2017) are appropriate to the circumstances of the Project because:

- It was developed from destructive samples collected in forests in Acre State;
- It was obtained in a PhD program with international recognition and peer-reviewed in the defense of the thesis;
- The predictor variable used (DBH) is the most widely used variable to predict biomass in allometric studies of trees in the Amazon forest;
- The models were calibrated using destructive samples and presented an $R2 = 0.901$ for below ground biomass and $R2 = 0.974$ for total biomass showing an excellent fit for dry tree biomass;
- It was developed for Western Amazonia, the same biome where the Project is located.

Expansion factors were used to include the biomass of trees smaller than 10 cm in diameter, palms, lianas, aboveground dead biomass and non-arboreal components (NOGUEIRA et al., 2008), as observed in Table 31. To maintain the conservatism of estimates and result robustness, only the factor for dead above ground biomass was applied.

The expansion factors mentioned are appropriate for the Project because:

- Factors were obtained from published data on Forest Ecology and Management, in a respected international journal;
- Factors were developed from empirical studies throughout the Amazon, the same biome where the Project is located.

Table 31 presents expansion factors appropriate for each forest type, according to Nogueira et al. (2008). Biomass values were converted to carbon by applying a conversion factor of 48,5% (NOGUEIRA, et al. 2008).

Table 31. Biomass expansion factors by forest type (NOGUEIRA et al., 2008).

Forest typology	Trees			Dead biomass	Non-arboreal components	Total
	DBH <10 cm	Palms	Liana			
Dense forest	0.065	0.019	0.031	0.137	0.002	0.254
Open forest	0.04	0.086	0.031	0.137	0.002	0.296

The carbon content in the dry biomass was obtained by multiplying the dry biomass by 0.485 (NOGUEIRA et al. 2008). This expansion factor is appropriate for the Project because it was obtained from a published international article.

The spatial estimate of carbon stock was obtained by geoprocessing using auxiliary variables such as elevation, soil type, and forest. Carbon stock per hectare varied from 665.9 to 1,207.9 tCO2e/ha in the Reference Region.

The results by sampled plot are presented in Table 32 including estimates of belowground, aboveground, and total dry biomass. In each plot, the forest typology was also classified and the central coordinate of the plot was presented.

Table 32. Results of dry biomass in the plots sampled in the Project Area with their respective forest typology and central coordinates.

Plot	Area	Biomass (kg/ha)			Forest Typology	Coordinates	
		Underground	Aboveground	Total		X	Y
1	0.5	26,586.0	179,803.9	206,563.3	FAP+FAB	-72.422	-8.20462
2	0.5	33,848.8	228,261.8	262,341.2	FAP+FB+FD	-72.4419	-8.15455
3	0.5	28,108.1	190,383.4	218,670.7	FAP+FD+FAB	-72.4514	-8.09411
4	0.2	36,250.4	244,872.4	281,363.2	FAP+FD+FAB	-72.4356	-8.10944
5	0.5	47,080.2	316,289.4	363,708.0	FAP+FAB	-72.4053	-8.23673
6	0.5	47,767.2	321,485.0	369,587.0	FAP+FAB	-72.3838	-8.26283
7	0.5	33,269.1	223,981.1	257,482.1	FAP+FAB	-72.3522	-8.22087

8	0.2	25,711.4	174,058.3	199,934.8	FAP+FD+FAB	-72.468	-8.09141
9	0.2	34,814.4	234,937.6	269,987.1	FAP+FB+FD	-72.4625	-8.12135
10	0.2	34,695.9	233,008.5	267,954.5	FAP+FAB	-72.3732	-8.23084
11	13.4	36,388.1	242,981.1	279,652.3	FAP+FB+FD	-72.4504	-8.14039
12	10.7	34,349.8	229,629.9	264,243.4	FAP+FB+FD	-72.4502	-8.1408
13	11.8	44,947.3	300,576.1	345,867.2	FAP+FB+FD	-72.4499	-8.14121
14	11.8	48,003.4	320,762.4	369,136.3	FAP+FB+FD	-72.4502	-8.14153
15	12.0	36,131.0	240,925.3	277,342.0	FAP+FB+FD	-72.4508	-8.14228
16	12.2	44,807.3	298,825.1	343,985.7	FAP+FB+FD	-72.4505	-8.14275
17	11.3	49,595.8	330,097.4	380,093.1	FAP+FB+FD	-72.4506	-8.14351
18	11.4	45,830.7	305,804.9	351,995.2	FAP+FB+FD	-72.4504	-8.14395
19	10.5	38,911.7	259,566.0	298,784.1	FAP+FB+FD	-72.4508	-8.14481
20	11.3	30,165.7	201,598.0	231,996.1	FAP+FB+FD	-72.4505	-8.14528
21	11.3	30,713.2	205,169.4	236,120.5	FAP+FB+FD	-72.4503	-8.14574
22	11.8	51,682.3	344,076.0	396,173.5	FAP+FB+FD	-72.4501	-8.1462
23	11.8	38,711.2	258,363.3	297,377.3	FAP+FB+FD	-72.4508	-8.14656
24	11.2	40,745.6	271,500.9	312,570.9	FAP+FB+FD	-72.4501	-8.14706
25	11.5	56,863.1	378,546.4	435,866.8	FAP+FB+FD	-72.4502	-8.14794
26	11.9	30,490.8	203,805.3	234,530.6	FAP+FB+FD	-72.4508	-8.14881
27	11.4	32,520.2	217,248.6	250,020.5	FAP+FB+FD	-72.4508	-8.14928
28	11.4	31,772.0	212,012.7	244,033.9	FAP+FB+FD	-72.4511	-8.1497
29	10.6	35,895.1	239,474.3	275,651.4	FAP+FB+FD	-72.4507	-8.15018
30	11.9	40,239.1	268,592.1	309,145.7	FAP+FB+FD	-72.451	-8.15117
31	11.9	43,795.4	291,754.0	335,899.2	FAP+FB+FD	-72.4506	-8.15172
32	11.1	34,224.5	228,335.5	262,829.0	FAP+FB+FD	-72.4501	-8.15228
33	13.4	32,159.4	214,781.1	247,190.2	FAP+FB+FD	-72.4504	-8.15275
34	11.2	33,894.7	226,473.5	260,630.0	FAP+FB+FD	-72.4511	-8.15314

35	10.9	34,626.0	231,142.7	266,039.1	FAP+FB+FD	-72.4572	-8.1532
36	11.6	34,407.1	229,614.9	264,291.6	FAP+FB+FD	-72.4574	-8.15374
37	12.0	41,292.6	275,430.9	317,048.8	FAP+FB+FD	-72.4573	-8.15426
38	11.6	32,055.3	214,154.6	246,457.9	FAP+FB+FD	-72.4434	-8.15619
39	12.5	44,128.2	294,410.8	338,885.8	FAP+FB+FD	-72.4577	-8.15617
40	12.5	32,450.1	216,845.5	249,545.9	FAP+FB+FD	-72.4575	-8.15667
41	12.5	31,292.6	209,032.8	240,567.8	FAP+FB+FD	-72.4577	-8.15712
42	12.4	39,828.0	266,220.7	306,355.1	FAP+FB+FD	-72.4579	-8.15808
43	11.9	34,649.3	231,597.3	266,513.2	FAP+FB+FD	-72.4579	-8.15913
44	12.4	40,415.7	270,035.5	310,763.6	FAP+FB+FD	-72.4579	-8.1596
45	12.6	43,949.1	293,865.5	338,151.3	FAP+FB+FD	-72.4581	-8.16004
46	12.5	32,930.9	220,069.9	253,254.7	FAP+FB+FD	-72.4585	-8.16269
47	12.5	41,446.9	277,191.6	318,955.2	FAP+FB+FD	-72.4583	-8.16329
48	11.9	31,522.8	210,868.6	242,631.7	FAP+FB+FD	-72.4585	-8.16437
49	12.4	36,805.6	246,073.9	283,161.9	FAP+FB+FD	-72.4585	-8.16537
50	12.1	40,687.3	271,675.4	312,679.5	FAP+FB+FD	-72.4586	-8.16585
51	12.0	39,018.9	260,602.8	299,924.6	FAP+FB+FD	-72.4587	-8.16634
52	9.7	34,391.3	230,004.7	264,658.8	FAP+FB+FD	-72.4587	-8.16687
53	10.1	49,264.6	328,480.0	378,134.2	FAP+FB+FD	-72.4587	-8.16736
54	10.5	38,501.8	257,197.3	295,997.3	FAP+FB+FD	-72.459	-8.16782
55	10.5	37,350.5	249,471.1	287,111.4	FAP+FB+FD	-72.4592	-8.16831
56	9.4	33,011.4	220,606.1	253,872.1	FAP+FAB	-72.4426	-8.17045
57	11.4	32,525.5	217,043.0	249,823.5	FAP+FB+FD	-72.4437	-8.15422
58	8.3	46,453.5	310,428.0	357,240.0	FAP+FB+FD	-72.4436	-8.15569
59	8.2	37,840.9	252,775.2	290,909.4	FAP+FB+FD	-72.4434	-8.1567
60	7.6	34,835.7	232,552.2	267,659.8	FAP+FB+FD	-72.4436	-8.15715
61	7.9	39,844.4	266,104.0	306,257.8	FAP+FB+FD	-72.4433	-8.15762

62	8.1	35,597.3	237,800.9	273,673.9	FAP+FB+FD	-72.4433	-8.15807
63	7.7	31,077.7	207,872.7	239,187.5	FAP+FB+FD	-72.4434	-8.1585
64	8.1	42,690.1	285,292.0	328,311.3	FAP+FB+FD	-72.4434	-8.15894
65	6.3	30,815.0	206,090.3	237,140.8	FAP+FB+FD	-72.4434	-8.15938
66	5.3	42,733.8	285,758.4	328,819.4	FAP+FB+FD	-72.4432	-8.16071
67	5.9	35,192.1	235,221.5	270,684.4	FAP+FB+FD	-72.4431	-8.16116
68	5.6	37,175.5	248,385.0	285,847.8	FAP+FB+FD	-72.458	-8.16154
69	5.5	44,878.3	299,923.0	345,147.2	FAP+FB+FD	-72.4429	-8.16274
70	5.8	30,993.8	207,226.8	238,458.2	FAP+FB+FD	-72.443	-8.16329
71	5.8	24,526.9	164,132.8	188,845.7	FAP+FD+FAB	-72.4433	-8.16518
72	5.7	23,222.3	155,292.3	178,692.3	FAP+FD+FAB	-72.4432	-8.16565
73	5.9	28,473.5	190,695.7	219,383.1	FAP+FD+FAB	-72.4431	-8.16618
74	5.6	16,391.6	109,699.2	126,215.1	FAP+FD+FAB	-72.4431	-8.16668
75	5.3	26,401.7	176,687.8	203,289.6	FAP+FD+FAB	-72.4431	-8.16718
76	5.6	24,370.5	163,288.7	187,841.3	FAP+FD+FAB	-72.443	-8.16771
77	5.5	33,255.3	222,319.4	255,830.0	FAP+FD+FAB	-72.4429	-8.16822
78	5.7	37,717.8	252,236.3	290,242.5	FAP+FD+FAB	-72.443	-8.16866
79	5.6	36,731.8	245,634.1	282,646.9	FAP+FD+FAB	-72.4432	-8.16908
80	4.6	33,564.7	224,674.6	258,493.2	FAP+FD+FAB	-72.4426	-8.16964
81	10.0	38,415.5	257,269.1	295,973.3	FAP+FD+FAB	-72.4452	-8.0846
82	10.0	33,246.9	222,226.2	255,728.6	FAP+FD+FAB	-72.4516	-8.08279
83	10.0	36,493.5	244,283.5	281,052.7	FAP+FD+FAB	-72.4448	-8.08568
84	10.0	38,747.7	259,209.2	298,251.9	FAP+FD+FAB	-72.4518	-8.08405
85	10.0	36,357.3	242,773.5	279,413.5	FAP+FD+FAB	-72.445	-8.08693
86	10.0	32,148.3	215,123.6	247,515.8	FAP+FD+FAB	-72.4521	-8.08531
87	10.0	42,542.8	284,258.4	327,129.6	FAP+FD+FAB	-72.4451	-8.08821
88	10.0	51,986.6	347,611.5	399,996.0	FAP+FD+FAB	-72.4523	-8.08656

89	10.0	30,346.4	203,257.9	233,831.9	FAP+FD+FAB	-72.4453	-8.08968
90	10.0	39,347.1	263,017.0	302,666.3	FAP+FD+FAB	-72.4526	-8.08795
91	10.0	31,981.6	213,963.4	246,188.2	FAP+FD+FAB	-72.4456	-8.09125
92	10.0	18,872.2	126,467.2	145,480.1	FAP+FD+FAB	-72.4529	-8.08949
93	10.0	43,330.4	289,185.5	332,854.8	FAP+FD+FAB	-72.4458	-8.09263
94	10.0	24,358.2	163,152.8	187,693.7	FAP+FD+FAB	-72.4531	-8.09085
95	10.0	31,449.2	210,163.4	241,854.9	FAP+FD+FAB	-72.446	-8.09383
96	10.0	22,810.4	152,938.3	175,917.7	FAP+FD+FAB	-72.4534	-8.09209
97	10.0	37,053.2	247,906.6	285,241.5	FAP+FD+FAB	-72.4461	-8.09519
98	10.0	39,187.5	261,982.4	301,470.4	FAP+FD+FAB	-72.4536	-8.0935
99	10.0	46,702.9	312,463.5	359,521.2	FAP+FD+FAB	-72.4463	-8.09669
100	10.0	48,653.3	325,058.7	374,087.8	FAP+FD+FAB	-72.4538	-8.09496
101	10.0	38,105.0	254,616.1	293,015.0	FAP+FD+FAB	-72.4466	-8.09807
102	10.0	30,476.6	203,983.1	234,690.4	FAP+FD+FAB	-72.4542	-8.09634
103	10.0	44,230.0	295,889.2	340,455.7	FAP+FD+FAB	-72.4467	-8.09945
104	10.0	31,694.8	212,099.1	244,034.1	FAP+FD+FAB	-72.4544	-8.09776
105	10.0	40,119.2	268,143.6	308,571.2	FAP+FD+FAB	-72.4469	-8.10095
106	10.0	43,823.3	292,948.7	337,108.2	FAP+FD+FAB	-72.4547	-8.09926
107	10.0	36,882.4	246,810.0	283,971.9	FAP+FB+FD	-72.4552	-8.10194
108	10.0	33,547.0	224,226.8	258,031.7	FAP+FB+FD	-72.4555	-8.10347
109	10.0	32,087.7	214,867.3	247,196.3	FAP+FB+FD	-72.4557	-8.10493
110	10.0	36,322.8	243,095.0	279,692.7	FAP+FB+FD	-72.4559	-8.10619
111	10.0	36,055.7	241,239.1	277,568.6	FAP+FB+FD	-72.4562	-8.10831
112	10.0	34,358.1	229,926.9	264,545.5	FAP+FB+FD	-72.4563	-8.10725
113	10.0	30,624.7	204,932.4	235,789.4	FAP+FD+FAB	-72.447	-8.10248
114	10.0	23,715.5	159,027.8	182,918.7	FAP+FD+FAB	-72.4473	-8.10386
115	10.0	34,584.2	231,639.6	266,483.2	FAP+FD+FAB	-72.4475	-8.10538

116	10.0	23,867.6	159,991.3	184,036.1	FAP+FD+FAB	-72.4478	-8.10681
117	10.0	31,370.1	210,319.6	241,922.2	FAP+FD+FAB	-72.4479	-8.10805
118	10.0	34,198.6	228,698.6	263,158.7	FAP+FD+FAB	-72.4486	-8.10943
119	10.0	28,087.0	187,950.8	216,250.8	FAP+FD+FAB	-72.4481	-8.11023
120	10.6	32,830.4	219,651.8	252,731.8	FAP+FAB	-72.4193	-8.22391
121	12.2	27,590.5	184,852.8	212,649.3	FAP+FAB	-72.4169	-8.22425
122	12.8	55,614.4	370,553.1	426,609.7	FAP+FAB	-72.4142	-8.22451
123	12.4	41,766.8	279,142.6	321,230.6	FAP+FAB	-72.413	-8.22441
124	12.7	47,774.3	319,833.4	367,968.0	FAP+FAB	-72.4118	-8.22448
125	12.9	34,969.1	233,972.4	269,206.7	FAP+FAB	-72.4105	-8.2245
126	12.7	54,504.0	364,249.9	419,173.4	FAP+FAB	-72.4093	-8.22453
127	13.2	45,446.2	304,122.4	349,912.9	FAP+FAB	-72.4082	-8.2247
128	13.4	44,682.1	299,081.7	344,101.3	FAP+FAB	-72.4071	-8.2246
129	13.3	32,779.4	219,558.5	252,583.5	FAP+FAB	-72.4059	-8.22463
130	13.1	30,072.3	201,124.3	231,425.9	FAP+FAB	-72.4047	-8.22463
131	13.2	34,008.0	227,771.3	262,034.4	FAP+FAB	-72.4034	-8.22467
132	12.9	33,031.4	221,286.7	254,565.3	FAP+FAB	-72.4009	-8.2245
133	13.3	28,003.5	187,932.4	216,140.8	FAP+FAB	-72.3985	-8.22492
134	13.1	28,345.9	190,212.8	218,766.4	FAP+FAB	-72.3964	-8.22549
135	13.2	29,380.5	196,781.8	226,382.7	FAP+FAB	-72.3951	-8.22524
136	6.1	43,347.4	290,609.8	334,278.6	FAP+FAB	-72.3938	-8.22517
137	13.4	29,395.5	197,135.6	226,748.1	FAP+FAB	-72.3926	-8.22555
138	13.5	32,434.4	217,184.7	249,863.2	FAP+FAB	-72.3915	-8.22535
139	13.7	33,558.3	225,019.2	258,825.8	FAP+FAB	-72.3904	-8.22516
140	11.0	28,073.0	188,016.1	216,299.7	FAP+FAB	-72.3893	-8.22535
141	13.7	31,616.2	211,858.1	243,710.0	FAP+FAB	-72.3882	-8.22517
142	13.0	35,507.0	238,034.2	273,804.6	FAP+FAB	-72.3872	-8.22536

143	14.2	29,704.3	199,104.5	229,029.5	FAP+FAB	-72.3862	-8.22552
144	14.5	29,611.8	198,335.5	228,169.4	FAP+FAB	-72.3853	-8.22535
145	14.3	42,354.7	283,673.2	326,345.6	FAP+FAB	-72.3844	-8.22558
146	14.7	33,369.9	223,410.0	257,031.5	FAP+FAB	-72.3834	-8.22533
147	14.8	31,027.5	207,955.6	239,213.9	FAP+FAB	-72.3825	-8.22535
148	15.0	69,342.2	463,013.2	532,894.9	FAP+FAB	-72.3817	-8.22552
149	15.0	46,637.8	311,395.7	358,396.2	FAP+FAB	-72.3808	-8.22577
150	15.0	50,782.2	338,966.8	390,145.3	FAP+FAB	-72.3798	-8.22544
151	14.9	34,262.0	229,071.2	263,595.7	FAP+FAB	-72.3788	-8.22578
152	15.0	39,206.0	261,942.7	301,451.7	FAP+FAB	-72.3777	-8.22575
153	15.0	42,153.1	281,840.1	324,315.9	FAP+FAB	-72.3767	-8.22528
154	15.0	34,122.6	228,222.0	262,605.0	FAP+FAB	-72.3759	-8.22553
155	14.7	33,955.0	227,319.9	261,531.0	FAP+FAB	-72.375	-8.2256
156	15.0	31,126.8	208,337.3	239,699.6	FAP+FAB	-72.374	-8.22549
157	19.9	43,547.2	290,840.0	334,725.2	FAP+FAB	-72.3723	-8.22533
158	20.0	33,374.6	223,021.6	256,653.5	FAP+FAB	-72.3706	-8.22531
159	20.2	31,762.0	212,109.1	244,117.8	FAP+FAB	-72.369	-8.22554
160	20.7	31,312.7	209,422.5	240,974.3	FAP+FAB	-72.3672	-8.22523
161	20.7	27,977.1	187,070.3	215,261.5	FAP+FAB	-72.3643	-8.22582
162	21.0	28,989.3	193,724.8	222,937.5	FAP+FAB	-72.3654	-8.22603
163	21.0	29,732.8	198,379.4	228,345.7	FAP+FAB	-72.3851	-8.23307
164	20.4	27,375.9	182,844.5	210,432.8	FAP-Alluvial	-72.3863	-8.24841
165	20.4	25,292.5	168,993.1	194,480.9	FAP-Alluvial	-72.3852	-8.24806
166	20.7	27,665.0	184,193.4	212,080.4	FAP+FAB	-72.3828	-8.23432
167	10.1	27,885.3	186,379.6	214,479.4	FAP-Alluvial	-72.3841	-8.24785
168	9.9	30,580.0	204,393.3	235,208.5	FAP+FAB	-72.3819	-8.23459
169	10.2	54,301.8	363,197.8	417,914.0	FAP-Alluvial	-72.383	-8.24746

170	10.3	47,729.1	319,087.6	367,183.1	FAP-Alluvial	-72.3819	-8.24687
171	10.4	48,644.6	324,912.5	373,934.3	FAP-Alluvial	-72.3804	-8.24136
172	10.3	51,094.6	341,452.0	392,940.3	FAP-Alluvial	-72.3794	-8.24165
173	20.7	27,453.0	183,291.0	210,957.7	FAP-Alluvial	-72.3784	-8.2416
174	21.0	26,455.5	176,748.7	203,408.7	FAP-Alluvial	-72.3776	-8.24164
175	21.0	22,456.1	150,086.0	172,714.9	FAP-Alluvial	-72.3766	-8.24127
176	21.5	22,965.4	153,654.1	176,794.2	FAP-Alluvial	-72.3757	-8.24166
177	21.8	24,894.5	166,393.5	191,479.4	FAP-Alluvial	-72.3747	-8.24175
178	21.1	26,761.8	178,766.6	205,735.7	FAP-Alluvial	-72.3739	-8.24151
179	22.0	25,795.5	172,488.3	198,481.2	FAP-Alluvial	-72.373	-8.24104
180	21.5	27,746.2	185,236.6	213,199.1	FAP-Alluvial	-72.3722	-8.24217
181	10.7	36,252.5	242,633.8	279,160.7	FAP-Alluvial	-72.3712	-8.24151
182	21.4	30,176.0	201,365.2	231,777.7	FAP-Alluvial	-72.3703	-8.24148
183	21.4	28,336.3	189,229.4	217,785.8	FAP-Alluvial	-72.3694	-8.24133
184	22.0	30,009.7	200,441.9	230,684.3	FAP-Alluvial	-72.3685	-8.24182
185	11.0	38,014.1	254,431.2	292,733.1	FAP-Alluvial	-72.3675	-8.2412
186	10.9	34,175.4	228,834.7	263,267.5	FAP-Alluvial	-72.3663	-8.24119
187	10.7	33,666.5	224,893.6	258,820.7	FAP+FAB	-72.3652	-8.24292
188	11.0	47,663.6	318,498.3	366,529.6	FAP+FAB	-72.364	-8.24234
189	22.0	29,725.6	198,765.3	228,718.4	FAP-Alluvial	-72.3876	-8.24681
190	10.9	44,905.1	300,663.0	345,906.5	FAP-Alluvial	-72.3872	-8.24875
191	11.1	42,822.8	286,099.0	329,252.9	FAP-Alluvial	-72.3884	-8.25015
192	18.0	26,578.0	177,176.9	203,965.3	FAP-Alluvial	-72.3897	-8.25041

Table 33 presents average carbon stock values per hectare of all land use and land cover classes in the baseline scenario, present in the Project Area, leakage belt and leakage management areas.

Table 33. Carbon stocks per hectare of initial forest class icl existing in the Project Area and Leakage Belt (Table 15a of VM0015 Methodology).

Initial forest class *icl*						$Ctot_{icl}$	
Name	Forest						
Id_{icl}	1						
Average carbon stock/ha + 90 % IC							
Cab_{icl}		Cbb_{icl}		Cdw_{icl}			
Stock C $tCO_2e\ ha^{-1}$	90% IC $tCO_2e\ ha^{-1}$	Stock C $tCO_2e\ ha^{-1}$	90% IC $tCO_2e\ ha^{-1}$	Stock C $tCO_2e\ ha^{-1}$	90% IC $tCO_2e\ ha^{-1}$	Stock C $tCO_2e\ ha^{-1}$	90% IC $tCO_2e\ ha^{-1}$
419.7	±13.6	62.8	±2.04	57.5	±1.86	540.0	±17.5

b) Post-deforestation classes estimated to exist in the Project Area and Leakage Belt in the baseline case and the existing non-forest classes in leakage management areas:

VM0015 methodology allows estimates from local studies and therefore the value of 59.1 tCO_{2e} ha^{-1} was taken as the reference for the carbon stock of the anthropogenic vegetation in the equilibrium class, the class that was projected to exist in the Project Area and Leakage Belt under the Project scenario. This carbon stock estimate was obtained by (WANDERLLI; FEARNSIDE, 2015), through a long-term study of the landscape and average vegetation composition in deforested areas of the Brazilian Amazon, which consists of a matrix composed of pasture, small-scale agriculture, and secondary vegetation, usually found in a post-deforestation scenario in the Amazon.

Wanderlli & Fearnside (2015) is a peer-reviewed scientific literature, and represents one of the most current studies for the Brazilian Amazon on carbon stocks in deforested areas, satisfying the requirements of section 4.5.6 of the VCS Standard:

1. The data were not collected directly from primary sources;

2. The data was collected from secondary sources, by researchers from INPA (renowned research institute for the subject in Brazil), published by an international and prestigious scientific journal (Forest Ecology and Management, 2015);

3. The data are from a period that accurately reflects current practice available for carbon stock determination;

4. No sampling was applied on this data;

5. The data is publicly available via website: http://www.ppginpa.eco.br/documents/teses_dissertacoes/wandelli-fearnside-2015-for-colman_Land-use-history-and-capoeira-growth.pdf. Accessed on June 18, 2018;

6. Available for independent assessment for VCSA and VVB;

7. The data are appropriate for geographical scope of VM0015,

8. Analysis by experts was not required; and

9. The data is not only kept in a central storage repository.

Calculation of carbon stock change factors (6.1.2 VM0015)

In the baseline scenario, the Project considers the change in carbon stock from forest cover replacement by a vegetation type that can be pasture areas, small-scale agricultural plantations, or plantations (temporary or permanent). AFOLU requirements provides that the carbon stock decomposition in soil carbon, below ground biomass, dead wood and harvested wood products in the baseline case be considered. To calculate this reduction in carbon stock, the VM0015 1.1 version applies a standard linear function to explain the reduction in carbon stock in initial forest classes (icl) and increase in carbon stock in post-deforestation use classes. Table 34 and Table 35 summarize how the carbon stock change factor was calculated.

Table 34. Change factors in carbon stock for initial forest classes icl (Method 1) (Table 20a of VM0015 Methodology).

Year after deforestation		$\Delta Cab_{icl,t}$	$\Delta Cbb_{icl,t}$	$\Delta Cdw_{icl,t}$	$\Delta ctot_{cl,t}$
1	t*	419.7	6.3	5.7	431.7
2	t*+1	0.0	6.3	5.7	12.0
3	t*+2	0.0	6.3	5.7	12.0
4	t*+3	0.0	6.3	5.7	12.0
5	t*+4	0.0	6.3	5.7	12.0
6	t*+5	0.0	6.3	5.7	12.0
7	t*+6	0.0	6.3	5.7	12.0
8	t*+7	0.0	6.3	5.7	12.0
9	t*+8	0.0	6.3	5.7	12.0
10	t*+9	0.0	6.3	5.7	12.0
11	t*+10				
12	t*+11				
13	t*+12				
14	t*+13				
15	t*+14				

16	t*+15				
17	t*+16				
18	t*+17				
19	t*+18				
20	t*+19				
21-T	t*+20...				

Table 35. Change factors in carbon stock for final classes fcl or zone z (Method 1) (Table 20b of VM0015 Methodology).

Year after deforestation		$\Delta ctot_{cl,t}$
1	t*	0.0
2	t*+1	5.9
3	t*+2	5.9
4	t*+3	5.9
5	t*+4	5.9
6	t*+5	5.9
7	t*+6	5.9
8	t*+7	5.9
9	t*+8	5.9
10	t*+9	5.9
11	t*+10	0
12	t*+11	0
13	t*+12	0
14	t*+13	0
15	t*+14	0
16	t*+15	0
17	t*+16	0

18	t*+17	0
19	t*+18	0
20	t*+19	0
21-T	t*+20…	

Calculation of baseline carbon stock changes (Step 6.1.3 VM0015)

Method 1 (activity data available for classes) was used to calculate the total baseline carbon stock change in the Project Area (Table 36) and in the Leakage Belt (Table 37) in the following year, equation 10 on page 72 of VM0015 version 1.1, as presented:

$$\begin{aligned}\Delta CBSLPA_t = \sum_{p=1}^{P}\Bigg(&\sum_{icl=1}^{Icl} ABSLPA_{icl,t} * \Delta Cp_{icl,t=t*} - \sum_{z=1}^{Z} ABSLPA_{z,t} * \Delta Cp_{z,t=t*}\\ &+ \sum_{icl=1}^{Icl} ABSLPA_{icl,t-1} * \Delta Cp_{icl,t=t*+1} - \sum_{z=1}^{Z} ABSLPA_{z,t-1} * \Delta Cp_{z,t=t*+1}\\ &+ \sum_{icl=1}^{Icl} ABSLPA_{icl,t-2} * \Delta Cp_{icl,t=t*+2} - \sum_{z=1}^{Z} ABSLPA_{z,t-2} * \Delta Cp_{z,t=t*+2} \quad + \cdots\\ &+ \sum_{icl=1}^{Icl} ABSLPA_{icl,t-19} * \Delta Cp_{icl,t=t*+19} - \sum_{z=1}^{Z} ABSLPA_{z,t-19} * \Delta Cp_{z,t=t*+19}\Bigg)\end{aligned}$$

Where:

ΔCBSLPAt: Total change in baseline carbon stock in the Project Area in the year t (tCO2-e);

ABSLPAicl, t: Area of the initial forest class icl cleared at time t within the Project Area in the baseline case (ha);;

ABSLPAicl, t-1: Area of the initial forest class icl cleared at time t-19 within the Project Area in the baseline case (ha);;

ABSLPAicl, t = t-19: Area of the initial forest class icl cleared at time t-19 within the Project Area in the baseline case (ha);;

ΔCpicl, t = t *: The factor of the average carbon stock change for the carbon pool fixed at the initial forest class icl applicable at time t (as shown in Table 20.a) (tCO2-e.ha-1);

ΔCpicl, t = t * + 19: The average carbon stock change factor for the carbon pool fixes the initial forest class icl applicable at the time t = t * + 19 (20th year after deforestation, (as shown in Table 20.a VM0015) (tCO2-e. ha-1);

ABSLPAz, t: Area of "deforested" z-zone at time t within the Project Area in the baseline case (ha);

ABSLPAz, t-1: Area of "deforested" z-zone at time t-1 in the Project Area in the baseline case (ha);

ABSLPAz, t-19: Area of "deforested" z-zone at time t-19 in the Project Area in the baseline case (ha);

ΔCpz, t = t * : Factor of average change in carbon stock for the applicable z carbon pool in time t = t * (according to Table 20.b VM0015) (tCO2-e.ha-1);

ΔCpz, t = t + 1: Factor of average change in carbon stock for the applicable carbon pool in time t = t * + 1 ((= second year after deforestation, as shown in Table 20.b VM0015) (tCO2-e.ha-1);

ΔCpz, t = t * + 19: Factor of average change in carbon stock for the applicable carbon pool in time t = t * + 19 ((20th year after deforestation, (as shown in Table 20.b VM0015) (tCO2-e.ha -1).

Table 36. Baseline of carbon stock change in the Project Area (Table 21b of VM0015 Methodology).

Change in carbon stocks by initial forest class *icl*		Change in total carbon stocks by initial forest class in the Project Area	
ID_{icl}>	1	CBSLPA $_{icl,t}$	CBSLPA
Name>	Forest	Annual	Cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e
2021	44,186	44,186	44,186
2022	92,065	92,065	136,251
2023	87,684	87,684	223,935
2024	135,963	135,963	359,898
2025	65,369	65,369	425,267
2026	102,103	102,103	527,370
2027	118,110	118,110	645,480
2028	110,104	110,104	755,583
2029	154,803	154,803	910,386
2030	128,015	128,015	1,038,401
2031	185,668	185,668	1,224,069
2032	157,834	157,834	1,381,903
2033	159,420	159,420	1,541,323
2034	91,968	91,968	1,633,291
2035	223,187	223,187	1,856,478
2036	72,184	72,184	1,928,662
2037	107,001	107,001	2,035,663
2038	116,657	116,657	2,152,319
2039	119,052	119,052	2,271,371
2040	124,849	124,849	2,396,220

Table 37. Carbon stock change baseline in the Project Area (Table 21b of VM0015 Methodology).

Change in carbon stocks by post-deforestation in Zone z		Change in total post-deforestation carbon stocks in the Project Area	
ID_{icl}>	1	$CBSLPA_{icl,t}$	CBSLPA
Name>	Zone 1	Annual	Cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e
2021	0	0	0
2022	604	604	604
2023	1,847	1,847	2,451
2024	2,995	2,995	5,446
2025	4,771	4,771	10,217
2026	5,532	5,532	15,750
2027	6,775	6,775	22,525
2028	8,202	8,202	30,726
2029	9,479	9,479	40,206
2030	11,333	11,333	51,538
2031	12,768	12,768	64,306
2032	14,364	14,364	78,670
2033	14,915	14,915	93,586
2034	15,564	15,564	109,150
2035	14,662	14,662	123,812
2036	16,566	16,566	140,378
2037	15,884	15,884	156,262
2038	15,518	15,518	171,780
2039	15,439	15,439	187,220
2040	14,836	14,836	202,056

Table 38. Total net change in carbon stock in the baseline scenario in the Project Area (Table 21b of VM0015 Methodology)

Change in net carbon stocks in the Project Area	
$CBSLPA_{icl,t}$	CBSLPA
Annual	Cumulative
tCO_2-e	tCO_2-e
44,186	44,186
91,461	135,647
85,837	221,484

132,969	354,452
60,597	415,050
96,571	511,620
111,335	622,955
101,902	724,857
145,323	870,181
116,682	986,863
172,900	1,159,763
143,470	1,303,233
144,505	1,447,738
76,404	1,524,141
208,525	1,732,666
55,617	1,788,284
91,117	1,879,401
101,139	1,980,539
103,612	2,084,151
110,013	2,194,164

Table 39. Carbon stock change baseline in the Leakage Belt area (Table 21c of VM0015 Methodology).

Change in carbon stocks by initial forest class *icl*		Change in total carbon stock by initial forest class in the Leakage Belt area	
ID_{icl}>	1	CBSLLK $_{icl,t}$	CBSLLK
Name>	Forest	Annual	Cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e
2021	50,192	50,192	50,192
2022	13,165	13,165	63,357
2023	22,658	22,658	86,015
2024	17,339	17,339	103,354
2025	12,204	12,204	115,558
2026	15,730	15,730	131,288
2027	28,978	28,978	160,266
2028	66,041	66,041	226,307
2029	38,992	38,992	265,299
2030	41,276	41,276	306,575
2031	40,763	40,763	347,338
2032	68,231	68,231	415,569
2033	33,434	33,434	449,003
2034	21,451	21,451	470,454
2035	60,892	60,892	531,347

2036	35,631	35,631	566,977
2037	99,954	99,954	666,931
2038	77,872	77,872	744,803
2039	47,489	47,489	792,292
2040	155,068	155,068	947,360

Table 40. Carbon stock change baseline in the Leakage Belt area (Table 21c of VM0015 Methodology).

Change in carbon stocks by post-deforestation in Zone z		Change in total carbon stock of post-deforestation in the Leakage Belt area	
ID_{icl}>	1	CBSLLK $_{icl,t}$	CBSLLK
Name>	Zone 1	Annual	Cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e
2021	0	0	0
2022	687	687	687
2023	848	848	1,534
2024	1,134	1,134	2,668
2025	1,339	1,339	4,007
2026	1,469	1,469	5,476
2027	1,643	1,643	7,120
2028	1,994	1,994	9,113
2029	2,842	2,842	11,955
2030	3,296	3,296	15,251
2031	3,769	3,769	19,019
2032	3,554	3,554	22,573
2033	4,232	4,232	26,805
2034	4,293	4,293	31,098
2035	4,267	4,267	35,364
2036	4,855	4,855	40,219
2037	5,037	5,037	45,256
2038	5,923	5,923	51,180
2039	5,999	5,999	57,179
2040	6,040	6,040	63,220

Table 41. Change in Net Total of carbon stock in a baseline scenario of Leakage Belt (Table 21c of VM0015 Methodology)

Change in net carbon stock in the Leakage Belt area	
CBSLLK $_{icl,t}$	CBSLLK
Annual	Cumulative
tCO_2-e	tCO_2-e
50,192	50,192
12,479	62,670
21,811	84,481
16,205	100,686
10,865	111,550
14,261	125,811
27,335	153,146
64,048	217,194
36,150	253,344
37,980	291,324
36,994	328,319
64,677	392,996
29,202	422,198
17,158	439,357
56,626	495,982
30,776	526,758
94,916	621,675
71,949	693,623
41,490	735,113
149,028	884,141

Baseline non-CO_2 emissions from forest fires (Step 6.2 VM0015)

Non-CO2 emissions have not been taken into account and counted in this Project, due to the low risk in the Project Area.

4.2 Project Emissions

Step 7 of VM0015 – Ex ante estimation of actual carbon stock changes and non-CO_2 emissions in the Project Area.

Ex ante estimation of actual carbon stock changes (Step 7.1 VM0015)

Ex ante estimation of actual carbon stock changes due to planned activities (Step 7.1.1 VM0015)

There are no plans for logging or new deforestation, and non-timber logging will be prioritized and will use all of the existing infrastructure of roads and trails on the property. Therefore, there is no estimate of reduction in carbon stock due to changes in carbon stock by deforestation for implementing infrastructure, such as opening roads or trails and forest patios in each annual production unit in the Project Area.

Charcoal Production and Fuelwood Collection

Coal and fuelwood production is not expected in the Project Area.

Optional accounting of significant carbon stock increase

Ex-ante estimate of carbon stock increase due to regeneration after management activities have been conservatively omitted, in addition to accounting for biomass expansion from palm and liana component.

Ex ante estimation of carbon stock changes due to unavoidable unplanned deforestation within the project area (Step 7.1.2 VM0015)

No significant and unavoidable deforestation is expected in the project setting due to the implemented activities. However, some unplanned deforestation may occur in the Project Area depending on the effectiveness of the proposed activities, which cannot be measured ex ante. The ex-post measurements prepared for the Monitoring Report will be important to determine actual emissions reductions

To allow for ex ante projections, a conservative assumption was made about the effectiveness of the proposed activities to define the Effectiveness Index (EI). The estimated value of EI is used to multiply the baseline projections by factor (1 - EI) and the result was taken to be the estimated ex ante emissions from unplanned deforestation in the project case. To calculate the actual ex-ante change in carbon stock due to unavoidable unplanned deforestation, equation 16 of the VM0015 Methodology version 1.1 was used, presented below and the results are shown in Table 42

$$\Delta CUDdPAt = \Delta CBSLt * (1 - EI)$$

Where:

ΔCUDdPAt: Ex-ante total change of the actual carbon stock due to unplanned and unavoidable deforestation in year t in the Project Area (tCO2-e);

ΔCBSLt: Total change in baseline carbon stock in the year in the Project Area (tCO2- e);

EI: Ex-ante index of estimated efficacy;

t: 1, 2, 3 … T, year of the proposed project crediting period (dimensionless)

Based on the history of deforestation that occurred in the area prior to the project start, the Efficiency Index (EI) of project activities was conservatively assumed to be 90% in the first five years of implementation, and that this value will gradually increase with its efficiency over the years.

Ex ante estimated net actual carbon stock changes in the project area (Step 7.1.3 VM0015)

The changes in carbon stock related to planned activities and Project effectiveness are presented in Table 42.

Table 42 - Ex-ante estimates of net carbon savings in the Project Area over the Project scenario (Table 27 of VM0015).

Project year t	Total decrease of carbon stock due to planned activities		Total increase of carbon stock due to planned activities		Total reduction of carbon stock due to unavoidable unplanned deforestation		Total change of carbon stock in case of project	
	Annual ΔCPAdPAt tCO_2e	Cumulative ΔCPAdPA tCO_2e	Annual ΔCPAiPAt tCO_2e	Cumulative ΔCPAiPA tCO_2e	Annual ΔCUDdPAt tCO_2e	Cumulative ΔCUDdPA CO_2e	Annual ΔCPSPAt tCO_2e	Cumulative ΔCPSPA tCO_2e
2021	0	0	0	0	4,419	4,419	4,419	4,419
2022	0	0	0	0	9,146	13,565	9,146	13,565
2023	0	0	0	0	8,584	22,148	8,584	22,148
2024	0	0	0	0	13,297	35,445	13,297	35,445
2025	0	0	0	0	6,060	41,505	6,060	41,505
2026	0	0	0	0	7,726	49,231	7,726	49,231
2027	0	0	0	0	8,907	58,137	8,907	58,137
2028	0	0	0	0	7,133	65,271	7,133	65,271
2029	0	0	0	0	10,173	75,443	10,173	75,443
2030	0	0	0	0	7,001	82,444	7,001	82,444
2031	0	0	0	0	10,374	92,818	10,374	92,818
2032	0	0	0	0	7,173	99,992	7,173	99,992
2033	0	0	0	0	7,225	107,217	7,225	107,217
2034	0	0	0	0	3,056	110,273	3,056	110,273
2035	0	0	0	0	8,341	118,614	8,341	118,614
2036	0	0	0	0	1,669	120,283	1,669	120,283
2037	0	0	0	0	2,734	123,016	2,734	123,016
2038	0	0	0	0	2,023	125,039	2,023	125,039
2039	0	0	0	0	2,072	127,111	2,072	127,111
2040	0	0	0	0	1,100	128,211	1,100	128,211

Ex ante estimation of actual non-CO_2 emissions from forest fires (Step 7.2 VM0015)

Non-CO_2 emissions from forest fires were not accounted for baseline scenario.

Total ex ante estimations for the Project Area (Step 7.3 VM0015)

The Table 43 presents the expected net changes and non-CO2 emissions in the Project Area. If these emissions occur during the development of Project activities, they will be monitored and reported to verify if there will be an increase in estimated emissions under the Project scenario.

Table 43 - Total ex-ante estimate of net changes in carbon stock and non-CO2 emissions in the Project Area (Table 29 of VM0015).

Project year t	Total decrease of carbon stock due to planned activities		Total decrease of carbon stock due to planned activities		Total reduction of carbon stock due to unavoidable unplanned deforestation		Total change of carbon stock in case of project		Total ex-ante estimation for actual non-CO2 emissions from forest fires in the Project Area	
	Annual ΔCPAdPAt tCO_2e	Cumulative ΔCPAdPA tCO_2e	Annual ΔCPAiPAt tCO_2e	Cumulative ΔCPAiPA tCO_2e	Annual ΔCUDdPAt tCO_2e	Cumulative ΔCUDdPA CO_2e	Annual ΔCPSPAt tCO_2e	Cumulative ΔCPSPA tCO_2e	Annual ΔEBBPSPAt tCO_2e	Cumulative EBBPSPA tCO_2e
2021	0	0	0	0	4,419	4,419	4,419	4,419	0	0
2022	0	0	0	0	9,146	13,565	9,146	13,565	0	0
2023	0	0	0	0	8,584	22,148	8,584	22,148	0	0
2024	0	0	0	0	13,297	35,445	13,297	35,445	0	0
2025	0	0	0	0	6,060	41,505	6,060	41,505	0	0
2026	0	0	0	0	7,726	49,231	7,726	49,231	0	0
2027	0	0	0	0	8,907	58,137	8,907	58,137	0	0
2028	0	0	0	0	7,133	65,271	7,133	65,271	0	0
2029	0	0	0	0	10,173	75,443	10,173	75,443	0	0
2030	0	0	0	0	7,001	82,444	7,001	82,444	0	0
2031	0	0	0	0	10,374	92,818	10,374	92,818	0	0
2032	0	0	0	0	7,173	99,992	7,173	99,992	0	0
2033	0	0	0	0	7,225	107,217	7,225	107,217	0	0
2034	0	0	0	0	3,056	110,273	3,056	110,273	0	0
2035	0	0	0	0	8,341	118,614	8,341	118,614	0	0
2036	0	0	0	0	1,669	120,283	1,669	120,283	0	0
2037	0	0	0	0	2,734	123,016	2,734	123,016	0	0
2038	0	0	0	0	2,023	125,039	2,023	125,039	0	0
2039	0	0	0	0	2,072	127,111	2,072	127,111	0	0
2040	0	0	0	0	1,100	128,211	1,100	128,211	0	0

4.3 Leakage

Step 8 of VM0015 – Ex-ante estimation of leakage

Ex ante estimation of the decrease in carbon stocks and increase in GHG emissions due to leakage prevention measures (Step 8.1 VM0015)

Leak prevention measures will occur at the boundaries of leakage management areas. As described in section 1.18, two activities proposed by the Project will contribute as management measures to leakage: "strengthening the management of non-timber forest products" and "updating and supplementary studies". Therefore, no activities to improve agricultural or pasture management, or forage production or any other activities that reduce carbon stocks and increase GHG emissions compared to the baseline scenario are planned.

Follow-up activities that act as leakage management will be monitored as indicated in section 5.3 and reported at all Project verification events.

Carbon stock changes due to activities implemented in leakage management areas (Step 8.1.1 VM0015)

Tables 30c of VM0015 are not applicable since no decrease in carbon stocks is expected due to the activities implemented in the leakage management areas.

Ex ante estimation of CH4 and N2O emissions from grazing animals (Step 8.1.2 VM0015)

As mentioned above, the development of activities that create a significant increase in CH_4 e N_2O emissions of grazing animals are not foreseen within the Project's activities. Thus, tables 31 and 32 of VM0015 are not applicable.

Total ex ante estimated carbon stock changes and increases in GHG emissions due to leakage prevention measures (Step 8.1.3 VM0015)

Table 33 of VM0015 is not applicable (rationales presented above).

Ex ante estimation of the decrease in carbon stocks and increase in GHG emissions due to activity displacement leakage (Step 8.2 VM0015)

Activities that will cause deforestation within the Project Area in the baseline case may be shifted outside the project boundary due to the implementation of the AUD project activity. A greater decrease in carbon stocks within the leakage belt for the project scenario than those predicted ex ante would indicate displacement of deforestation activities due to the project.

Ex-ante activity displacement leakage was calculated based on anticipated combined effectiveness of the proposed leakage prevention measures and project activities. As explained above, the Project will seek to prevent deforestation through the activities of "strengthening the management of non-timber forest products" and "updating and complementing studies".

The activity of strengthening the management of non-timber forest products seeks to identify improvements and other opportunities to be developed in order to strengthen the practice in the region. Through the valuation of the standing forest it is expected to influence new dynamics and sustainable productive models for the region, providing a positive model of a forest-based and sustainable economy in the Amazon. Therefore, it is expected that the scope of results will reach the major number possible of stakeholders through the communication channels available for the project. In addition, the "updating and supplementary studies" activity will also work with different stakeholders, with a special focus on local rural communities that have shown interest in working for the project.

Although the Project aims to reach 100% of the agents at baseline, a "Leakage Displacement Factor" was conservatively considered. The calculation of ex ante change in the actual carbon stock due to unavoidable unplanned deforestation used an equation similar to equation 16 from VM0015 Methodology version 1.1 presented in Step 7.1. 2; however, adapting it by multiplying the estimated baseline carbon stock changes for the Project Area by a "Displacement Leakage Factor" (DLF) representing the percentage of deforestation expected to be displaced outside the project boundary, starting with a 10% rate and decreasing it over the project life cycle. The equation is presented below:

$$\Delta CADLKt = \Delta CBSLPAt * DLF$$

Where:

ΔCADLKt: Total decrease in carbon stock due to displaced deforestation in the year t (tCO2e);

ΔCBSLPAt: Total change in baseline carbon stock in the Project Area in year t (tCO2e);

DLF: Leakage displacement factor (%).

Thus, a displacement factor of 10% was adopted during the first five years. Then, the reduction of the leakage displacement factor is gradual, already considering the influence of the project in this context. Therefore, the leakage displacement factor tends to approach zero during the 30 years of project implementation. The ex ante estimation of leakage due to activity displacement for the first fixed baseline period is found in Table 44 and the total ex ante leakage is shown in Table 45.

Table 44. Estimated ex-ante leakage due to activity displacement (Table 34 of VM0015 Methodology version 1.1)

Project year t	Decrease in carbon stocks due to deforestation displacement		Total ex-ante estimated increase in GHG emissions due to displaced forest fires	
	Annual $CADLK_t$ tCO_2e	Cumulative CADLK tCO_2e	Annual $EADLK_t$ tCO_2e	Cumulative EADLK tCO_2e
2021	4,419	4,419	0	0
2022	9,146	13,565	0	0
2023	8,584	22,148	0	0
2024	13,297	35,445	0	0

2025	6,060	41,505	0	0
2026	7,726	49,231	0	0
2027	8,907	58,137	0	0
2028	7,133	65,271	0	0
2029	10,173	75,443	0	0
2030	7,001	82,444	0	0
2031	10,374	92,818	0	0
2032	7,173	99,992	0	0
2033	7,225	107,217	0	0
2034	3,056	110,273	0	0
2035	8,341	118,614	0	0
2036	1,669	120,283	0	0
2037	2,734	123,016	0	0
2038	2,023	125,039	0	0
2039	2,072	127,111	0	0
2040	1,100	128,211	0	0

Ex ante estimation of total leakage (Step 8.3 VM0015)

Table 45. Ex ante estimated total leakage (Table 35 of VM0015 Methodology version 1)

Project year t	Total ex ante increase in GHG emissions due to increase in grazing activities		Total ex-ante estimated increase in GHG emissions due to displaced forest fires		Decrease in carbon stocks due to displaced deforestation		Decrease in carbon stocks due to leakage prevention measures		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
	Annual $EGLK_t$ tCO_2e	Cumulative EGLK tCO_2e	Annual $EADLK_t$ tCO_2e	Cumulative EADLK tCO_2e	Annual $CADLK_t$ tCO_2e	Cumulative CADLK tCO_2e	Annual $CLPMLK_t$ tCO_2e	Cumulative CLPMLK tCO_2e	Annual CLK_t tCO_2e	Cumulative CLK tCO_2e	Annual ELK_t tCO_2e	Cumulative ELK tCO_2e
2021	0	0	0	0	4,419	4,419	0	0	4,419	4,419	0	0
2022	0	0	0	0	9,146	13,565	0	0	9,146	13,565	0	0
2023	0	0	0	0	8,584	22,148	0	0	8,584	22,148	0	0
2024	0	0	0	0	13,297	35,445	0	0	13,297	35,445	0	0
2025	0	0	0	0	6,060	41,505	0	0	6,060	41,505	0	0
2026	0	0	0	0	7,726	49,231	0	0	7,726	49,231	0	0
2027	0	0	0	0	8,907	58,137	0	0	8,907	58,137	0	0
2028	0	0	0	0	7,133	65,271	0	0	7,133	65,271	0	0
2029	0	0	0	0	10,173	75,443	0	0	10,173	75,443	0	0
2030	0	0	0	0	7,001	82,444	0	0	7,001	82,444	0	0
2031	0	0	0	0	10,374	92,818	0	0	10,374	92,818	0	0
2032	0	0	0	0	7,173	99,992	0	0	7,173	99,992	0	0
2033	0	0	0	0	7,225	107,217	0	0	7,225	107,217	0	0
2034	0	0	0	0	3,056	110,273	0	0	3,056	110,273	0	0

2035	0	0	0	0	8,341	118,614	0	0	8,341	118,614	0	0
2036	0	0	0	0	1,669	120,283	0	0	1,669	120,283	0	0
2037	0	0	0	0	2,734	123,016	0	0	2,734	123,016	0	0
2038	0	0	0	0	2,023	125,039	0	0	2,023	125,039	0	0
2039	0	0	0	0	2,072	127,111	0	0	2,072	127,111	0	0
2040	0	0	0	0	1,100	128,211	0	0	1,100	128,211	0	0

4.4 Estimated Net GHG Emission Reductions and Removals

Step 9 of VM0015 – Ex ante total net anthropogenic GHG emission reductions

Significance Assessment (Step 9.1 VM0015)

Using the most recent EB-CDM approved "Tool for testing significance of GHG emissions in A/R CDM Project activities" it was possible to verify that above ground biomass will contribute 78% of the expected emissions in the baseline scenario, below ground biomass with 12% and dead wood with 11%. Therefore, all represent significant sources of emissions (above 5%).

Calculation of ex-ante estimation of total net GHG emissions reductions (Step 9.2 VM0015)

Equation 19 was used as suggested by VM0015 methodology version 1.1 to estimate ex ante net reduction of emissions in the Project. The result is shown in

Table 46 below (Table 36 of VM0015 Methodology version 1.1).

$$\Delta REDDt = (\Delta CBSLPAt + EBBBSLPAt) - (\Delta CPSPAt + EBBPSPAt) - (\Delta CLKt + ELKt)$$

Where:

ΔREDDt: Reduction of ex-post anthropogenic GHG emissions attributed to the project's AUD activity in year t (tCO_2e);

ΔCBSLPAt: Sum of changes in baseline carbon stock in the Project Area in year t (tCO_2e);

EBBBSLPAt: Sum of baseline emissions caused by biomass burning in the Project Area in year t (tCO_2e);

ΔCPSPAt: Sum of ex-post changes in carbon stock in the Project Area in year t (tCO_2e);

EBBPSPAt: Sum of ex-post emissions caused by biomass burning in the Project Area in year t (tCO_2e);

ΔCLKt: Sum of ex-post changes of carbon stock per leakage in year t (tCO_2e);

ELKt: Sum of ex-post emissions from leakage in year t (tCO_2e);

t: 1, 2, 3 … T, one year of the proposed credit period (dimensionless).

Calculation of ex ante Verified Carbon Units (VCUs) (Step 9.3 VM0015)

Equation 20 from Methodology VM0015 was used to estimate the number of VCUs. Risk Factor the parameter was estimated using the VCS AFOLU Non-Residency Risk Tool, resulting in 10%. The result is shown in

Table 46 below (Table 36 of VM0015 Methodology version 1.1).

$$\Delta VCUt = \Delta REDDt - VBCt$$

$$VBCt = (\Delta CBSLPAt - \Delta CPSPAt) * RFt$$

Where:

VCUt: Number of Verified Carbon Units that can be traded in year t (tCO2e);

ΔREDDt: Reduction of ex-post anthropogenic GHG emissions assigned to project's AUD activity in year t (tCO2e);

VBCt: Number of buffer credits deposited in the VCS buffer in year t (t CO2-e);

ΔCBSLPAt: Sum of changes in baseline carbon stock in the Project Area in year t (tCO2e);

ΔCPSPAt: Sum of ex-post changes in carbon stock in the Project Area in year t (tCO2e);

RFt: Risk factor used to calculate the VCS credit buffer (%);

t: 1, 2, 3 … T, one year of the proposed credit period (dimensionless).

Table 46. Ex-ante estimation of net anthropogenic GHG emission reductions (ΔREDDt) and Verified Carbon Units (VCUt) (Table 36 of VM0015 Methodology).

Project Year t	Changes in baseline carbon stock		Ex-post project carbon stock changes		Ex-post leakage belt carbon stock changes		Ex-post GHG emissions reduced		Ex-post marketable VCUs		Reserve credits (ex-post)	
	annual		cumulative		annual		cumulative		annual		cumulative	
	ΔCBSLPAt		ΔCBSLPA		ΔCPSPAt		ΔCPSPA		ΔCLKt		ΔCLK	
	tCO_2-e		tCO_2-e		tCO_2e		tCO_2e		tCO_2e		tCO_2e	
2021	44,186	44,186	4,419	4,419	4,419	4,419	35,348	35,348	31,372	31,372	3,977	3,977
2022	91,461	135,647	9,146	13,565	9,146	13,565	73,169	108,517	64,937	96,309	8,231	12,208
2023	85,837	221,484	8,584	22,148	8,584	22,148	68,669	177,187	60,944	157,253	7,725	19,934
2024	132,969	354,452	13,297	35,445	13,297	35,445	106,375	283,562	94,408	251,661	11,967	31,901
2025	60,597	415,050	6,060	41,505	6,060	41,505	48,478	332,040	43,024	294,685	5,454	37,354
2026	96,571	511,620	7,726	49,231	7,726	49,231	81,120	413,159	72,235	366,920	8,885	46,239
2027	111,335	622,955	8,907	58,137	8,907	58,137	93,521	506,681	83,279	450,199	10,243	56,482
2028	101,902	724,857	7,133	65,271	7,133	65,271	87,636	594,316	78,159	528,357	9,477	65,959
2029	145,323	870,181	10,173	75,443	10,173	75,443	124,978	719,294	111,463	639,820	13,515	79,474
2030	116,682	986,863	7,001	82,444	7,001	82,444	102,680	821,975	91,712	731,533	10,968	90,442
2031	172,900	1,159,763	10,374	92,818	10,374	92,818	152,152	974,127	135,900	867,432	16,253	106,694
2032	143,470	1,303,233	7,173	99,992	7,173	99,992	129,123	1,103,249	115,493	982,925	13,630	120,324
2033	144,505	1,447,738	7,225	107,217	7,225	107,217	130,055	1,233,304	116,327	1,099,252	13,728	134,052
2034	76,404	1,524,141	3,056	110,273	3,056	110,273	70,291	1,303,595	62,957	1,162,209	7,335	141,387
2035	208,525	1,732,666	8,341	118,614	8,341	118,614	191,843	1,495,438	171,825	1,334,033	20,018	161,405
2036	55,617	1,788,284	1,669	120,283	1,669	120,283	52,280	1,547,719	46,885	1,380,919	5,395	166,800
2037	91,117	1,879,401	2,734	123,016	2,734	123,016	85,650	1,633,369	76,812	1,457,730	8,838	175,638
2038	101,139	1,980,539	2,023	125,039	2,023	125,039	97,093	1,730,462	87,181	1,544,912	9,912	185,550
2039	103,612	2,084,151	2,072	127,111	2,072	127,111	99,468	1,829,929	89,314	1,634,225	10,154	195,704
2040	110,013	2,194,164	1,100	128,211	1,100	128,211	107,812	1,937,742	96,921	1,731,146	10,891	206,595

5 MONITORING

5.1 Data and Parameters Available at Validation

Data/Parameter	DAP
Data Unit	cm
Description	Diameter at Breast Height (130 cm) for each tree with DBH equal to or greater than 15 cm in each forest inventory plot.
Source of data	Measured in the field by Florestal Paisagismo
Value applied	See spreadsheet with field data
Justification of choice of data or description of measurement methods and procedures applied	VCS VM0015 Methodology Requirement Forest inventory data collected less than 10 years ago in multiple plots located over a wide spatial distribution.
Purpose of Data	• Baseline scenario determination • Calculating baseline emissions • Calculating project emissions • Calculating leakage
Comments	Main variable for carbon stock estimation

Data/Parameter	$BSAcS=0,064DAP^{2,671}$
Data Unit	Kg/ha
Description	Equation to convert DBH to above ground dry biomass
Source of data	MELO, A. W. F. de. Alometria de árvores e biomassa florestal na Amazônia Sul-Ocidental. 2017. 154 f. Tese (Doutorado em Ciências de Florestas Tropicais) – Instituto Nacional de Pesquisas da Amazônia, Manaus
Value applied	Not applicable
Justification of choice of data or description of measurement methods and procedures applied	Equation developed for forests with the same characteristics as the Reference Region
Purpose of Data	• *Determination of the baseline scenario* • *Calculating baseline emissions* • *Calculating project emissions* • *Leakage calculation*
Comments	Refer to document:

	- IF_IFLOR_VALPARAISO_2022_0106 - IF_Inventario_Regeneracao_parcelas_2012_RF_2022_0106 - IF_VALPARAISO_Caderneta de Campo_UPA2_2012_RF_2022_0106 - IF_VALPARAISO_Caderneta de Campo_UPA3_2011_RF_2022_0106 - IF_VALPARAISO_CARDERNETA DE CAMPO UPA9_2010_RF_2022_0106 - Tabela_Sintese_parcelas_VF_01062022 - VM0015_planilha de calculo_jurua-1.0

Data/Parameter	$BSAbS=0,009D^{2,685}$
Data Unit	Kg/ha
Description	Equation to convert DBH to below ground dry biomass
Source of data	MELO, A. W. F. de. Alometria de árvores e biomassa florestal na Amazônia Sul-Ocidental. 2017. 154 f. Tese (Doutorado em Ciências de Florestas Tropicais) – Instituto Nacional de Pesquisas da Amazônia, Manaus
Value applied	Not applicable
Justification of choice of data or description of measurement methods and procedures applied	Equation developed for forests with the same characteristics as the Reference Region
Purpose of Data	• Determination of the baseline scenario • Calculating baseline emissions • Calculating project emissions • Leakage calculation
Comments	Refer to document: - IF_IFLOR_VALPARAISO_2022_0106 - IF_Inventario_Regeneracao_parcelas_2012_RF_2022_0106 - IF_VALPARAISO_Caderneta de Campo_UPA2_2012_RF_2022_0106 - IF_VALPARAISO_Caderneta de Campo_UPA3_2011_RF_2022_0106 - IF_VALPARAISO_CARDERNETA DE CAMPO UPA9_2010_RF_2022_0106 - Tabela_Sintese_parcelas_VF_01062022 - VM0015_planilha de calculo_jurua-1.0

Data/Parameter	0.137
Data Unit	Kg/ha
Description	Conversion factor from above ground dry biomass to standing dead wood
Source of data	Nogueira, E.; Fearnside, P.; Nelson, B., et al., 2008. Estimativas de biomassa florestal na Amazônia Brasileira: Novas equações alométricas e ajustes da biomassa dos inventários de volume de madeira. Forest Ecology and Management, 256 (11), pp.1853-1857
Value applied	0.137
Justification of choice of data or description of measurement methods and procedures applied	Value found in scientific literature, developed for forests with the same characteristics as the Reference Region
Purpose of Data	• *Determination of the baseline scenario* • *Calculating baseline emissions* • *Calculating project emissions* • *Leakage calculation*
Comments	Refer to document: - VM0015_planilha de calculo_jurua-1.0

Data/Parameter	CF
Data Unit	t
Description	Carbon content in dry biomass
Source of data	Nogueira, E.; Fearnside, P.; Nelson, B., et al., 2008. Estimativas de biomassa florestal na Amazônia Brasileira: Novas equações alométricas e ajustes da biomassa dos inventários de volume de madeira. Forest Ecology and Management, 256 (11), pp.1853-1867
Value applied	0,485 t
Justification of choice of data or description of measurement methods and procedures applied	Value found in scientific literature
Purpose of Data	• Baseline scenario determination • Calculation of baseline emissions • Calculation of project emissions • Leakage calculation
Comments	-

Data/Parameter	44/12
Data Unit	dimensionless
Description	Conversion factor between carbon mass to CO2 mass, where 44 tCO2 corresponds to 12 tC
Source of data	From scientific literature 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 AFOLU
Value applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	IPCC standard value
Purpose of Data	• Baseline scenario determination • Calculating baseline emissions • Calculating project emissions • Calculating leakage
Comments	-

Data/Parameter	Ctot
Data Unit	tCO2e/ha
Description	Average carbon stock per hectare in all carbon pools in the forest class used in the baseline scenario
Source of data	Calculated by field measured data, allometric equations and conversion factors
Value applied	540,0 tCO2e/ha
Justification of choice of data or description of measurement methods and procedures applied	Above and below ground biomass estimates were made using forest inventory data, allometric equations developed in areas similar to the Project Area (MELLO, 2017). The dead wood pool was estimated based on forest inventory data and equations by Nogueira et al. (2008)
Purpose of Data	• Baseline scenario determination • Calculating baseline emissions • Calculating project emissions • Calculating leakage
Comments	Refer to document: - VM0015_planilha de calculo_jurua-1.0

5.2 Data and Parameters Monitored

Data/Parameter	ABSLPAt
Data unit	ha
Description	Annual area of baseline deforestation in the Project Area in year t
Source of data	Qualified and scientifically recognized sources such as PRODES, DETER, and MapBiomas
Description of measurement methods and procedures to be applied	Monitoring of forest cover in the Project Area through the analysis of satellite images. The data from one of the sources above will be assessed considering the Project Area boundary
Frequency of monitoring/recording	Annual
Monitored Value	To be counted after start of the Project
Monitoring equipment	Digital processing program remote sensing images and geographic information system
QA/QC procedures to be applied	Images with special resolution of 30 m or higher and the minimum mapping unit is 1 ha will be used in mapping. The minimum accuracy of the land use and land cover classification map is 80%.
Purpose of the data	This parameter will be used to calculate the emissions in the project scenario
Calculation method	If areas of unplanned deforestation are detected, the Forest Cover Reference Mark Map will be updated by map algebra
Comments	-

Data/Parameter	ΔCUDdPAt
Unit	tCO2e
Description	Total change in actual carbon stock due to unavoidable unplanned deforestation in year t in the Project Area

Data Source	Calculated using the detected areas of forest loss in the Project Area and average carbon stock
Description of the measurement methods and procedures applied	Monitoring of the ABSLPAt indicator for subsequent calculation of the change in carbon stock resulting from unplanned and unavoided deforestation
Monitoring/Recording Frequency	Annual
Applied Value	To be counted after start of the Project
Monitoring equipment	Emission spreadsheets
QA/QC procedures applied	Good practices applied in the calculation of ABSLPAt
Data Purpose	This parameter will be used to calculate the emissions in the project scenario
Calculation method	The carbon stock variation is estimated by multiplying the detected area of forest loss in the Project Area by the average carbon stock per area unit.
Comments	-

Data/Parameter	AUFPAicl,t
Unit	ha
Description	Areas affected by forest fires in the icl class in which carbon stock recovery occurs in year t
Data Source	Proper sources for forest fire detection and the scars caused to identify and classify affected areas
Description of the measurement methods and procedures applied	Identification and classification of affected areas from proper forest fire detection sources and the scars caused
Monitoring/Recording Frequency	Whenever forest fires occur

Applied Value	To be accounted after the start of the Project and when any forest fire occurs
Monitoring equipment	Digital processing program remote sensing images and geographic information system
QA/QC procedures applied	Images with special resolution of 30 m or higher and the minimum mapping unit is 1 ha will be used in mapping. The minimum accuracy of the land use and land cover classification map is 80%.
Data Purpose	This parameter will be used to calculate the emissions in the project scenario
Calculation method	If affected areas are detected, the Forest Cover Reference Mark Map will be updated by map algebra
Comments	-

Data/Parameter	∆CUFdPAt
Unit	*tCO2e*
Description	Total reduction in carbon stock due to unplanned (and planned - where applicable) forest fires in year t in the Project Area
Data Source	Calculated using the affected areas in the Project Area and the average carbon stock
Description of applied measurement methods and procedures	Monitoring of the AUFPAicl,t indicator for subsequent calculation of change in carbon stock from areas affected by forest fires
Frequency of monitoring/recording	Whenever a forest fire occurs
Applied Value	To be counted after the start of the Project and when a forest fire occurs
Monitoring equipment	Emission spreadsheets
QA/QC procedures applied	Good practices applied in the calculation of AUFPAicl,t

Data Purpose	This parameter will be used to calculate the emissions in the project scenario
Calculation method	The change in carbon stock is estimated by multiplying the affected area by the average carbon stock per unit area.
Comments	-

Data/Parameter	ACPAicl,t
Unit	ha
Description	Analysis Area within the Project Area affected by catastrophic events in class icl in year t
Data Source	High resolution satellite imagery
Description of the measurement methods and procedures applied	Carrying out photointerpretation of high-resolution satellite images identifying areas of forest cover affected by catastrophic events
Monitoring/Recording Frequency	Whenever a catastrophic event occurs
Applied Value	To be counted after Project start and when a catastrophic event occurs
Monitoring equipment	Remote sensing images and geographic information system
QA/QC procedures applied	Images with special resolution of 30 m or higher and the minimum mapping unit is 1 ha will be used for mapping. The minimum accuracy of the land use and land cover classification map is 80%.
Data Purpose	This parameter will be used to calculate the emissions in the project scenario
Calculation method	If affected areas are detected, the Forest Cover Reference Mark Map will be updated by map algebra
Comments	-

Data/Parameter	ΔCUCdPAt
Unit	tCO2e
Description	Total reduction in carbon stock due to catastrophic events in year t in the Project Area
Data Source	Calculated using the affected areas in the Project Area and the average carbon stock
Description of applied measurement methods and procedures	Monitoring of the ACPAicl,t indicator for subsequent calculation of the change in carbon stock from areas affected by catastrophic events
Frequency of monitoring/recording	Whenever a catastrophic event occurs
Applied Value	To be counted after Project start and when a catastrophic event occurs
Monitoring equipment	Emission spreadsheets
QA/QC procedures applied	Good practices applied in the calculation of ACPAicl,t
Data Purpose	This parameter will be used to calculate the emissions in the project scenario
Calculation method	The change in carbon stock is estimated by multiplying the affected area by the average carbon stock per unit area.
Comments	-

Data/Parameter	ΔCLPMLKt
Unit	tCO2e
Description	Decrease of carbon stock due to leakage prevention measures in year t
Data Source	Follow-up report of the project activities that were implemented and other records related to the leakage prevention activities

Description of applied measurement methods and procedures	Follow up on the grazing activities following the 8.1.1 section's guidelines of VM0015 methodology v1.1
Frequency of monitoring/recording	Annual
Applied Value	To be counted after start of the Project
Monitoring equipment	Emission spreadsheets
QA/QC procedures applied	To be defined when realized
Data Purpose	This parameter will be used to calculate the leakage
Calculation method	Emissions will be calculated using the guidelines in section 8.1.1 of VM0015 methodology v1.1
Comments	No leakage prevention activities are planned that would generate a decrease in the carbon stock

Data/Parameter	EgLKt
Unit	tCO2e
Description	Emissions from grazing livestock in the leakage management areas in year t
Data Source	Existing records on the practice of grazing
Description of applied measurement methods and procedures	Follow up on the grazing activities following the 8.1.2 section's guidelines of VM0015 methodology v1.1
Frequency of monitoring/recording	Annual
Applied Value	To be counted after start of the Project
Monitoring equipment	Emission spreadsheets
QA/QC procedures applied	To be defined when realized

Data Purpose	This parameter will be used to calculate the leakage
Calculation method	Emissions will be calculated using the guidelines in section 8.1.2 of VM0015 methodology v1.1
Comments	No grazing activities are planned

Data/Parameter	ABSLLKt
Unit	ha
Description	Annual area of baseline deforestation within the leakage belt in year t
Data Source	Qualified and scientifically recognized sources such as PRODES, DETER, and MapBiomas
Description of applied measurement methods and procedures	Monitoring of forest cover in the Leak Belt through satellite image analysis. Data from one of the above sources will be evaluated considering the boundary of the Leak Belt
Frequency of monitoring/recording	Annual
Applied Value	To be counted after start of the Project
Monitoring equipment	Remote sensing images from digital processing and geographic information system program
QA/QC procedures applied	Images with special resolution of 30 m or higher and the minimum mapping unit is 1 ha will be used for mapping. The minimum accuracy of the land use and land cover classification map is 80%.
Data Purpose	This parameter will be used to calculate the leakage
Calculation method	If areas of unplanned deforestation are detected, the Forest Cover Reference Mark Map will be updated by map algebra
Comments	-

Data/Parameter	ΔCADLKt
Unit	tCO2e
Description	Total reduction in carbon stocks due to displaced deforestation in year t
Data Source	Calculated using the detected areas of forest loss in the Leakage Belt, the average carbon stock, and the estimated loss in carbon stock at baseline for the Leak Belt
Description of the measurement methods and procedures applied	Monitoring of the ABSLLKt indicator for subsequent calculation of the change in carbon stock from unplanned and unavoided deforestation
Monitoring/Recording Frequency	Annual
Applied Value	To be accounted after start of the Project
Monitoring equipment	Emission spreadsheets
QA/QC procedures applied	Good practices applied in the calculation of ABSLLKt
Data Purpose	This parameter will be used to calculate the leakage
Calculation method	The carbon stock change is estimated by multiplying the detected area of forest loss in the Leak Belt by the average carbon stock per unit area, minus the carbon stock change estimated in the baseline for the Leak Belt
Comments	-

Data/Parameter	RFt
Unit	%
Description	Risk factor used to calculate VCS buffer credits
Data Source	VCS Non-Permanence Risk Report

Description of the measurement methods and procedures applied	Monitoring the RFt indicator by applying the AFOLU Non-Permanence Risk Tool and record in the VCS Non-Permanence Risk Report
Monitoring/Recording Frequency	Annual
Applied Value	10%, in which it will be tracked and updated after the start of the Project, if necessary
Monitoring equipment	AFOLU Non-Permanence Risk Tool
QA/QC procedures applied	Good practices applied using AFOLU Non-Permanence Risk Tool
Data Purpose	This parameter will be used to calculate the number of credits that must be deposited in the buffer
Calculation method	The risk factor will be calculated using the latest version of AFOLU Non-Permanence Risk Tool
Comments	-

Data/Parameter	No. of reports
Unit	Number/year
Description	The data will be used to monitor project activities. In this way, the reports from "satellite monitoring of deforestation" and "implementation, monitoring and evaluation of activities developed by the project" will be followed up and counted.
Data Source	- Deforestation monitoring report; - Follow-up report of the project activities that have been implemented; - Report planning the activities to be developed in the following years.
Description of the measurement methods and procedures applied	All data and reports produced by the project will be stored in digital files for the entire duration of the Project. In this way, the reports from "satellite monitoring of deforestation" and

	"implementation, monitoring and evaluation of activities developed by the project" will be followed up and counted.
Monitoring/Recording Frequency	Annual
Applied Value	To be accounted after registration of the Project.
Monitoring equipment	Not applicable
QA/QC procedures applied	The systematic information in reports will be validated among proponents, allowing greater reliability and data quality. Furthermore, the Project will undergo continuously generated data and information assessment, allowing to identify improvements in the collection and registration processes, and incorporating them when identified.
Data Purpose	Not applicable
Calculation method	Not applicable
Comments	-

Data/Parameter	No. of trainings and/or interventions
Unit	Number/year
Description	The data will be used to monitor Project activities. Therefore, training and interventions carried out from activities for "property surveillance improvement" and "strengthening the management of non-timber forest products" will be monitored and counted.
Data Source	Reports (e.g. follow-up report on project activities that have been implemented), participant attendance lists, contracts, and other documents.
Description of the measurement methods and procedures applied	All data and reports produced by the project will be stored in digital files for the entire duration of the Project. Therefore, training/interventions linked to activities for "property surveillance improvement" and "strengthening of the management of non-timber forest products" will have records of their development through reports, attendance lists, contracts, and other documents, which will be followed up and counted.

Monitoring/Recording Frequency	Annual
Applied Value	To be accounted after the Project registration.
Monitoring equipment	Not applicable
QA/QC procedures applied	The systematic information in reports will be validated among proponents, allowing greater reliability and data quality. Furthermore, the Project will undergo continuously generated data and information assessment, allowing to identify improvements in the collection and registration processes, and incorporating them when identified.
Data Purpose	Not applicable
Calculation method	Not applicable
Comments	-

Data/Parameter	No. of procedures/protocols
Unit	Number/year
Description	The data will be used to monitor project activities. Therefore, the procedures and protocols produced from activities for "property surveillance improvement", "implementation, monitoring and assessment of activities developed by the Project" and "strengthening the management of non-timber forest products" will be monitored and counted.
Data Source	Documents with procedures and protocols described referring to themes related to the Project
Description of the measurement methods and procedures applied	All data and reports produced by the project will be stored in digital files for the entire duration of the Project. Therefore, the procedures and protocols created from activities for "property surveillance improvement", "implementation, monitoring and evaluation of activities developed by the Project" and "strengthening the management of non-timber forest products" will be registered in documents, as well as followed up and counted.

Monitoring/Recording Frequency	Annual
Applied Value	To be accounted after the Project registration.
Monitoring equipment	Not applicable
QA/QC procedures applied	The systematic information in reports will be validated among proponents, allowing greater reliability and data quality. Furthermore, the Project will undergo continuously generated data and information assessment, allowing to identify improvements in the collection and registration processes, and incorporating them when identified.
Data Purpose	Not applicable
Calculation method	Not applicable
Comments	-

5.3 Monitoring Plan

The monitoring plan comprises two main parts:

i) Monitoring changes in carbon stocks and GHG emissions considering periodic checks that will occur within a fixed baseline period (PART 1), and

ii) Monitoring key parameters for reassessment of baseline at the end of a fixed baseline period (PART 2).

All procedures of the monitoring plan have been defined according to methodology guidelines applied to the Project, in this case VM0015, as well as the VCS certification.

PART 1. MONITORING CHANGES IN CARBON STOCKS AND GHG EMISSIONS FOR PERIODIC VERIFICATION

1.1 Monitoring actual changes in carbon stocks and GHG emissions within the Project Area

Monitoring actual changes in carbon stock and GHG emissions within the Project Area involves four main scopes, which are:

i) project implementation,

ii) land use and land cover change,

iii) carbon stocks and non-CO2 emissions, and

iv) impacts from natural disturbances and other catastrophic events.

Procedures applied to this monitoring plan comprise what is developed and applied within the project's perspective, therefore, within the scope iii) activities that lead to planned deforestation were not approached, since they do not occur in the baseline and no activities in this level are planned for the Project, as well as non-CO_2 emissions, since emissions derived from biomass burning were not considered in the baseline.

Details about the four scopes to be monitored are presented below.

a) Technical description of monitoring tasks

Changes in carbon stock due to conversion of forest into non-forest areas through unplanned deforestation will be monitored. Likewise, changes in carbon stock due to uncontrolled forest fires and other catastrophic events will be monitored and deducted from project scenario in cases where they are significant.

As explained in section 1.1, the proponents will carry out two main activities for this follow-up, which consist of monitoring deforestation via satellite images and improving property vigilance, with opportunity for on-field checking in cases where deforested areas are detected. In addition, two other activities will be carried out in the project, in short term that consist in "strengthening the management of non-timber forest products" and "implementation, monitoring and assessment of activities carried out". All activities, as well as their specific actions will be monitored and assessed.

b) Data to be collected

Table 47 - Data to be collected for monitoring changes in carbon stocks and GHG emissions for periodic verification for the Project Area.

Data/ Parameter	Description	Unit	Source	Frequency
ABSLPAt	Annual area of baseline deforestation in the Project Area in year t	ha	Qualified and scientifically recognized sources such as PRODES, DETER, and MapBiomas	Annual
ΔCUDdPAt	Total change in actual carbon stock due to unavoidable unplanned deforestation in year t in the Project Area	tCO2e	Calculated using the detected areas of forest loss in the Project Area and average carbon stock	Annual
AUFPAicl,t	Areas affected by forest fires in the icl class in which carbon stock	ha	Proper sources for forest fire detection and the scars	Whenever forest fires occur

	recovery occurs in year t		caused to identify and classify affected areas	
ΔCUFdPAt	Total reduction in carbon stock due to unplanned (and planned - where applicable) forest fires in year t in the Project Area	tCO2e	Calculated using the affected areas in the Project Area and the average carbon stock	Whenever forest fires occur
ACPAicl,t	Analysis Area within the Project Area affected by catastrophic events in class icl in year t	ha	High resolution satellite imagery	Whenever a catastrophic event occurs
ΔCUCdPAt	Total reduction in carbon stock due to catastrophic events in year t in the Project Area	tCO2e	Calculated using the affected areas in the Project Area and the average carbon stock	Whenever a catastrophic event occurs

c) Brief description of data collection procedures

The implementation of the Project activities will be monitored through timelines, performance reports of the activities and indicators, financial reports, attendance lists, minutes of meetings, established procedures and protocols, maps of forest cover, among other relevant documents.

The monitoring of the conversion of forest areas into non-forest areas through unplanned deforestation will be developed by mapping the forest cover of the Project Area, using qualified and scientifically recognized sources such as PRODES and DETER, developed by the National Institute for Space Research, MapBiomas, developed by a collaborative network of NGOs, universities and technology startups, among other qualified sources. The choice of methodology will be assessed in order to meet the requirements of data quality and accuracy. After the deforestation data are collected, they will be compared to the baseline scenario, and the emission reduction values for the monitored period will be based on the comparison between expected and actual deforestation.

Regarding changes in carbon stocks due to uncontrolled forest fires and other catastrophic events, these will be monitored through photointerpretation of high resolution images as well as proper sources of forest fire detection and scars caused for identification and classification of affected areas. To verify the damage to vegetation and recovery, NDVI analysis will be carried out, and if necessary, there will be on-field checking in the affected areas. In cases where affected forest areas are identified, the reduction in carbon stock caused by forest fires, natural disturbances or other catastrophic events will be evaluated by multiplying the mapped area of forest loss by the average forest carbon stock. If there is a significant decrease in carbon stock, this decrease will be reported in the verification processes using the Tables 25e, 25f and 25g of VM0015 methodology version 1.1.

d) Quality control and quality assurance procedures

The follow-up of activities at Juruá REDD+ Project, the activity "implementation, monitoring and assessment of activities carried out" is planned, which will allow to continuously monitoring the Project, accompanied by assessment processes, allowing the incorporation of learning and improvements and, consequently, quality assurance to the project.

As described in the previous items, the changes in carbon stock due to the conversion of forest to non-forest areas by unplanned deforestation will be monitored. Likewise, changes in carbon stocks due to uncontrolled forest fires and other catastrophic events will be monitored and deducted over the project scenario in the cases where they were significant. The control and quality assurance of these analyses will be performed through the accuracy process indicated by the methodology VM0015 version 1.1 (section 2.5), which will be the same regardless the type of data used in the monitoring.

The analysis will be done through the general accuracy analysis and the kappa index obtained from a confusion matrix as the one from Congalton (1999), in which will be generated through a geographic information system, at least 100 points randomly distributed according to the analyzed area. The validation will be performed using high spatial resolution satellite images and/or data collected in the field. The minimum mapping accuracy, according to VM0015, for each class or category on the land use and land cover map, should be 80%.

In addition to the accuracy process performed, when necessary, field verifications will be made in areas where conversion of forest areas to non-forest areas is identified, either by unplanned deforestation or by uncontrolled forest fires and other catastrophic events.

e) Data Archiving

Biofílica Ambipar Environment will store all data and reports related to Juruá REDD+ Project in digital files for the duration of the Project. Archiving will also involve a digital copy of all physical data produced in the field. This physical data, if necessary, will be stored by Amazônia Agroindústria.

All documents related to Project monitoring will be provided to the auditors at each verification event.

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

The procedures described will be under responsibility of Biofílica Ambipar Environment and Amazônia Agroindústria.

1.2 Leakage monitoring

The leakage monitoring by the Project involves two main scopes, which are:

i) changes in carbon stocks and GHG emissions associated with leakage prevention activities, and

ii) changes in carbon stocks and GHG emissions associated with leakage from displacement activities

The procedures applied to this monitoring plan comprises what is developed and applied within the project's perspective, therefore, within the scope ii) monitoring changes in GHG emissions from biomass burning was not approached, since it was not considered in the baseline.

Details about the monitoring the two scopes are presented below.

a) Technical description of monitoring tasks

No changes are expected in carbon stock and GHG emissions associated with the leak prevention activities, since no activities, such as land improvement or grazing area management, are expected to alter carbon stock and increase GHG emissions when compared to the baseline scenario. However, if such activities prove necessary, the ex-ante changes in carbon stock and GHG emissions associated with these activities will be estimated according to step 8 of the Approved VM0015 Methodology. If the results are relevant, they will be monitored and data will be presented to verifiers at each verification event using the tables 30b, 30c, 31, 32 and 33 of VM0015 Methodology version 1.1.

Changes in carbon stocks and GHG emissions associated with leakage from displacement activities will be monitored using the same technique applied for monitoring changes in carbon stocks due to conversion of forest to non-forest areas by unplanned deforestation in the Project Area.

b) Data to be collected

Table 48 -Data to be collected for monitoring changes in carbon stock and GHG emissions for periodic checks regarding the Leakage Belt.

Data/ Parameter	Description	Unit	Source	Frequency
ΔCLPMLKt	Decrease of carbon stocks due to prevention measures in the leakage belt in year t	tCO2e	Follow-up report of project activities that were implemented and other records related to the leakage prevention activities	Whenever the event occurs
EgLKt	Emissions from grazing animals in the Leakage Belt areas in year t	tCO2e	Existing records on the practice of grazing	Whenever the event occurs
ABSLLKt	Annual area of baseline deforestation	ha	Qualified and scientifically recognized sources such as	Annual

	within the Leakage Belt in year t		PRODES, DETER, and MapBiomas	
ΔCADLKt	Total decrease of carbon stocks displaced due to deforestation in year t	tCO2e	Calculated using the detected areas of forest loss in the Leakage Belt, the average carbon stock, and the estimated loss in carbon stock at baseline for the Leakage Belt	Annual

c) Brief description of data collection procedures

As explained in item a), no changes in carbon stocks and GHG emissions associated with leak prevention activities are expected, since no activities are foreseen to alter carbon stocks and increase GHG emissions when compared to the baseline scenario. However, if such activities prove necessary, ex-ante changes in carbon stocks and GHG emissions associated with these activities will be monitored and presented in the verifications.

The monitoring, considering the data collection procedures will consider the following activities:

- List of leak prevention activities;
- Production of a map showing the areas of intervention and the type of intervention;
- Recognition of areas where leakage prevention activities may affect the carbon stock;
- The non-forest classes existing in these areas in the baseline case will be identified;
- The carbon stocks in the identified classes will be measured or a conservative literature estimate will be used;
- The carbon stock changes in the leakage management areas under the project scenario will be reported using Table 30b of VM0015;
- Calculation of net carbon stock changes caused by leakage prevention measures during the fixed baseline and project crediting period;
- The results of the calculations will be reported in Table 30c of the approved VM0015 Methodology.

Regarding the changes in carbon stocks and GHG emissions associated with leakage from displacement activities, these will be monitored using the same methods applied to monitor the conversion of forest into non-forest areas by unplanned deforestation in the Project Area; that is, qualified and scientifically recognized sources will be used such as PRODES, DETER and MapBiomas, where they will be assessed for data quality and accuracy requirements. in the Leakage Belt, if there is a deforestation event larger than expected for the baseline scenario, and is attributed to deforestation agents in the Project Area, the losses in carbon stock will be accounted and reported using Table 22c or Table 21c of the Approved VM0015 Methodology version 1.1.

d) Quality control and quality assurance procedures

The quality control and assurance for monitoring changes in carbon stocks and GHG emissions associated with leakage prevention activities will be determined according to the activity, if implemented, and concerning to changes in carbon stocks and GHG emissions associated with leakage by displacement activities will be carried out through accuracy analysis, as indicated by VM0015 methodology version 1.1 (section 2.5).

The analysis related to classification accuracy will be performed using the overall accuracy analysis and the kappa index obtained from a confusion matrix such as Congalton (1999), in which at least 100 points randomly distributed in relation to the analyzed area will be generated through a geographic information system. The validation will be carried out using high spatial resolution satellite images and/or data collected in the field. The minimum mapping accuracy, according to VM0015, for each class or category on the land use and land cover map, should be 80%.

e) Data Archiving

Biofílica Ambipar Environment will store all data and reports from Juruá REDD+ Project in digital files for the duration of the Project. Archiving will also involve a copy in digital format of all physical data produced in the field. This physical data, if necessary, will be stored by Amazônia Agroindústria.

All documents related to Project monitoring will be made available to the auditors at each verification event.

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

The procedures described will be responsibility of Biofílica Ambipar Environment and Amazônia Agroindústria.

1.3 Monitoring of ex-post reductions in net anthropogenic GHG emissions

Details on the monitoring are presented below.

a) Technical description of monitoring tasks

In the verification procedures, the results will be represented using Table 36 of VM0015 Methodology version 1.1, together with spatial data (deforestation maps, where available).

b) Data to be collected

Table 49 - Data to be collected for monitoring changes in carbon stock and GHG emissions for periodic checks related to VCU generation.

Data/ Parameter	Description	Unit	Source	Frequency
RFt	Risk factor used to calculate the VCS buffer	%	VCS Non-Permanence Risk Report	Annual

c) Brief description of data collection procedures

The calculation of the number of Verified Carbon Units (VCU's) to be produced by the Project activities in year t will be done using the Equations 19 and 20 of VM0015 Methodology version 1.1.

d) Quality control and quality assurance procedures

All tasks and tools listed in part 2 of VM0015 Approved Methodology will be used to ensure that the data is adequate for the verification process and that the number of Verified Carbon Units is reliable.

e) Data filling

Biofílica Ambipar Environment will store all data and reports related to Juruá REDD+ Project in digital files for the duration of the Project. Archiving will also involve a copy in digital format of all physical data produced in the field. This physical data, if necessary, will be stored by Amazônia Agroindústria.

All documents related to Project monitoring will provided to the auditors at each verification event.

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

The procedures described will be responsibility of Biofílica Ambipar Environment and Amazônia Agroindústria.

PART 2. MONITORING FURTHER BASELINE PROJECTIONS

2.1 Updating information on agents, drivers and underlying causes of deforestation

The Project baseline will be updated and used to review the baseline projections after a fixed period of 6 years, in addition to statistical and spatial data, studies and information on agents, drivers and underlying causes of deforestation needed to carry out Steps 2 and 3 of the Approved VM0015 Methodology Version.

2.2 Update the land use and land cover change in the baseline component

The Project will track updates to the national and sub-national baselines, and apply improvements consistent with the rigor applied to the Project. Otherwise, step 4 of VM0015 Methodology will be redone considering the period of the last 6 years and using updated variables on agents, drivers, and underlying causes of deforestation in the Reference Region. The area of annual deforestation and the location of deforestation at baseline are the two main components to be reviewed.

The assumptions and hypotheses considered in modeling the dynamic component of future deforestation (population data) as well as the data used in the spatial projection (updated roads, location and distance of new deforestation) will be reviewed and updated.

2.3. Maintaining the Baseline Carbon Component

According to the results generated during the changes in the carbon stock monitoring processes throughout the Project, the spatial estimation of carbon component can be reviewed in the VM0015 Methodology version 1.1, Part 3, item 1.1.3. Therefore, if more accurate estimates are available by using techniques such as LIDAR or SAR interferometric data, they will be applied to the period of baseline review.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	ABSLPAt
Unit	ha
Description	Annual area of deforestation in the project area at year t
Data source	PRODES
Description of applied measurement methods and procedures	Monitoring of forest cover in the Project Area through analysis of satellite images. The PRODES data were assessed considering the Project Area boundary
Monitoring/Recording Frequency	Annual
Applied Value	0 ha
Monitoring equipment	Digital processing program remote sensing images and geographic information system
QA/QC procedures applied	Images with a special resolution of 30 m or more were used for mapping, and the minimum mapping unit is 1 ha. The minimum accuracy of the land use and land cover classification map is 80%.

Data Purpose	This parameter was used to calculate the emissions in the project scenario
Calculation method	If areas of unplanned deforestation were detected, the Forest Cover Reference Mark Map would be updated by map algebra
Comments	-

Data / Parameter	ΔCUDdPAt
Unit	tCO2e
Description	Total actual carbon stock change due to unavoided unplanned deforestation at year t in the project area
Data source	Calculated using the detected areas of forest loss in the Project Area and average carbon stock
Description of the measurement methods and procedures applied	Monitoring of the ABSLPAt indicator for subsequent calculation of the change in carbon stock resulting from unplanned and unavoided deforestation
Monitoring/Recording Frequency	Annual
Applied Value	0 tCO2e
Monitoring equipment	Emission spreadsheets, satellite image data
QA/QC procedures applied	Good practices applied in the calculation of ABSLPAt
Data Purpose	This parameter was used to calculate the emissions in the project scenario
Calculation method	The carbon stock variation is estimated by multiplying the detected area of forest loss in the Project Area by the average carbon stock per area unit.
Comments	-

Data / Parameter	AUFPAicl,t
Unit	ha
Description	Areas affected by forest fires in class icl in which carbon stock recovery occurs at year t
Data source	Proper sources for forest fire detection and the scars caused to identify and classify affected areas
Description of the measurement methods and procedures applied	Identification and classification of affected areas from proper forest fire detection sources and the scars caused
Monitoring/Recording Frequency	Whenever forest fires occur
Applied Value	0 ha
Monitoring equipment	Digital processing program remote sensing images and geographic information system
QA/QC procedures applied	Images with special resolution of 30 m or higher would be used for mapping, and the minimum mapping unit is 1 ha. The minimum accuracy of the land use and land cover classification map is 80%.
Data Purpose	This parameter was used to calculate the emissions in the project scenario
Calculation method	If affected areas were detected, the Forest Cover Reference Mark Map would be updated by map algebra
Comments	-

Data / Parameter	ΔCUFdPAt
Unit	tCO2e
Description	Total decrease in carbon stock due to unplanned (and planned – where applicable) forest fires at year t in the project area

Data source	Calculated using the affected areas in the Project Area and the average carbon stock
Description of the measurement methods and procedures applied	Monitoring of the AUFPAicl,t indicator for subsequent calculation of change in carbon stock from areas affected by forest fires
Monitoring/Recording Frequency	Whenever a forest fire occurs
Applied Value	0 *tCO2e*
Monitoring equipment	Emission spreadsheets
QA/QC procedures applied	Good practices applied in the calculation of AUFPAicl,t
Data Purpose	This parameter was used to calculate the emissions in the project scenario
Calculation method	The change in carbon stock is estimated by multiplying the affected area by average carbon stock per unit area.
Comments	-

Data / Parameter	ACPAicl,t
Unit	ha
Description	Annal area within the Project Area affected by catastrophic events in class icl at year t
Data source	High resolution satellite imagery
Description of the measurement methods and procedures applied	Carrying out photointerpretation of high-resolution satellite images identifying areas of forest cover affected by catastrophic events
Monitoring/Recording Frequency	Whenever a catastrophic event occurs
Applied Value	0 ha

Monitoring equipment	Remote sensing images and geographic information system
QA/QC procedures applied	Images with special resolution of 30 m or higher would be used for mapping, and the minimum mapping unit is 1 ha. The minimum accuracy of the land use and land cover classification map is 80%.
Data Purpose	This parameter was used to calculate the emissions in the project scenario
Calculation method	If affected areas were detected, the Forest Cover Reference Mark Map would be updated by map algebra
Comments	-

Data / Parameter	ΔCUCdPAt
Unit	tCO_2e
Description	Total decrease in carbon stock due to catastrophic events at year t in the project area
Data source	Calculated using the affected areas in the Project Area and average carbon stock
Description of the measurement methods and procedures applied	Monitoring of the ACPAicl,t indicator for subsequent calculation of change in carbon stock from areas affected by catastrophic events
Monitoring/Recording Frequency	Whenever a catastrophic event occurs
Applied Value	0 tCO_2e
Monitoring equipment	Emission spreadsheets
QA/QC procedures applied	Good practices applied in the calculation of ACPAicl,t
Data Purpose	This parameter was used to calculate the emissions in the project scenario

Calculation method	The change in carbon stock is estimated by multiplying the affected area by average carbon stock per unit area.
Comments	-

Data / Parameter	∆CLPMLKt
Unit	tCO2e
Description	Decrease of carbon stock due to leakage prevention measures in year t
Data source	Follow-up report of project activities that were implemented and other records related to the leakage prevention activities
Description of the measurement methods and procedures applied	Follow up on the grazing activities following the 8.1.1 section's guidelines of VM0015 methodology v1.1
Monitoring/Recording Frequency	Annual
Applied Value	0 tCO2e
Monitoring equipment	Emission spreadsheets, satellite image data
QA/QC procedures applied	To be defined when realized
Data Purpose	This parameter was used to calculate the leakage
Calculation method	The emissions were calculated using the guidelines in section 8.1.1 of VM0015 methodology v1.1
Comments	No leakage prevention activities are planned that would generate a decrease in the carbon stock

Data / Parameter	EgLKt
Unit	tCO2e

Description	Emissions from grazing livestock in the leakage management areas in year t
Data source	Existing records on the practice of grazing
Description of the measurement methods and procedures applied	Follow up on the grazing activities following the 8.1.2 section's guidelines of VM0015 methodology v1.1
Monitoring/Recording Frequency	Annual
Applied Value	0 tCO2e
Monitoring equipment	Emission spreadsheets, satellite image data
QA/QC procedures applied	To be defined when realized
Data Purpose	This parameter was used to calculate the leakage
Calculation method	The emissions were calculated using the guidelines in section 8.1.2 of VM0015 methodology v1.1
Comments	No grazing activities are planned

Data / Parameter	ABSLLKt
Unit	ha
Description	Annual area of deforestation within the leakage belt in year t
Data source	PRODES
Description of the measurement methods and procedures applied	Monitoring of forest cover in the Leak Belt through satellite image analysis. The PRODES data was evaluated considering the boundary of the Leak Belt
Monitoring/Recording Frequency	Annual
Applied Value	58 ha

Monitoring equipment	Digital processing program remote sensing images and geographic information system
QA/QC procedures applied	Images with a special resolution of 30 m or more were used for mapping, and the minimum mapping unit is 1 ha. The minimum accuracy of the land use and land cover classification map is 80%.
Data Purpose	This parameter was used to calculate the leakage
Calculation method	The Forest Cover Reference Mark Map was updated by map algebra
Comments	-

Data / Parameter	ΔCADLKt
Unit	tCO_2e
Description	Total decrease in carbon stocks due to displaced deforestation at year t
Data source	Calculated using the detected areas of forest loss in the Leakage Belt, the average carbon stock, and the estimated loss in carbon stock at baseline for the Leakage Belt
Description of the measurement methods and procedures applied	Monitoring of the ABSLLKt indicator for subsequent calculation of the change in carbon stock from unplanned and unavoided deforestation
Monitoring/Recording Frequency	Annual
Applied Value	0 tCO_2e
Monitoring equipment	Emission spreadsheets, satellite image data
QA/QC procedures applied	Good practices applied in the calculation of ABSLLKt
Data Purpose	This parameter was used to calculate the leakage

Calculation method	The carbon stock change is estimated by multiplying the detected area of forest loss in the Leak Belt by the average carbon stock per unit area, minus the carbon stock change estimated in the baseline for the Leakage Belt
Comments	-

Data / Parameter	RFt
Unit	%
Description	Risk factor used to calculate VCS buffer credits
Data source	VCS Non-Permanence Risk Report
Description of the measurement methods and procedures applied	Monitoring the RFt indicator by applying the AFOLU Non-Permanence Risk Tool and record in the VCS Non-Permanence Risk Report
Monitoring/Recording Frequency	Annual
Applied Value	10%
Monitoring equipment	AFOLU Non-Permanence Risk Tool
QA/QC procedures applied	Good practices applied using AFOLU Non-Permanence Risk Tool
Data Purpose	This parameter was used to calculate the number of credits that must be deposited in the buffer
Calculation method	The risk factor was calculated using the latest version of AFOLU Non-Permanence Risk Tool
Comments	-

Data / Parameter	No. of reports
Unit	Number/year

Description	The data will be used to monitor project activities. In this way, the reports from "satellite monitoring of deforestation" and "implementation, monitoring and evaluation of activities developed by the project" will be followed up and counted.
Data source	- Deforestation monitoring report; - Follow-up report of the project activities that have been implemented; - Report planning the activities to be developed in the following years.
Description of the measurement methods and procedures applied	All data and reports produced by the project will be stored in digital files for the entire duration of the Project. In this way, the reports from "satellite monitoring of deforestation" and "implementation, monitoring and evaluation of activities developed by the project" will be followed up and counted.
Monitoring/Recording Frequency	Annual
Applied Value	To be accounted after registration of the Project.
Monitoring equipment	Not applicable
QA/QC procedures applied	The systematic information in reports will be validated among proponents, allowing greater reliability and data quality. Furthermore, the Project will undergo continuously generated data and information assessment, allowing to identify improvements in the collection and registration processes, and incorporating them when identified.
Data Purpose	Not applicable
Calculation method	Not applicable
Comments	-

Data / Parameter	No. of trainings and/or interventions
Unit	Number/year

Description	The data will be used to monitor project activities. Therefore, training and interventions carried out from activities for "property surveillance improvement" and "strengthening the management of non-timber forest products" will be monitored and counted.
Data source	Reports (e.g. follow-up report on project activities that have been implemented), participant attendance lists, contracts, and other documents.
Description of the measurement methods and procedures applied	All data and reports produced by the project will be stored in digital files for the entire duration of the project. Therefore, training/interventions linked to activities for "property surveillance improvement" and "strengthening of the management of non-timber forest products" will have records of their development through reports, attendance lists, contracts, and other documents, which will be followed up and counted.
Monitoring/Recording Frequency	Annual
Applied Value	To be accounted after registration of the Project.
Monitoring equipment	Not applicable
QA/QC procedures applied	The systematic information in reports will be validated among proponents, allowing greater reliability and data quality. Furthermore, the Project will undergo continuously generated data and information assessment, allowing to identify improvements in the collection and registration processes, and incorporating them when identified.
Data Purpose	Not applicable
Calculation method	Not applicable
Comments	-

Data / Parameter	No. of procedures/protocols
Unit	Number/year
Description	The data will be used to monitor project activities. Therefore, the procedures and protocols produced from activities for "property

	surveillance improvement", "implementation, monitoring and assessment of activities developed by the Project" and "strengthening the management of non-timber forest products" will be monitored and counted.
Data source	Documents with procedures and protocols described referring to themes related to the Project
Description of the measurement methods and procedures applied	All data and reports produced by the project will be stored in digital files for the entire duration of the project. Therefore, the procedures and protocols created from activities for "property surveillance improvement", "implementation, monitoring and evaluation of activities developed by the Project" and "strengthening the management of non-timber forest products" will be registered in documents, as well as followed up and counted.
Monitoring/Recording Frequency	Annual
Applied Value	To be counted after registration of the Project.
Monitoring equipment	Not applicable
QA/QC procedures applied	The systematic information in reports will be validated among proponents, allowing greater reliability and data quality. Furthermore, the Project will undergo continuously generated data and information assessment, allowing to identify improvements in the collection and registration processes, and incorporating them when identified.
Data Purpose	Not applicable
Calculation method	Not applicable
Comments	-

6.2 Baseline Emissions

The calculated carbon estimate for the above and below ground stocks considering the averages of calculated values for managed forest and primary forest was 114.5 tC/ha (± 13.6 t.C/ha) for the above ground reservoir, 17.1 tC/ha (± 2.0 t.C/ha) for the below ground reservoir and 15.7 tC/ha (± 1.9 t.C/ha) for dead wood.

Table 50. Carbon stocks per hectare for the initial icl class existing in the Project Area and Leakage Belt.

Initial forest class *icl*						$Ctot_{icl}$	
Name:	Forest						
ID_{icl}	1						
Average carbon stock per hectare + 90% CI							
Cab_{icl}		Cbb_{icl}		Cdw_{icl}			
C stock	± 95% CI	C stock	± 95% CI	C stock	± 95% CI	C stock	± 95% CI
$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$
419.7	13.6	62.8	2.0	57.5	1.9	540.0	17.5

Where:

Cabicl = Average carbon equivalent stock per hectare for above ground biomass pool for initial forest class (tCO2e/ha);

Cbbicl = Average carbon equivalent stock per hectare for underground biomass pool for initial forest class (tCO2e/ha);

Cdwicl = Average carbon equivalent stock per hectare for dead biomass pool for initial forest class (tCO2e/ha);

Ctoticl = Average carbon equivalent stock per hectare for total biomass pool for initial forest class (tCO2e/ha).

To calculate the baseline, the number of hectares of each forest class that could be deforested in the absence of the project was extracted from the land use and land cover maps. The results of the baseline projections show deforestation in 2021 of 102 hectares in the Project Area. (Table 51) and 123 hectares in the Leakage Belt (Table 52).

Table 51. Annual areas of unplanned deforestation from baseline in the Project Area for the monitored period 2021.

Established area after deforestation by Zone within the Project Area		Total deforestation from baseline in the Project Area	
IDz>	1		
Name>	Zone 1	$ABSLPA_t$	ABSLPA
Project year *t*	ha	ha	ha
2021	102	102	102

Table 52. Annual areas of unplanned deforestation from baseline in the Leakage Belt for the monitored period 2021.

Established area after deforestation by Zone within the Leak Belt		Total deforestation from baseline in the Leak Belt	
IDz>	1		
Name>	Zone 1	ABSLLK*t*	ABSLLK
Project year *t*	ha	ha	ha
2021	116	116	116

To calculate the baseline carbon stock changes in the Project Area and the Leakage Belt for year t, method 1 of VM0015, version 1.1, by equation 10 - presented in page 72 of this VM0015.

$$
\begin{aligned}
\Delta CBSLPA_t = \sum_{p=1}^{P} \Bigg(& \sum_{icl=1}^{Icl} ABSLPA_{icl,t} * \Delta Cp_{icl,t=t*} - \sum_{z=1}^{Z} ABSLPA_{z,t} * \Delta Cp_{z,t=t*} \\
& + \sum_{icl=1}^{Icl} ABSLPA_{icl,t-1} * \Delta Cp_{icl,t=t*+1} - \sum_{z=1}^{Z} ABSLPA_{z,t-1} * \Delta Cp_{z,t=t*+1} \\
& + \sum_{icl=1}^{Icl} ABSLPA_{icl,t-2} * \Delta Cp_{icl,t=t*+2} - \sum_{z=1}^{Z} ABSLPA_{z,t-2} * \Delta Cp_{z,t=t*+2} \quad + \cdots \\
& + \sum_{icl=1}^{Icl} ABSLPA_{icl,t-19} * \Delta Cp_{icl,t=t*+19} - \sum_{z=1}^{Z} ABSLPA_{z,t-19} * \Delta Cp_{z,t=t*+19} \Bigg)
\end{aligned}
$$

Where:

ΔCBSLPAt: Total change in baseline carbon stock within the Project Area in year t (tCO2-e);

ABSLPAicl,t: Area of the initial forest class icl deforested in year t within the Project Area in the baseline case (ha);

ABSLPAicl,t-1: Area of the initial forest class icl deforested in year t-1 within the Project Area in the baseline case (ha);

ABSLPAicl,t=t-19: Area of the initial forest class icl deforested in year t-19 within the Project Area in the baseline case (ha);

ΔCpicl,t=t*: Mean of the carbon stock variation factor for the initial forest class fixed carbon pool icl applied in year t (according to Table 20.a) (tCO2-e.ha-1);

ΔCpicl,t=t*+19: Mean of the carbon stock variation factor for the initial forest class fixed carbon pool icl applied at year t=t*+19 (20th year after deforestation, as shown in Table 20.a) (tCO2-e.ha-1);

ABSLPAz,t: area of zone z "deforested" in year t within the Project Area in the baseline case (ha);

ABSLPAz,t-1: Area of zone z "deforested" in year t-1 within the Project Area in the baseline case (ha);

ABSLPAz,t-19: Area of zone z "deforested" in year t-19 within the Project Area in the baseline case (ha);

ΔCpz,t=t*: Average carbon stock variation factor for the z-zone fixed carbon pool applied in year t = t* (according to Table 20.b) (tCO2-e.ha-1);

ΔCpz,t=t+1: Average carbon stock variation factor for the z-zone fixed carbon pool applied in year t = t*+1 (2nd year after deforestation, according to Table 20.b) (tCO2- e.ha1);

ΔCpz,t=t*+19: Average carbon stock variation factor for the z-zone fixed carbon pool applied in year t = t*+19 (20th year after deforestation, according to Table 20.b) (tCO2- e.ha-1).

The total emissions in the Project Area baseline scenario for year 2021 was 43,594 tCO2e, as shown in Table 53. The total emissions in the Leak Belt Baseline scenario for year 2021 was 52,433 tCO2e, as shown in Table 54.

Table 53. Total carbon stock changes from Project Area baseline scenario (table 21.b. VM0015).

Carbon stock changes by initial forest class icl		Total change in carbon stock by initial forest class in the Project Area		Post-deforestation carbon stock changes by zone z		Total changes in post-deforestation carbon stock by zone in the Project Area		Total change in carbon stock in the Project Area	
$_{icl}$ID >	1	$\Delta CBSPLA_{iclt,}$	$\Delta CBSPA_{icl}$	ID$_{says}$>	1	$\Delta CBSPA_{z,t}$	$\Delta CBELPA_{z}$	$\Delta CBSLPA_{t}$	ΔCBSLPA
Name>	Forest	annual	cumulative	Name>	Zone 1	annual	cumulative	annual	cumulative c
Project year t	tCO_2e	tCO_2e	tCO_2e	Project year t	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2021	44,186	44,186	44,186	2021	0	0	0	44,186	44,186

Table 54. Total carbon stock changes from the Leakage Belt baseline scenario (Table 21.c. VM0015).

Carbon stock changes by initial forest class icl		Total change in carbon stock of initial forest class in the Leakage belt		Post-deforestation carbon stock changes by zone z		Total changes in post-deforestation carbon stock by zone in the Leakage Belt		Total changes in carbon stock in the Leakage Belt	
$_{icl}$ID >	1	$\Delta CBSLK_{iclt,t}$	$\Delta CBSLK_{icl}$	ID$_{says}$>	1	$\Delta CBSLK_{z,t}$	$\Delta CBSLK_{z}$	$\Delta CBSLK_{t}$	ΔCBSLK
Name>	Forest	annual	cumulative	Name>	Zone 1	annual	cumulative	annual	cumulative
Project year t	tCO_2e	tCO_2e	tCO_2e	Project year *t*	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2021	50,192	50,192	50,192	2021	0	0	0	50,192	50,192

6.3 Project Emissions

6.3.1 Emissions due to planned deforestation and degradation activities

Emissions due to planned deforestation activities

There were no emissions associated with planned deforestation activities in the Project Area. There were no open areas of infrastructure or any activity causing planned deforestation in the Project Area during the monitored period.

Table 55. Decrease in carbon stock due to planned deforestation in the Project Area (Table 25.a VM0015).

Project Year t	Planned Deforestation Area x Decrease in Carbon Stock in the Project Area		Total Decrease in carbon stock due to planned deforestation	
	IDcl =	1	annual	cumulative
	APDPAicl,t	Ctoticl,t	ΔCPDdPAt	ΔCPDdPA
	ha	tCO2e ha-1	tCO2e	tCO2e
2021	0	540.0	0	0

Emissions due to planned timber harvesting activities

As expected, there were no emissions associated with timber harvesting activities in 2021. In addition, within the scope of the Project, there are only non-timber forest product extraction activities, and based on the fact that VM0015 considers it conservative to disregard these products from the calculations, all extraction activities have been excluded.

Table 56. Decrease in carbon stock due to planned logging activities in the Project Area (Table 25.b VM0015).

Project year t	Areas of planned logging activities x Decrease in carbon stock in the Project Area		Total carbon stock decline due to planned logging activities	
	IDcl =	1	annual	cumulative
	APLPAicl,t	Ctoticl,t	ΔCPLdPAt	ΔCPLdPA
	ha	tCO2e ha-1	tCO2e	tCO2e
2021	0	540.0	0.0	0.0

Emissions due to planned fuelwood collection and charcoal production activities

There were no emissions associated with planned fuelwood collection and charcoal production activities in the Project Area.

Table 57. Decrease in carbon stock due to planned fuelwood collection and charcoal production activities in the Project Area (table 25.c VM0015).

Project year t	Areas of planned fuelwood collection and charcoal production activities x Decrease of carbon stock in the Project Area		Total decrease of carbon stock due to planned fuelwood collection and charcoal production activities	
	IDcl =	1	annual	IDcl =
	APFPAicl,t	Ctoticl,t	ΔCUFdPAt	APFPAicl,t
	ha	tCO2e ha-1	tCO2e	ha
2021	0	540.0	2021	0

Emissions from forest fires and catastrophic events

During the monitored period, there were no significant emissions from forest fires and catastrophic events in the Project Area (Table 58 and Table 59, respectively).

Table 58. Carbon stock decrease (ex-post) due to forest fires in the Project Area (Table 25.e. VM0015).

Project year t	Areas affected by forest fires x Decrease in carbon stock		Decrease of total carbon stock due to forest fires	
	IDcl =	1	annual	cumulative
	AUFPAicl,t	Ctoticl,t	ΔCUFdPAt	ΔCUFdPA
	ha	tCO2e ha-1	tCO2e	tCO2e
2021	0	540.0	0.0	0.0

Table 59. Carbon stock reduction (ex-post) due to catastrophic events (Table 25.f VM0015).

Project year t	Areas affected by catastrophic events x Decrease in carbon stock		Decrease of total carbon stock due to catastrophic events	
	IDcl =	1	annual	cumulative
	ACPAicl,t	Ctoticl,t	ΔCUCdPAt	ΔCUCdPA
	ha	tCO2e ha-1	tCO2e	tCO2e
2021	0	540.0	0.0	0.0

Removals due to carbon stock increase by planned activities

The increase in carbon stock due to planned activities, in areas that would be deforested in the baseline, has been omitted.

Table 60. Ex-post estimate of change in net carbon stock in the Project Area under the project scenario (Table 27 VM0015)

Project Year t	Total decrease of carbon stock due to planned activities		Total increase of carbon stock due to planned activities		Reduction of total carbon stock due to fires and catastrophic events		Total carbon stock increase due to fires and catastrophic events	
	Annual	cumulative	Annual	cumulative	Annual	cumulative	Annual	cumulative
	ΔCPDdPAt	ΔCPDdPA	ΔCPAiPAt	ΔCPAiPA	ΔCFCdPAt	ΔCFCdPAt	ΔCCFCiPAt	ΔCFCiPA
	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e
2021	0	0	0	0	0	0	0	0

6.3.2 Emissions due to unplanned and unavoided deforestation

For analysis of land use and land cover change, Juruá REDD+ Project is based on two main activities: monitoring deforestation through satellite images and property surveillance. The monitoring of deforestation through satellite images used PRODES data, available in vector format (shapefile) and matrix (raster) and with a spatial resolution of 30 meters. According to the PRODES methodology (CÂMARA et al. 2006), The images undergo geometric correction with a displacement error of less than 1 pixel (30 x 30 m). These images cover the monitoring period (2021) and can be located through the Orbit/Scene Point Landsat 231/66 e 232/66.

The main activities performed by the PRODES system to monitor the forest cover of the Brazilian Amazon are detailed below. The satellite image monitoring activity aims to understand the context of deforestation and invasions, and consequently improve the agility and assertiveness of field patrols for the maintenance of forest cover.

Pre-processing

The image pre-processing procedures performed by the PRODES Project consist of the following steps (CÂMARA et. al., 2006):

1) Selection of images with less cloud cover and acquisition date closer to the dry season in the Amazon and with proper radiometric quality;

2) Georeferencing of the images with a spatial resolution of 30 meters on topographic maps at the scale 1:100,000 and images in orthorectified MrSID format by NASA.

Interpretation and Classification

The satellite image classification method used by PRODES follows four main steps: First, a spectral mixture model is generated, identifying in the images the vegetation, soil and shadow components. This technique is known as linear spectral mixture model (MLME), which aims to estimate the percentage of vegetation, soil and shade components for each cell (pixel) of the satellite image. The second step is the application of segmentation technique, which identifies spatially adjacent regions (segments) in the satellite image that have similar spectral characteristics. After segmenting, the individual classification of segments occurs, in order to identify the forest classes, non-forest vegetation, hydrography and deforestation (anthropic vegetation). Finally, the result of the classified segmentation is submitted to the classification editing or auditing process, performed by an expert, and finalized with the creation of the state mosaics.

Map Accuracy Evaluation

The analysis period of forest cover conversion in the Project Area and Leakage Belt in 2021. The only classes found within these limits were: forest and deforestation. Within the Project Area no records of forest cover conversion were identified, but there were changes within the Leakage Belt. Therefore, the accuracy checking of PRODES data was carried out. It was done from the visual assessment of the Forest and Deforestation classes in the Planet images, with 4.77 meters of spatial resolution in band composition 1-2-3 dated August 2021. The accuracy value in the verification process for land use classes in the Project Area and Leakage Belt was approximately 99%, higher than the 90% established by VM0015. The Figure 28 demonstrates the methodology adopted to perform the PRODES mapping accuracy assessment.

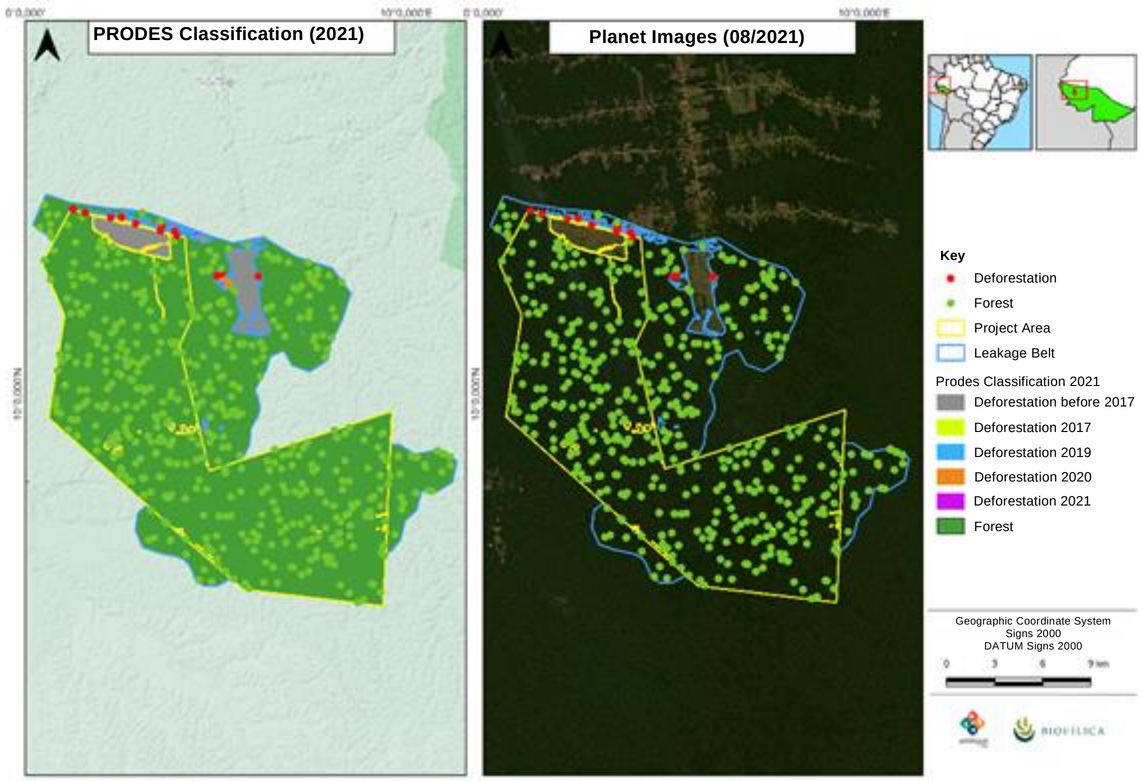

Figure 28. Assessment map of accuracy points.

It was observed in the Planet images areas without forest cover within the Leakage Belt that were not included in the PRODES mapping. Thus, to increase our data accuracy, we supplemented the PRODES data by mapping these areas that were not classified as deforestation and with the deforestation data from Global Forest Watch, the years of this new deforestation were identified and mapped according to the satellite images. After this adjustment in the PRODES classification, 500 points were randomly distributed in the analyzed areas (Project Area and Leakage Belt) in classes of forest and deforestation from 2017 to obtain a larger area of deforestation for data accuracy. For each point, a visual interpretation was made on the Planet image (reference). With the reference points, land use and land cover map of the verified period, it was possible to assess the PRODES classification through the confusion matrix analysis (Table 61), as established by Congalton and Green (2008). The confusion matrix was based on random allocation points in two distinct classes. There were 488 randomized points in forest class and 12 in the deforestation class.

Table 61. Confusion matrix generated to assess PRODES data for the period 2017 to 2021.

		PRODES x PLANET				
		Reference		Total	User accuracy	Omission Error
		Deforestation	Forest			
Classified	Deforestation	**12**	0	12	100.0%	0.0%
	Forest	1	**487**	488	99.8%	0.2%
Total		13	487	**500**		
Producer accuracy		92.3%	100.0%			
Omission Error		7.7%	0.0%			
Map Accuracy						99.80%

Total unplanned deforestation in the Project Area during this monitoring period is 0 hectares, according to PRODES data (2021). The data for the monitored period (2021) is shown in Table 62 below.

Table 62.Deforested areas observed annually in each zone within the Project Area (Table 13.b. VM0015).

Established area after deforestation by Zone within the Project Area		Total Deforestation Monitored in the Project Area		Baseline
IDz>	1			
Name>	Zone 1	Annual	Cumulative	Annual
Project year t	ha	ha	ha	ha
2021	0	0	0	102

The total change in carbon stock due to unplanned and unavoided deforestation in the Project Area over this monitoring period is presented in Table 63.

Table 63. Ex-post carbon stock change in the Project Area (Table 21.b.2. VM0015).

Carbon stock changes by initial forest class icl		Total changes in carbon stock by initial forest class in the Project Area		Changes in carbon stock by post-deforestation z-zone		Total changes in carbon stock in post-deforestation zones in the Project Area		Total carbon stock change in the Project Area	
IDicl>	1	ΔCBSLPAicl,t	ΔCBSLPAicl	IDiz>	1	ΔCBSLPAz,t	ΔCBSLPAz	ΔCBSLPAt	ΔCBSLPA
Name>	Forest	annual	cumulative	Name>	Zone 1	annual	cumulative	annual	cumulative
Project year t	tCO2-e	tCO2-e	tCO2-e	Project year t	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e
2021	0	0	0	2021	0	0	0	0	0

6.3.3 Total (Ex-Post) Carbon Stock Change in the Project Area

The calculation of the total carbon stock change (ex-post) in the Project Area used the same methods described in items 6.1.2 and 6.1.3 of the approved VCS methodology VM0015, considering the changes observed during the monitoring period. The total ex-post carbon stock change of the Project Area under the project scenario in this monitoring period is presented in Table 64.

Table 64. Total ex-post estimate of net current net changes in carbon stock and GHG emissions in the Project Area (Table 29 VM0015).

Project Year t	Total carbon stock decrease due to planned activities		Total carbon stock increase due to planned activities		Total ex post carbon stock decrease due to unavoided unplanned deforestation		Total ex post net carbon stock change	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	ΔCPDdPAt	ΔCPDdPA	ΔCPAiPAt	ΔCPAiPA	ΔCUDdPAt	ΔCUDdPA	ΔCPSPAt	ΔCPSPA
	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e
2021	0	0	0	0	0	0	0	0

6.4 Leakage

6.4.1 Total reduction of carbon stock (ex-post) and GHG emissions increase due to leak prevention activities

No leak management activities occurred that led to a reduction in carbon stock or increase in GHG emissions.

6.4.2 Total reduction of carbon stock (ex-post) and GHG emissions increase due to leak

As defined in the VCS VM0015 methodology, leakage is only considered when the detected deforestation is above the baseline in the Leakage Belt area. The activity data for the Leakage Belt area were determined using the same methods applied in mapping deforestation in the Project Area.

Total deforestation in the Leak Belt was 58 hectares in the monitored period, according to PRODES data, and is therefore lower than the predicted value (123 hectares) in the baseline scenario. As mentioned for the Project Area, the PRODES data used in monitoring the Leakage Belt also had its accuracy analyzed, the methodology and results of this analysis are described in section 6.3.2. The data for the year 2021 is shown in Table 65.

Table 65. Annual deforested areas in each zone within the monitored Leak Belt (Table 13.c. VM0015).

Established area after deforestation per Zone within the Leak Belt		Total deforestation monitored in the Leak Belt		Baseline
IDz>	1			
Name>	Zone 1	Annual	Cumulative	Annual
Project year t	ha	ha	ha	ha
2021	58	58	58	116

The total change in carbon stock due to unplanned and unavoided deforestation in the Leakage Belt was calculated by the following formula:

$$\Delta CBSLLK_t = \sum_{y=1}^{t}\left(\sum_{icl=1}^{icl} AUDLK_{icl,y} * \Delta Ctot_{icl,t-y} - \sum_{fcl=1}^{fcl} AUDLK_{fcl,y} * \Delta Ctot_{fcl,t-y}\right)$$

Where:

ΔCBSLLKt: Total changes in carbon stock due to unplanned and unavoided deforestation in the Leakage Belt in year t;

AUDLKicl,y: Unplanned deforested area in the initial forest class icl in year t in the Leakage Belt within the project scenario;

ΔCtoticl,Ac: Loss of carbon stock in the initial forest class icl at age of change Ac (number of years after land use and land cover change);

AUDLKfcl,y: Area of the final non-forest class fcl in year t in the Leakage Belt after unplanned deforestation within the project scenario;

ΔCtotfcl,Ac: Carbon stock gain in the final non-forest class fcl after deforestation at age of change Ac (number of years after land use and land cover change).

The total change in carbon stock due to unplanned and unavoided deforestation in the Leakage Belt in this monitoring period is presented in Table 66.

Table 66. Ex-post carbon stock change in the Leak Belt area (table 21.c. VM0015)

Carbon stock changes by initial forest class icl		Total changes in carbon stock by initial forest class in the Leakage belt		Changes in carbon stock by post-deforestation z-zone		Total carbon stock changes of post-deforestation zones in the Leakage Belt		Total change in carbon stock in the Leakage Belt	
IDicl>	1	ΔCBSLLKicl,t	ΔCBSLLKicl	IDiz>	1	ΔCBSLLKz,t	ΔCBSLLKz	ΔCBSLLKt	ΔCBSLLK
Name>	Forest	annual	cumulative	Name>	Zone 1	annual	cumulative	annual	cumulative
Project Year t	tCO2-e	tCO2-e	tCO2-e	Project Year t	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e
2021	25,117	25,117	25,117	2021	0	0	0	25,117	25,117

The total ex-post changes of carbon stock in the Leak Belt due to displacement activities in this monitoring period are presented in Table 67.

The leakage is calculated by the difference between the ex-post and ex-ante analyses. In this case, the result is that the value of carbon stock changes in the monitoring period for the year 2021 were less than zero (<0). Thus, the ex-post leakage was set to zero in these monitored years, as recommended by item 1.2 - Leakage Monitoring, of VCS VM0015.

Table 67. Ex post estimation of totals due to deforestation displacement.

Ex-ante carbon stock changes in the Leakage Belt			Ex-post changes of carbon stock in the Leakage Belt		Total ex-post leakage	
IDiz>	ΔCBSLLKt	ΔCBSLLK	ΔCBSLLKt	ΔCBSLLK	ΔCBSLLKt	ΔCBSLLK
Name>	annual	cumulative	annual	cumulative	annual	cumulative
Project Year t	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e
2021	50,192	50,192	25,117	25,117	0	0

6.4.3 Total estimated ex-post leakage

The total leakage estimates are presented in the Table 68.

Table 68 - Ex post estimated total leakage (Table 35 VM0015)

Project year t	Total ex post decrease in carbon stocks due to displaced deforestation		Carbon stock decrease due to leakage prevention measures		Total net carbon stock change due to leakage	
	annual	cumulative	annual	cumulative	annual	cumulative
	ΔCADLKt	ΔCADLK	ΔCLPMLKt	ΔCLPMLK	ΔCLKt	ΔCLK
	tCO2-e	tCO2-e	tCO2e	tCO2e	tCO2e	tCO2e
2021	0	0	0	0	0	0

6.5 Net GHG emission reductions and removals

The reductions of anthropogenic GHG emission were calculated according to equations 19, 20 and 21 of the VCS VM0015 methodology version 1.1. The risk factor was estimated using the Non-Permanence Risk Report, resulting in a VCS (VBC) credit buffer of 10%. The calculated reductions of ex-post GHG emissions are presented in $\Delta REDDt = (\Delta CBSLPAt + EBBBSLPAt) – (\Delta CPSPAt + EBBPSPAt) – (\Delta CLKt + ELKt)$

Where:

ΔREDDt: Reduction of ex-post anthropogenic GHG emissions assigned to project's AUD activity in year t (tCO2e);

ΔCBSLPAt: Sum of changes in baseline carbon stock in the Project Area in year t (tCO2e);

EBBBSLPAt: Sum of baseline emissions caused by biomass burning in the Project Area in year t (tCO2e);

ΔCPSPAt: Sum of ex-post changes in carbon stock in the Project Area in year t (tCO2e);

EBBPSPAt: Sum of ex-post emissions caused by biomass burning in the Project Area in year t (tCO2e);

ΔCLKt: Sum of ex-post changes of carbon stock per leakage in year t (tCO2e);

ELKt: Sum of ex-post emissions from leakage in year t (tCO2e);

t: 1, 2, 3 … T, one year of the proposed credit period (dimensionless).

$$VCUt = REDDt – VBCt$$

$$VBCt = (CBSLPAt - CPSPAt) * RFt$$

Where:

VCUt: Number of Verified Carbon Units that can be traded in year t (tCO2e);

$\Delta REDDt$: Reduction of ex-post anthropogenic GHG emissions assigned to project's AUD activity in year t (tCO_2e);

VBCt: Number of buffer credits deposited in the VCS buffer in year t ($t\ CO_2\text{-}e$);

$\Delta CBSLPAt$: Sum of changes in baseline carbon stock in the Project Area in year t (tCO_2e);

$\Delta CPSPAt$: Sum of ex-post changes in carbon stock in the Project Area in year t (tCO_2e);

RFt: Risk factor used to calculate the VCS credit buffer (%);

t: 1, 2, 3 … T, one year of the proposed credit period (dimensionless).

Table 69.

$$\Delta REDDt = (\Delta CBSLPAt + EBBBSLPAt) - (\Delta CPSPAt + EBBPSPAt) - (\Delta CLKt + ELKt)$$

Where:

$\Delta REDDt$: Reduction of ex-post anthropogenic GHG emissions assigned to project's AUD activity in year t (tCO_2e);

$\Delta CBSLPAt$: Sum of changes in baseline carbon stock in the Project Area in year t (tCO_2e);

EBBBSLPAt: Sum of baseline emissions caused by biomass burning in the Project Area in year t (tCO_2e);

$\Delta CPSPAt$: Sum of ex-post changes in carbon stock in the Project Area in year t (tCO_2e);

EBBPSPAt: Sum of ex-post emissions caused by biomass burning in the Project Area in year t (tCO_2e);

$\Delta CLKt$: Sum of ex-post changes of carbon stock per leakage in year t (tCO_2e);

ELKt: Sum of ex-post emissions from leakage in year t (tCO_2e);

t: 1, 2, 3 … T, one year of the proposed credit period (dimensionless).

$$VCUt = REDDt - VBCt$$

$$VBCt = (\Delta CBSLPAt - \Delta CPSPAt) * RFt$$

Where:

VCUt: Number of Verified Carbon Units that can be traded in year t (tCO_2e);

$\Delta REDDt$: Reduction of ex-post anthropogenic GHG emissions assigned to project's AUD activity in year t (tCO_2e);

VBCt: Number of buffer credits deposited in the VCS buffer in year t ($t\ CO_2\text{-}e$);

$\Delta CBSLPAt$: Sum of changes in baseline carbon stock in the Project Area in year t (tCO_2e);

$\Delta CPSPAt$: Sum of ex-post changes in carbon stock in the Project Area in year t (tCO_2e);

RF_t: Risk factor used to calculate the VCS credit buffer (%);

t: 1, 2, 3 … T, one year of the proposed credit period (dimensionless).

Table 69. Ex-post reduction of anthropogenic GHG emissions (ΔREDDt) and Verified Carbon Units (VCUt) (Table 36 VM0015).

Project Year t	Changes in baseline carbon stock		Ex-post project carbon stock changes		Ex-post leakage belt carbon stock changes		Ex-post GHG emissions reduced		Ex-post marketable VCUs		Reserve credits (ex-post)	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	ΔCBSLPAt	ΔCBSLPA	ΔCPSPAt	ΔCPSPA	ΔCLKt	ΔCLK	ΔREDDt	ΔREDD	VCUt	VCU	VCBt	VCB
	tCO2-e	tCO2-e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e
Aug/01/2020 - Jul/31/2021	44,186	44,186	0	0	0	0	44,186	44,186	39,767	39,767	4,419	4,419

7 REFERENCES

ACRE. Governo do Estado do Acre. Zoneamento Ecológico-Econômico do Estado do Acre, Fase II (Escala 1:250.000): Documento Síntese. 2. Ed. Rio Branco: SEMA, 2010. 356 p.

ACRE. Governo do Estado. Avaliação do desmatamento no estado do Acre para os anos de 2011 e 2012 com base na metodologia da UCEGEO – Rio Branco: IMEC, 2013. 36 p.

ACRE. Governo do Estado do Acre. Plano de Prevenção e Controle do Desmatamento e Queimadas do Estado do Acre – PPCDQ – Acre. Rio Branco: SEMA, 2018. 72 p

ACRE. Secretaria de Estado de Meio Ambiente. Plano estadual de recursos hídricos do Acre – Rio Branco: SEMA, 2012. pp.243.

ALMEIDA, M. W. B. de; PANTOJA, M. C. “Justiça Local nas Reservas Extrativistas”. Raízes. v. 23, n. 1-2, p. 27-41, Campina Grande, 2004.

ALENCAR, A. et al. Desmatamento na Amazônia: indo além da “emergência acrônica”. Belém: IPAM, 2004.

ANDRADE, M. B.; FERRANTE, L.; FEARNSIDE, P. M. Brazil’s Highway BR-319 demonstrates a crucial lack of environmental governance in Amazonia. Environmental Conservation, p. 1–4, 2021.

ARAÚJO, E. A. de; MOREIRA, W. C. de L.; SILVA, J. de F.; BARDALES, N. G.; AMARAL, E. F. do.; PEREIRA, S. dos S.; OLIVEIRA, E. de; SOUZA, R. E. de; SILVA, S. S. da; MELO, A. W. F. de. Levantamento pedológico, aptidão agrícola e estratificação pedoambiental do Campus Floresta. Cruzeiro do Sul, Acre / Ananindeua: Itacaiúnas. 116p. 2019.

ARTAXO, Paulo; DIAS, Maria Assunção; NAGY, Laszlo; LUIZÃO, Flávio; CUNHA, Hillândia; QUESADA, Carlos; MARENGO, José; KRUSCHE, Alex. Perspectivas de pesquisas na relação entre clima e o funcionamento da floresta amazônica. Amazônia sem fronteiras/artigos,[S.l.],p.4146,18set.2014.Disponívelem:https://www.researchgate.net/publication/315349782_Perspectivas_de_pesquisas_na_relacao_entre_clima_e_o_funcionamento_da_floresta_Amazonica. Acesso em: 3 jun. 2022.

BAHIA, R. B. C. Contexto geológico da bacia do Acre. In: ADAMY, A. Geodiversidade do estado do Acre. Programa Geologia do Brasil – Levantamento da Geodiversidade. Porto Velho: CPRM, 2015. p.17-36.

BARDALES, N.G.; ARAÚJO, E. A. de.; MELO, A. W. F. de.; LANI, J. L.; AMARAL, E. F. do.; AMARAL, E. F. Zoneamento Pedoclimático da Seringueira no Acre. Brasília, DF: Embrapa. 207-242 p. 2021. In: Zoneamento pedoclimático para a seringueira no estado do Acre / Eufran Ferreira do Amaral, Rivadalve Coelho Gonçalves, editores técnicos. – Brasília, DF : Embrapa, 244p. 2021.

BARRETO, P. AMINTAS BRANDÃO JR.; HERON MARTINS; DANIEL SILVA; CARLOS SOUZA JR.; MÁRCIO SALES; TARCÍSIO FEITOSA. Risco de desmatamento associado à hidrelétrica de Belo Monte. Belém, PA: Instituto do Homem e Meio Ambiente da Amazônia-IMAZON, 2011.

BRASIL. Novo Código Florestal. Lei nº 12.651 de 25 de maio de 2012. Sobre a proteção da vegetação nativa. Diário Oficial. Brasília. 28 maio. 2012.

BRASIL. Ministério das Minas e Energia. Departamento Nacional de Produção Mineral. Projeto RADAMBRASIL. Folha SC. 18 Javari/Contamana; geologia, geomorfologia, pedologia, vegetação e uso potencial da terra. Rio de Janeiro: 1977. 420 p. (Levantamento de Recursos Naturais, 13).

BROWN, S et. al. Baselines for land-use change in the tropics: application to avoided deforestation Projects. Mitigation and Adaptation Strategies for Climate Change, 12:1001- 1026. 2007.

CABIESES, F. La ufia de gato y su entorno: de la selva a la farmacia. Lima: Universidad de San Martin de Porres—Faculdad de Ciencias dela Comunicacion, 1997. 231 p.

CASTELO BRANCO, José M. B. C. 1959. "Peruanos na região acreana" IN: Revista do Instituto Histórico e Geográfico Brasileiro. Rio de Janeiro: Imprensa Nacional, vol. 244. CASTELO BRANCO. J. M. B. C 1950. "O Gentio Acreano" IN: Revista do Instituto Histórico e Geográfico Brasileiro. Rio de Janeiro, Imprensa Nacional, vol. 207, abril- junho.

CARLOTTO, M. J. Reducing the effects of space-varying wavelength-dependent scattering in multispectral imagery. International Journal of Remote Sensing, v. 20, n. 17, p. 3333- 3344, 1999.

CAVALCANTE, L.M. Geologia do Estado do Acre. In: SOUZA, C.M.; ARAUJO, E.A.; MEDEIROS, M.F.S.T.; MAGALHÃES, A.A. (Org.). Recurso naturais: geologia, geomorfologia e solos do Acre. Rio Branco, AC: SEMA, 2010. (Coleção temática do ZEE; v. 2) p. 10-29.

CONGALTON, R. G.; KASS GREEN. Assessing the accuracy of Remotely Sensed data: principles and practices. New York – CRC Press, 1999.

COSTA. F. de S. C. et al. Inventário de emissões antrópicas e sumidouros de gases de efeito estufa do Estado do Acre: ano-base 2010. Rio Branco: Embrapa Acre, 2012. 144 p.

DAVIDSON, E. A. et al. The Amazon basin in transition. Nature, v. 481, n. 7381, p. 321–328, 19 jan. 2012.

FEARNSIDE, P.M. Desmatamento na Amazônia brasileira: história, índices e consequências. Megadiversidade. v. 1, n.1, p. 54-59, 2005.

FEARNSIDE, P. M.; GRAÇA, P. M. L. DE A. BR-319: Brazil's Manaus-Porto Velho Highway and the Potential Impact of Linking the Arc of Deforestation to Central Amazonia. Environmental Management, v. 38, n. 5, p. 705–716, 21 set. 2006.

FEARNSIDE, P. M. et al. Modeling of deforestation and greenhouse-gas emissions in the area of influence of the Manaus-Porto Velho (BR-319) highway. Revista Brasileira de Meteorologia, v. 24, n. 2, p. 208–233, jun. 2009.

FEARNSIDE, P.M. 2001. Efeitos de uso de terra e manejo florestal no ciclo de carbono na Amazônia brasileira. pp. 173-196 In: V. Fleischresser (ed.) Causas e Dinâmica do Desmatamento na Amazônia, Ministério do Meio Ambiente, Brasília, DF. 436 pp.

FISCH, G.; MARENGO, J. A.; NOBRE, C. A. Uma revisão geral sobre o clima da Amazônia. Acta Amazonica, v.28, n.2, p.101-126, 1998.

Hyndman RJ, Khandakar Y (2008). "Automatic time series forecasting: the forecast package for R." Journal of Statistical Software, 26(3), 1–22. doi: 10.18637/jss.v027.i03

Hyndman R, Athanasopoulos G, Bergmeir C, Caceres G, Chhay L, O'Hara-Wild M, Petropoulos F, Razbash S, Wang E, Yasmeen F (2022). forecast: Forecasting functions for time series and linear models. R package version 8.16, https://pkg.robjhyndman.com/forecast/JONG, W.; MELNYK, M.; LOZANO, L. A; ROSALES, M.; GARCIA, M. UÃa de gato: f ate and future of a peruvian forest resource. Bogor: CIFOR, 1999. isp. (Occasional Paper, 22).

IBGE – Instituo Brasileiro de Geografia e Estatística. Produção da Pecuária Municipal. Available at: http://www.ibge.gov.br/home/estatistica/economia/ppm/2012/default.shtm. Accessed in May 25, 2022.

KUHN, I.N. e LAMPERT, A.L. Análise Financeira. Universidade regional do noroeste do estado do rio grande do sul – unijuí. Ed. Unijuí, 2012. – 86 p.

LAURANCE, W.F.; VASCONCELOS, H.L. Consequências ecológicas da fragmentação florestal na Amazônia. Oecologia Brasiliensis. v.13, n. 3, p. 434-451, 2009.

Machado, Frederico Soares Manejo de Produtos Florestais Não Madeireiros: um manual com sugestões para o manejo participativo em comunidades da Amazônia. Frederico Soares Machado. Rio Branco, Acre: PESACRE e CIFOR, 2008. https://www.florestal.gov.br/documentos/publicacoes/1684-manejo-de-produtos-florestais-nao-madeireiros/file

MAPA – MINISTÉRIO DA AGRICUTURA, PECUÁRIA E ABASTECIMENTO. Cadastro Nacional de Produtores Orgânicos. Published in 2019. Available at: https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/organicos/cadastro-nacional produtores-organicos. Accessed in 5/25/2022.

MARTINI, A. Tecendo Limites no Alto Rio Juruá. Curitiba: Brazil Publishing, 2019. 166p.

MELO, A. W. F. de. Alometria de árvores e biomassa florestal na Amazônia Sul-Ocidental. 2017. 154 f. Tese (Doutorado em Ciências de Florestas Tropicais) – Instituto Nacional de Pesquisas da Amazônia, Manaus.

MIRANDA, E. M. de.; SOUSA, J. A. de; PEREIRA, R. de C. A. Subsídios técnicos para o manejo sustentável da unhade-gato (Uncaria spp.) no Vale do Rio Juruá, AC. Rio Branco: Embrapa Acre, 2001.

NOGUEIRA, E.M.; FEARNSIDE, P.M.; NELSON, B.W., BARBOSA, R.I.; KEIZER, E.W.H. Estimates of forest biomass in the Brazilian Amazon: New allometric equations and biomass adjustments of wood volume inventories. Forest Ecology and Management, v. 256, n. 11, p. 1853-1867, 2008.

PAVAN, M.N.; CENAMO, M.C. REDD+ nos estados da Amazônia: Mapeamento de iniciativas e desafios para integração com a estratégia brasileira. Instituto de Conservação e Desenvolvimento Sustentável do Amazonas (Idesam), 2 ed., 2012

PERZ, S. et al. Road building, land use and climate change: prospects for environmental governance in the Amazon. Philosophical Transactions of the Royal Society B: Biological Sciences, v. 363, n. 1498, p. 1889–1895, 27 maio 2008.

REZENDE, R. S. Problemas de urbanização e gestão territorial na reserva extrativista do Alto Juruá, Acre. V Encontro Nacional da Anppas, Florianópolis, 2010.

SANDOVAL, M. et al. Anti-inflammatory and antioxidant activities of cat's claw (Uncaria tomentosa and Uncaria guianensis) are independent of their alkaloid content. Phytomedicine. v.9, n.4, p.325-327, 2002.

SANGERMANO F.; EASTMAN, J. R.; ZHU, H. Similarity Weighted Instance-based Learning for the Generation of Transition Potentials in Land Use Change Modeling. Transactions in GIS, Volume 14, número 5, 2010.

SANTOS, H.G. et al. Sistema Brasileiro de Classificação de Solos. 5.ed. Brasília, DF: Embrapa, 2018. 356p

SHACKLETON et al. Non-Timber Forest Products in the Global Context. Springer. 2011. 301p.

SILVA, J.M.C.; RYLANDS, A.B.; FONSECA, G.A.B. The Fate of the Amazonian Areas of Endemism. Conservation Biology, v. 19, n. 3, p. 689-694, 2005.

SOARES-FILHO, B. S. et al. Modelling conservation in the Amazon basin. Nature, v. 440, n. 7083, p. 520–523, 23 Mar. 2006.

SOARES-FILHO, B. S.; COUTINHO CERQUEIRA, G.; LOPES PENNACHIN, C. Dinamica—a stochastic cellular automata model designed to simulate the landscape dynamics in an Amazonian colonization frontier. Ecological Modelling, v. 154, n. 3, p. 217–235, 1 set. 2002.

SOARES-FILHO, B. S. et al. Modelling conservation in the Amazon basin. Nature, v. 440, n. 7083, p. 520–523, 23 Mar. 2006.

SOARES-FILHO, B. S.; RODRIGUES, H. O.; COSTA, W. L. Modeling environmental dynamics with Dinamica EGO. 3. ed. Belo Horizonte: Universidade Federal de Minas Gerais, Centro de Sensoriamento Remoto, 2009.

SOUSA, M. M. de; OLIVEIRA, W. de. Análise Morfológica da rede de Drenagem do Alto Juruá/AC, extraída de MDE-SRTM. Uberlândia: Caminhos de Geografia, 2016.

SOUZA, A. L. de; CIMERMAN, S. Uncaria tomentosa (Cat's claw): uma potencial estratégia terapêutica para herpes labial. Revista Panamericana de Infectologia. v.12, n.2, p.51-57, 2010.

UNFCCC. Land use, land-use change and forestry. Decision 11/CP.7. 2002. Available at < FCCC/CP/2001/13/Add.1 (unfccc.int) > Accessed in: June 2, 2022.

VALDIONES, A.P. et al. Desmatamento Ilegal na Amazônia e no Matopiba: falta transparência e acesso à informação. ICV: 2021. 17 p.

WILLIAMS, J. E. Review of antiviral and immunomodulating properties of plants of the peruvian rainforest with a particular emphasis on Uña de gato and Sangre de grado. Alternative Medicine Review. v.6, n.6, p.567-579, 2001.

YANAI, A. M. et al. Avoided deforestation in Brazilian Amazonia: simulating the effect of the Juma Sustainable Development Reserve. Forest Ecology and Management, v. 282, p. 78–91, 15 out. 2012.