JURUÁ REDD+ PROJECT

Document Prepared by

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Juruá REDD+ Project is a partnership between Biofílica Ambipar Environmental Investments S/A 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 24,974.54 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 scenario of the region existing prior to the implementation of the project, it was identified that the main drivers of deforestation and degradation that act in the Reference Region during the historical period are creation of settlement projects with the opening of new tracks, conversion of areas for cattle ranching, opening of primary forest areas for annual clearings, and opening of roads for selective timber collection. These factors contributed to the process of degradation and threat to the forest area increasing the environmental impacts in the region. It is found that, between 2010 and 2020, the Project Reference Region had a historical deforestation rate of 2,057 hectares per year considering the implementation of these activities. Thus, it is expected that the Juruá REDD+ Project will avoid, through the containment of deforestation, on average about 13,798 tCO2e in annual GHG emissions reductions and 413,927 tCO2e in GHG emissions reductions over 30 years of the project. All the proposed activities to curb deforestation will become economically viable with the combination of non-timber forest product management together with the commercialization of carbon credits through REDD+ mechanisms.

Audit Type	Period	Program	VVB Name	Number of years

Validation	(31/07/2020 – 31/07/2050)	VCS	Earthood	30
Verification	31/07/2020 – 30/07/2022	VCS	Earthood	2
Total	31/07/2020 – 30/07/2022	-	-	2

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 4.2, 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 (section 3.3).

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.

Eligibility Criteria

Not applicable.

1.5 Project Proponent

Organization name	Biofílica Ambipar Environmental Investments S/A
Contact person	Soraya Pires
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Organization name	Amazônia Agroindústria EIRELI
Contact person	James Castro Cameli
Title	Managing Partner
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Telephone	+55 68 99926-1691
Email	jamescameli@yahoo.com.br

1.6 Other Entities Involved in the Project

Organization name	Vasta Insumos da Amazônia Ltda
Role in the project	Commercialization of environmental services generated by the management of non-timber forest products such as cat's claw
Contact person	James Castro Cameli

Title	Managing Partner
Address	Rua Pedro Teles n°360 Bairro: Centro, Cruzeiro do Sul, Acre
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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
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1.7 Ownership

Amazônia Agroindústria EIRELI 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 EIRELI registered in the INCRA - SIGEF land information system which were submitted to VVB as commercially sensitive information – section 1.18.

Table 1. Parts of Amazônia Agroindústria EIRELI property, with respective sizes contained in the documents of the (SIGEF).

Name	Ownership registration	Area (ha) in Descriptive Memorial	Area (ha) in SIGEF geographic database
Seringal Valparaíso - Part 1	5,197	21,110.51	21,109.02
Seringal Valparaíso - Part 2	5,197	3,865.81	3,865.52
Seringal Valparaíso – Total	5,197	24,976,32	24,974.54

The Project uses the geographic database provided by SIGEF to calculate the area of the property (24,974.54 ha). The geographic data was developed in QGIS 3.28.2 software that uses the Universal Transverse Mercator (UTM) projection.

The descriptive memorials and plan inform the calculated area through the Local Geodetic System (LGS) instead of adopting the Universal Transverse Mercator (UTM) projection plane. For this reason, there is a slight difference between the property documents (24.976,32 ha) and geographic database (24,974.54 ha).

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 settlers in the region. The supporting documents have been submitted to VVB.

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 v4.5 (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 July 31, 2020 as the starting date, representing the milestone to implementing management or protection plans 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 July 31, 2020 to July 30, 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)
Jul/20 - Jul/21	3,787
Jul/21 - Jul/22	4,905
Jul/22 - Jul/23	5,452
Jul/23 - Jul/24	4,134
Jul/24 - Jul/25	4,727
Jul/25 - Jul/26	1,932
Jul/26 - Jul/27	4,719
Jul/27 - Jul/28	1,841
Jul/28 - Jul/29	2,482
Jul/29 - Jul/30	3,343
Jul/30 - Jul/31	13,179
Jul/31 - Jul/32	11,330
Jul/32 - Jul/33	10,264
Jul/33 - Jul/34	14,928
Jul/34 - Jul/35	14,879
Jul/35 - Jul/36	11,777
Jul/36 - Jul/37	7,965
Jul/37 - Jul/38	10,497
Jul/38 - Jul/39	15,609

Jul/39 - Jul/40	23,025
Jul/40 - Jul/41	18,456
Jul/41 - Jul/42	17,809
Jul/42 - Jul/43	37,017
Jul/43 - Jul/44	21,020
Jul/44 - Jul/45	24,413
Jul/45 - Jul/46	21,933
Jul/46 - Jul/47	33,079
Jul/47 - Jul/48	21,088
Jul/48 - Jul/49	20,705
Jul/49 - Jul/50	27,635
Estimated total ERs	413,927
Total number of years of credit	30
Average annual ERs	13,798

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 in association with biodiversity conservation and local community support in the Alto Juruá region. 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, the Project will seek to avoid the deforestation of 10.962 hectares of forest and, therefore, conserve associated natural resources through rational and sustainable use.

Initial studies, coordination and stakeholder engagement

The activities related to the Project's initial coordination extended to the first meetings held with the landowner and the signing of a contract that defined the terms of a long-term partnership aimed at environmental conservation and socioeconomic development in the region. This stage also included the hiring of experts and meetings with technical partners to initiate the Project's baseline and feasibility studies, covering financial indicators, as well as the socioeconomic, ecological, and physical characterization of the area—including vegetation, biodiversity, climate, and geomorphology.

In parallel, stakeholder engagement campaigns were carried out, including six structured meetings held between 2020 and 2021 to present and discuss the Project with key stakeholders and to foster their early involvement in forest conservation efforts. These activities are essential for the design of effective REDD+ interventions, particularly in regions affected by complex land use dynamics. Local dialogues —

especially with communities near high-risk zones such as the James Road (Ramal do James) — have proven instrumental in raising awareness and directly reducing deforestation pressures.

It is understood that such engagement initiatives, even in their early phases, can generate measurable impacts in terms of deforestation containment and GHG emission reductions. Moreover, these stakeholder engagement processes are intended to continue throughout the project's implementation and monitoring cycle, forming part of a long-term strategy to align community interests with forest preservation objectives.

Therefore, the initial coordination phase not only served to build the technical and operational foundation for the Project but also catalyzed social processes that are expected to enhance the effectiveness and permanence of REDD+ outcomes over time.

Improved property surveillance

The property surveillance activity aims to mitigate and prevent unplanned deforestation in the Project Area through on-field physical presence. Currently, surveillance actions are conducted by the property's employees, but without well-defined procedures. The objective of this activity is to enhance and adapt surveillance actions within the Project Area by continuously improving and revising conduct procedures. This involves establishing clear protocols, providing training to workers, and ensuring appropriate action is taken in cases of illegal activities. The procedures will be implemented and improved in accordance with the Juruá REDD+ Project's Property Surveillance Plan, which will establish the necessary guidelines for action and resolution of incidents within the Project area. The patrols will be conducted safely, respecting the code of conduct followed by the proponents, which was formalized in the partnership for the development of the REDD+ project.

Through this activity, more effective surveillance actions are promoted, which aid in mitigating and preventing illegal deforestation, thereby reducing emissions. Additionally, if necessary, the Project will strengthen local partnerships, particularly with law enforcement agencies, to combat illegal activities and facilitate the reporting of complaints.

To support the field activities of property surveillance, the Project proposes utilizing remote monitoring through satellite image monitoring. The surveillance team will use the products of this monitoring activity to assess areas identified during field monitoring, understand the context of deforestation pressure, and refine strategies to prevent and combat illegal activities. This approach will lead to greater accuracy and efficacy in addressing deforestation.

Deforestation monitoring using satellite images

Regular monitoring of deforestation will be conducted through the use of satellite images, enabling the tracking of changes in land use and land cover within the Project's boundaries. This monitoring process will generate reports that pinpoint the locations of deforestation, providing a deeper understanding of the deforestation dynamics. These reports will serve as valuable input for enhancing on-field interventions, making them more effective and precise.

By supporting the strategic plan for field patrols, this monitoring activity plays a crucial role in curbing deforestation and preventing invasions. It directly contributes to the preservation of forest cover and associated natural resources. The information gathered from the monitoring process serves as a foundation for comprehending the deforestation dynamics in the region and provides detailed insights into the areas facing the greatest pressure from illegal deforestation and associated risks.

Strengthening the management of non-timber forest products

The project will focus on developing the extraction of non-timber forest product with the objective to strengthening the existing practice in the Project Area. This will be achieved by identifying production improvements and additional market opportunities, by providing training for sustainable production and harvesting within the potential mapped lines and by identifying and selecting partners that can help with the work program.

The activity aims to map stakeholders who have the potential to participate in the management of non-timber forest products. This will encourage the engagement of all stakeholders in promoting sustainable development practices. The primary objective of the activity is to enhance the value of forest conservation while aligning it with sustainable production. Within the Project Area, one of the main non-timber forest products is cat's claw (Uncaria tomentosa), which is a woody climbing vine.

Cat's claw is predominantly found in the Vale de Juruá, as documented by Miranda et al. (2001). Traditional populations have utilized it for medicinal purposes, including the treatment of dysentery, rheumatism, and diabetes, as mentioned by Cabiesis (1997) and Jong et al. (1999). It is worth noting that cat's claw extract-based phytotherapeutic products are among the 12 registered products approved for distribution by the Brazilian Unified Health System, as recognized by the Ministry of Health. The Ministry of Health has assigned a recommendation grade B III for the use of cat's claw extract in the treatment of knee osteoarthritis (1) and active rheumatoid arthritis (2). Extensive chemical, biological, and pharmacological studies have demonstrated the immunostimulant, anti-inflammatory, antiviral, and cancer cell growth inhibitory effects of this species (Williams, 2001; Sandoval et al., 2002; Souza & Cimerman, 2010).

Regarding the ongoing Project, several opportunities have been identified and mapped. These opportunities include gaining a more precise understanding of the cat's claw life cycle, developing improved techniques to facilitate the regrowth of the mother plant, and exploring the utilization of by-products generated during the bark extraction process of the vine.

The activity aimed at strengthening the management of non-timber forest products holds the potential to foster the growth of a forest-based and sustainable economy in the Amazon region. Its primary objective is to promote the appreciation of environmental assets derived from preserved forests while increasing production through sustainable practices. The expected impacts include the valuation of the intact forest and the conservation of the area. These positive outcomes will give rise to new dynamics and sustainable production models in the region, ultimately contributing to the fight against 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.

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. This will enable the Project to address the intended benefits in a clearer and more transparent way, 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, the Project requires complementary studies about natural resources and socioeconomic, and to maintain VCS requirements, which, for example, requires the reassessment of the baseline every six years, therefore, 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 2, and include the initial coordination, planning, project concept, development activities and the relationship with the project stakeholders.

Table 2 - Activities of Juruá REDD+ Project

Activity	Description	Start Date	Conclusion Date	Stakeholder Engagement
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.	Started in 2020	Completed in 2021	Exclusive involvement of proponents in the coordination and initial planning.
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.	Started in 2020	Planned to continue throughout the project duration	Exclusive involvement of proponents in the identification and selection of potential strategic partners.
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.	Started in 2020	Completed in 2020	Activity conducted solely by proponents.
1.4 Signing the contract	Signing the contract between the bidders.	Started in 2022	Completed in 2022	Action restricted to the proponents for formalization of the contract between parties
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.	Started in 2020	Completed in 2021	Activity restricted to proponents for the analysis of project financial indicators.
2.2 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.	Started in 2020	Completed in 2021	Action exclusively by proponents in the construction and structuring of the cartographic base.

2.3 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.	Started in 2020	Completed in 2021	Conducted exclusively by the proponents.
2.4 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.	Started in 2020	Completed in 2021	Action conducted exclusively by the proponents.
2.5 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.	Started in 2020	Completed in 2021	Proponents directly involved in the baseline assessment and carbon credit potential.
2.6 Stakeholder consultation and engagement	Six meetings were held with stakeholders to present and discuss the project and to foster engagement in forest conservation	Started in 2020	Completed in 2021	Participation of all stakeholders, including meetings for project presentation and discussion.
2.7 Preparation of the Project Description document	Development of the Project Description document according to the criteria set out by VCS	Started in 2020	Completed in 2022	Proponents in collaboration with Biofílica Ambipar Environmental Investments S/A.
3. Management and Development				
3.1 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.	Started in 2022	Planned to continue throughout the project duration	Activity is executed by Amazônia Agroindústria workers and the status and results are informed and consulted with all stakeholders.
3.2 Monitoring deforestation using satellite images	Promoting the remote monitoring of deforestation, contributing to understand the deforestation dynamics	Started in 2021	Planned to continue throughout the project duration	Activity led by Biofílica Ambipar Environmental Investments S/A,

	and, consequently, to the improvement of field interventions.			and all stakeholders are informed.
3.3 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	Planned to start in 2022	Planned to start after verification using resources from carbon credits revenue and continue throughout the project duration	Involvement of direct stakeholders in management and training, with consultation and information to indirect stakeholders.
3.4 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.	Planned to start in 2022	Planned to start after verification using resources from carbon credits revenue and continue throughout the project duration	Inform and consult all stakeholders about the activities and their results.
3.5 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	Started in 2022	Planned to continue throughout the project duration	Inform all stakeholders about the need for ongoing technical studies and their results.

Building on the information in Table 2, the table 2A below offers a structured summary of project activities, outlining their anticipated impacts on deforestation and GHG emissions reductions, as well as the associated indicators and targets.

Table 2A – Objectives, Expected Impacts and Indicators of Juruá REDD+

Activity	Description	Expected Impact on Avoided Deforestation / GHG Emissions	Indicators	Goal
Satellite deforestation monitoring	Monthly analysis of satellite alerts (PRODES/MapBiomas) focused on high-risk areas.	Supports timely identification of deforestation events; enables response actions; contributes directly to GHG emission reductions.	Deforestation monitoring status	Full year monitoring of Project Area and Leakage Belt
Stakeholder engagement	Informal dialogues with residents, especially those near the James Road (Ramal do James).	Raises local awareness; directly reduces pressure on project area.	Number of stakeholders engagement campaigns	At least one stakeholder engagement campaign per year
On-site surveillance activities	Field presence by Amazônia Agroindústria staff to deter illegal activities and respond to alerts.	Contributes directly to preventing unplanned deforestation and GHG reductions.	Surveillance occurrence status	Full year Project Area surveillance
Strengthening of non-timber forest product (NTFP) management	Technical planning and identification of sustainable extraction opportunities, especially for cat's claw.	Supports conservation by valuing standing forest and generating sustainable income.	NTFP management strengthening actions	At least 1 action per year
Monitoring and evaluation of project activities	Development of monitoring tools and tracking of annual project performance indicators.	Supports continuous improvement of project performance; increases efficiency of GHG mitigation.	Annual M&E reports; updated monitoring strategy.	At least 1 report per year

Low-Impact Agricultural Management

The Low-Impact Agricultural Management activities planned within the Leakage Management Areas of the Valparaíso property are a cornerstone of the Juruá REDD+ Project's strategy to prevent leakage and promote sustainable practices. These activities will be tailored to address the risk of deforestation displacement while simultaneously promoting environmental conservation and economic development.

One of the main components of Low-Impact Agricultural Management will be the implementation of targeted training programs for local stakeholders close to the project area, especially those related to the deforestation agents mentioned in section 3.4, such as family farmers from settlements and ranchers from private properties. These programs will aim to equip participants with knowledge and practical skills to adopt sustainable agricultural practices that reduce environmental impacts and the need to convert forest lands to pasture lands or agriculture.

The synergy between capacity-building initiatives and the strategic utilization of Valparaíso's infrastructure positions Low-Impact Agricultural Management as a vital component of the Juruá REDD+ Project's leakage prevention strategy. By integrating training programs with practical applications and leveraging existing resources, the project ensures that local stakeholders are equipped to adopt sustainable practices, reduce deforestation risks and support long-term conservation goals.

Project Governance Structures

The management of the Juruá REDD+ Project is the responsibility of Biofílica Ambipar and Amazônia Agroindústria EIRELI. The obligations and commitments of the parties are described as follows:

Biofílica Ambipar Environmental Investments S/A Responsibilities: application of the VM0015 methodology for the preparation of the baseline and the protocols for emission quantification and MRV; project design in compliance with VCS standard requirements, including protocols for project activity management and stakeholder engagement; continuous technical and operational co-management, encompassing legal support, communication, and stakeholder relations; remote monitoring of forest cover and the implementation/coordination of additional actions aimed at reducing/mitigating greenhouse gas (GHG) emissions; preparation of the PDD (Project Design Description) and MRs (Monitoring Reports), as well as leading the validation and verification processes; credit commercialization and financial co-management of the Project.

Amazônia Agroindústria EIRELI Responsibilities: operational investments (OPEX) and execution of the planned project activities in the field; maintenance of land tenure compliance for the rural property where the project is developed (Seringal Valparaíso); infrastructure and logistical support for other professionals involved in the Project; provision of relevant information, including land tenure, environmental, and legal documents; communication and relationship with project stakeholders; providing necessary support for audit processes, the creation of communication materials, and other commercial processes; co-management of the REDD+ project.

During the conception and development of the project, other organizations were involved in conducting specific studies, diagnostics, and the compilation of information. Thus, their responsibilities are outlined as follows:

Vasta Insumos da Amazônia Ltda Responsibilities: Vasta Insumos da Amazônia Ltda belongs to the same owner as Amazônia Agroindústria EIRELI and is responsible for developing activities related to the management of non-timber forest products, such as cat's claw. The implementation of these activities will be carried out when financial resources are available from the issuance and commercialization of carbon credits linked to the Juruá REDD+ Project.

Responsibilities of another associated management and results consultant: Consultant Gilberto Siqueira was responsible for local and regional development and monitoring during the project's initial phases, performing functions in the planning and implementation of the first actions.

Jurisdictional status

Biofílica Ambipar Environmental Investments S/A 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 Environmental Investments S/A 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 km^2/year); and 2011-2015, using as reference level the period from 2001-2010 for calculation of the average deforestation rate (496 km^2/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. The Project is being developed on a private property of 24,974.54 hectares, according to geographic database presented by SIGEF. As presented in section 3.3, the Project Area (AP) is equivalent to a total of 24,076 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 3 and area location in the Figure 1.

Table 3. 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

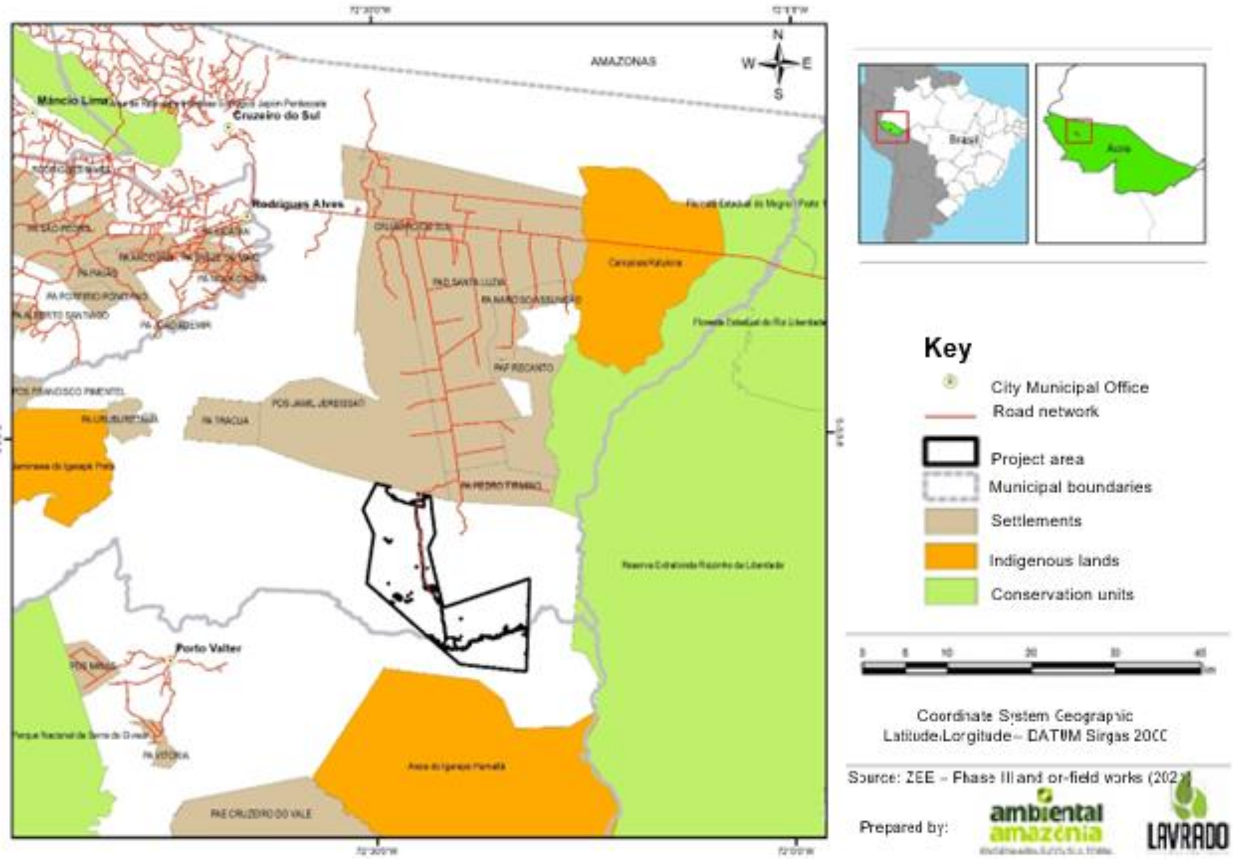


Figure 1. Location of Juruá REDD+ Project, South East Amazon, Acre State, Cruzeiro do Sul and Porto Walter municipalities, Brazil.

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 25,4°C. The average maximum temperature is 27.7°C and the average minimum temperature is around 22.2°C (INMET, 2020) (According to Figure 2).

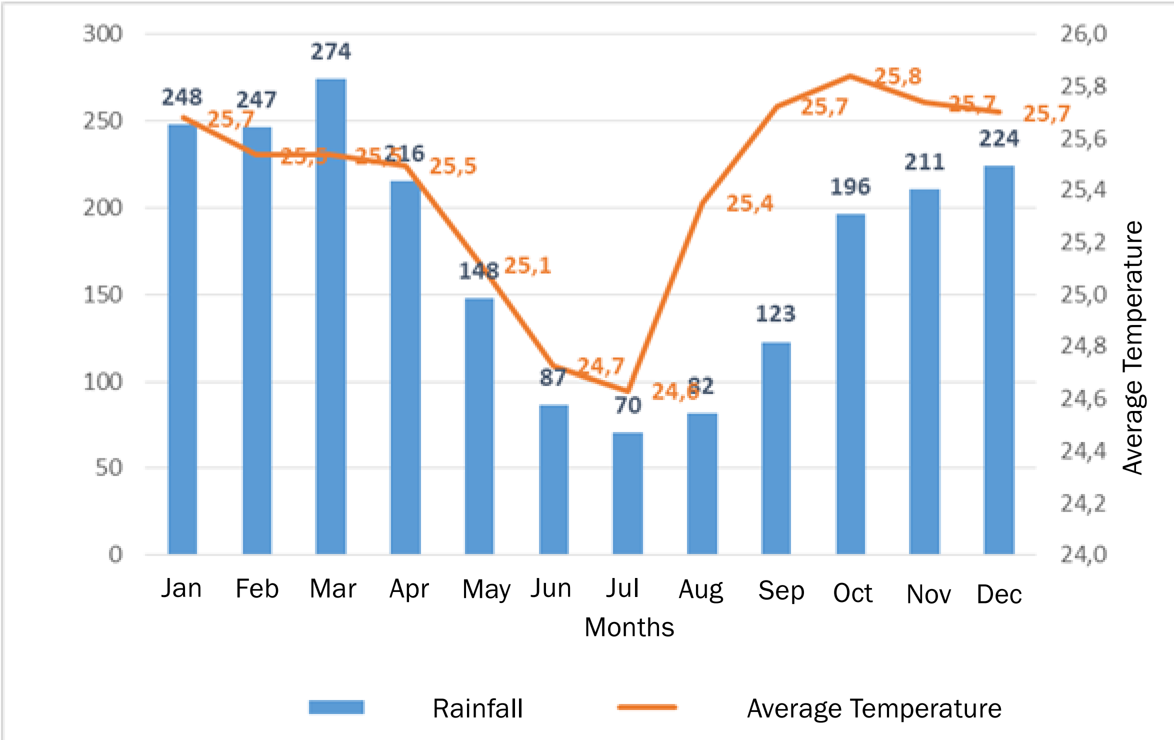


Figure 2. Variation of temperature and rainfall during 43 years (1962;1970-1990 and 1993-2005) in the Cruzeiro do Sul municipality, Acre State, Brazil. Source: Adapted from INMET (2020).

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).

Temperature is an important factor for plant development. The highest temperatures of the year occur between August and October (between 37 and 38 °C from 13:00 to 15:00 hours), local time. It was found over a historical series for the rubber plantation that the average temperature ranged from 24.95 °C to 25.04 °C , with higher temperatures northwest of the rubber plantation (Figure 3).

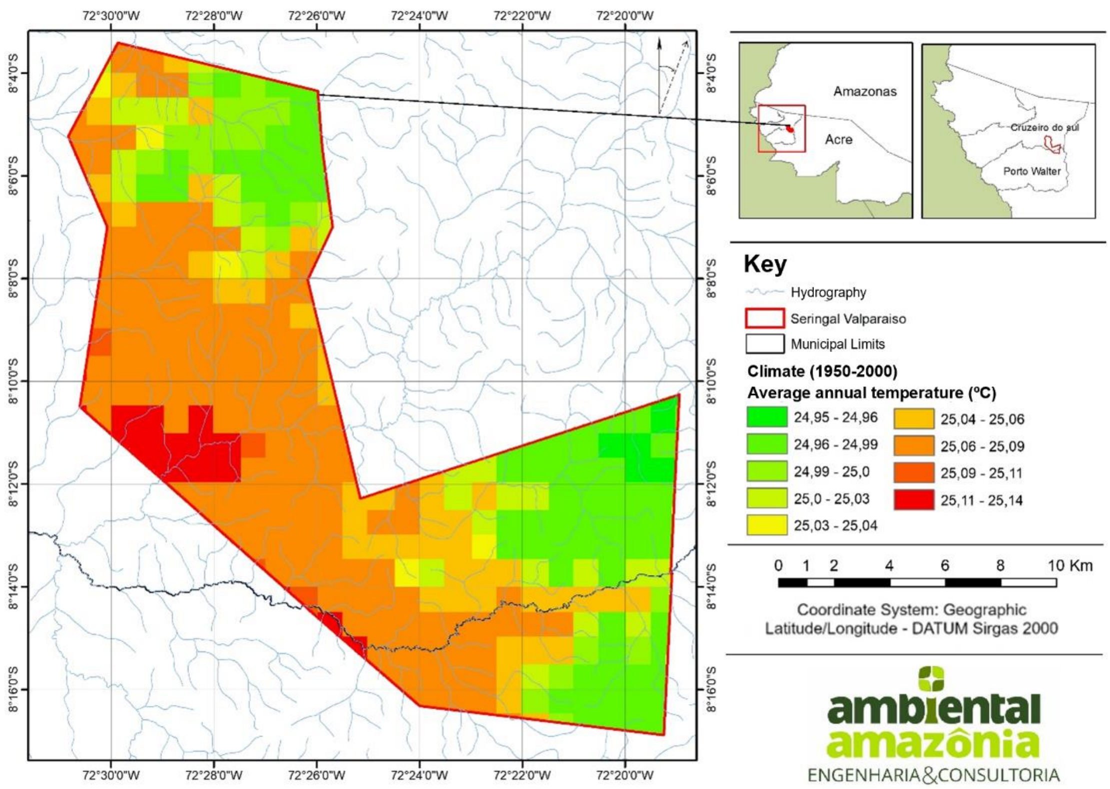


Figure 3. Mean annual temperature variation in Seringal Valparaíso (REDD+ Juruá Project), South-western Amazonia, Acre State, municipalities of Cruzeiro do Sul and Porto Walter, Brazil. Source: WorldClim (2022).

The rainfall regime is characterized by a rainy period of seven months (October to April). The months from December to March are the rainiest with 1,095 mm of rainfall. This corresponds to 56 % of the total annual precipitation. There is a five-month period (May to September) with the least rainfall, 323 mm, the rainy period corresponding to the hottest period of the year. The average rainfall for the Valparaiso rubber plantation in the historical series was 169.2 mm to 176.2 mm, with the northwestern region of the rubber plantation the wettest over the decades (Figure 4).

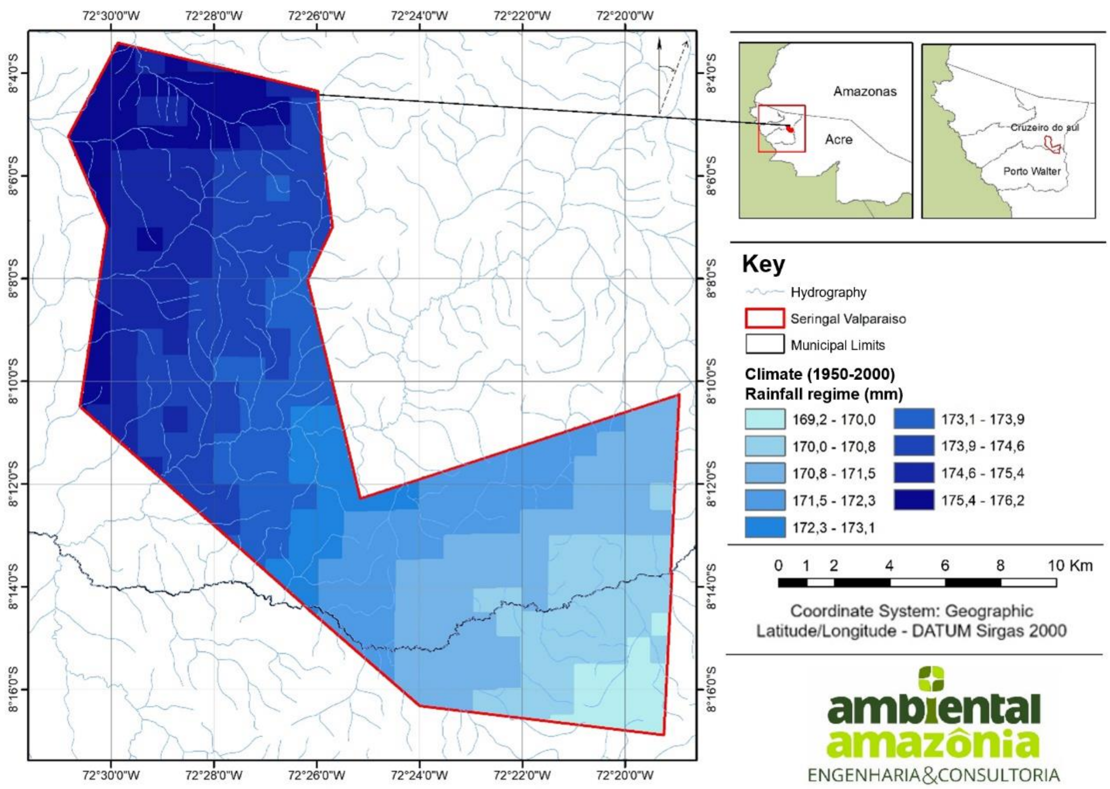


Figure 4. Rainfall variation in Seringal Valparaíso (REDD+ Juruá Project), South-western Amazonia, Acre State, municipalities of Cruzeiro do Sul and Porto Walter, Brazil. Source: WorldClim (2022).

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 5).

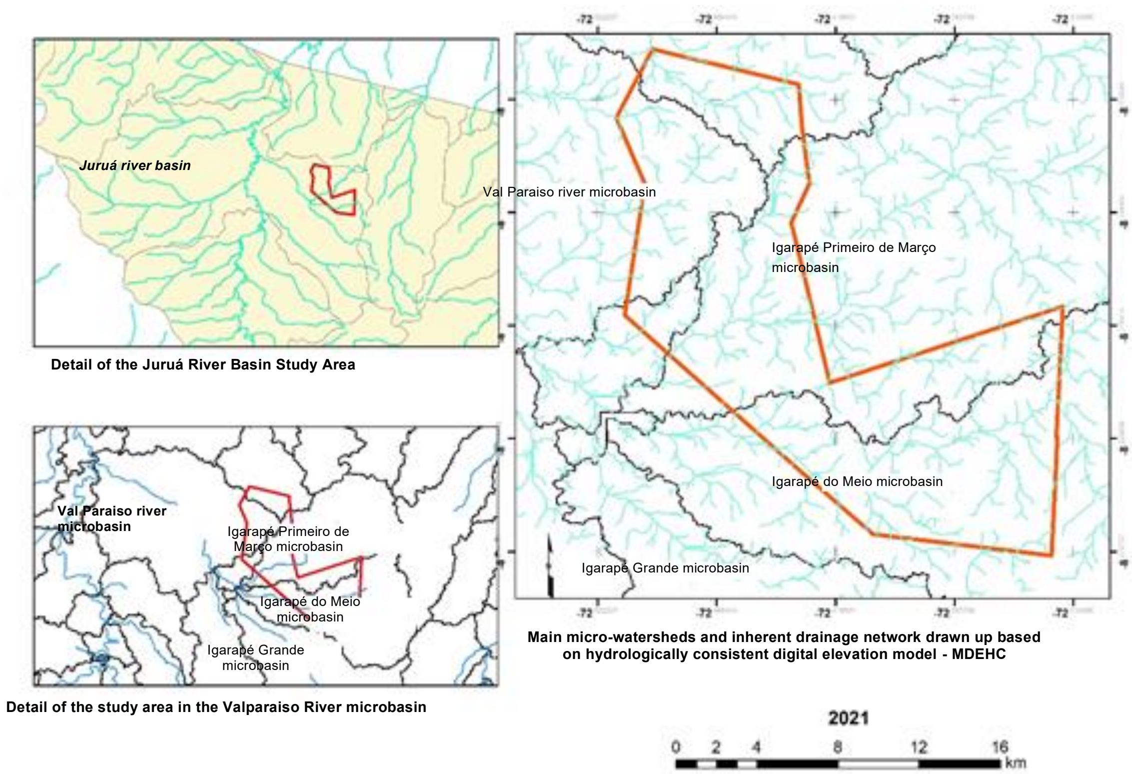


Figure 5. Main microbasins that drain the Seringal Valparaíso area (Juruá REDD+ Project), South East Amazon, Acre State, in Cruzeiro do Sul and Porto Walter municipalities, Brazil.

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 6) 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 6). There was a predominance of the Acrisols class with 75% of the total area of the property where the Project is located (Table 4), 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.

Table 4. Description and distribution of soil orders and suborders 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	**24.1**
ARGILUVIC PLINTHOSOLS	6.9
HAPLIC PLINTHOSOLS	17.2
TOTAL ORDERS	**100**

Source: Ambiental Amazônia, 2021.

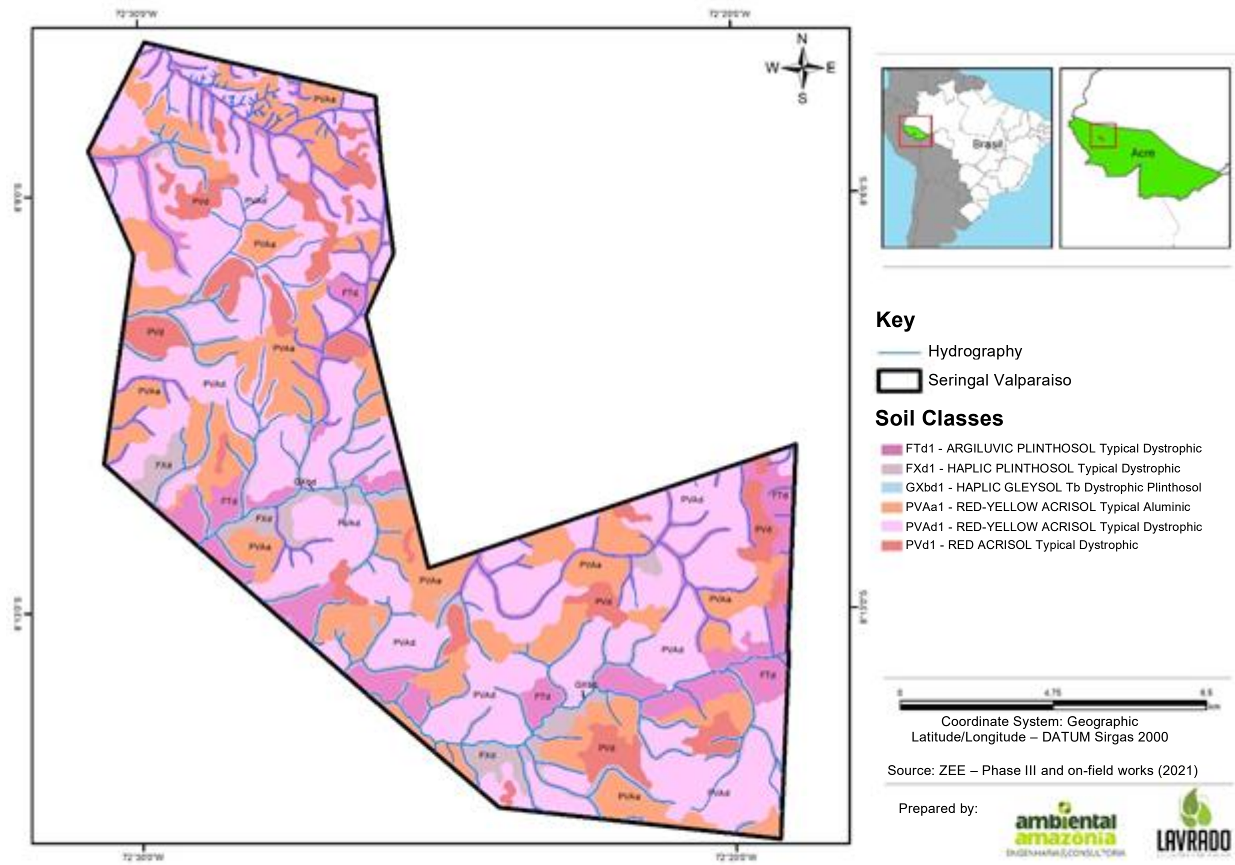


Figure 6. Distribution of soil classes in Seringal Valparaíso (Juruá REDD+ Project), South-Western Amazon, Acre State, Cruzeiro do Sul and Porto Walter municipalities, Brazil. Source: Ambiental Amazônia, 2021.

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 5), with lithology composed of sandy pelite from the Pleistocene, moderately developed material, and low soil fertility (BARDALES, et al., 2021).

Table 5. 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

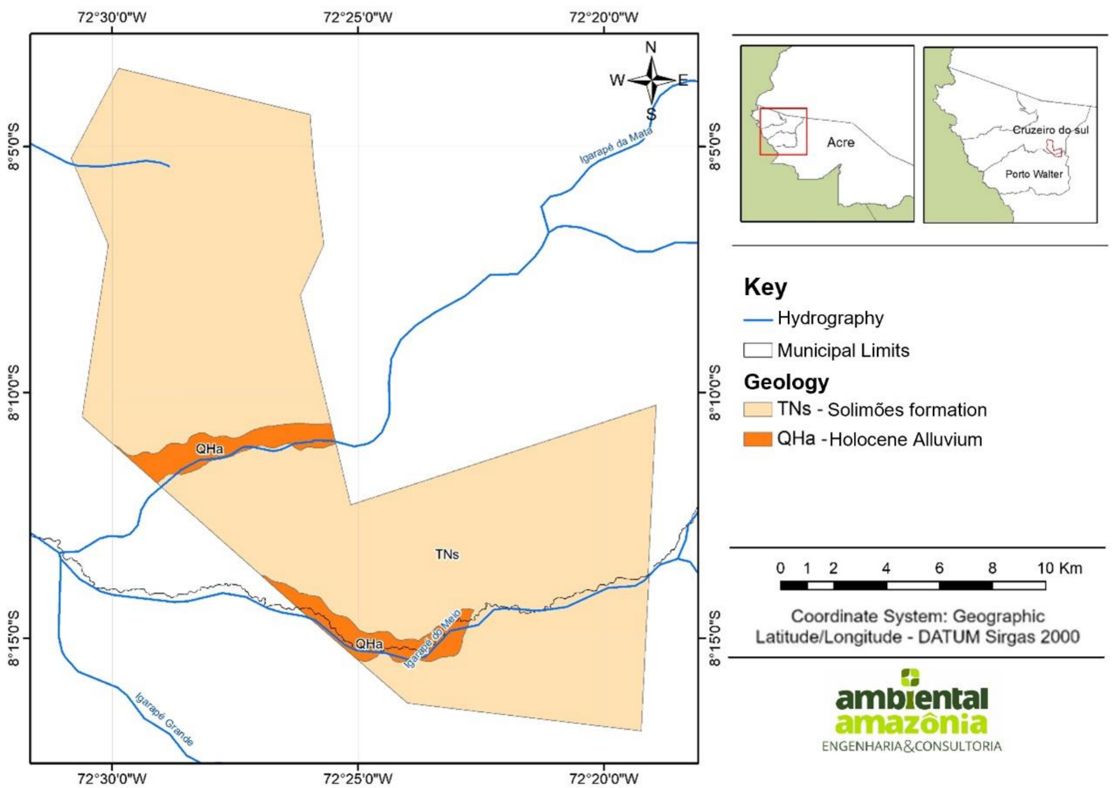


Figure 7. Distribution of geological units of Seringal Valparaíso (REDD+ Juruá Project), South-Western Amazon, State of Acre, municipalities of Cruzeiro do Sul and Porto Walter, Brazil. Source: Ambiental Amazônia, 2021.

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 (Table 6 and Figure 8):

<u>Amazon Plains</u>: 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).

<u>Juruá Depression – Iaco</u>: 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 6. 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	Geomorphological Units	Area
		%
Dc	Juruá-Iaco depression, cross dissection model	95
Aptf	Amazon Plains - accumulation model in plains and river terrace	5
TOTAL	-	**100**

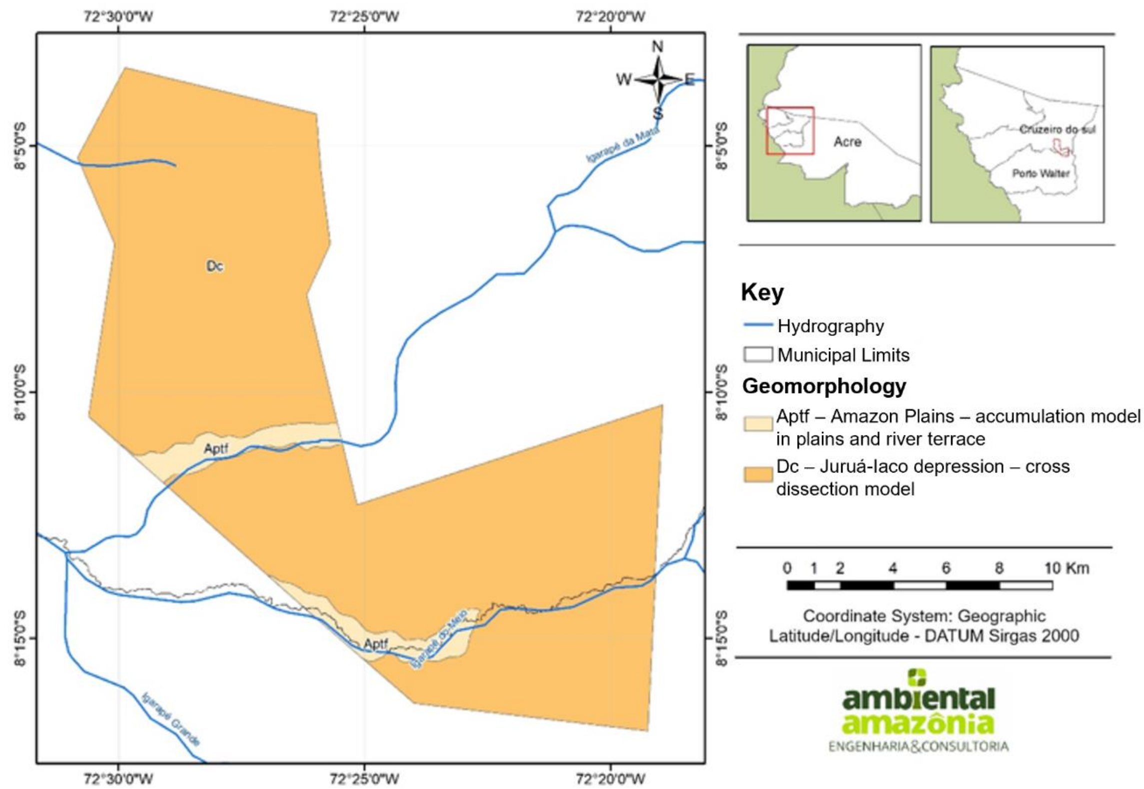


Figure 8. Distribution of geomorphological units of Seringal Valparaíso (REDD+ Juruá Project), South-Western Amazon, State of Acre, municipalities of Cruzeiro do Sul and Porto Walter, Brazil. Source: Ambiental Amazônia, 2021.

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).

The slope classes of the Seringal are shown in Figure 9. The area has a predominance of flat to gently undulating relief. The flat relief with 0 to 3% slope occupies 40% of the property. These are areas with the best aptitude for intensive agriculture. The gently undulating to undulating relief represents 28%. These are areas with little topography moved, gentle slopes with intensive agriculture with moderate conservationist practices.

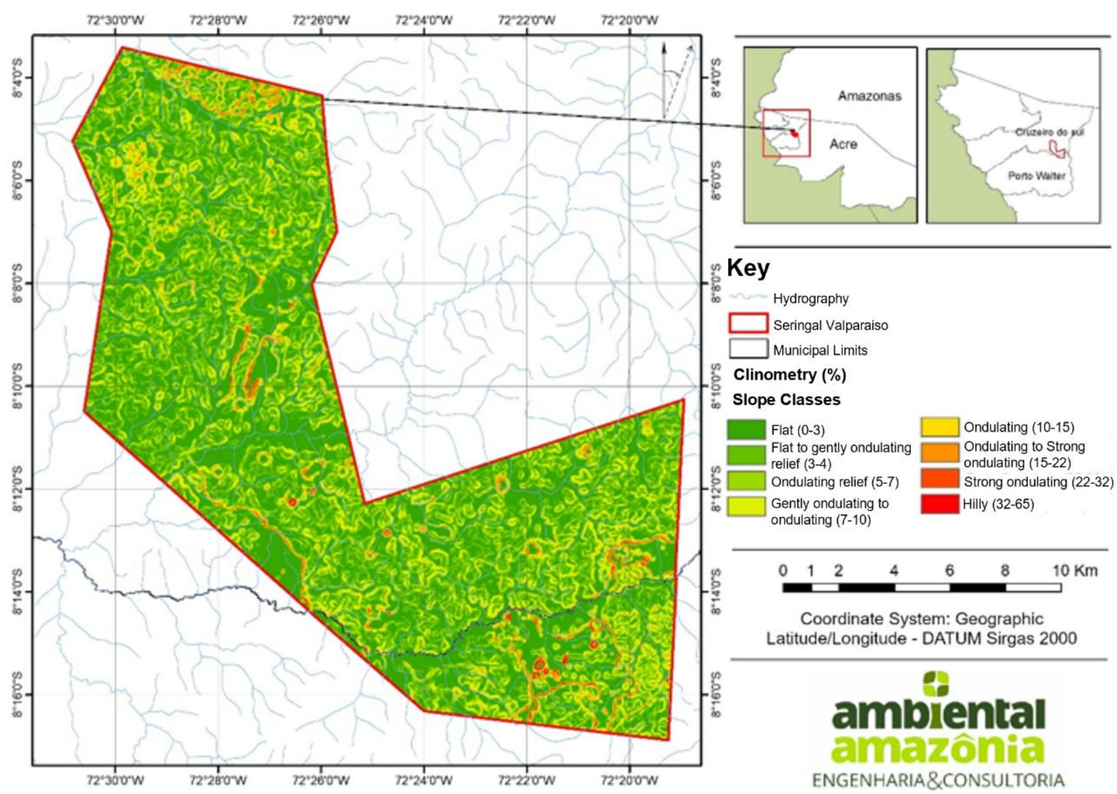


Figure 9. Distribution of relief classes in Seringal Valparaíso (Projeto REDD+ Juruá), South-western Amazon, State of Acre, municipalities of Cruzeiro do Sul and Porto Walter, Brazil. Source: Ambiental Amazônia, 2021.

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 rainfall 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 The Project Area consists entirely of Open Ombrophilous Forest, what indicates only one forest class as initial class of the project (described in section 3.4 Baseline Scenario). In terms of vegetation characterization, four forest typologies are identified in the Project Area: Open forest with Palm Trees and patches of Open Forest with Bamboos (FAP+FAB); Open Forest with Palms dominant, Open Forest with

Bamboos significant and patches of Dense Forest (FAP+FAB+FD); Open Forest with Palm Trees dominant, Dense Forest significant and patches of Open Forest with Bamboos (FAP+FD+FAB); and Open Forest with Palm Trees in alluvial areas (FAP-Alluvial) (ACRE, 2010). For a better understanding about their peculiarities, descriptions of these forest typologies taken from the Second Phase of the Ecological-Economic Zoning do Estado do Acre (ACRE, 2010) are presented below. The association of typologies follows the definitions provided by the First Phase of the Ecological-Economic Zoning do Estado do Acre (ACRE, 2000), where the first typology is the dominant, second the significant and third patches when occur.

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

FAP+FAB+FD: "Open Forest with Palms is dominant in this forest, Open Forest with Bamboos is significant and patches of Dense Forest."

FAP+FD+FAB: "Open Forest with Palms is dominant in this forest, Dense Forest is significant and patches of Open Forest with Bamboos."

FAP-Alluvial: "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."

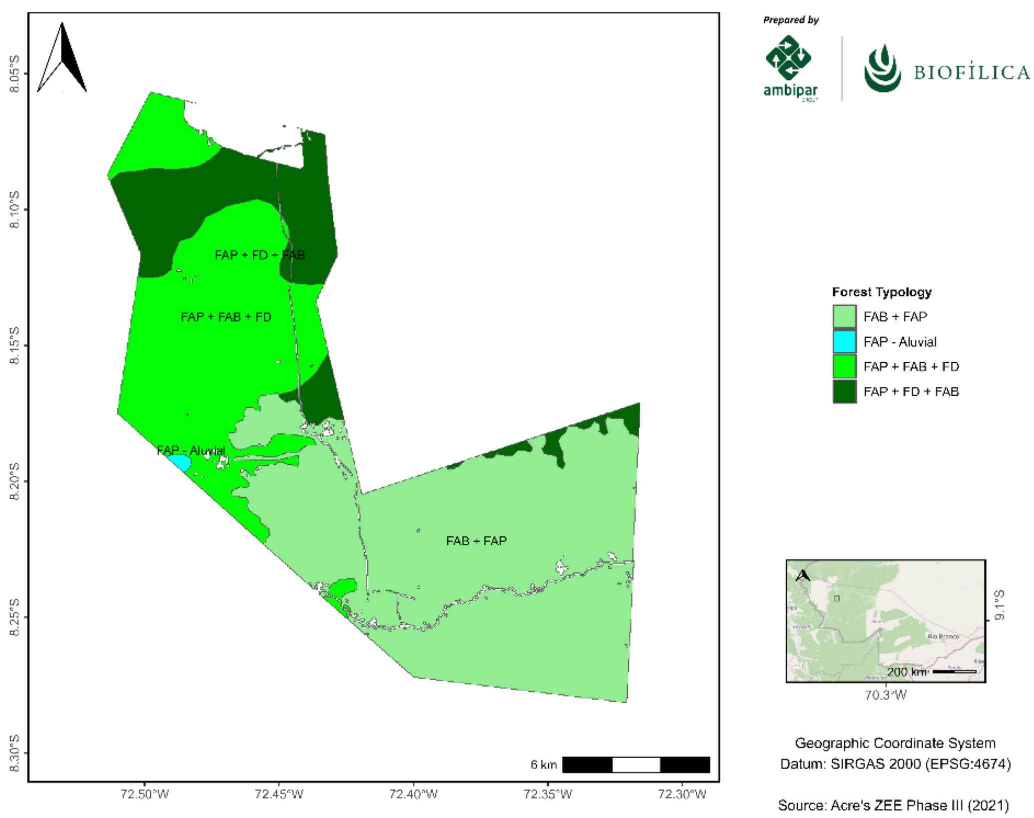


Figure 10. Seringal Valparaíso Forest Typologies (Juruá REDD+ Project). South-western Amazon, State of Acre, municipalities of Cruzeiro do Sul and Porto Walter, Brazil. Source: Acre's ZEE Phase III, 2021.

Table 7. Forest typologies and area distribution in Seringal Valparaíso (REDD+ Juruá Project), South-western Amazonia, Acre State, municipalities of Cruzeiro do Sul and Porto Walter, Brazil.

Typologies		Project Area (ha)	% of Project Area
FAB + FAP	Typology named for Open Forest with Palm Trees, in which several species of palm trees can be found with patches of Open Forest with Bamboo understory	12,932	53.7%
FAP + FD + FAB	Open Forest with Palms is dominant in this forest, Dense Forest is significant and patches of Open Forest with Bamboos	3,527	14.7%
FAB + FAB + FD	Open Forest with Palms is dominant in this forest, Open Forest with Bamboos is significant and patches of Dense Forest	7,572	31.4%
FAP Alluvial	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.	45	0.2%
TOTAL		**24,076**	**100.0**

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. The Project complies with the law as it's carried out in a property registered in CAR, as required by article 9, and because it is among the types of environmental services listed in article 3.

- **Law no. 12.727, dated 12/17/2012**: Provides for the protection of native vegetation; amends Law No. 12,651, of May 25, 2012, which regulates 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. This law aims at sustainable development and the establishment of general rules on the protection of native vegetation, Permanent Preservation Areas (APP) and Legal Reserve areas (RL). The Project complies with this law since it takes place on a property with RL and APP duly delimited and protected and because it doesn't includes activities that violate the limits of exploration and management within these areas.

- **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. This law, known as the forest code, regulates how native vegetation can be exploited.

The project complies with it as it takes place on a property that complies with the requirements of the forest code regarding protected areas and explotation limits. In addition, the only exploitation that the project contemplates is that of non-timber products, an activity that, according to art. 21 is freely permited within the legal reserve area.

- **Law no. 12.187, dated 12/29/2009**: Establishes the National policy on Climate Change – PNMC and other provisions. The Project contributes to this National Policy because the activities developed are in harmony with the objectives: the Project helps to reduce the impacts from anthropic actions on the climate system, in line with Art. 3, contributes to the reduction of anthropic emissions of greenhouse gases and the conservation of environmental resources, in line with Art. 4, among others.

- **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.". Further information about how the project complies with this state law can be found at section 1.11.

- **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." The project complies with this law as it has a management plan for non-timber forest products and authorization for the use of forest non-timber products from IBAMA and Acre Environment Institute (IMAC).

- **State Law no. 3.883, dated December 17, 2021**: Provides on State System for Protected Natural Areas – SEANP, which includes state, municipal and federal conservation units, indigenous lands, legal reserves (RL) and permanent preservation areas (APP). For RL and APP, SEANP aims to promote public policies and actions directed at the sustainable use of natural resources, the formation of ecological corridors and other compatible measures. The project complies with this law by including activities that foucus at the sustainable use of natural resources.

- **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, as Brazil is a Kyoto Protocol Non-Annex I Parties, having no obligation to reduce greenhouse gases emissions under the UN Framework Convention on Climate Change (UNFCCC).

Furthermore, REDD+ Juruá Project has no current or historical connection with any credit generation initiative related to the Clean Development Mechanism (CDM), or other regulatory or voluntary schemes.

There is another REDD+ project near the REDD+ Juruá Project, causing a overlapping between the Project Areas of the two projects. However, according with ownership documents, it's clear that the overlapping area belongs to Juruá Project Proponent James Castro Cameli (see section 1.5 and 1.7). All documents regarding the situation were shared with the auditors and with Verra along with a letter explaining the circumstances.

1.16.2 Other Forms of Environmental Credit

Not applicable. The Juruá REDD+ Project has not been registered and does not wish registration in any other GHG program other than the VCS Program.

1.16.3 Supply Chain (Scope 3) Emissions

Not applicable. The Juruá REDD+ Project and proposed activities will not affect emissions from goods and services in a supply chain.

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.

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

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 interested parts 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. Among the opportunities mapped to improve cat's claw management are a more accurate knowledge of the species life cycle and better harvesting techniques to favor the regrowth of the mother plant (see 1.11 for details). Both favoring people information and awareness relevant to sustainable development.

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

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 413,927 of tCO2e from GHG emissions in 30 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. In addition, through the implementation and consolidation of the project's communication channels (see 1.11 for details) the project will be able to disseminate its activities, achievements and positive impacts in relation to climate change to interested parties, contributing to awareness and human capacity on global climate mitigation.

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 outand 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 52 hectares of a forest coverage preventing the emission of 20,390 tCO2e 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 52 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 8, as follows.

Table 8. 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 % (212/24076) 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 52 ha of rain forest, the Juruá REDD+ Project prevented the release of 20,390 tCO_2e to the atmosphere during the monitoring period.	Prevented the release of 20,390 tCO_2e 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 52 ha of humid tropical rainforest.	Preserved 52 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 % (212/24076) 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

1.18.1 Leakage Management

One of the main objectives of the REDD+ Juruá Project is to prevent unplanned deforestation and, consequently, reduce greenhouse gas emissions. The activities described in Section 1.11, such as monitoring deforestation through satellite imagery and strengthening the management of non-timber forest products, directly contribute to achieving this goal. Among the initiatives proposed by the Project, two are fundamental as leakage management measures: the conduction of Updates and Complementary Studies and Low-Impact Agricultural Management.

The leakage prevention actions of the Juruá REDD+ Project are directly related to the deforestation agents identified in the region, considering the specificities of each group and the practices that contribute to the conversion of forest areas. These measures aim to mitigate the impacts generated by activities associated with slash-and-burn agriculture, pasture expansion, and agro-pastoral exploitation, promoting sustainable alternatives and income improvement opportunities.

The project identified the following deforestation agents: Family producers in settlement projects, Settlers, and Medium and large producers, as described in section 3.4 Baseline Scenario.

Both settlers and squatters use slash-and-burn techniques, followed by the cultivation of temporary crops and subsequent introduction of pastures. Such initiatives proposed by the project aim to empower settlers to adopt more sustainable agricultural practices, reducing pressure on forests, promoting the efficient use of existing land, and enabling more profitable production alternatives. Medium and large producers will have the opportunity to engage in adopting sustainable management practices and reducing the opening of new areas, as well as disseminating technical knowledge and best practices.

The Leakage Management Areas were delineated based on criteria that consider the historical and current land use within the Seringal Valparaíso property, where the Juruá REDD+ Project is being implemented, and the leakage management plan, that was presented to the VVB. The definition of this spatial boundary prioritized areas that were deforested until 2020 and have consolidated pastureland that are managed by the project proponent company Amazônia Agroindústria for livestock production (are not forest lands as stated in section 1.1.4 of VM0015 v.1.1).

The available infrastructure at the property headquarters plays a strategic role in implementing training and capacity-building activities for local stakeholders close to the project area, especially those related to the deforestation agents mentioned in section 3.4, such as family farmers from settlements and ranchers from private properties. The facilities will be used to conduct workshops and training sessions on sustainable management of low-impact agricultural management and as support for field campaigns from the activity “updates and complementary studies”. The intention is for local stakeholders to acquire skills that can be applied on their properties, thus reducing pressure for new areas of deforestation.

Low-Impact Agricultural Management

The Low-Impact Agricultural Management activities planned within the Leakage Management Areas of the Valparaíso property are a cornerstone of the Juruá REDD+ Project's strategy to prevent leakage and promote sustainable practices. These activities will be tailored to address the risk of deforestation displacement while simultaneously promoting environmental conservation and economic development.

One of the main components of Low-Impact Agricultural Management will be the implementation of targeted training programs for local stakeholders and identified deforestation agents. These programs will aim to equip participants with knowledge and practical skills to adopt sustainable agricultural practices that reduce environmental impacts and thus optimize their production and improve household incomes.

The synergy between capacity-building initiatives and the strategic utilization of Valparaíso's infrastructure positions Low-Impact Agricultural Management as a vital component of the Juruá REDD+ Project's leakage prevention strategy. By integrating training programs with practical applications and leveraging existing resources, the project ensures that local communities are equipped to adopt sustainable practices, reducing deforestation risks and supporting long-term conservation goals.

Activities of updates and complementary studies

This activity focuses on enhancing the understanding of the demands of local stakeholders and deforestation agents, particularly their agricultural practices. The proposal aims to update and complement existing information, with the goal of adjusting the project's planning to the region's most recent dynamics, considering changes in land-use practices and the impacts resulting from those practices.

These complementary studies are essential for a more accurate analysis of the needs and expectations of the various agents involved, such as family producers, land squatters, and medium and large landowners. From this update, it will be possible to adjust intervention approaches, such as low-impact agricultural management training, to local realities and changes in agricultural activities, promoting more sustainable and economically viable practices.

Furthermore, the complementary studies will allow for the identification of possible new areas of pressure for deforestation and a better understanding of the challenges faced by stakeholders in transitioning to sustainable practices. By updating this information, the project will strengthen its leakage prevention strategies and engagement with local communities, ensuring that interventions are increasingly aligned with local needs and realities, contributing to the long-term effectiveness of conservation efforts.

1.18.2 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.

1.18.3 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.

The known environmental impacts of cat's claw management are few and associated with the explored species, such as *Uncaria tomentosa* population decline due to unproper cut, making regrowth impossible or overexplotation. The mitigation mesures adopted are presented in the cat's claw management plan, elabored in 2019, with a characterization of the appropriate exploitation to be carried out within the property. According with this document, the exploration should 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 andfavoring the regrowth of the mother plant. Furthermore, there is a total volume of the harvest stipulated (282,53 tons in 2019, 2020 and 2021), avoiding overexplotation. 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 local stakeholders. In the first instance the Project activities will focus on the Project Area and therefore will not involve any local rural community. The activities of the REDD+ Juruá Project will be developed under the ownership and use rights of Amazônia Agroindústria EIRELI.

The Project foresees the execution of the activities only within the limits of the property belonging to Amazônia Agroindústria, that is, no activities will be performed 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, as seen in Figure 13, only around the Seringal Valparaíso Farm, and they do not depend directly on the area for subsistence or for any other activity.

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 Juruá REDD+ Project will implement and consolidate a communication plan containing guidelines on the communication channels available and on the necessary steps to be taken in cases where suggestions and complaints are received from stakeholders.

The strategy cited above will allow the good management and efficient implementation of the Project, together with the stakeholders, contributing to the expected goals of containment of deforestation and reduction of emissions from deforestation and forest degradation. These actions allow stakeholders to raise concerns about potential negative impacts during Project implementation.

The communication of the REDD+ Juruá Project with stakeholders will be done through three main means: virtual, written, oral 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. The opening of these communication channels provides the engagement of the surrounding communities due to their knowledge about the Project design and implementation, including the monitoring results, the risks, costs, and benefits that the Project may bring, and the understanding of all relevant laws and regulations covering local workers' rights.

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 means on the websites of Biofílica Ambipar Environmental Investments S/A 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 summary of the Project design document will be made available at the headquarters of the Seringal Valparaiso property for consultation by all stakeholders, as well as monitoring reports. A suggestion box will be made available at the entrance of the property, along with forms for registering complaints, demands and suggestions, which will be collected every two months.

Face-to-face/oral communication: information and news will be passed on through meetings, events, lectures, and other face-to-face meetings to discuss the Project's activities and results with the interested parties. In these face-to-face meetings, a registration form will be given for the registration of possible suggestions, demands, or complaints.

Through the communication channels, until the next verification the Project will communicate its development and implementation, including the monitoring results and the VCS Program validation and verification processes, making available all the documents and information related to the Project, including the risks, costs and benefits that the project may bring to local stakeholders, validation/verification body's site visit and any relevant laws and regulations covering workers' rights in the host country.

All procedures are described in the Juruá REDD+ Project communication plan.

First Stakeholder Consultations

Six stakeholder meetings were held in order to:

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

A summarized version of the project was presented and delivered to the stakeholders in the form of a brochure containing information about the objectives, expected results, scope of the project, proposed activities, and especially the communication channels for possible comments, suggestions, or complaints.

In addition to the materials delivered, the meetings were held using a Power Point presentation, orally transmitting, with the support of images, graphs, and infographics, information about the Project. The content of these slides is based on demonstrating the objectives of the meeting to the stakeholders, presenting who the Project proponents are, elucidating the global climate panorama, climate change, compliance with laws, statutes, and other regulatory frameworks,, the location of the Project, the surrounding area, and the main drivers of deforestation and degradation in the Project region. Along with this general initial presentation, the slides emphasize key aspects such as the location of the area, scope and type of the Project, expected results, summary and status of the main activities undertaken. In this summary, the planning, the design and conception of the project, the development, the validation and verification process, the follow-up of the audit process, and finally the management and monitoring during the implementation process are demonstrated and explained.

At the end of the presentation, the possible environmental and socio-economic impacts, significant risks, and the monitoring that will be developed throughout the project are presented so that the stakeholders have a broad and transparent view of the project.

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

During the communication process with the stakeholders, the materials made available, such as pamphlets, explanatory letter, and the invitation to participate in the presentation, contained the communication channels open and signaled for eventual suggestions, doubts, and complaints. For greater awareness and to make information available to interested communities, the Project document was left at the headquarters of Amazônia Agroindustria EIRELI.

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.

The meeting at the headquarters of the Amazônia Agroindústria company on November 25, 2021 was attended by five people. The meeting with the community on November 28, 2021 was attended by nineteen community members, and finally the meeting with the institutions on November 29, 2021 was attended by ten representatives, according to the attendance lists shared with VVB.

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 11) and by an attendance list with the participants' signatures.

Figure 11. 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.

In addition to the public consultation meetings that were organized by the Project management team, the summary documentation of the Project was disseminated. The planned meetings were previously disclosed through an invitation and by phone calls to the institutions. During the meetings, relevant and adequate information was presented about the potential costs, risks, and benefits to the communities, meetings that were held in a participatory and transparent manner with the communities living around the Project area. The record of contributions and suggestions were collected during the meetings, and the Project office address, telephone number, and email address were made available for further comments, suggestions, or complaints.

The contributions from the interested parties, as mentioned above, only happened during the meetings and were focused on the inclusion of activities to be developed in partnership with the communities that live around the Project's geographical area. The other channels made available: email, telephone, and the project office address did not receive any contributions.

Second Stakeholder Consultations

In order to inform and involve the Project's stakeholders again, after a long time from the development of the first consultation, a new round of presentations and conversations with stakeholders was carried out in order to bring updated information on the Project. There were eight meetings held on July 11, 12, 13 and 14, 2023, in the city of Cruzeiro do Sul, at the headquarters of the institutions visited and with the surrounding community, at the Municipal School of Elementary Education Maria José Bezerra Fontes.

The meetings took place with the stakeholders mapped in the Project (session 2.5): Asa Real do Riozinho Liberdade Association - Resex Liberdade, Local community, residents of the surrounding Seringal Valparaís, Recanto Family Agriculture Cooperative of the Forest Settlement Project - PAF Recanto, Technical Team - Amazônia Agroindústria, National Indian Foundation - Alto Juruá (FUNAI-CZS), Owner Amazônia Agroinústria - James Castro Cameli, SEAGRI - Secretary of State for Agriculture and EMATER - Technical Assistance and Rural Extension Company of Acre and SEBRAE - Brazilian Micro and Small Business Support Service.

During these meetings, a power point presentation was given in printed or projected form with the information related to the Project that will be mentioned below, in addition, it was requested to fill out a questionnaire whose objective was to identify any doubts that may have remained regarding the Project and finally, all participants signed an attendance list.

The person responsible for making this inquiry was Mr. Emanuel Amaral, representative of Ambiental Amazônia. After the interaction between the participants, the objectives of the meeting were presented by Mr. Emanuel Amaral:

1) Ensure that all stakeholders are aware and informed about the Juruá REDD+ Project and its objectives;

2) To provide an opportunity for stakeholders to participate in the discussion and construction process of the Project;

3) Facilitate the agreement of commitments of the Juruá REDD+ Project in the planning, implementation and monitoring phases.

The presentation made, using a simplified language passed to the participants the following information:

Objectives of the Juruá REDD+ Project, start, execution period, location, activities to be carried out and average amount of emissions reduced; status of activities and the current phase of the project (Project Validation and Verification Certification Process), informing of audit activities, forms of contribution and contact route with the audit body; give the proponent's awareness of respect and obligations to Brazilian laws and regulations regarding labor rights and human rights in Acre, Brazil; and guidance on communication channels consisting of telephone, e-mail, and address of the Project proponents.

Afterwards, the participants expressed themselves and made some contributions that focused on the proposal to include activities to be developed in partnership. These contributions were made in order to generate benefits for local communities, promoting the improvement of family farming, improving income and improving the energy and communication systems of communities. With this, it is intended to influence the social issues and living conditions of the communities surrounding the Project area, which are distributed in indigenous lands, conservation units and human settlements. The aim is to reduce social vulnerability and increase the level of socio-economic conditions and the quality of life of these families, promoting forest conservation.

As mentioned above, after the presentation, a questionnaire was administered to some representatives of the social group, as a way to check if there were any doubts or contributions on the issues that were addressed. Participants were given a copy of the presentation with instructions on how further contributions could be made to the Project, address where requests for information, contributions and comments would be received, as a form of communication channels.

All the materials used to carry out this consultation were shared with VVB in order to demonstrate the activities carried out and their evidence.

Day 11/07/2023:

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

Day 12/07/2023:

2. National Indian Foundation (FUNAI-CZS);

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

Day 13/07/2023:

4. Proponent Company’s Technicians.

5. Project Owner-Proponent - James Cameli

Day 14/07/2023:

6. Local community, residents in the surrounding area of Seringal Valparaíso- Municipal School of Elementary Education Maria José Bezerra Fontes - Cruzeiro do Sul - Acre

7. Recanto Family Agriculture Cooperative of the Forest Settlement Project - PAF Recanto

8. Asa Real do Riozinho Liberdade Association - RESEX LIBERDADE

The meetings were documented in a photographic record (Figure 12) and by means of an attendance list signed by the participants.

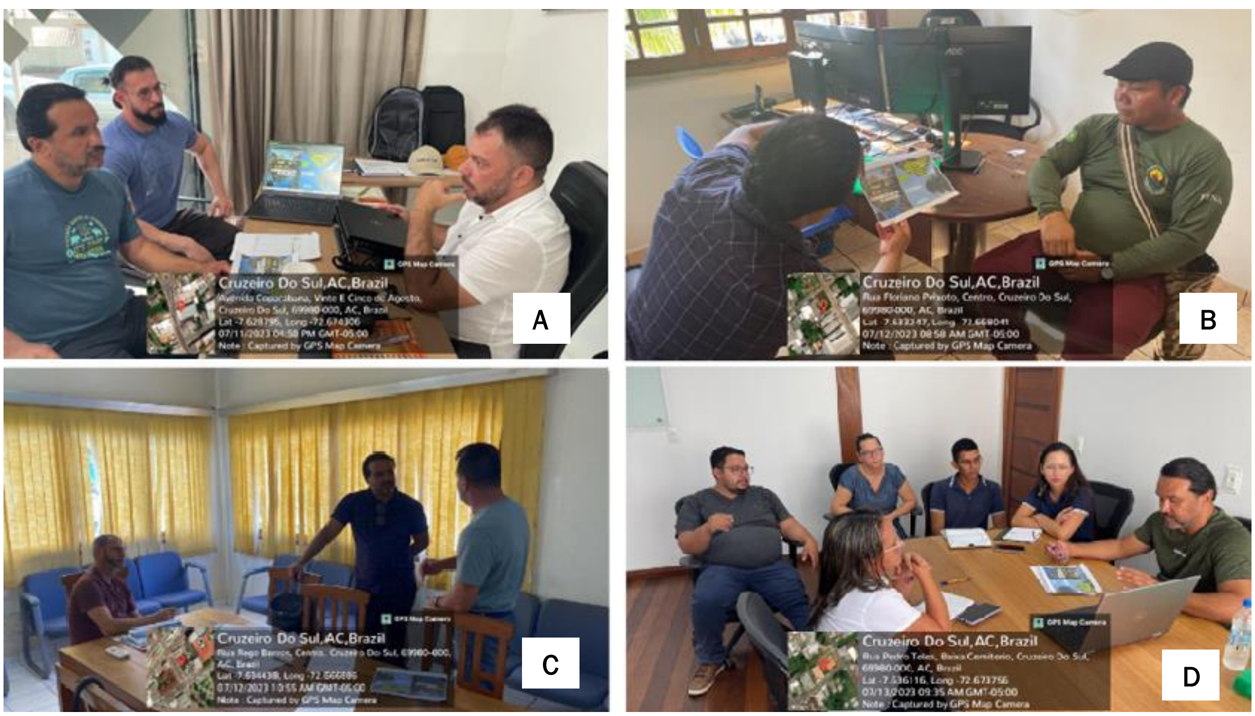


Figure 12. Meeting with stakeholders: A) Meeting with the Manager of the Juruá Regional Unit - SEBRAE- Brazilian Service to Support Micro and Small Enterprises; B) Meeting with the Substitute Regional Coordinator of the National Indian Foundation - Alto Juruá (FUNAI-CZS); C) Meeting with the Manager of SEAGRI and the Head of the EMATER Division; D) Meeting with the owner's technical team; E) Meeting with the owner James Castro Cameli; F) Meeting with the local community, living around the Seringal Valparíso; G) Meeting with the President of the Recanto Family Agriculture Cooperative of the Forest Settlement Project - PAF Recanto; H) Meeting with the president of the Asa Real Association of Riozinho Liberdade, from the community of RESEX Liberdade.

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 7,697 hectares of deforestation within the Project Area in 30 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.

The meetings to present the project and publicly consult with the communities about the Action Plan and presentation of the Project took place on November 25, 28 and 29, 2021 and took place through extensive community involvement. In this feedback, participants were able to understand and collaborate with the project design and development as described in Section 2.2.

In addition to these meetings and community participation meetings and other stakeholders described above, the project went through the public consultation event on the Verra registration platform for comments, suggestions, and clarification of doubts about the Juruá REDD+ Project, which took place in the period August 22, 2022, to September 21, 2022. The importance of the engagement and collaboration of these stakeholders in this process was reinforced by sending formal invitations to those directly and indirectly involved in the forest conservation sector, such as community associations, non-governmental organizations (NGOs), educational institutions, private companies, and public agencies present in the city of Cruzeiro do Sul - Acre. This invitation was made via mailing, with information about the project and an invitation to participate in the public consultation.

At the end of the public consultation period, which was widely publicized by Biofílica Ambipar Environmental Investments S/A and Amazônia Agroindústria EIRELI through communication networks such as LinkedIn, emails and whatsapp, it was identified that there were no negative comments from the participants in the process. In this period, the Project received from the conformation of the Verra agency and availability of supporting documentsonly one anonymous comment indicating interest in the Projec in which the proponents do not consider as suggestions or criticism, being considered irrelevant and was not incorporated into the design of the project.

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. Therefore, 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 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.

Ambiental Amazônia, with the objective of identifying the populations around the Seringal that may be affected by the Project, as well as the public bodies representing these surrounding communities, used geographic data, bibliographic data and information obtained from municipal administrations and government departments from all municipalities in the reference region.

Considering a buffer of 20 km surrounding the Project Area, (Figure 13), 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). Note, therefore, that there are no indigenous peoples or traditional communities in the Project Area, only around the Seringal Valparaíso Farm.

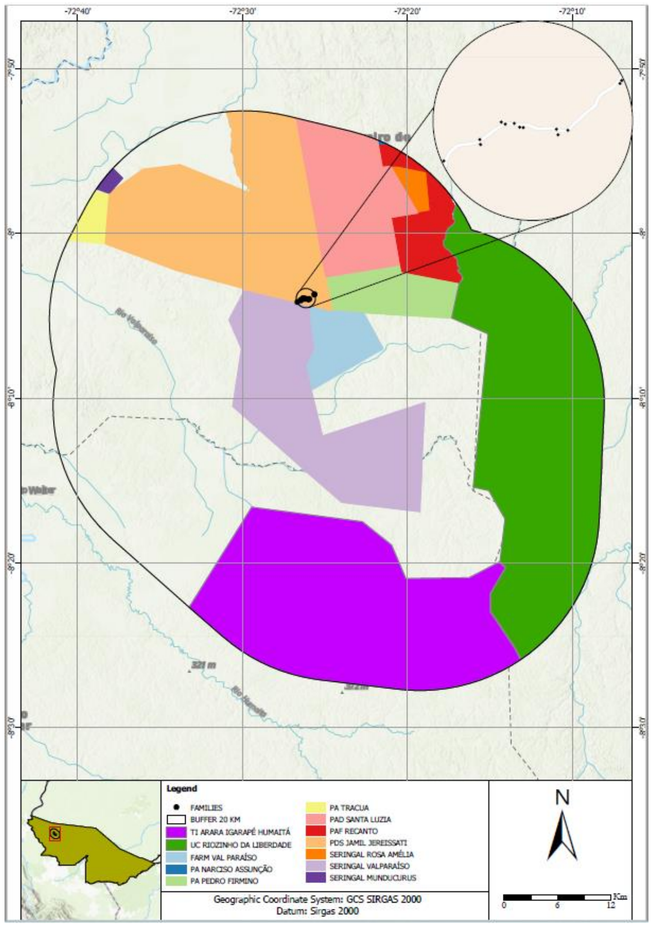


Figure 13. Identification of stakeholders of Seringal Valparaíso (Juruá REDD+ Project).

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.

Stakeholder Classification

Based on the survey and identification of stakeholders, they have been classified as direct and indirect (Table 9), depending on their level of involvement and impact on the Project. This classification may change as the REDD+ Juruá Project develops.

Direct stakeholders are those with an immediate connection to the project and who participate in or are directly impacted by its activities. Indirect stakeholders, though not directly involved, are still affected by the project's outcomes in an indirect manner. It is important to note that, over time, indirect stakeholders may become direct stakeholders as the project management adapts to changes and emerging needs.

The direct stakeholders of the project include the local community, especially residents in the surrounding area of Seringal Valparaíso (known as "Ramal do James").

Among the indirect stakeholders are communities and settlement projects, such as the Directed Settlement Project (PAD) Santa Luzia, Sustainable Development Project (PDS) Jamil Jereissati, PA Recanto, PA Tracuá, PA Pedro Firmino, and PA Narciso Assunção. In addition, other locations, such as the rubber plantations Rosa Amélia and Munducurus, and the Shawãdawa People's Association of Igarapé Humaitá (APSIH), are also indirect stakeholders.

Agencies such as the Chico Mendes Institute for Biodiversity Conservation (ICMBio), the National Indian Foundation (FUNAI), the Brazilian Service of Support for Micro and Small Enterprises (SEBRAE-CZS), the Technical Assistance and Rural Extension Company of Acre (EMATER-AC), the Recanto Family Farming Cooperative of the Recanto Forest Settlement Project - PAF Recanto, the Asa Real Association of Riozinho Liberdade (RESEX Liberdade), as well as secretariats like the State Department of Agriculture, the National Institute of Colonization and Agrarian Reform (INCRA), and the State Secretariat of Production and Agribusiness (SEPA), are also indirect stakeholders. Although not directly linked to the project, they have influence over its operations and long-term outcomes.

Table 9 – Stakeholder Classification for the REDD+ Juruá Project

Stakeholder	Relationship with the Juruá REDD+ Project
Local community, residents in the surrounding area of Seringal Valparaíso ("Ramal do James")	Direct
National Indian Foundation (FUNAI)	Indirect
Chico Mendes Institute for Biodiversity Conservation (ICMBio)	Indirect
Brazilian Service of Support for Micro and Small Enterprises (SEBRAE-CZS)	Indirect
Technical Assistance and Rural Extension Company of Acre (EMATER-AC)	Indirect
Family Farming Cooperative of Recanto from the Forest Settlement Project - PAF Recanto	Indirect

Asa Real Association of Riozinho Liberdade (RESEX Liberdade)	Indirect
State Department of Agriculture (SEAGRI)	Indirect
Shawãdawa People's Association of Igarapé Humaitá (APSIH)	Indirect
Amazônia Agroindústria EIRELI	Proponent
National Institute of Colonization and Agrarian Reform (INCRA)	Indirect
State Secretariat of Production and Agribusiness (SEPA)	Indirect
Directed Settlement Project (PAD) Santa Luzia	Indirect
Sustainable Development Project (PDS) Jamil Jereissati	Indirect
PA Recanto	Indirect
PA Pedro Firmino	Indirect
PA Tracuá	Indirect
Rosa Amélia and Munducurus Property	Indirect

Stakeholder Consultations

As stated in section 2.2 in the theme of "Stakeholder Consultations", 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' (Figures 14 and 15) "branch" with representatives of 18 families.

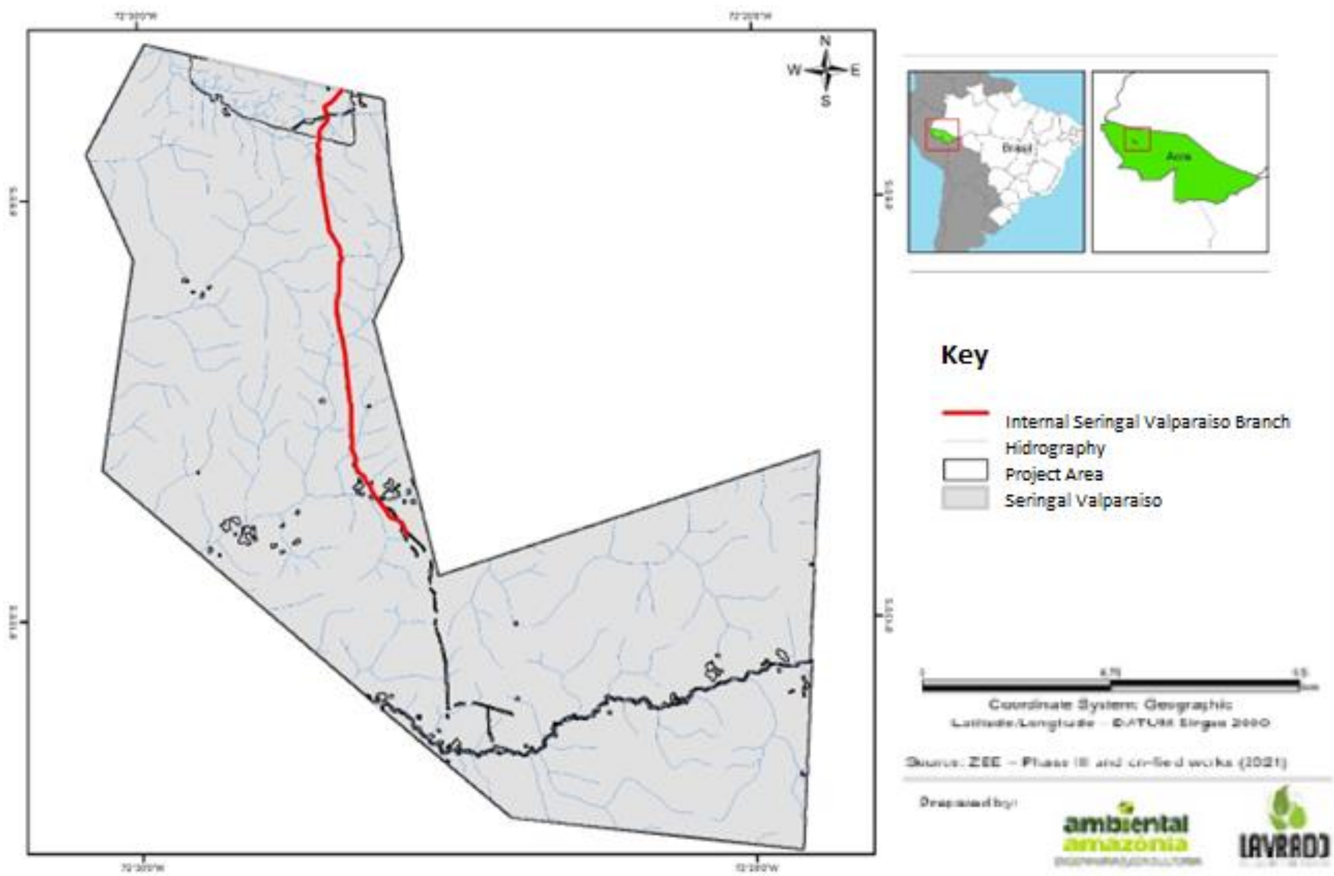


Figure 14. Location map of the "James Branch".

Figure 15. 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 predicts to strengthen the relationship with stakeholders, and also propose 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 EIRELI as described in section 1.7. The Project provides the execution of activities only within the boundaries of the property belonging to Amazônia Agroindústria EIRELI, 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 11%.

There are no stakeholders in the Project area, only around, as shown in (Figure 13), so there is no occurrence of likely natural and human-induced risk to local stakeholders and to their well-being expected during the project lifetime, including project design and consultation. Risks that may affect food security, land loss and climate changes are also not predictable for the stakeholders.

In addition, it can be assured that the project proponent or any other entity involved in the development or implementation of the project is not involved in any form of discrimination or sexual harassment. Biofílica Ambipar Environment Investments, belonging to the Ambipar Group, has a code of ethics and conduct that represents all the companies of the Group. Thus, the document serves as a primordial instrument to guide the conduct of all parties involved, in the adoption of good practices in relationships and in doing business, guiding attitudes of respect for diversity, to combat any form of prejudice.

It was identified one potencial risk to the project benefits, as well as their respective mitigating measures. The riskis listed below:

Risk: Non-timber forest product management activities have a low risk of negative impacts (section 2.1).

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.

In addition to the risk to local stakeholders, as described in the "AFOLU Non-Permanence Risk Tool, v4.0", which refers to the management team, it can be said that there are individuals with significant experience in AFOLU project design and implementation, carbon accounting and reporting under the VCS Program or other approved GHG programs.

A description of the team members follows below:

Plínio Ribeiro – Biofílica Ambipar Environmental Investments S.A (Executive Director)

Location: São Paulo, São Paulo – Brazil.

Plínio Ribeiro has a degree in Business Administration from Instituto de Ensino e Pesquisa INSPER and a master's degree in Public Administration and Environment from Columbia University and the Earth Institute (USA). He participated in several conservation projects on the lower Rio Negro, through the Instituto de Pesquisas Ecológicas – IPÊ since 2005, and was one of the producers of Jean Michel Cousteau's documentary "Return to the Amazon". He works for Biofílica Ambipar Environmental Investments S.A since 2008, where he has already leaded Project, Operations and Business Management. Currently, he is the Executive Director and shareholder of the company.

Cláudio Pádua – Biofílica Ambipar Environmental Investments S.A (Scientific Director)

Location: Brasília, Distrito federal – Brazil.

Cláudio Pádua has a degree in both Business Administration and Biology, a master's degree in Latin American Studies and a PhD in Ecology from the University of Florida in Gainsville (USA). A retired professor from the University of Brasilia, Pádua is currently the dean of the Escola Superior de Conservação e Sustentabilidade and the vice-president of the Instituto de Pesquisas Ecológicas (IPÊ). He is also a Senior Associate Researcher at the Center for Environment and Conservation Studies at Columbia University (USA) and an International Conservation Director at the Wildlife Trust Alliance, as well as an advisor to the Brazilian Biodiversity Fund (FUNBIO) and WWF Brazil. Pádua represents Brazil before the International Advisory Group (IAG) of the G7 Pilot Program. In 2003, together with his wife, Suzana Pádua, he was appointed by Time Magazine a "Hero of the Planet" for his activities on behalf of biodiversity conservation. Between 1997 and 2007, he won six conservation awards, and three national and three international ones. Pádua has published two books and over 30 papers in scientific journals, both national and international. Since 2008 directs the involvement and scientific production of Biofílica as Scientific-Director and advisor.

Paula Conde - Biofílica Ambipar Environmental Investments S.A (Financial and Administrative Manager)

Location: São Paulo, São Paulo – Brazil.

Paula Conde has a degree in Business Administration from São Luís - PUC and post graduate degree in Accounting and Financial Managment from FAAP. She has large experience, most of it in one of the largest media and educational group in Latin America – Editora Abril, where she worked with Finance Control and Reporting, Treasury, Accounting and Financial Reconciliation, Accounts Payable & Receivable and Royalties. At Biofílica Ambipar Environmental Investments S.A, she is responsible for administrative and financial activities, logistical support to the team and to projects.

Caio Gallego - Biofílica Ambipar Environmental Investments S.A (Operations Manager)

Location: São Paulo, São Paulo – Brazil.

Caio Gallego is a Forest Engineer graduated from ESALQ-USP. Specialist in geoprocessing and remote sensing aimed at environmental conservation area, mapping and analysis of changes in land use. Has knowledge facing the Sustainable Forest Management, environmental modeling and the use of alternative GIS for forestry and agribusiness. Has advanced knowledge in the use of GIS softwares and analysis of change on the land use and land cover as ArcGIS, QuantumGIS and DinâmicaEGO.

Márcio Sales – Biofílica Ambipar Environmental Investments S.A (Statistical Modeling Specialist)

Location: Belém, Pará – Brazil

Márcio Sales is a statistician, graduated from the Federal University of Pará, MSc in Geography from the University of California, Santa Barbara and PhD candidate in Production Ecology and Resource Conservation at Wageningen University, The Netherlands. He is a specialist in data analysis and conducts research in geostatistical modeling of processes distributed in space and time. He works at Biofílica Ambipar Environmental Investments S.A producing projections of GHG emissions from future deforestation for project baselines and monitoring deforestation by satellite.

Susane Rasera - Biofílica Ambipar Environmental Investments S.A (Carbon Project Specialist)

Location: São Paulo, São Paulo – Brazil.

Forest Engineer with a master's degree in Forest Resources, both from the University of São Paulo (ESALQ Campus). She has experience in Forest Ecosystem Conservation, mainly on Forest Restoration and forest biomass and carbon allocation. She is currently a REDD+ Project Analyst and takes a specialization course in Ecological Restoration.

Leonardo Almeida - Biofílica Ambipar Environmental Investments S.A (Carbon Project Coordinator)

Location: São Paulo, São Paulo – Brazil.

Leonardo Almeida is a Forest Engineer, graduated from Paulista State University (Botucatu Campus) with extension in Hochschule Weihenstephan-Triesdorf in Germany. Certified in Green Belt, he is experienced in project management and process improvement in the forest production chain. He has also worked with sustainable forest management, wood panel production and environmental licensing. At Biofílica Ambipar he is the coordinator of the AAR Corridors for Life Grouped Project and of another grouped project under development, that will work on sustainable management practices in cattle ranching following ALM (Agriculture and Land Management) methodologies.

Luana Cordeiro - Biofílica Ambipar Environmental Investments S.A (Carbon Project Manager)

Location: São Paulo, São Paulo – Brazil.

Luana Cordeiro is a Forestry Engineer graduated from USP – ESALQ and Technical in the Environment formed by the State Technical School of São Paulo. During the graduation was coordinator of the environmental suitability group of Campus Piracicaba in the planning, implementation and monitoring of restored areas, and coordinator of the social entrepreneurship group Enactus, developing social projects in Piracicaba (SP). Developed in her project a Model of Solid Waste Management Plan for Sawmills of Native Species, focusing on the sustainable production of the timber sector in the Amazon.

Priscila Coutinho R. Ferreira – Biofilica (Carbon Project Analyst)

Location: São Paulo, São Paulo - Brazil

Priscila Coutinho is a Biologist since 2010, MSc in Genetics, Biodiversity and Conservation (UESB, 2014) and MSc in Biodiversity Conservation and Sustainable Development (IPÊ, 2022). She worked mainly in primatology and fauna conservation, in research projects and environmental licensing. Her experience with carbon stock monitoring and the carbon market began around 2019 and expanded during her master's degree in 2020-2022. At Biofílica, she works as Project Analyst.

Amanda Rocha Fiallos - Biofílica Ambipar Environmental Investments S.A (Carbon Project Analyst)

Location: São Paulo, São Paulo – Brazil.

Amanda Fiallos is a Forest Engineer, graduated at the University of São Paulo (USP/ESALQ). She has experience in forest restoration and conservation projects, environmental education, geoprocessing and remote sensing applied to the planning areas of planted forests. Currently she works as a Project Analyst at Biofílica.

Nathanael Campos – Biofílica Ambipar Environmental Investments S.A (Carbon Project Analyst)

Location: São Paulo, São Paulo – Brazil

Nathanael Campos is a Forest Engineer and has a degree in Agricultural Sciences, both from the University of São Paulo (Campus ESALQ). During his undergraduate studies he worked with public policies for family farming and greenhouse gas emissions inventory. He also has experience with GIS tools and remote sensing, with emphasis on environmental analysis.

Marco Antonio Martins – Biofílica Ambipar Environmental Investments S.A (Geoprocessing Analyst)

Location: São Paulo, São Paulo - Brazil

Marco Antonio Martins is a geographer, graduated from the University of São Paulo (FFLCH-USP). During his undergraduate studies he worked with geoprocessing and remote sensing projects applied to forest monitoring, territorial planning, mapping of coastal habitats and restored areas in conservation units.

Franciane Almeida – Biofílica Ambipar Environmental Investments S.A (Geoprocessing Analyst)

Location: São Paulo, São Paulo – Brazil

Franciane Almeida is a Forest Engineer, graduated at the Federal University of Lavras (UFLA). She has experience in geoprocessing and remote sensing applied to the areas of forest planning, silviculture and harvesting, recovery of degraded areas and land tenure regularization.

Proponents: Amazônia Agroindústria EIRELI

James Cameli – Amazônia Agroindústria EIRELI (Sponsor)

Location: Cruzeiro do Sul, AC – Brazil

James Cameli, successful and recognized businessman throughout the Western Brazilian Amazon. Owner of a conglomerate of 5 companies, operating for over 30 years in the sectors of agriculture, telecommunications, construction, industrialization and processing of forest products and environmental services. He is a supporter of environmental conservation policies and projects, and is convinced that the "standing forest" is one of the greatest riches of the region and, therefore, represents a strategic asset for the social and economic development of Brazil and its contribution to changing the current global climate conditions.

Gilberto Siqueira – Amazônia Agroindústria EIRELI (General Coordinator)

Location: Rio Branco, AC – Brazil

Gilberto Siqueira has a basic professional education in civil engineering, is a specialist in wood and wood structures and in high management programs, consolidating himself professionally as an expert in planning and regional development in the Amazon. He created and presided over the Acre Technology Foundation - FUNTAC; implemented and coordinated the National Center for Traditional Populations - CNPQ/IBAMA, precursor of ICMBio/MMA; worked for more than 30 years in the public sector, exercising the functions of State Secretary, notably in the areas of Planning, Coordination and Economic Development; Advisor to the Federal Senate; President of the State Commission for Ecological and Economic Zoning - ZEE/AC, among other State Commissions related to Forest Resources, Tourism, Logistics and Regional Infrastructure; Coordinated and/or acted as consultant in the implementation of Regional Integrated Development Programs in Acre, Amapá, Maranhão and Rondônia, which had BIRD, BID and BNDES as their main source of funding.

Scarlett Siqueira do Valle – Amazônia Agroindústria EIRELI (Legal Advisor)

Location: São Paulo, São Paulo, Brazil

Scarlett Siqueira do Valle is an independent lawyer (401449 OAB/SP), graduated in Law from Centro Universitário de Brasília - UNICEUB and PhD candidate in Communication and Semiotics at Pontifícia Universidade Católica de São Paulo - PUC-SP. She has experience in the areas of Law for Startups; Digital Law; LGPD and Business Law. As a corporate lawyer, she has experience in environmental conservation projects.

Veriton Viana da Costa – Amazônia Agroindústria EIRELI (Technical Advisor and Local Support)

Location: Cruzeiro do Sul, AC – Brazil

Veriton Costa is an agronomist engineer and agriculture technician, graduated from the Federal University of Acre (UFAC). He has experience in Financial Management, Registration of traditional populations, physical and chemical soil analysis, Geoprocessing (ArcGis), People Management, Project Elaboration, Report Elaboration (Power BI and Excel), Fiscalization in Agricultural and Forestry Defense, Lectures and Courses. At Amazônia Agroindústria EIRELI he acts as Advisor and Local Support.

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.

Grievance Redress Procedure

In order to address grievances, a procedure has been established to resolve disputes with communities and other stakeholders that may arise during the planning, implementation, and evaluation of the project. The procedure aims to respectfully address complaints, grievances, and feedback raised by the project stakeholders.

The feedback and grievance redress procedure will always take into account the traditional methods used by communities and other stakeholders to resolve conflicts, following the steps below for handling grievances:

First, the project proponents will seek to amicably resolve all grievances received through the project's channels and provide a written response in a culturally appropriate manner.

Second, any grievances that cannot be resolved through amicable negotiations will be referred to mediation by a neutral third party.

Third, any grievances that cannot be resolved either amicably or through third-party mediation will be referred to: a) Arbitration, to the extent allowed by the laws of the relevant jurisdiction; or b) Competent courts in the relevant jurisdiction, without prejudice to a party's ability to submit the grievance to a competent supranational adjudicatory body, if any.

The Grievance Redress Procedure includes a communication channel that will be implemented by the Project. This will be used to handle complaints of any kind, as well as to serve as a means for feedback and general communication between the parties. All relevant information regarding this procedure is detailed in the Communication Plan of the Juruá REDD+ Project.

Oversight and Accountability Policies

Biofílica Ambipar Environmental Investments, a subsidiary of the Ambipar Group, follows a code of ethics and conduct applicable to all its companies. This document serves as a fundamental guideline to ensure good governance, establishing standards of conduct and best practices for all parties involved in the project. The oversight and accountability policies ensure compliance with established norms and transparency in all phases of project development and implementation, promoting integrity and accountability for all stakeholders involved in the process.

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, published on 03-December-2012.

Furthermore, the following tools were used:

• VT0001 - Tool for the Demonstration and Assessment of Additionality in VCS Agriculture,

Forestry and Other Land Use (AFOLU) Project Activities, v3.0, published on 01-February, 2012.

• AFOLU Non-Permanence Risk Tool v4.0, published on 19-September-2019.

• Tool for testing significance of GHG emissions in A/R CDM project activities, v1.0, published on 04-May, 2007.

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 10).

Table 10. 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

Spatial Limits (1.1 VM0015)

Reference Region

The Reference Region of Juruá REDD+ Project comprises an area of **549,600** hectares (**425,628** hectares of forest in July 2020) and presents a historical deforestation rate (from 2010 to 2020) of **2,057** hectares per year (0.46% of the Reference Region's forest area in 2010).

We defined the Reference Region using as a basis the hydrographic basins boundaries and location of the main drivers of deforestation (settlements and small farms next to the Project Area). The definition of the Reference Region limit respects the guidelines described in the methodology approved by VCS version VM0015 1.1, as well as dimensions suggested by Brown et al. (2007). For example, we removed areas of dense forests, as the project area is 100% composed of open forests (see below).

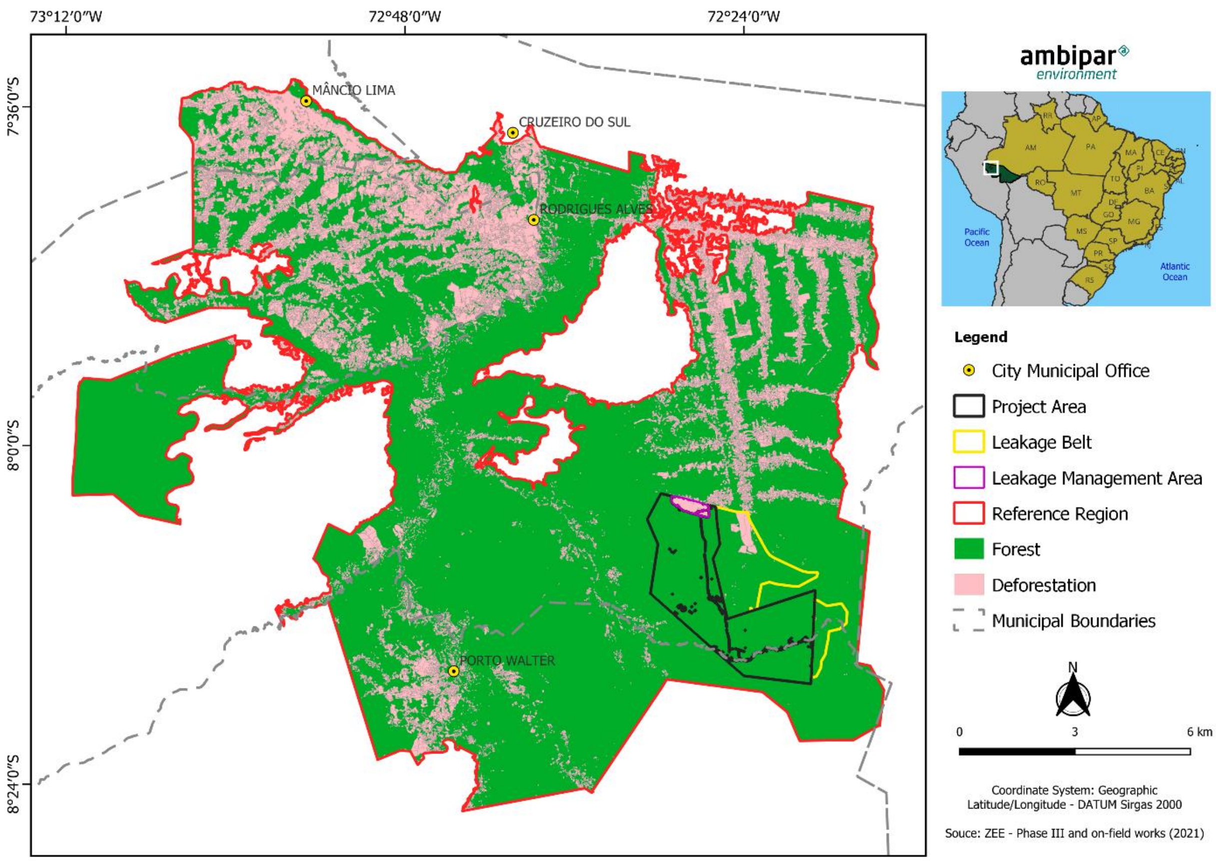


Figure 16. Location of the Reference Region, Project Area, Leakage Management Area and Leakage Belt of Juruá REDD+ Project.

The territorial analyses of the region followed the zoning definitions of Acre's Ecological-Economic Zoning (ZEE-AC) (ACRE, 2022). ZEE-AC divides the territory into zones according to the need for protection, conservation, and recovery of natural resources and sustainable development, as established by Decree No. 4.297 of July 10, 2002 (BRASIL, 2022). The establishment of these zones was guided by the principles of utility and simplicity to facilitate the implementation of their boundaries and restrictions by public authorities, as well as to ensure their understanding by citizens.

The definition of each zone and subzones within the territory of Acre was established using the methodology applied in ZEE-AC – Phase II, based on positivist principles proposed by the Secretariat of Strategic Affairs (SAE), which focuses on understanding natural and socioeconomic processes. Additionally, the Acre government introduced an innovative approach by including subjective human expressions: the system of values, aspirations, ways of life, language, and the vision of local populations in the cultural-political dimension. Objectively, the zones were defined as follows:

- Zone 1: Consolidation of Sustainable Production Systems
- Zone 2: Sustainable Use of Natural Resources and Environmental Protection
- Zone 3: Priority Areas for Territorial Planning
- Zone 4: Cities of Acre

According to ZEE-AC, there is a mosaic of land units in the reference region, as shown in the table below:

Table 11. Mosaic of land units in the reference region.

Type of Land Unit	Área (ha)	Percentage
Settlements	190,436	34.6%
City	566	0.1%
Federal Public Lands (GLEBFED)	72,689	13.2%
Rural properties (IRU)	105,646	19.2%
Land Vacancy	180,263	32.8%

The Reference Region follows at a higher deforestation rate than occurs in Acre (annual average of 0.22%). According to Acre's Ecological-Economic Zoning (ZEE) (ACRE, 2021), the highest deforestation rates in the state occur in land categories that involve explicit land ownership, such as settlements and private plots, as opposed to Indigenous lands and conservation units, where land ownership is indirect and follows different cultural standards.

At the state level, 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, 2006), 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).

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 in settlement projects** (ACRE, 2018) who are 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** (ACRE, 2021) whose main activity is beef cattle raising with large extensions of pastures. And **settlers** (ACRE, 2021) that have a low conversion rate and occupation based on small plantations.

Infrastructure drivers: the main deforestation drives are the **roads** (BR 364 and secondary roads) (Fearnside, 2005; ACRE, 2018 e ACRE, 2021) and the **occupations on the margins of Juruá river and its tributaries** (ACRE, 2021). 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 (INPE/Embrapa, 2021). All these drives were considered to define the baseline and deforestation dynamics for Juruá REDD+ Project, provided for the validation/verification body.

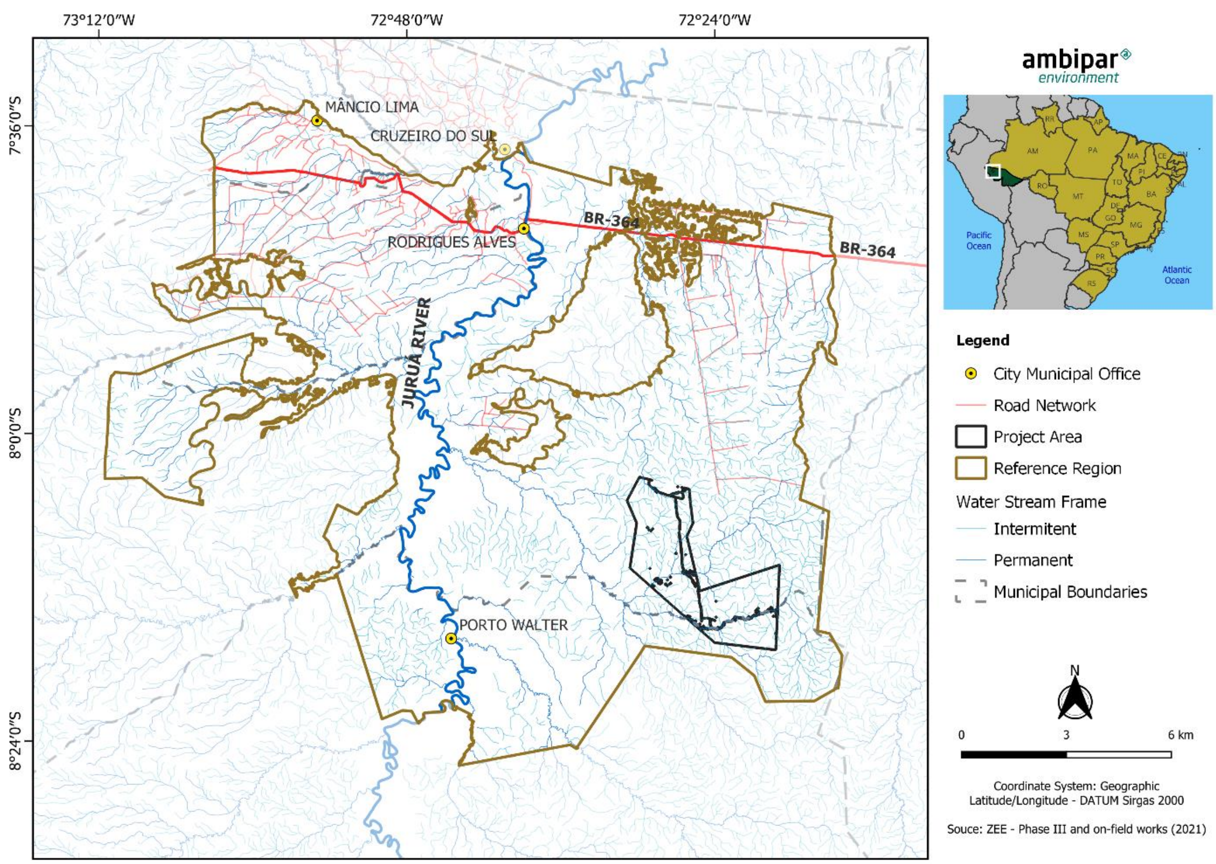


Figure 17. Location and distribution of deforestation drivers in the Reference Region of Juruá REDD+ Project.

b) **Landscape and ecological conditions:**

Forest typologies: The dominant forest typology in the region is the Open Ombrophilous Forest. It occupies 70.62% of the Reference Region, 100% of the forest area in the Reference Region and 100% do the Project Area.

Table 12. Forest typology

Forest Typology	Subclass	Area in the RR (ha)	% of the RR	Area in the P.A. (ha)	% of P.A.
Anthropized areas	-	123,486	22.47%	0	0.00%
Ombrophile Open Forest	FAB + FAP	73,784	13.43%	12,939	53.74%
	FAB - Aluvial	2,049	0.37%	0	0.00%
	FABD	2,960	0.54%	0	0.00%
	FAP	27,823	5.06%	0	0.00%
	FAP + FAB	2,660	0.48%	0	0.00%
	FAP + FAB + FD	39,152	7.12%	7,569	31.44%
	FAP + FD	146,553	26.67%	0	0.00%
	FAP + FD + FAB	61,009	11.10%	3,524	14.64%
	FAP - Aluvial	65,074	11.84%	44	0.18%
	FAP - Aluvial + Pab	4,565	0.83%	0	0.00%
ND/Undefined	-	484	0.09%	0	0.00%
Total		549,600	100.00%	24,076	100.00%

Source: ACRE (2018)

The statistical explanation for defining Ombrophile Open Forest as the sole representative stratum of the Project Area is provided in Section 5.1 Baseline Emissions, under the item Carbon stock calculation, sampling error and uncertainty assessment. In this section, it is explained that there is no statistical significance in further sub-stratification. Table 47 shows that the 90% confidence intervals overlap, indicating that the mean carbon densities of the different forest types are not statistically different.

Therefore, the forest subtypes were only used to improve precision due to the imbalance of samples from Salimon et al. (2011) concerning the forest types in the Project Area (PA) and Leakage Belt (LB). For all other project approaches, the vegetation type of the Project Area will be considered as a single type: Ombrophile Open Forest.

Altitude: The average altitude in the Reference Region is 2248 m above sea level, with variations from 163 to 291 m. The Project Area has an average altitude of 241 m (ACRE, 2010) and altitude range of 193 to 267 m, with more than 90% 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 (ACRE, 2010).

Table 13. Spatial landscape attributes and ecological conditions in the Reference Region of the Project Area.

Percentile	Elevation in the RR (m)	Elevation in the AP (m)	Slope in the RR (deg)	Elevation in the RR (deg)
0	163	193	0,00	0,00
5	190	212	0,93	0,93
10	194	215	1,32	1,32
15	199	217	1,85	1,86
20	202	219	2,08	2,08
25	206	220	2,09	2,08
30	209	221	2,63	2,64
35	212	223	2,78	2,95
40	214	224	2,93	2,95
45	217	225	3,35	3,36
50	220	226	3,70	3,72
55	223	228	3,85	3,84
60	225	229	4,15	4,16
65	229	231	4,64	4,67
70	232	232	4,77	4,77
75	235	234	5,43	5,26
80	239	236	5,90	5,65
85	243	238	6,60	6,23
90	248	241	7,51	6,79
95	255	244	9,24	7,94
100	291	267	32,32	19,07

Source: ACRE (2010).

Rainfall: In the Project Area, the average annual rainfall in the historical reference period was 2,022 to 2,593 mm and in the Reference Region it is 1,954 to 2,614 mm (HIJMANS et al., 2005), the two regions being in similar climatic conditions.

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 33.2 % of the area still without land title regularization (land void) (ACRE, 2021).

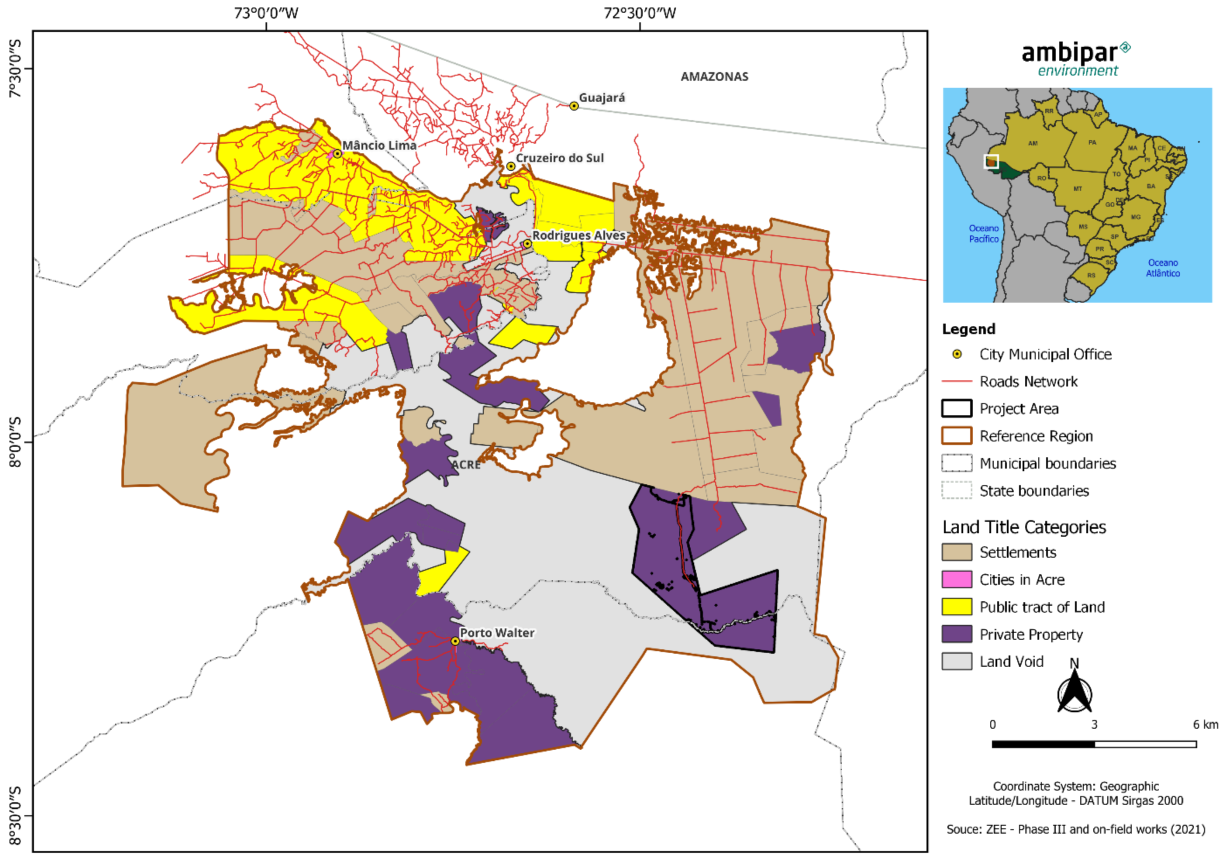


Figure 18. Juruá REDD+ Project Area Location in the Reference Region.

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 (ACRE, 2021).

Land use: the current and planned Project Area land use classes (forest and anthropogenic vegetation) are the same throughout the Reference Region (ACRE 2006; ACRE, 2018, ACRE, 2021).

Related Policies and legislation: the Project Area is under the same policies and legislations applicable to other areas in the Reference Region (ACRE, 2006; ACRE, 2018) 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. The Project Area boundaries area defined by the land covered by forests in 01/08/2020, thus excluding land covered by anthropogenic vegetation and water bodies, using the UCEGEO classification data (see topic "forests" ahead). 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 19);
- 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.

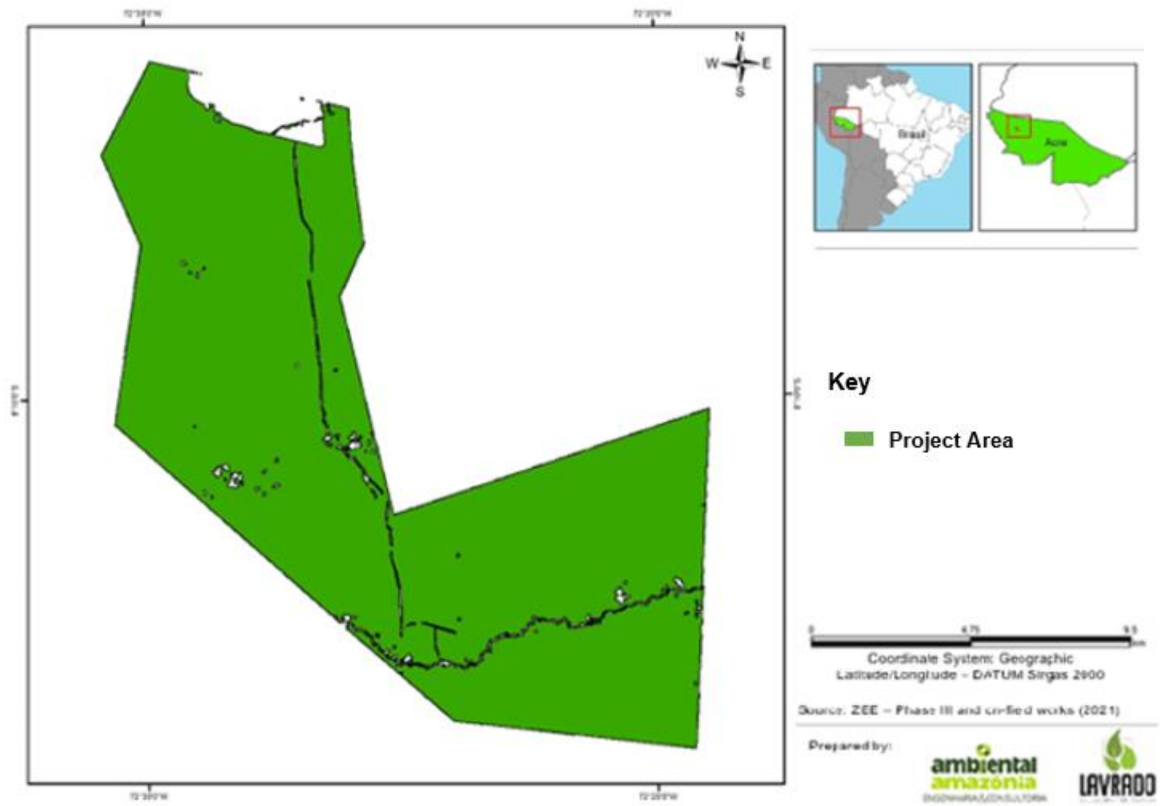


Figure 19. Physical boundary of the Project Area.

Leakage Belt

There are no data or studies available for 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 analysis approach (option II offered by the approved methodology VCS VM0015 version 1.1). A multi-criteria approach comprising the map of potential change of forests to anthropogenic vegetation (Figure 31) built in the spatial projection of deforestation section was used for the multicriteria analysis here. The premise is that leakage is more likely to occur in areas of high deforestation probability, as these areas likely offer better conditions for post-deforestation activities performed by actors stablished near the project area. Since the probability map is based on spatial drivers of deforestation (shown in Figure 20 below), examination of their corresponding weights of evidence (shown in Figure 30), allows concluding that the main criteria of the mobility analysis are:

Criteria that facilitate deforestation: variables/classes have **positive** weights of evidence. They represent accessibility and the land tenure classes that are more suitable for deforestation: a) locations up to 380m away from the nearest deforestation b) locations up to 2,7km away from the nearest road, c) locations up to 2km from the nearest river, d) private properties.

Criteria that restrain deforestation: variables/classes that have **negative** weights of evidence. They are composed by the protected lands and specific soil conditions: d) Indigenous Land and e) Gleysoils and neosoils.

A GIS map of each factor involved in the analysis is shown in Figure 20 below.

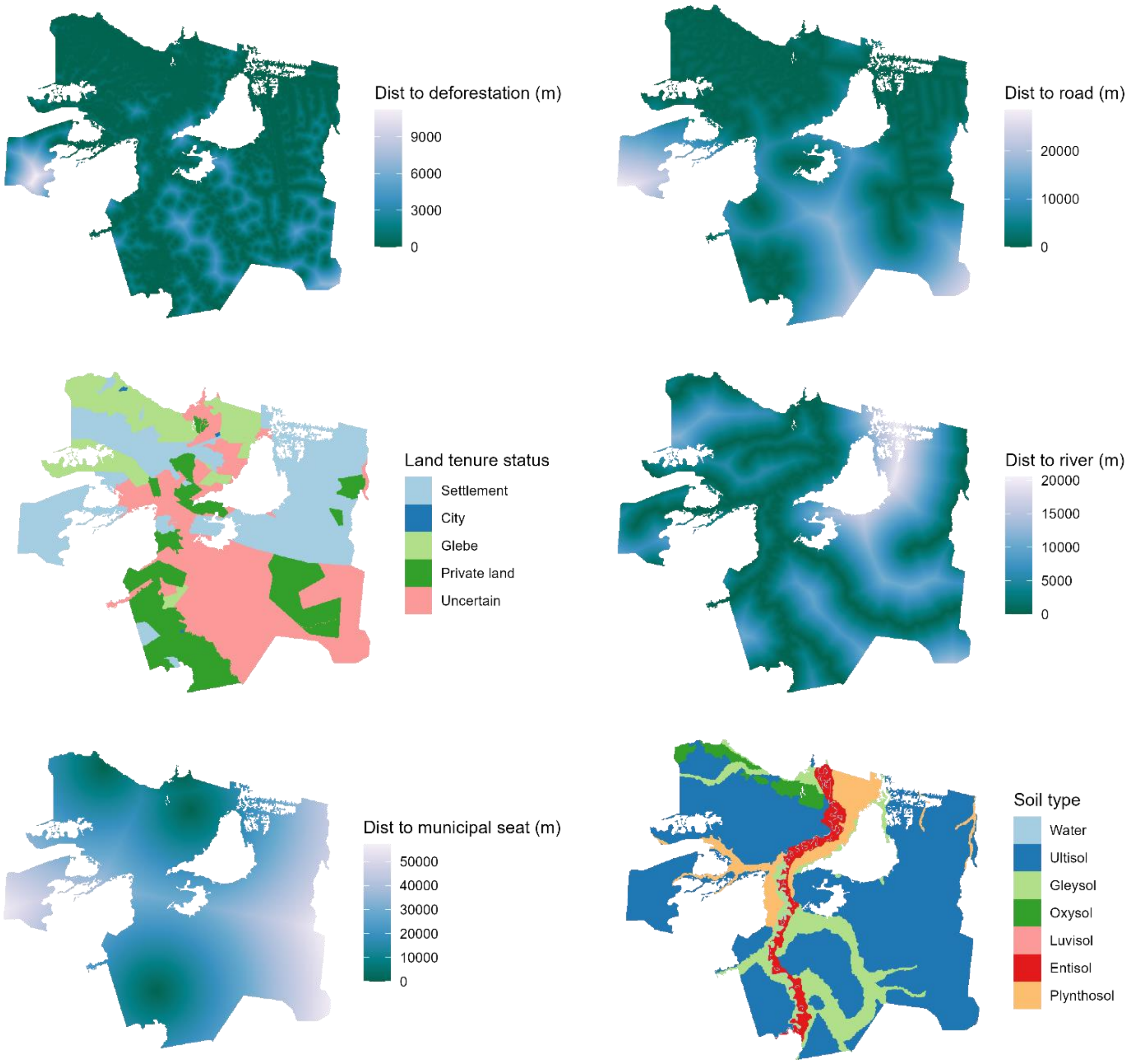


Figure 20. Maps of all variables used to produce the deforestation risk map, used as the criteria in our mobility analysis.

Ultimately, the areas with the highest transition potential located next to the Project Area and hydrographic network were used to define the spatial boundaries of the Leakage Belt. These regions are predominant in east of the Project Area. The design of the Leakage Belt excluded the area of another

REDD+ project enrolled in Verra under ID:1113 located in the vicinity, as well as its Leakage Belt. The Leakage Belt corresponds to an area of 10,231 hectares (Figure 21).

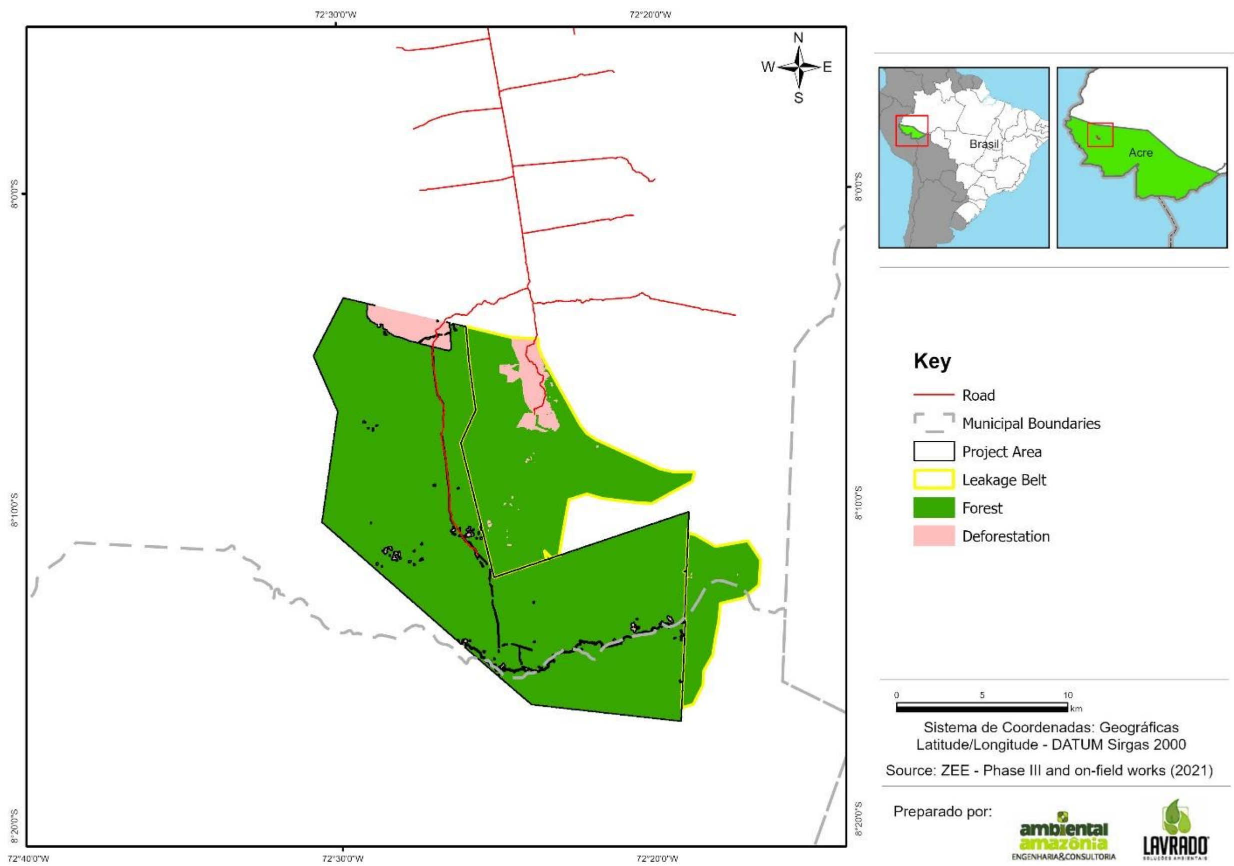


Figure 21. Leakage Belt in Juruá REDD+ Project, Cruzeiro do Sul and Porto Walter municipalities, Acre State.

Leakage Management Areas

The Leakage Management Areas were delineated based on criteria that consider the historical and current land use within the Seringal Valparaíso property, where the Juruá REDD+ Project is being implemented. The definition of these areas prioritized regions that were deforested until 2020, totaling approximately 721 hectares. These areas mainly include planned pastures, regenerating secondary vegetation, and infrastructure, such as the property headquarters (are not forest lands as stated in section 1.1.4 of VM0015 v.1.1)..

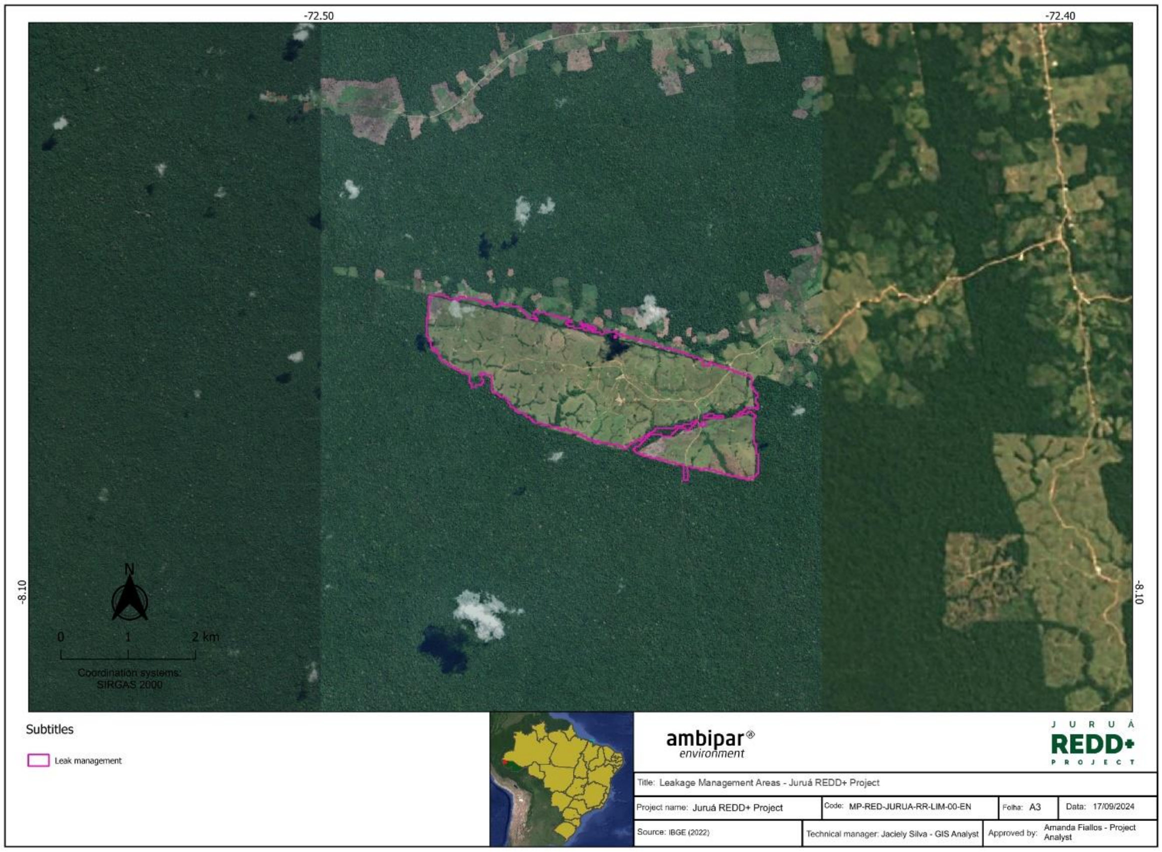


Figure 22. Leakage Management Areas in Juruá REDD+ Project, Cruzeiro do Sul and Porto Walter municipalities, Acre State.

The available infrastructure at the property headquarters plays a strategic role in implementing training and capacity-building activities for local stakeholders, which will be carried out as part of the leakage management measures. The facilities will be used to conduct workshops and training sessions on the sustainable management of low-impact agricultural management and updates and complementary studies to promote good conservation practices. The intention is for local stakeholders to acquire skills that can be applied on their properties, thus reducing pressure for new areas of deforestation.

Additionally, the headquarters' infrastructure base will serve as a central support point for surveillance and monitoring activities within the project area. Patrol activities aimed at preventing unplanned deforestation will rely on the existing structure for planning operations and receiving information obtained through satellite monitoring. This coordinated use of the facilities facilitates a faster and more effective response to any indications of illegal activities within and around the Project area.

Therefore, the definition of the Leakage Management Areas boundaries was designed to efficiently utilize the available resources and infrastructure, integrating the support base for Project Area surveillance, complementary studies and local stakeholders on sustainable agriculture management training for leakage management. These actions are designed to minimize the risk of displacement of deforestation activities, creating conditions for local agents to recognize the benefits of maintaining standing forests and to adopt sustainable productive practices.

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 the 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 2020 forest cover reference map (Figure 23), 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. The UCEGEO forest definition is the same as the one used by the Brazilian Forest Service, therefore, in line with the definition adopted by FAO. Land cover classification data from UCEGEO in vector (shapefiles) and audited (attached annual assessment reports) formats were requested from the Climate Change Institute through a request letter. Additionally, satellite images of the two working scenes were made available. 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. On that account, the forest areas considered within the project boundaries are the areas classified as "forest" in UCEGEO spatial databases for at least 10 years.

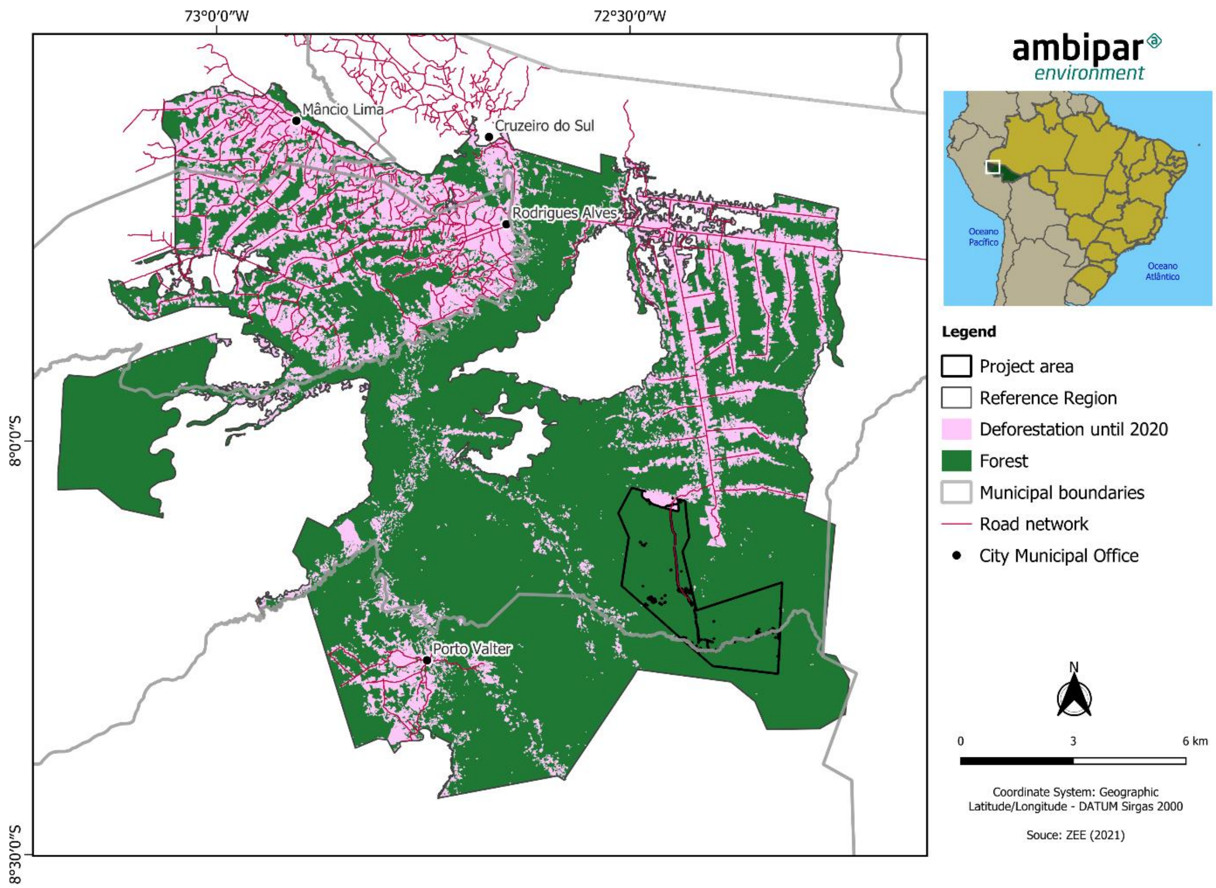


Figure 23. Reference map of forest cover until 2020 in the Reference Region of Juruá REDD+ Project.

Temporal Limits (1.2 VM0015).

Start date and end date of the historical reference period: historical reference period for Juruá REDD+ Project is July 28, 2010 to September 17, 2020 shows the spreading of deforestation over forest areas the surrounding of the Project Area during the historical reference period. These dates were set especially taking into account the availability of UCEGEO data (Table 12) 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 07/31/2020. Deforestation in the baseline scenario in this document was forecast until 2030.

Start date and end date of the first fixed period of the baseline: the first fixed period of the baseline is 07/31/2020 to 07/30/2030 (10 years in accordance with VM0015).

Monitoring period:

In accordance with VM0015 requirement, the maximum duration of the monitoring period for land use and land use change is one fixed baseline period (10 years) from the Project start date, what means from July 31, 2020 until July 30, 2030. Regarding the verification, the monitored period of the Project was from July 31, 2020, until July 30, 2022, covering a period of 2 years.

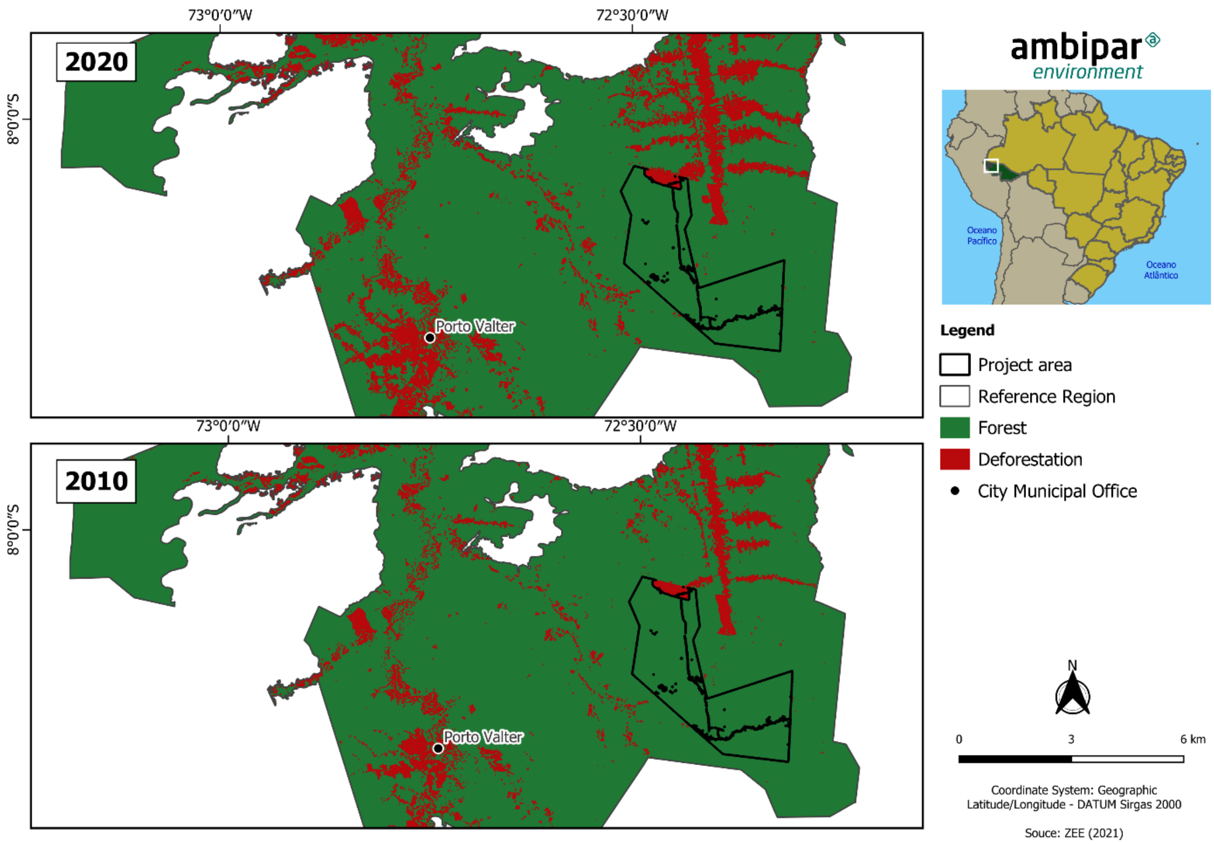


Figure 24. Maps of land use and land cover from 2010 to 2020.

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

The carbon stocks considered in the Project are presented in Table 14 and Table 15. 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 5 of this document.

Table 14. Carbon stocks included or excluded in the limit of Juruá REDD+ Project (Table 3 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	Significant stock included representing 5.8% of total carbon stock
Underground	Included	Significant stock included representing 15.4% of the total carbon stock.
Dead Wood	Included	Significant stock included representing 6.7% of the total carbon stock.
Harvested wood products	Excluded	There is no harvest of wood products activities in the project area.
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.

Inclusion of Non-tree aboveground carbon pool is optional according to the VM0015. We estimated the carbon stocks of this pool using conservative expansion factors and decided to include it, once the significance assessment revealed that this pool contributes to 5,8% of the total emissions reductions in the project area during the project period. The inclusion of the non-tree component carbon pool is also supported by literature results (Nogueira et al, 2008), which report significant non-tree carbon stocks in this pool for open forests in the Amazon, which is the dominant forest type in Acre.

Table 15. 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.
		CO_2	Excluded	Insignificant source.

Source		Gas	Included?	Rationale
	Cattle Emission	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 16) 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.

Table 16. 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 (km^2)	Acquisition date (DD/MM/AA)	Identifier	
		Spatial (m)	Spectral			Path	Row
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 17, which corresponds, respectively, to the minimum classes of the VM0015, 2.2 "Forest Land" and "Non-Forest Land". The description of classes used in the Project, within the Reference Region, at the beginning of the historical period (2010) are presented below:

- **Forest** (425,628 ha): area of remaining forest belonging to different open forest phytophysiognomies.
- **Anthropic vegetation in balance** (123,487 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 17. 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 18).

Table 18. Matrix of Potential changes in land use and land cover (table 7a of VM0015).

ID_{cl}			Initial Class	
			0	1
ID		Name	Forest	Anthropic Vegetation
Final Class	0	Forest	Forests in equilibrium	-
	1	Anthropic Vegetation	Deforestation	Anthropic Vegetation in Equilibrium

Table 19. 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 25), 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 (July 31), to calculate the deforestation rate and its dynamics over 32 years.

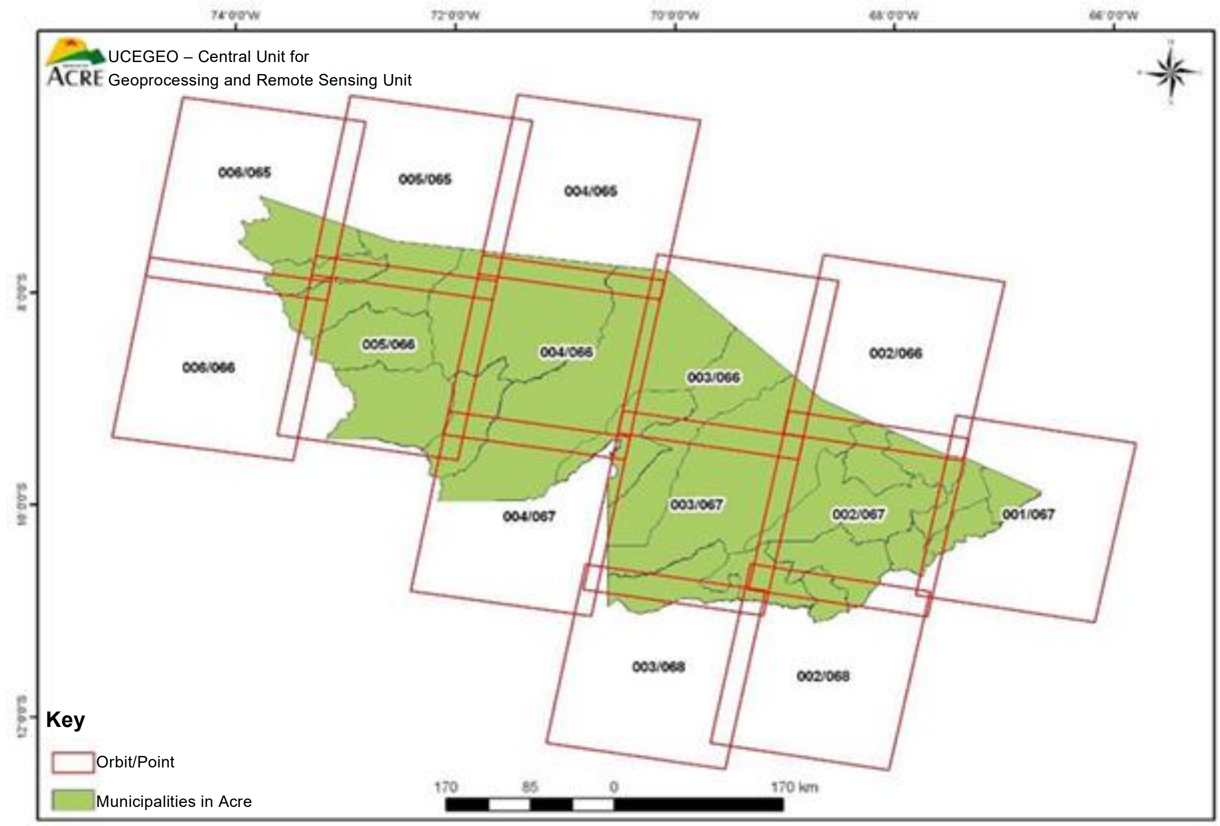


Figure 25. Landsat 5TM scenes (orbit/point) covering the State of Acre.

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://glovis.usgs.gov/app and https://www.usgs.gov/centers/eros/science/usgs-eros-archive-landsat-legacy-global-land-survey-gls. 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 (Latuf e Carmo, 2010 e ACRE,2013), 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 79 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.

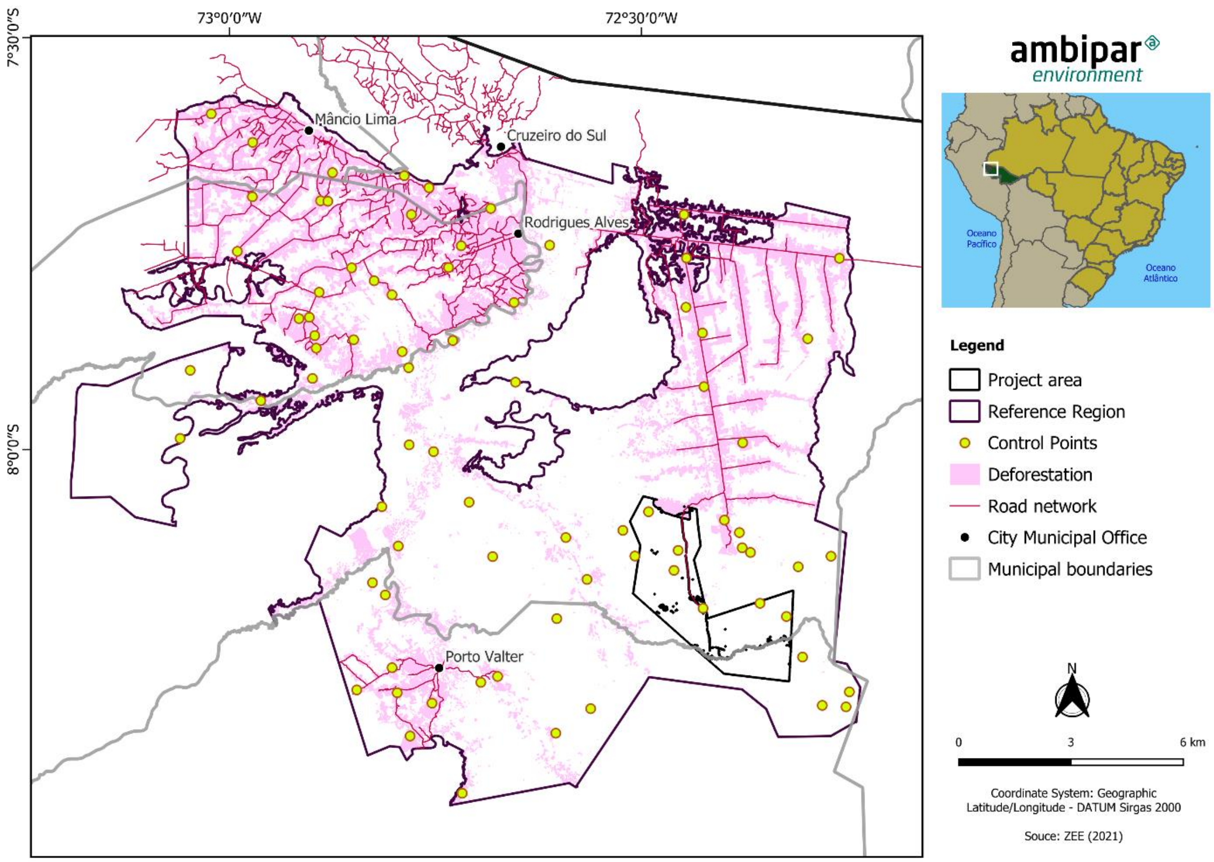


Figure 26. Distribution of reference spots used to assess the deforestation map accuracy.

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 20) according to Congalton (1999). The overall mapping accuracy for different land use classes presented values above 90%.

Table 20. Confusion matrix for data assessment from UCEGEO 2020.

		Reference			
Land use		Forest	Anthropic Vegetation	TOTAL	User Accuracy (%)
Classification	Forest	43	3	46	93,47
	Anthropic Vegetation	1	32	33	96,96
	TOTAL	44	35	79	

	Producer Accuracy (%)	97,72	91,42		**Overall accuracy: 95,21**

Results of the 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 20,567 hectares of deforested area (4.6% of the remaining forest cover in 2010) between 2010 and 2020. The Table 21 shows that changes have occurred between the forest and anthropic vegetation classes. The graph in Figure 27 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.

Table 21. Matrix of land use change in the Reference Region between 2010 and 2020 (Table 7a of Methodology VM0015).

<table>
<tr><th colspan="2" rowspan="3">ID_{cl}</th><th rowspan="3">Name</th><th colspan="4">Initial Class (2010)</th><th>Total (ha)</th></tr>
<tr><th colspan="2">Forest</th><th>Anthropic vegetation</th><th>ND/undefined</th><th></th></tr>
<tr><th colspan="2">I1</th><th>I2</th><th>I3</th><th></th></tr>
<tr><td rowspan="3">Final Class (2020)</td><td>F1</td><td>Forest</td><td colspan="2">425,629</td><td>0</td><td>0</td><td>425,629</td></tr>
<tr><td>F2</td><td>Anthropic vegetation</td><td colspan="2">20,567</td><td>102,920</td><td>0</td><td>123,487</td></tr>
<tr><td>F3</td><td>ND/undefined</td><td>0</td><td>0</td><td colspan="2">484</td><td>484</td></tr>
<tr><td colspan="3">Total (ha)</td><td colspan="2">446,196</td><td>102,920</td><td>484</td><td>549,600</td></tr>
</table>

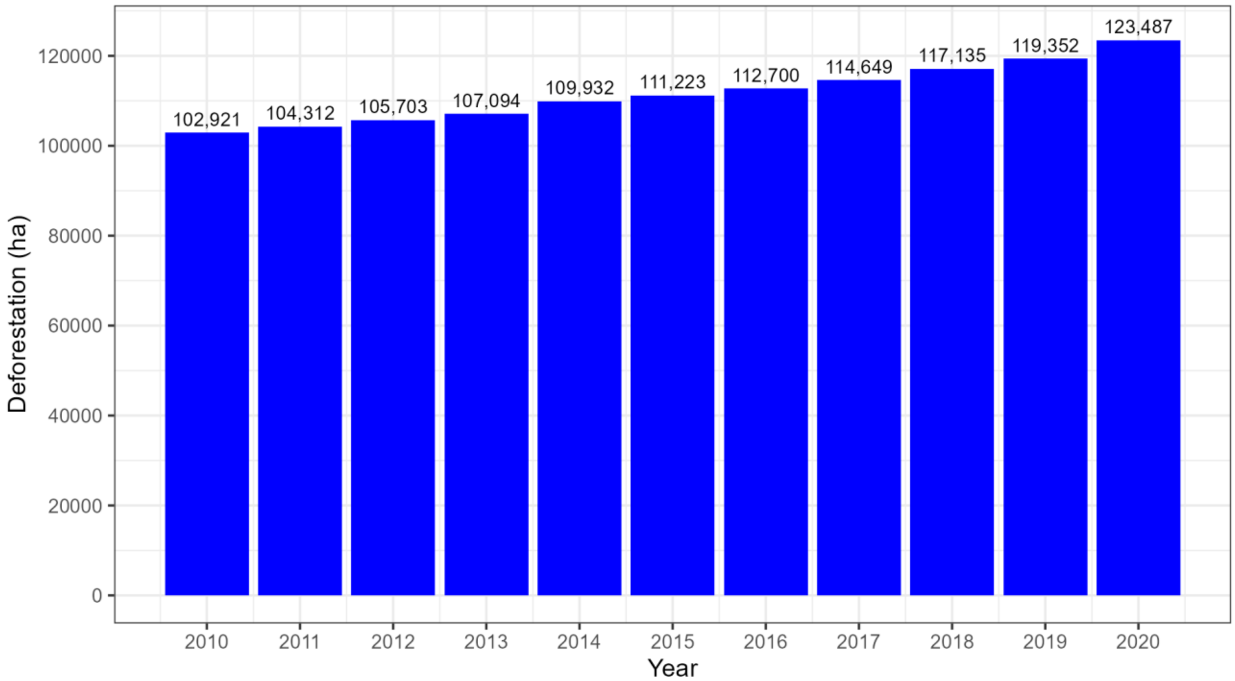


Figure 27. Cumulative deforestation in Reference Region between 2010 and 2020.

Table 22: Historical deforestation in Reference Region during the Historical Reference Period

Year (t)	ARR_{t-1} (ha)	$ABSLRR_{i,t}$ (ha)	$RBSLRR_{i,t}$ (%)
2011	444,805	1,391	0.313%
2012	443,414	1,391	0.314%
2013	442,023	1,391	0.315%
2014	439,185	2,838	0.646%
2015	437,894	1,291	0.295%
2016	436,416	1,477	0.339%
2017	434,467	1,949	0.449%
2018	431,982	2,486	0.575%
2019	429,764	2,217	0.516%
2020	425,629	4,136	0.972%

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

In the area that makes up the Project Reference Region, there is a population of approximately 40,014 people, distributed across cities, settlements, possessions, family properties and medium and large properties.This population (IBGE, 2022) is more concentrated along the BR-364 highway, in the tributaries, and along the banks of the main rivers in the region.

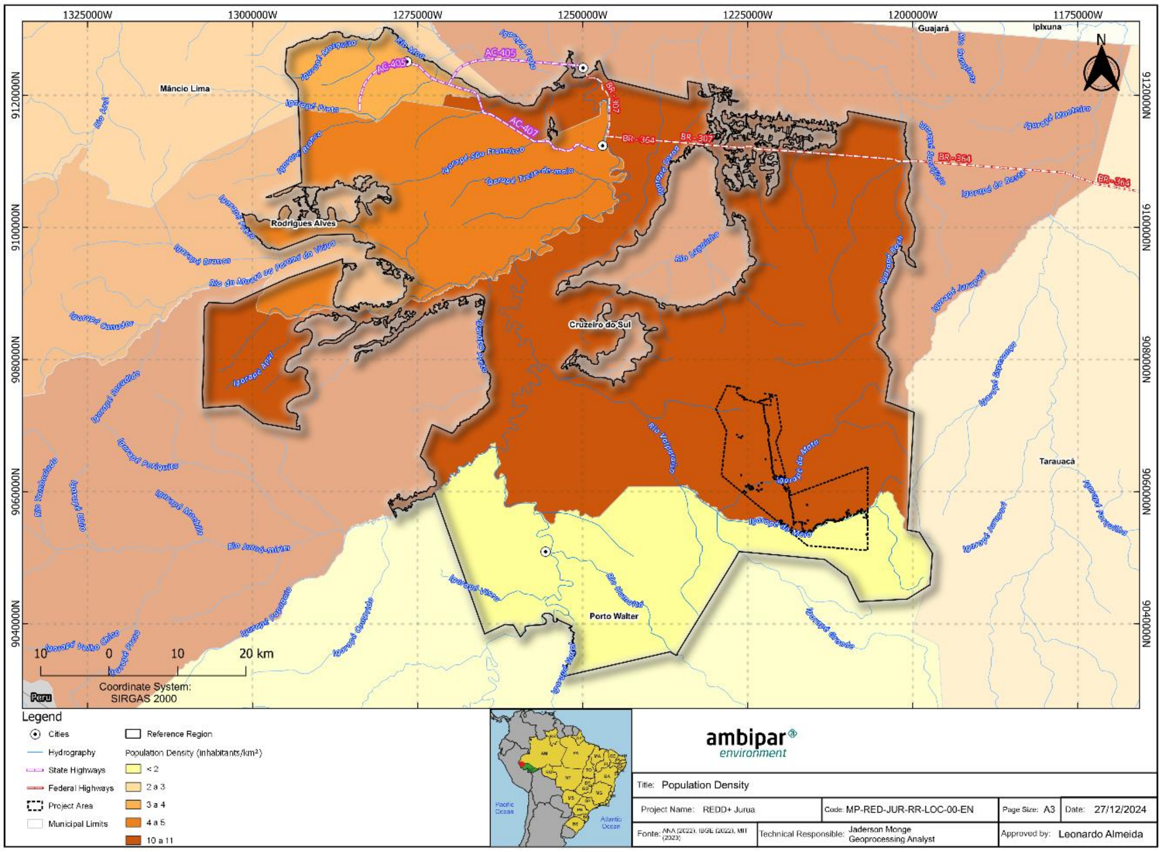


Figure 28. Population density in the Reference Region.

Acre has a history of land occupation and natural resource use that spans different periods and contexts. The first period of commercial resource use occurred during the rubber boom, when latex extraction from rubber trees led to the migration of workers and the establishment of rubber plantations, resulting in significant changes to the landscape and the way of life of local communities. In recent decades, the region has seen an expansion of agriculture and cattle ranching, with the agricultural frontier advancing over forested areas. Deforestation for agricultural, livestock, and infrastructure purposes has been one of the main causes of environmental degradation and biodiversity loss. Logging also plays a significant role in the local economy.

In August 2020, the Deforestation Alert System (SAD)[1] of the Institute of Man and Environment (Imazon) detected 1,499 square kilometers of deforestation in the Legal Amazon, a 68% increase compared to

[1] Fonseca, A., Cardoso, D., Ribeiro, J., Ferreira, R., Kirchhoff, F., Amorim, L., Monteiro, A., Santos, B., Ferreira, B.,Souza Jr., C., & Veríssimo, A. 2020. Boletim do desmatamento da Amazônia Legal (agosto 2020) SAD (p. 1). Belém: Imazon. Disponível: https://imazon.org.br/wp-content/uploads/2020/09/SAD-agosto-2020.pdf.

August 2019, when deforestation totaled 893 square kilometers. This report highlights that Acre is among three states that account for nearly 80% of deforestation in the Legal Amazon.

Deforestation dynamics in this region have historical roots due to the promotion of colonization that took place during the dictatorship. At that time, the federal government supported the occupation of land by settlers who, after clearing forest areas, were granted title to the land.

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. For this analysis, the deforestation dynamics within each land category were assessed, according to Acre's Ecological-Economic Zoning (ZEE)[2].

According to Acre's Ecological-Economic Zoning (ZEE-AC)[2], the highest deforestation rates occur in land categories involving explicit land ownership, such as settlements and private plots. Comparing the relationship between deforestation and land tenure for 2005, the base year for the ZEE-AC – Phase II data, and 2018, the base year for the ZEE-AC – Phase III data, it is evident that private plots, along with settlements, play a significant role in deforestation, accounting for over 60% of all deforestation in Acre.

Moreover, the ZEE highlights that changes in land tenure or ownership can influence deforestation rates in two ways: (1) deforestation rates increase proportionally with the likelihood of land expropriation, or (2) deforestation rates rise as the expected duration of land occupation decreases (Cattaneo, 2001)[3]. In this context, squatters also play an important role in driving deforestation, as their official land tenure remains uncertain.

The contribution of each land category to deforestation is presented in the table below:

Table 23. Contribution of each land category to deforestation within the Reference Region from 2010 to 2020.

Type of Land Unit	Area (ha)	Percentage
Settlements	14,246.11	55.19%
Federal Public Land (GLEBFED)	4,493.62	17.40%
Land Vacancy	3,200.48	12.39%
Rural Properties (IRU)	3,866.69	14.97%
Cities of Acre	1.80	0.01%

[2] Acre, Governo do Estado Zoneamento ecológico-econômico do Acre. Secretária de Estado do Meio Ambiente. Rio Branco: Semapi. Disponível em: https://sema.ac.gov.br/zee-acre/.

[3] CATTANEO, A. Deforestation in the Brazilian Amazon: comparing the impacts of macroeconomic shocks, land tenure, and technological change. Land Economics, v. 77, n. 2, p. 219, 2001. Disponível em: https://le.uwpress.org/content/77/2/219.

Thus, the following agents of deforestation were identified:

I. Agent name: **Family producers in settlement projects**

Relative importance: family farmers in settlements are responsible for 55.19% of deforestation in the Reference Region, from 2010 to 2020.

Brief description: There are 27 settlements in the Reference Region, divided into three categories: Differentiated Settlement Project, Conventional Settlement Project and Agroforestry Hub. The table below presents the settlements listed in Acre's Ecological-Economic Zoning (ZEE):

Table 24 - Settlements in the Reference Region

	SUBTYPE	NAME	FONT	Zone ZEE-AC
1	Differentiated Settlement Project	PAF HAVAI	INCRA	Zona 2
2	Differentiated Settlement Project	PDS FRANCISCO PIMENTEL	INCRA	Zona 2
3	Differentiated Settlement Project	PDS MINAS	INCRA	Zona 2
4	Differentiated Settlement Project	PAF RECANTO	INCRA	Zona 2
5	Differentiated Settlement Project	PDS JAMIL JEREISSATI	INCRA	Zona 2
6	Differentiated Settlement Project	PAE CRUZEIRO DO VALE	INCRA	Zona 2
7	Conventional Settlement Project	PA ARCO ÍRIS	INCRA	Zona 1
8	Conventional Settlement Project	PA SÃO PEDRO	INCRA	Zona 1
9	Conventional Settlement Project	PA ALBERTO SANTIAGO	INCRA	Zona 1
10	Conventional Settlement Project	PA PAVÃO	INCRA	Zona 1
11	Conventional Settlement Project	PA TREZE DE MAIO	INCRA	Zona 1
12	Conventional Settlement Project	PA IUCATAN	INCRA	Zona 1
13	Conventional Settlement Project	PA NARCISO ASSUNÇÃO	INCRA	Zona 1
14	Conventional Settlement Project	PA PEDRO FIRMINO	INCRA	Zona 1
15	Conventional Settlement Project	PA PORFIRIO PONCIANO	INCRA	Zona 1
16	Conventional Settlement Project	PA JOAO ADEMIR	INCRA	Zona 1
17	Conventional Settlement Project	PA URUBURETAMA	INCRA	Zona 1
18	Conventional Settlement Project	PA URUBURETAMA	INCRA	Zona 1
19	Conventional Settlement Project	PA TRACUA	INCRA	Zona 1
20	Conventional Settlement Project	PAD SANTA LUZIA	INCRA	Zona 1
21	Conventional Settlement Project	PA VITORIA	INCRA	Zona 1
22	Conventional Settlement Project	PA VITORIA	INCRA	Zona 1

23	Conventional Settlement Project	PA SAO DOMINGOS	INCRA	Zona 1
24	Conventional Settlement Project	PA NOVA CINTRA	INCRA	Zona 1
25	Agroforestry Hub	RODRIGUES ALVES	SIGEF	Zona 1
26	Agroforestry Hub	MANCIO LIMA	ITERACRE	Zona 1
27	Agroforestry Hub	CRUZEIRO DO SUL	SIGEF	Zona 1

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.. These practices are responsible for most of the deforestation in the Reference Region, conditioned by thousands of small polygons every year.

Statistics on historical deforestation attributable to the agent: from 2010 to 2020, 14,246.11 hectares were deforested in the Reference Region representing an annual average of 1,424.6 hectares, which were attributed to actions of family producers in the settlement.

II. Agent name: **Settlers**

Relative importance: the squatters in the Reference Region are primarily in areas of land void (land vacancies and federal public land) and are responsible for 29.79% of the deforestation that occurs in the Reference Region, from 2010 to 2020.

Brief description: The land tenure issue in Acre is indeed complex and intertwined with a long history of land occupation and use, marked by conflicts among different actors. The figure of the squatter, often characterized as an "invader," must be understood within a specific historical, legal, and social context. Squatters are essentially farmers and extractivists who occupy public or vacant lands without legal title to ownership but have been using the land continuously, in many cases for decades. The land voids that constitute areas without regularized land tenure corresponds to 33,2% of the Reference Region. 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.

Statistics on historical deforestation attributable to the agent: between 2010 and 2020, 3,200.48 hectares were deforested in the Reference Region representing an annual average of 320 hectares, which were attributed in squatters in areas of land void.

III. Agent name: **Medium and large producers**

Relative importance: medium and large cattle ranchers contribute with 14.97% of deforestation in the Reference Region that has already occurred from 2010 to 2020 and are made up of medium and large properties, such as Juruá REDD+ Project.

Brief description: Private properties occupy 19.1% of the Reference Region and count 12 properties that have cattle ranching and extractivism as their economic exploitation base, since 5 properties are farms and 7 are rubber plantations.

Statistics on historical deforestation attributable to the agent: between 2010 and 2020 3,866.69 hectares were deforested in the Reference Region representing an annual average of 386.67 hectares, which were attributed to these private properties.

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 drivers (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.

Variables explaining the quantity of deforestation

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, 18,130.8 hectares were deforested in the Reference Region representing an annual average of 3,531 Hectares, of which 70.2% come from family properties (settlements + rural 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.

Also see section "Identifying of underlying causes of deforestation" and Table 24 for a more detailed explanation of each driver.

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 weights of evidence coefficients, 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;
- 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 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)

The main underlying causes of deforestation in the State of Acre and the Reference Region in the historical reference period were:

1. Territorial planning issues related to road pavement, land tenure and lack of technical expertise.

Both the studies reported in "Acre State's Deforestation Prevention and Combat Plan" PPCD-AC, phase I (ACRE, 2018) and the Ecological-Economic Zoning studies – ZEE Phase III (ACRE, 2021) identified territorial planning issues related to road pavement, land tenure and lack of technical expertise among the main problems facilitating the occurrence of deforestation in the region. Both studies counted with participation of society. The ZEE studied the deforestation in relation to the different property units and their evolution, and the PPCD conducted an analysis of the main problems and factors influencing the deforestation in the Acre State.

2. Change in deforestation spatial patterns from medium and big parcels to small parcels.

An analysis from the Amazon Institute for Environmental Research (ACRE, 2017) added to this picture the change in pattern from medium and big to small deforestation parcels, specially by family producers, for which more 85% of the rural population has cattle ranching as the dominant land use.

These mall producers are, 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 underlying causes above reveal the main drivers of deforestation, shown in Table 24. Their order of appearance in the table reflects their chronological occurrence and relevance according to intensity, frequency, and impact. To address the definition, adjustment and success of public policies for reducing deforestation, the separation of drives into two groups can be helpful. 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.

Project measures that will be implemented to address the identified underlying causes of deforestation.

Identifying the main underlying causes of deforestation in Acre State and the Reference Region in the historical reference period can indicate actions developed by the Project that could possibly contribute to mitigate these deforestation activities.

Actions such as updating and complementing studies can contribute to a better understanding of how to address the underlying causes of deforestation. Furthermore, the activity aimed at strengthening the management of non-timber forest products may address the lack of technical knowledge identified in the first underlying cause cited and may provide an alternative source of income for the rural landowners cited in the second underlying cause.

Table 25. Drivers related to deforestation and fires in the Amazon and the State of Acre.

Drives	Typical situations in the Amazon	Situations observed in Acre	Association with deforestation agents identified in step 3.1	Likely future development and Project design approach
Direct drives or drives causing deforestation	Illegal extraction of wood	Weaknesses in the inspection of management plans	Wood illegal extraction is related to family producers, squatters and medium-sized owners since it's directly related to the process of opening branches and large producers are generally associated with Management Plans.	As the frontier of deforestation advances, illegal extraction increases (Fearnside, 2006). The project has two actions that aim to curb this process: first, the focus on non-timber forest management and, second, surveillance and monitoring of property boundaries to avoid this type of action.
	Uncontrolled fire, forest fires	Use of fire for unlicensed food production	This action is more common related to family producers, although more recently it has also been associated with medium and large producers for the renewal of pastures for meat production.	The use of fire to clear new areas for agricultural and livestock production is the main factor of degradation in the Amazon (Brown et al., 2017, Silva, 2017). There is a growing trend of this land use in the region. The land owner proponent, won't make any more conversions and is working on a strategy to intensify his already existing pasture area. Around the project, access to new technologies will be sought to reduce the use of fire, such as low-carbon agriculture, rotation with pulse, among others.
	Ranching practices with low technology level	Pastures for extensive cattle ranching in 70-90% of deforested areas	More than 80% of Acre deforested area was converted into pasture (ACRE, 2021). It is the land use most adopted by producers. And, at this point, all agents are directly involved (family producers in	A large part of Acre pastures is either degraded or in the process of degradation and the growth of pasture area is constant (ACRE, 2021). Inside the projects focus property, the owner established a pasture intensification and management strategy in order to incorporate pasture division technology, adapted varieties and genetic improvement as a way of

			settlements, squatters and medium and large producers)	increasing the level of technology adopted so the property can be a model for surrounding producers.
	Development of low-tech agriculture	Migratory agriculture in 10-20% of deforested areas; agricultural activities in less than 4%	Low technology agriculture is primarily associated with family production (in settlements and rural possessions), large producers use high technology for grain production or crop-livestock integration	Deforestation in the Amazon is directly related to the low technological agriculture (Margulis, 2006, Fearnside, 2006 and ACRE, 2021). One of the difficulties is access to technologies, due to the low ratio technical assistance and rural extension workers. This tend to intensify in the coming years due to the rural population increase (ACRE, 2018). The project aims to involve small producers so they have access to better technologies for land use.
	Human settlement projects	Weak infrastructure and technical follow-up for producers	New settlements are one of the main drivers of deforestation in the Amazon (Fearnside, 2006). It is associated with family farmers.	There is no forecast for new settlements in the Project region (ACRE, 2021).
	Extreme climatic conditions	Droughts in 2005, 2010, and 2016	Extreme climatic events are already a reality in the Amazon. They appear as severe droughts (2005, 2010 and 2016), heavy rains, unseasonal cold weather and storms.	It's expected that these events will become more common in the future (Silvestrini et al. 2011, Lewis et al., 2011, Brown et al., 2017 and Marengo et al., 2018). One way to mitigate it is by conserving the original forest cover.
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	Surveillance in protected areas is a challenge in the Amazon. However, there are no conservation units in the reference region.	Conservation units are an efficient strategy to reduce deforestation (ACRE, 2018)
	Construction and paving of roads	Deforestation along highways BR 317, BR 364,	Construction and/or paving of roads is one of the main drivers of deforestation in the Amazon	It is expected that the creation of new branches and the paving of roads will continue to increase deforestation (ACRE, 2018 and ACRE, 2021). The

		AC 040 and AC 090; spreading deforestation inside the forest	(Fearnside, 2006) and it's a catalyst for all agents (family farmers in settlements, squatters and medium and large producers)	project area is on the frontier of deforestation in Acre and is under external pressure.
	Land speculation	Speculation faster than jurisdiction	The action is very concentrated on large and medium-sized companies, since the capitalization index of family farming is low (ACRE, 2018)	In Acre the land regularization process is expected to improve (ACRE, 2021)
	Fiscal and financial incentives	Adaptation to local needs should replace centralized management	Most finantial aids are associated with livestock (ACRE, 2021) and they are used by large, small and medium regularized landowners.	In the future an agricultural plan for the State of Acre with definition of priority productive chains is expected.
	Slow land-use planning process	Low social and political acceptance	Acre has one of the greatest territorial management implementations in long-term, which is Ecological-Economic Zoning (ZEE) (ACRE, 2021). This action involves and impacts all agents.	ZEE is a Law that must be applied in the process of land use and occupation.
	Delay in regularizing georeferenced registration and land allocation	Historical omission, process standardization Slow land allocation process	It's difficult to conclude the land regularization processes (ACRE, 2018).This omission and institutional difficulty affects all agents in synergy with other actions such as financial aid and territorial organization.	ZEE sets Acre Zone 3 areas as a priority for land regularization (ACRE, 2021).

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 (ACRE, 2017).

Conclusion (3.5 VM0015)

Based on historical deforestation and its environmental and economic characteristics, and the relationship between agents, drivers and underlying causes of deforestation that explain the pressure on forest cover in the Reference Region of Juruá REDD+ Project, it's conclusive the most likely future deforestation trend within the Reference Region and Project Area. The collected data and evidence support the hypothesis that the pressure of deforestation agents and drivers will increase, or at least remain above the historical average, as the result of a potential 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, 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. **For conservativeness**, we assume that future deforestation rates for the baseline **will follow the historical average.**

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 occur 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 have contributed to deforestation in recent years, mainly due to family production. Most 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.

In recent years, the deforestation in the Reference Region follows an increasing trend, indicating that efforts of public policies for reducing deforestation have generated few results. However, it is important to remember that these policies 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 varied observed trends (decreasing, then increasing) in deforestation rates during the historical period analyzed. Although recent years in the series show increasing deforestation rates, approach "a" (historical average) was conservatively selected to project future deforestation rates in the reference region.

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 "a" (historical average) 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 as the observed historical relative average in the Reference Region during the historical reference period (Figure 29), according to equation 3 of VM0015 v 1.1 (page 44).

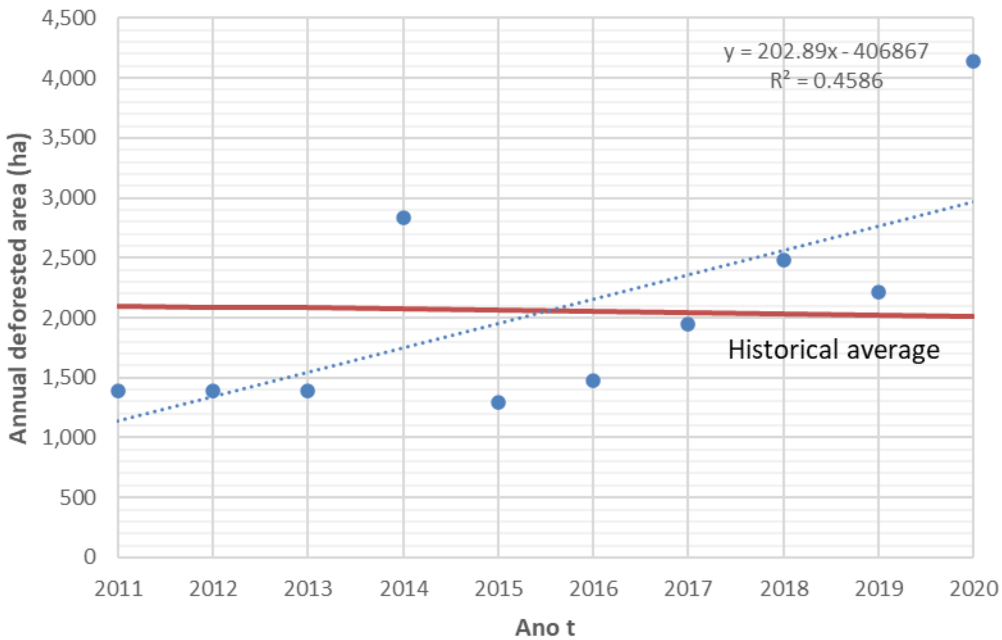


Figure 29: Evolution of deforestation in the Reference Region during the historical period

The historical average deforestation rate in the reference region was **2057 hectares** per year, or **0.47%** per year (Table 26). We used the relative annual deforestation rates calculated via the method described by Puyravaud (2003), cited in footnote 26 of VM0015 v1.1.

Since 2015, deforestation rates have been increasing, with a sharp spike in 2020. This trend aligns with the current context of intensified invasions of private and public lands by land grabbers and squatters, as well as an increase in families settling in new projects. For example, PAD Santa Luzia, the settlement closest to the Project, has experienced growth since its creation, as can be seen from data from public institutions, even with the exodus of some young people to nearby cities. Therefore, the use of the historical average may be overconservative as a predictor of future deforestation rate. Nevertheless, the deforestation forecast values for the period from July 2020 to July 2030 are presented in Table 26

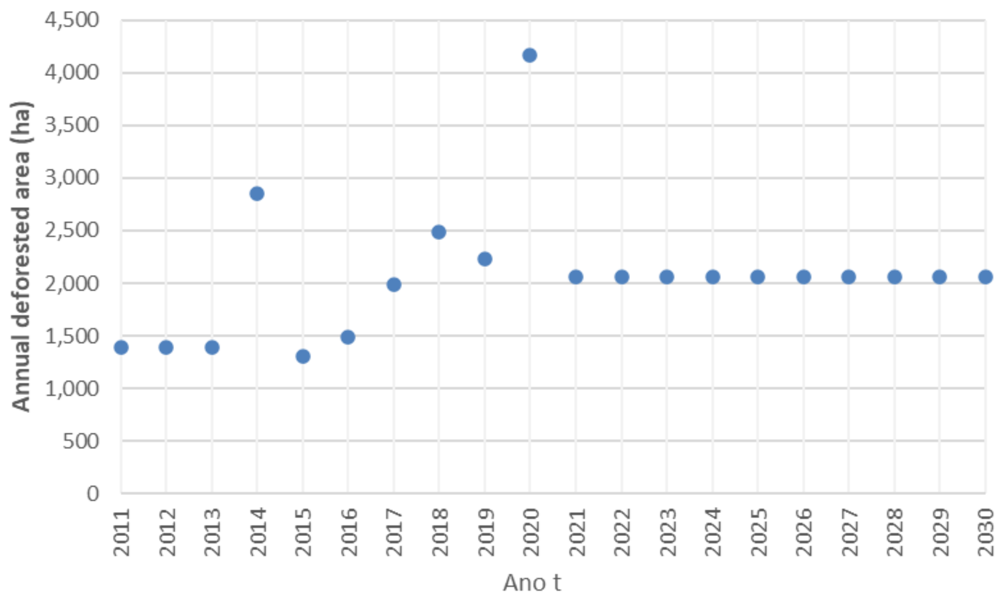


Figure 30: Deforestation projections for the period 2021-2030.

Table 26. Baseline of annual deforestation in the Reference Region (Table 9.a of VM0015 Methodology).

Project Year	Strata i in Reference Region 1 $ABSLRR_{i,t}$ (ha)	Total		
		Annual $ABSLRR_{i,t}$ (ha)	Cumulative ABSLRR (ha)	Annual $RBSLRR_{i,t}$ (%)
Jul/20 - Jul/21	2,004	2,004	2,004	0,4754%
Jul/21 - Jul/22	1,994	1,994	3,998	0,4754%
Jul/22 - Jul/23	1,985	1,985	5,983	0,4755%
Jul/23 - Jul/24	1,976	1,976	7,959	0,4755%
Jul/24 - Jul/25	1,966	1,966	9,925	0,4755%
Jul/25 - Jul/26	1,957	1,957	11,883	0,4755%
Jul/26 - Jul/27	1,948	1,948	13,830	0,4756%
Jul/27 - Jul/28	1,939	1,939	15,769	0,4756%
Jul/28 - Jul/29	1,930	1,930	17,699	0,4756%
Jul/29 - Jul/30	1,921	1,921	19,619	0,4756%

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 2020-2050 for the Reference Region (Table 27), the Project Area (Table 28) and Leakage Belt (Table 29) are exposed.

Table 27. Baseline of annual deforestation in the Project Area (Table 9.b of VM0015 Methodology).

Project year (t)	Strata i in Project Area 1 ABSLPA $_{i,t}$ (ha)	Total	
		Annual	Cumulative
		ABSLPA $_{i,t}$ (ha)	ABSLPA (ha)
Jul/20 - Jul/21	16	16	16
Jul/21 - Jul/22	21	21	37
Jul/22 - Jul/23	23	23	59
Jul/23 - Jul/24	17	17	76
Jul/24 - Jul/25	19	19	95
Jul/25 - Jul/26	6	6	101
Jul/26 - Jul/27	18	18	120
Jul/27 - Jul/28	6	6	125
Jul/28 - Jul/29	8	8	133
Jul/29 - Jul/30	12	12	145

Table 28. 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)
Jul/20 - Jul/21	0	0	0
Jul/21 - Jul/22	0	0	0
Jul/22 - Jul/23	0	0	0
Jul/23 - Jul/24	0	0	0
Jul/24 - Jul/25	4	4	4
Jul/25 - Jul/26	0	0	4
Jul/26 - Jul/27	5	5	9
Jul/27 - Jul/28	9	9	18
Jul/28 - Jul/29	9	9	27
Jul/29 - Jul/30	12	12	39

Projection of the location of future deforestation (4.2 VM0015)

The simulation of deforestation was performed using the Dinamica EGO Software that expands existing deforestation and generate new deforestation until 2030 in regions of higher probability according to the weights of evidence (see below). The construction of the model was carried out in three stages: model input data systematization, calibration of variables, and modeling the future deforestation.

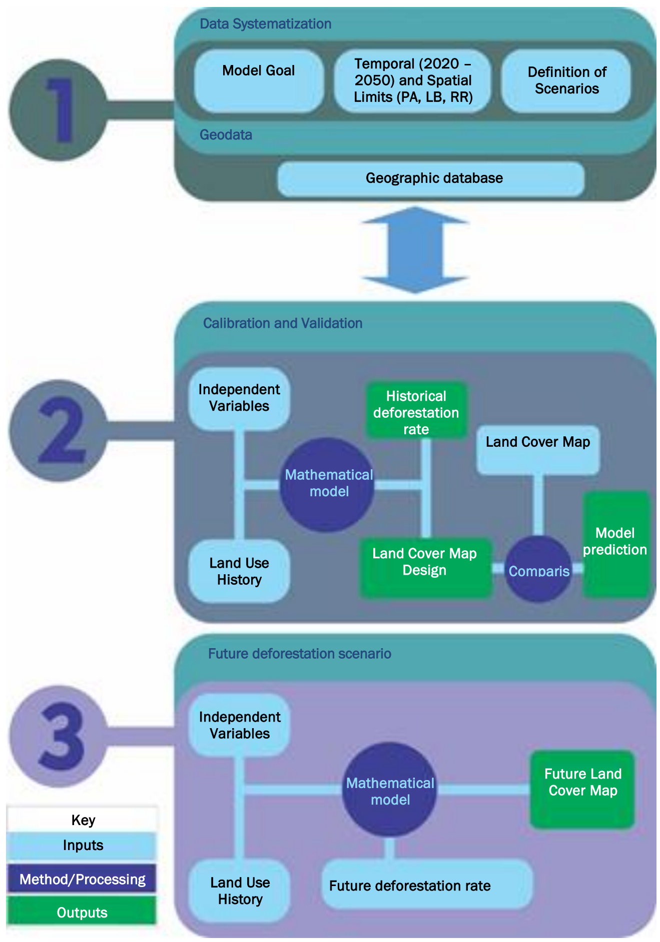


Figure 11: Projection model flowchart for future deforestation in the project's Reference Region.

Preparation of factor maps (4.2.1 VM0015)

Six drives were selected (land tenure, soil type, distance to deforestation, distance to permanent hydrographic network and 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) 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 29. List of maps, variables and factor maps. (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	28,656	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
2	River accessibility	ZEE Acre	meters	River accessibility with permanent water regime	0.0	20,571	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
3	Accessibility to deforested area	UCEG EO Acre	meters	Accessibility to deforested area	0.0	11,272	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
4	Accessibility to municipal settlements	IBGE	meters	Accessibility to municipal settlements	0.0	57,321	Values close to zero mean high accessibility	Euclidean distance (ArcGis)
5	Land tenure status	ZEE Acre	meters	Land tenure status	1	5	Each value indicates a class or category	Raster polygon by identification (ArcGis)
6	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)

The figure below shows maps of each of the factors listed above and used to produce the best risk map selected in substep ***b,*** ahead in this section:

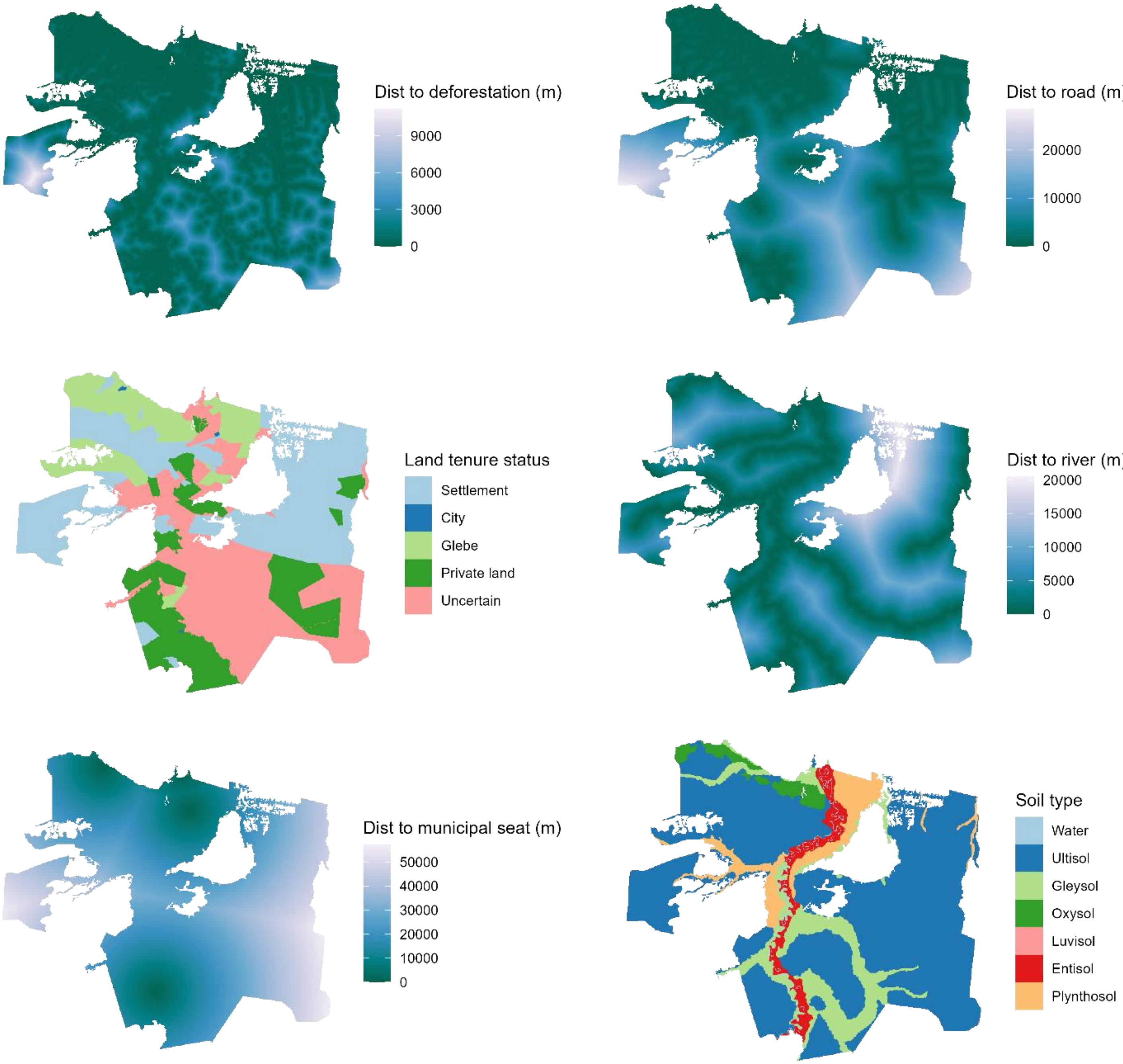


Figure 32. Maps of all variables used to produce the deforestation risk map.

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 predictions of new deforestation rates in regions of higher probability according to the estimated weights of evidence (Figure 33). 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 produce new deforestation spots with each interaction depending on how many future simulation steps are desired from the calculated transition rates.

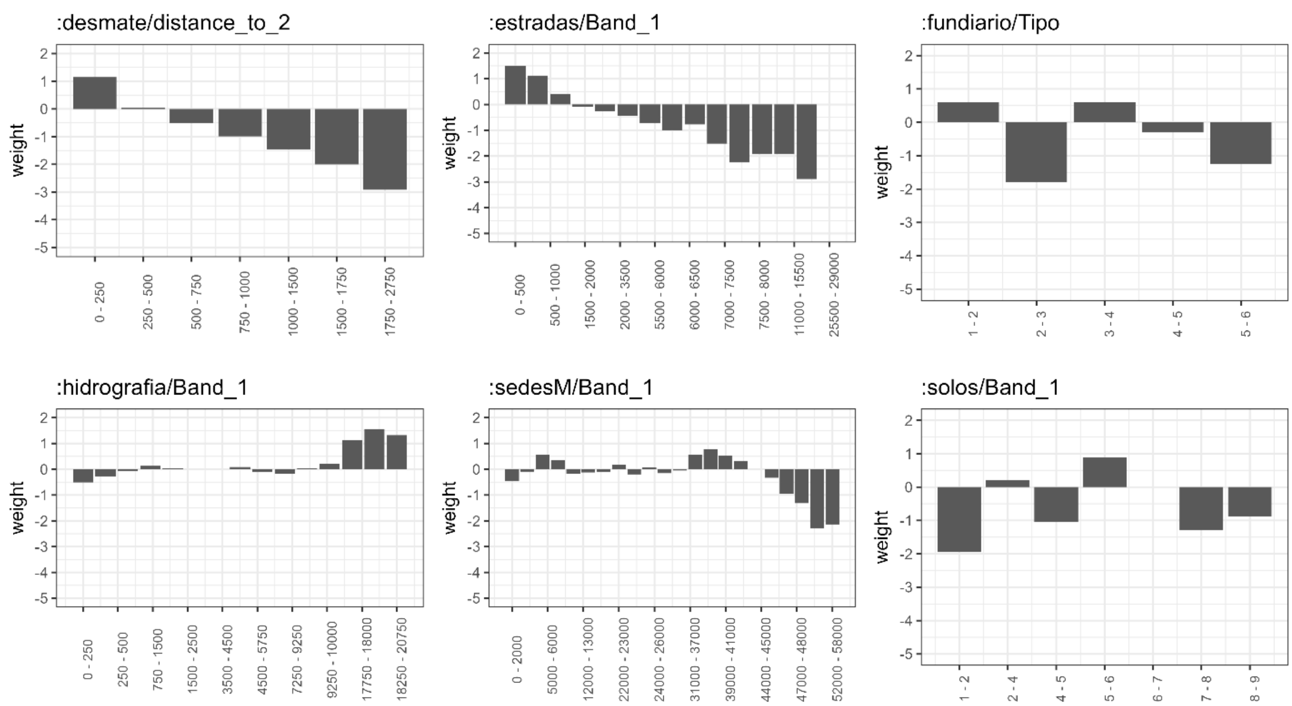


Figure 33. Estimated weights of evidence.

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 34). 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.

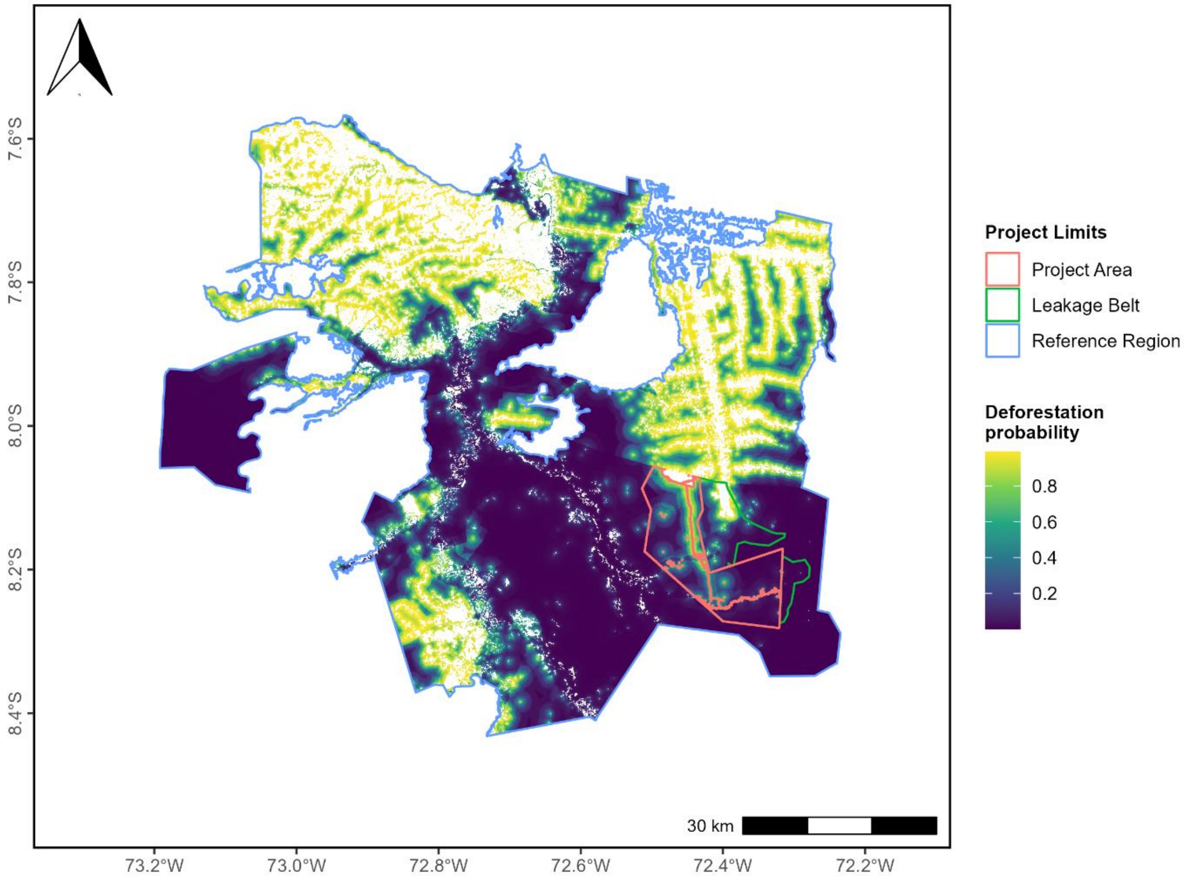


Figure 34. Map of potential for change from forest to anthropogenic vegetation (deforestation risk) in the Reference Region.

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 2050 in the Reference Region of Juruá REDD+ Project. This result indicates that projected deforestation occurred in the high-risk areas.

Selection of the most accurate map

The model above was fit using all variables in the model. The weights of evidence of Figure 31 show the weight of each variable to deforestation. The methodology recommends that several model are ran and the most accurate risk map is selected. Thus, we ran 5 additional submodels with a random number of variables and variable selection and compared the results. Table 30 below shows the resulting FOM values for each model. The FOM for all models are above the minimum FOM threshold recommended by the methodology, but he full model is the best among them.

Table 30: Selection of the most accurate map

Model #	# of variables	Included variables	FOM value	bove threshold?
1 (all)	6	dist. deforestation,dist. roads,land status,dist river,dist municipality,soil	0,0579	Yes
2	3	dist river, dist municipality, soil	0,0307	Yes
3	4	dist. deforestation, land status, dist municipality, soil	0,0501	Yes
4	4	land status, dist river, dist municipality, soil	0,0272	Yes
5	4	dist deforestation, dist roads, dist river, soil	0,0569	Yes
6	2	dist estradas, dist municipality	0,0496	Yes

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 2050 was estimated for the entire Reference Region. 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 35 and Figure 36 show the cumulative deforestation in the Project Area until 2050.

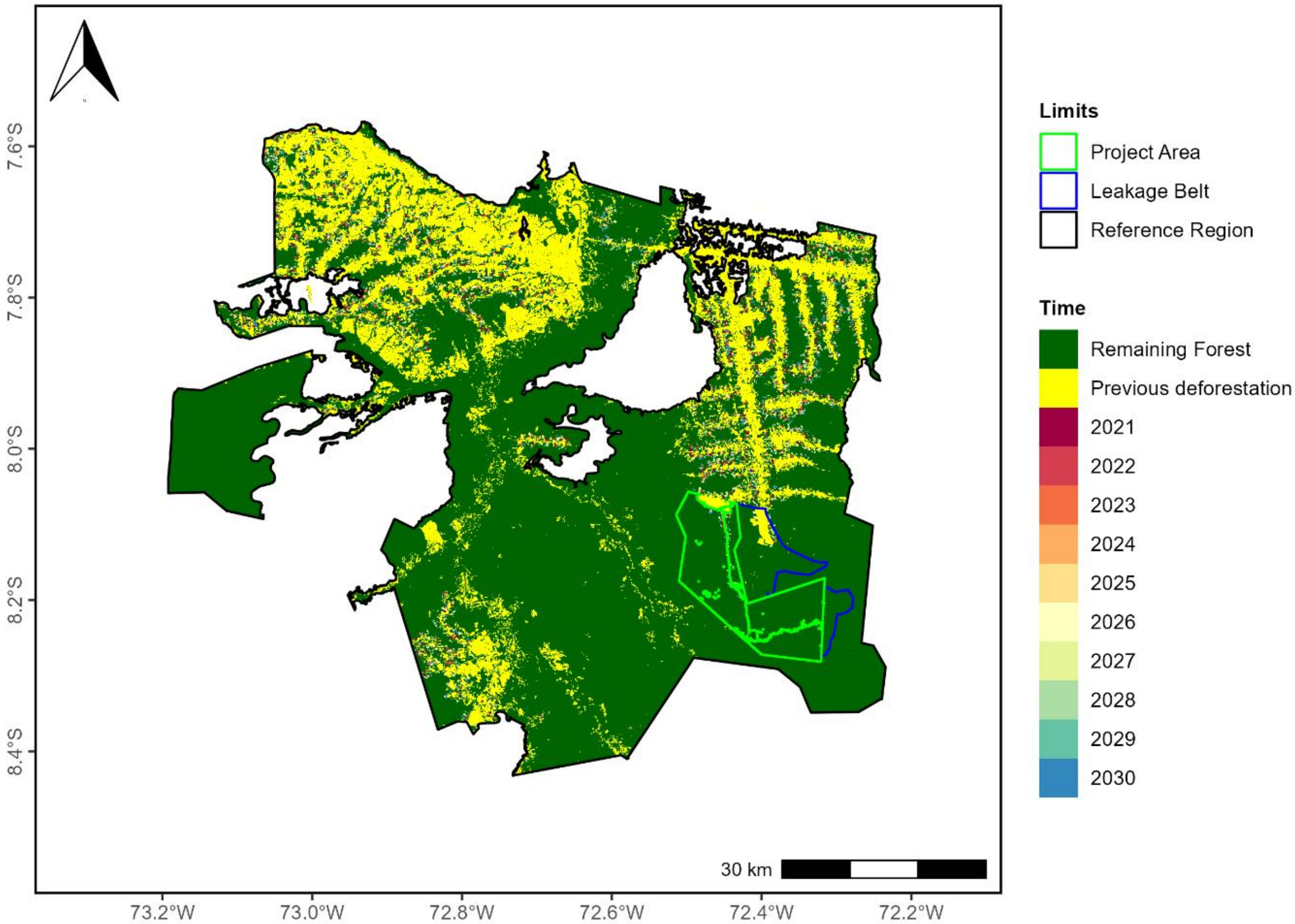
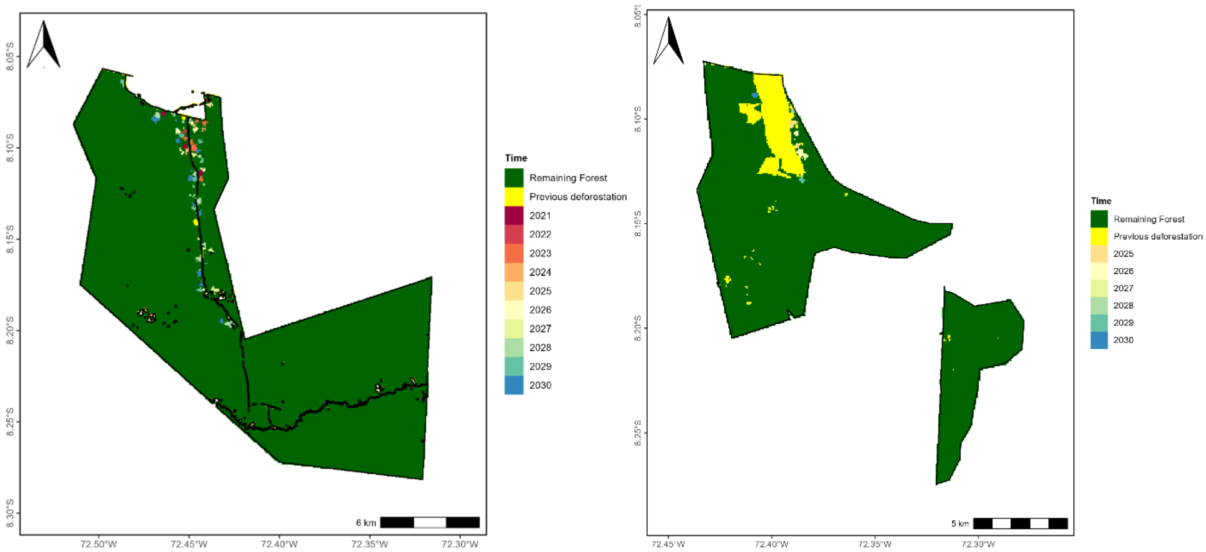


Figure 35. Deforestation projection map in the Reference Region of Juruá REDD+ Project for 2030.



(a) (b)

Figure 36. Simulation of the annual deforestation projection map in the Juruá REDD+ Project's a) Project and b) Leakage Belt, up to 2030.

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 **2,057** hectares per year (0.40%

p.a.) to implement these activities (see section 3.3). Over the next 10 years, a loss of **20,057** hectares is projected in this scenario.

The identification of the underlying causes in the Reference Region were based on the information of the "Acre State's Deforestation Prevention and Combat Plan" PPCD-AC, phase I (ACRE, 2018). And the Ecological-Economic Zoning studies – ZEE Phase III (ACRE, 2021).

The ZEE studied deforestation in relation to the different property units and their evolution, and the PPCD conducted an analysis of the main problems and factors influencing deforestation in the Acre State. Both studies counted with participation of society, which identified that territorial planning issues related to road pavement, land tenure and lack of technical expertise emerged among the main problems. An analysis from the Amazon Institute for Environmental Research (ACRE, 2017) added to this picture the pattern changes from medium and big deforestation parcels to small parcels, specially by family producers, for which more 85% of the rural population has cattle ranching 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 18, 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.

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

The implementation of activities for the management of non-timber forest products (NTFPs) and complementary activities to contain and monitor deforestation caused by the agents of scenario (i), described above, has proven to be the most viable option for the project region. For the Project to be effective in containing deforestation and promoting local socioeconomic development, certain actions are necessary, as well as specific investments. These investments include capacity building and training in the potential lines mapped by the Project, establishing partnerships for the development of activities, and improving practices, among other activities described in Section 1.11. These are investments that are generally not made in forest management operations. Therefore, the economic viability of forest management is significantly reduced without the additional revenue from trading credits registered in the VCS.

Despite the potential contribution of forest management for timber production to forest conservation and maintaining carbon stock, the practice presents significant limitations within the context of the REDD+ Juruá Project. The application of the VT0001 methodology requires the identification of realistic land-use scenarios and an evaluation of their feasibility. In the case of sustainable forest management (SFM), economic, environmental, and social analyses have shown that this alternative is not plausible under regional conditions.

Studies such as those by Barreto et al. (2006) and Schneider et al. (2002) highlight that transportation can represent up to 40% of the total costs of forest operations in the Amazon, in addition to requiring additional infrastructure such as access roads and storage yards, which increase environmental and financial impacts. Moreover, licensing for timber exploration involves bureaucracy and significant costs, making the process even more burdensome. According to Escolhas (2023), forest concessions in Brazil face regulatory challenges that hinder their effective implementation, including high initial costs and lengthy regularization processes, factors that also apply to SFM on private properties.

Additionally, SFM requires greater capital for acquiring machinery and advanced technical training, limiting the involvement of local communities and reducing opportunities for social inclusion. As a highly mechanized activity, it also exposes workers to greater occupational risks, contrasting with NTFP management, which promotes broader community participation and utilizes less technology-intensive methods.

From an environmental perspective, SFM implies greater impacts due to the need for opening access roads and support areas, increasing forest fragmentation and project emissions. This could reduce the generation of Verified Carbon Units (VCUs), reducing the project's effectiveness in mitigating greenhouse gas emissions. Furthermore, market risks associated with SFM, such as fluctuations in demand for certified timber and competition with illegal timber (Escolhas, 2023), add an element of uncertainty that negatively impacts its economic viability.

The economic modeling conducted within the project framework indicates that NTFP management, combined with carbon credit trading, is sufficient to achieve conservation and local development objectives. This combination reduces operational costs, increases community engagement, and minimizes environmental impacts, ensuring greater sustainability for the region.

Therefore, the decision not to adopt forest management as a viable scenario was based on detailed analyses, as required by the VT0001 methodology. This approach ensures that the project aligns with regional conditions and conservation and sustainability objectives, utilizing more suitable and effective activities, such as NTFP management.

ii-b) Management of non-timber forest products, with other complementary REDD+ activities and with registration as an AFOLU VCS Project.

Implementation of non-timber forest product management activities, activities to contain and monitor deforestation caused by the agents of scenario and AFOLU VCS Project certification.

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 37), or 47,820 hectares and average rates of 0.29 ± 0.11% (INPE, 2021).

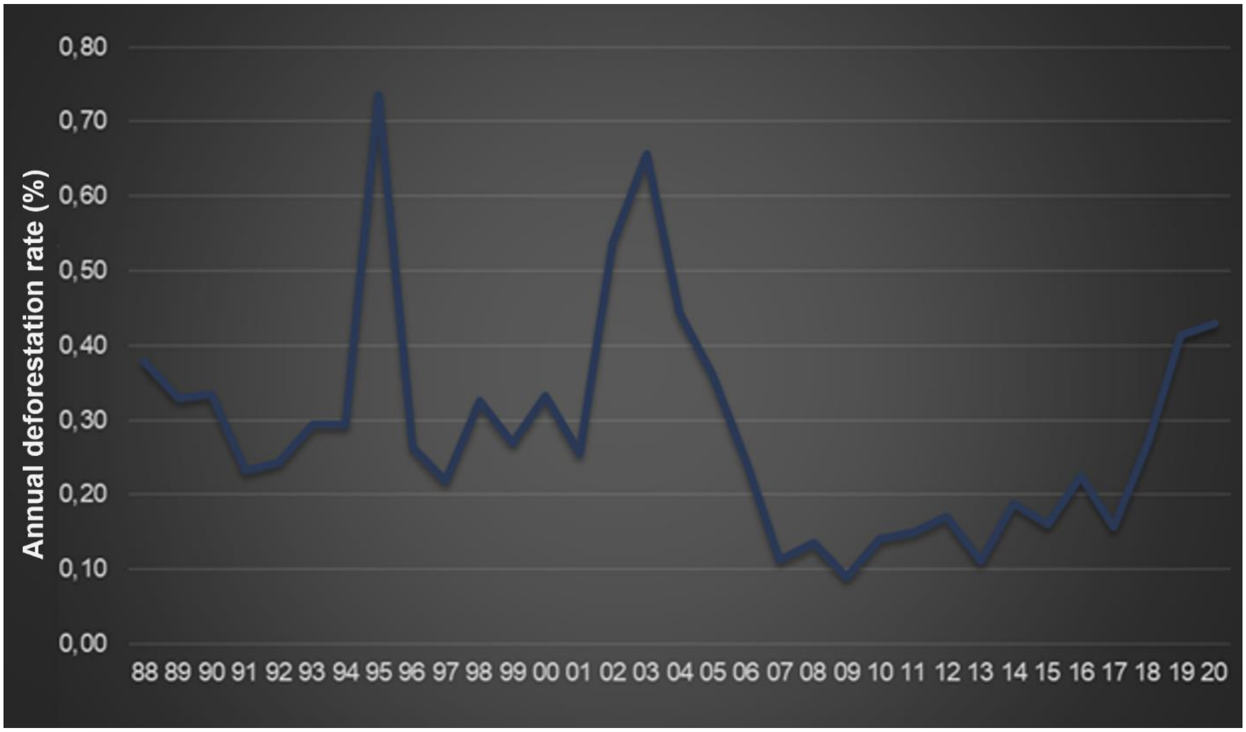


Figure 37. Deforestation dynamics in Acre State (INPE, 2021).

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 was evidenced by sharing documents with VVB that certify ownership of the project area and the proper permits for project activities, such as management licenses and permits for transport of non-timber forest products. When activities are carried out, they will be accompanied by these licenses.

Sub-step 1c. Baseline Scenario Selection

Described in Section 3 - Application of the Methodology, Item 3.4 Baseline Scenario.

Step 2 - Investment Analysis

Sub-step 2a. Defining the Appropriate Analysis Method

Evaluations and comparisons of the results of scenarios (i), (ii) and (ii-b) were made, in which scenario (i) as already described in this document in sub-step 1a, refers to: Continuation of land use activities prior to the Project (baseline scenario), in this scenario there are no financial benefits or any type of revenue 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 already described in sub-step 1a of this document refers to the management of non-timber forest products with REDD+ activities without the registration as an AFOLU VCS Project, whereas scenario (ii-b) is the same scenario (ii) described in this document in sub-step 1a, but with the inclusion of carbon credit revenues, the intent of this scenario is to evaluate if with the carbon credit revenues it would be possible to make the protection of the area viable, In scenario (ii), only with revenues from the management of non-timber forest products, the project had a negative NPV, since the resources from this activity were insufficient to make the protection of the area financially viable. Therefore, a comparative analysis of investments between scenarios (i), (ii) and (ii-b) was performed.

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 31 and Table 32. 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 31. 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 without carbon credit revenues
(ii-b) Management of non-timber forest products with REDD+ activities with registration as an AFOLU VCS Project.	Forest management, with complementary activities of containment and monitoring of deforestation	Trading of non-timber forest products with carbon credit revenues

Table 32. Variables and values considered determine the Project's cash flows.

Activity	Cash flow	Item	Value BRL	Period	Remarks	Scenarios
Forest Management	Revenues	Cat's claw (R$/ton)	1,400.00	2023-2049	Forest management activity licensed by the Environmental Institute of Acre	Scenario II
Forest Management	Costs	Cat's claw (R$/ton)	861.87	2023-2049	Forest management activity licensed by the Environmental Institute of Acre	Scenario II
Forest Management	Expenses	General and Administrative Expenses (annual)	8,000.00	2022-2049	Forest management activity licensed by the Environmental Institute of Acre	Scenario II
REDD+	Expenses	Expenses with REDD+ Activities (Annual Period Average)	1,425,913.17	2022-2049	Forest management activity licensed by the Environmental Institute of Acre with REDD+ activities.	Scenario II

REDD+	Revenues	Medium Generation VCUs (30 Years)	1,003.86 VCUs	2022-2049	Project with REDD+ activities	Scenario II-b
REDD+	Revenues	Average VCUs Price (30 Years)	38.01	2022-2049	Project with REDD+ activities	Scenario II-b
REDD+	Costs	Average Cost VCUs (30 Years)	1.71	2022-2049	Project with REDD+ activities	Scenario II-b

Each cash flow scenario is composed considering the sources described in Table 25. The premises provided in Table 26 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 4,446,072.21 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.

Given this, when we evaluate scenario (ii-b), that is, scenario (ii) described in sub-step 1a, but with the inclusion of the revenue from the carbon credits generated by the project, the project starts to present a positive NPV of R$18,174,090.94. The conclusion, therefore, is that scenario (ii-b) shows the best financial indicator and that the VCS AFOLU Project without the financial benefit of the credits registered in the VCS is not an attractive financial scenario.

Sub-step 2d. Sensitivity Analysis

Table 33 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 33. 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 (cat's claw)	60% of base value	100% of base value
	b. average price per ton (cat's claw)	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 4,653,093.36 for condition a, and BRL 4,549,582.78 for condition b and BRL 4,515,078.00 for condition c. For Perspective 2, all scenarios presented negative VPL of BRL 4,394,316.92 for condition a, and BRL 4,342,561.63 for condition b and BRL 4,377,066.41 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 (Acre, 2021) in Acre State and has a high potential for forest exploitation, due to the low degree of conversion of the region. For the analysis of the Common Practice we used the ZEE land base, hydrography and road network (Acre, 2006 and Acre, 2021), the information collected in the field work, and the evaluation of the activities planned and executed by the landowner. Ten (10) private properties were identified (Table 34) 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 3,664.4 hectares and occupy 6.62% of the Reference Region.

Table 34. Certified private properties located in the Reference Region.

Subtype	Name	Owner	Source	Status	Zones	Area (ha)
Private Property	GLEBA BURITIRANA	ASSOCIAÇAO AGRICOLA DA COLONIA BURITIRANA	INCRA	CERTIFIED	Zone 1	1,284.4
Private Property	FAZ SÃO FRANCISCO	FRANCISCO CLEBER DA COSTA PEDROSA	INCRA	CERTIFIED	Zone 1	2,579.6
Private Property	BOA VISTA REAL ESTATE	MARIO MACIEL DA ROCHA FILHO	INCRA	CERTIFIED	Zone 1	1,502,8
Private Property	FAZENDA CINCO IRMÃOS	CORREIA IRMÃOS	INCRA	CERTIFIED	Zone 1	1,319.2
Private Property	FAZENDA VAL PARAÍSO	EPITÁCIO TOMÉ DE MELO JUNIOR	INCRA	CERTIFIED	Zone 1	4,945.5

Rubber Plantation (Seringal)	SERINGAL ROSA AMÉLIA	FRANCISCO TOMÉ DE OLIVEIRA	INCRA	CERTIFIED	Zone 1	1,286.2
Rubber Plantation (Seringal)	SERINGAL PUCALPA II	ESTATE OF MANOEL BEZERRA CORREIA	INCRA	CERTIFIED	Zone 1	3,847.0
Rubber Plantation (Seringal)	SERINGAL LUCÂNIA PART A	CORREIA IRMÃOS	INCRA	CERTIFIED	Zone 1	6,518.0
Rubber Plantation (Seringal)	SERINGAL LUCÂNIA	CORREIA IRMÃOS	INCRA	CERTIFIED	Zone 1	9,105.6
Rubber Plantation (Seringal)	SERINGAL PORTO ALEGRE	MARIA ODETE ALVES BEZERRA	INCRA	CERTIFIED	Zone 1	4,256.2

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 9,105.6 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. (ACRE, 2021).

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 since 2019. Amazônia Agroindústria is interested in carrying out projects aimed at the environmental conservation of the forest area of the properties, maintaining its ownership, developing environmental and social activities for the surrounding communities and the possibility of identifying new economic vocations for the forest area of the properties through monetization of environmental services from the activities developed on the property.

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.

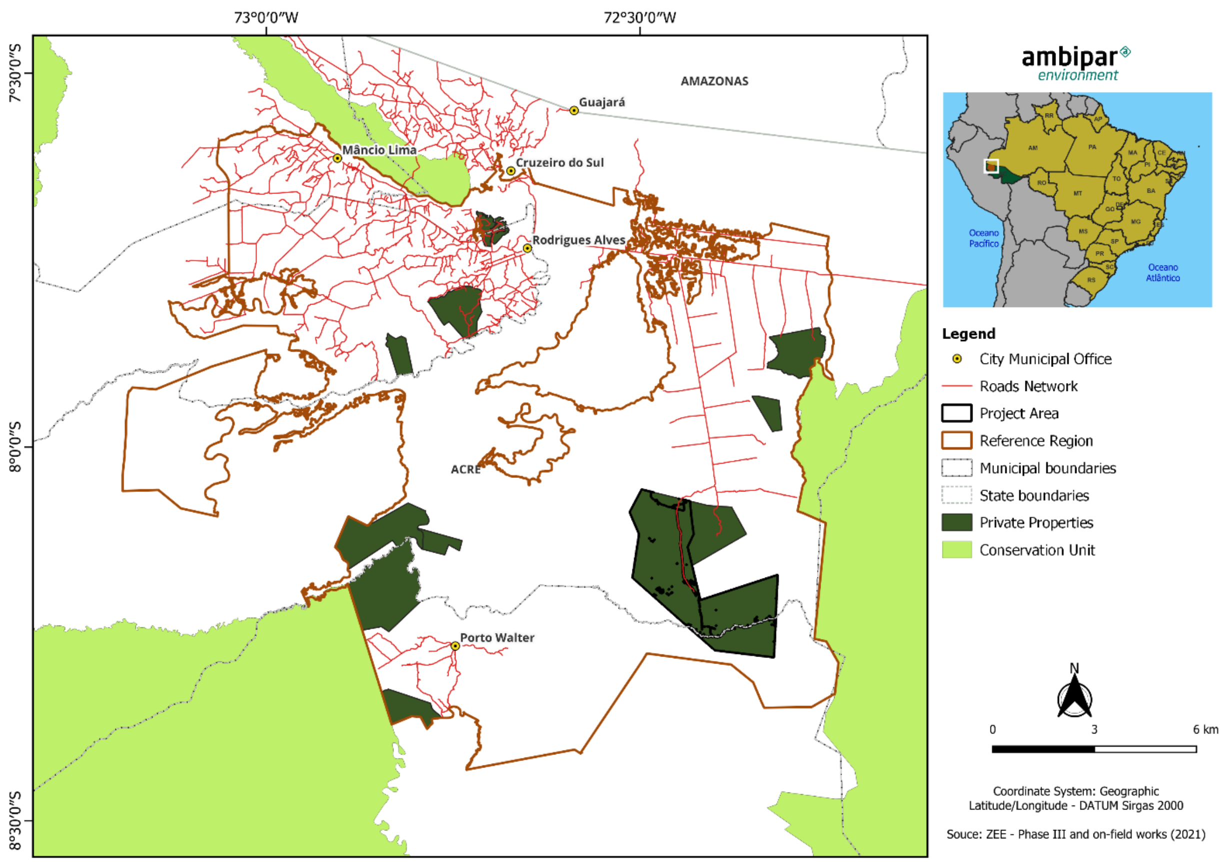


Figure 38. Reference Region map with private properties and conservation units analyzed.

3.6 Methodology Deviations

There are no methodology deviations to report.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

Starting from July 31, 2020, the Juruá REDD+ Project implemented a set of actions focused on the continuous monitoring of deforestation, using high-resolution satellite imagery to ensure detection and immediate response to any deforestation events. Monitoring was carried out through the combination of data from the Brazilian Amazon Forest Monitoring Program by Satellites (PRODES) and the MapBiomas Alert initiative, enhancing the ability to analyze and identify changes in forest cover. Additionally, initial activities such as technical planning (2020–2021), the development of feasibility studies (2020–2021), and baseline determination (2020–2021) established the foundation for mitigation and deforestation control actions. These activities provided essential technical inputs to understand local dynamics and design efficient prevention strategies.

Beyond technological measures, a crucial aspect of the conservation of the Juruá area was the work of engaging with local stakeholders, especially the communities living near the project area. Since the beginning of the project, efforts have been made to establish an ongoing dialogue with these communities, aiming to raise awareness about the project's importance and the benefits of keeping the forest standing. Conversations with residents of the settlement established in the James Road (Ramal do James) were particularly relevant, as our baseline indicated that this area posed a higher risk of deforestation. This interaction with stakeholders, initiated in 2020, was essential in reducing deforestation pressures by promoting awareness and strengthening the commitment to forest conservation.

These interactions were essential for community members to understand the existence and objectives of the Juruá REDD+ Project, including the potential for generating carbon credits and the economic and environmental benefits that can result from forest conservation. Although it is not possible to prove that these conversations directly prevented invasions, they certainly contributed to a better understanding of the project and the consequences of deforestation activities within the project area.

Additionally, to increase effectiveness in combating unauthorized deforestation, from 2022 onwards, property surveillance was intensified with physical presence in the field, enabling quicker and more accurate actions in response to detections made by remote monitoring. This combination of advanced satellite technologies and an active field presence ensured strict enforcement, resulting in a more efficient intervention capacity.

The integrated approach allowed the project to quickly identify deforestation areas and act to control any illegal activities, ensuring that protection measures were implemented before deforestation advanced. The use of annual data from PRODES, complemented by more frequent monitoring from MapBiomas Alert, ensured continuous coverage of risk areas, strengthening control over deforestation dynamics both within the project area and in the Leakage Belt. Although actions such as improving property surveillance (initiated in 2022) and strengthening the management of non-timber forest products (planned for 2022) were implemented at later stages, the initial activities were sufficient to establish effective control and ensure positive results from the start.

The annual bulletins and deforestation data analysis reports enabled adjustments in enforcement strategies throughout the monitoring period, ensuring adaptability and continuous improvement of control actions. The accuracy and quality of data provided by PRODES and MapBiomas Alert allowed the project to act proactively, effectively reducing GHG emissions associated with deforestation. Thus, due to the activities implemented since 2020, such as community engagement and initial remote monitoring, it is concluded that the project achieved 100% deforestation reduction during the first monitoring period, even before the intensification of specific measures in 2022.

These measures ensured that, during the monitoring period, the project achieved the goal of 100% reduction in unauthorized deforestation, significantly contributing to the conservation of carbon stocks in the region and ensuring the environmental integrity of the project area. The positive outcome reflects the Juruá REDD+ Project's commitment to climate change mitigation and forest protection, providing a solid foundation for the continuity of activities and the generation of high-quality carbon credits.

Thus, the monitoring and surveillance strategy of the Juruá REDD+ Project proved effective in maintaining control over the area of influence, acting preventively and ensuring that unplanned deforestation was completely avoided, thereby securing the permanence of the expected environmental benefits. The integration of these activities, from the initial technical planning to the progressive implementation of specific actions, confirms that the project achieved its goal of completely controlling deforestation during the first monitoring period.

The activities described in section 1.11, even though some were not fully implemented during the first monitoring period, play a crucial role in the future strategy of the Juruá REDD+ Project. With the generation of carbon credits and the influx of new financial resources, it will be possible to intensify actions such as strengthening the management of non-timber forest products and implementing, monitoring, and evaluating the activities carried out, aimed at promoting the sustainable use of natural resources and optimizing deforestation control strategies. These complementary activities will be essential to reinforce forest conservation, create sustainable economic alternatives for local communities, and improve monitoring of risk areas. The updating and completion of technical studies, for example, will allow continuous adjustments to the project's actions, ensuring that measures are adapted according to the needs and challenges identified in the field. With these future efforts, it is expected to further enhance the project's effectiveness in preventing unplanned deforestation, ensuring the longevity and positive impact of conservation actions in the region.

The table below provides an overview of the main activities implemented or planned under the Juruá REDD+ Project, including implementation progress, observed or anticipated impacts on GHG emissions, and the methods used for monitoring.

Table 35 - The main activities of the Juruá REDD+ Project are described in the table below and include implementation, impacts, how they were monitored, and the monitoring period of the activities carried out.the Mapbiomas Alert initiative PRODES 2021 covered the period from August 1, 2020 to July 31,

2021 and PRODES 2022 covered the period from August 1, 2021 to July 31, 2022 . As such, MapBiomas Alert data from July 1, 2020 to July 31, 2020 were used to complement PRODES, allowing the identification of deforestation polygons that occurred throughout the monitored period. The metodology the accuracy of the PRODES and MapBiomas Alert data was described in more detail in section 7.3.2.

Activity	Description	Implementation	Impact on GHG Emissions	How Implementation Was Monitored	Monitoring Period
1.Initial Coordination and Planning					
1.1 Technical meetings with the owner and their representatives to plan and design the Project, as well as to define the hiring of companies for all subsequent stages	Meetings between the owner, the technical team, developers, and managers to plan project activities, from conception to validation and first verification.	Started in 2020	Indirectly contributes to planning activities that will reduce GHG emissions.	Monitored through meeting minutes and records.	Activity completed in 2021
1.2 Researching potential partners and identifying strategic institutions	Identifying local, national, and international partners, such as consultants, researchers, and institutions that could contribute to project development.	Started in 2020	Indirectly contributes to strengthening the project and its capacity to reduce GHG emissions.	Monitored through meeting minutes and records.	Continues throughout the entire monitoring period and project duration.
1.3 Allocation of resources for project construction and financing of initial stages	Project financing with own resources, including the use of property infrastructure, such as vehicles and a single-engine Cessna Skylane 182, used in natural resource assessment actions.	Started in 2020	Financial support for structuring and developing activities that directly impact GHG emissions reduction.	Monitored and verified by the proponent Amazônia Agroindústria EIRELI.	Activity completed in 2020
1.4 Contract signing	Contract signing between the bidders.	Started in 2022	Process of project implementation.	Legal and administrative monitoring of contract execution by the proponents.	Activity completed in 2022
2. Project design and concept, with initial studies					
2.1 Feasibility study construction	Initial assessment of financial indicators, such as Net Present Value, Internal Rate of Return, Benefit-Cost Ratio (B/C), and Project Pay-Back.	Started in 2020	Contributes to the selection of solutions that result in lower GHG emissions.	Monitored through legal and administrative execution of contracts by the proponents.	Activity completed in 2021
2.2 Structuring and construction of the project's geographic information system	Development of a geographic database adjusted to the official cartographic base of the State of Acre, enabling more detailed analyses at	Started in 2020	Provides the foundation for implementing deforestation prevention actions, contributing to GHG emissions reduction.	Continuous monitoring of the database and adjustments.	Activity completed in 2021, but analyzed and monitored throughout the project.

	the property level, through partnership with Lavrado.				
2.3 Socioeconomic assessment and natural resources evaluation	Studies conducted by Ambiental Amazônia, Lavrado, and Impacto Plus, involving 10 specialized technicians, enabling the characterization of the Project Area and its surroundings in terms of socioeconomic aspects, vegetation, biodiversity, and climate, hydrology, geology, geomorphology, and soils.	Started in 2020	Data collected help formulate strategies that reduce GHG emissions in the local context.	Annual reports and reviews of socioeconomic impact.	Activity completed in 2021
2.4 Estimation of forest and soil carbon stocks	Studies developed in partnership with Lavrado to estimate forest carbon stock for the Project Area based on forest inventory data already carried out in the area, as well as soil carbon stock estimation (up to 100 cm) through soil profile sampling within the project construction framework.	Started in 2020	Essential for estimating GHG emissions reductions and generating carbon credits.	Annual reviews based on new analyses conducted.	Activity completed in 2022, but analyzed and monitored throughout the project.
2.5 Baseline determination and potential generation of carbon credits	Initial assessment of the baseline and the project's credit potential.	Started in 2020	Crucial for calculating emissions reduction and eligibility for credits.	Monitored through periodic reviews.	Activity completed in 2022, but analyzed and monitored throughout the project.
2.6 Stakeholder consultation and engagement	Six meetings were held with stakeholders to present and discuss the project and to foster engagement in forest conservation	Started in 2020	Allows the project to be adjusted to maximize stakeholder acceptance and create environmental awareness, generating impacts on GHG emissions reduction.	Monitored through records of consultations and meeting minutes.	Continuously monitored through the Project's Communication Channels and engagement campaigns.
2.7 Preparation of the project description document	Development of the project description document according to the criteria defined by VCS	Started in 2020	Directly contributes to the project's eligibility for carbon credits generation.	Monitored through periodic reviews and audits.	Activity completed in 2022, but analyzed and monitored throughout the project.
3. Management and development					
3.1 Improvement of property surveillance	Development of actions to improve property surveillance to mitigate and prevent unplanned deforestation in the Project Area, as well as the consequent reduction of greenhouse gas emissions, through	Started in 2022	Direct impact on GHG emissions reduction by preventing unplanned deforestation.	Monitoring reports, detection, and immediate reports alongside LandViewer satellite images.	Continuously monitored

	physical presence in the field.				
3.2 Deforestation monitoring using satellite images	Promote remote monitoring of deforestation, contributing to understanding the dynamics of deforestation and, consequently, improving field interventions.	Started in 2021	Directly contributes to deforestation prevention and the consequent reduction of GHG emissions.	Satellite images analyzed monthly.	Continuously monitored
3.3 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 mapped potential lines, as well as the implementation of partnerships for the development of selected actions.	Planned for post-verification	Helps in forest conservation by involving local stakeholders, contributing to emissions reduction by valuing the ecosystem.	Reports on economic and ecological impact.	Activity not yet started, planned to begin after verification, using resources from carbon credits revenue and continue throughout the project duration.
3.4 Implementation, monitoring, and evaluation of activities carried out	Monitor the status and execution of each activity, as well as their results, through the strategies defined in the monitoring plan, allowing continuous evaluation of what will be carried out, enabling the incorporation of learning and improvements.	Planned for post-verification	Continuous evaluation allows adjustments that improve the efficiency of GHG emissions reduction.	Annual reviews and continuous monitoring.	Activity not yet started, planned to begin after verification, using resources from carbon credits revenue and continue throughout the project duration.
3.5 Updating and complementing studies	Conducting technical studies required for the development of Project activities throughout its duration and subsequent verification, such as: review of baseline study, complementing natural and socioeconomic resource studies using secondary and/or primary data, among other actions as needed.	Started in 2022	Provides updated foundations for strategies that reduce GHG emissions.	Annual reports on the progress of studies and recommendations for adjustments.	Planned to continue throughout the project duration.

Additionally, **Table 35A below provides a synthesized overview of each project activity that directly contributed to GHG emissions reductions, along with their respective indicators, results, and outcomes.**

Table 35A – Summary of Project Activities: Implementation Status, Monitoring, and Contribution to GHG Emission Reductions

Activity	Start Date	Indicator Goal	Implementation Status	Indicator Result	How It Was Monitored	Outcome on GHG Emissions
Satellite deforestation monitoring	2021	Full year monitoring of Project Area and Leakage Belt	Fully implemented: all project area and leakage belt were monitored during the monitoring period	100% of Project Area and Leakage Belt monitored during the Monitoring Period	Satellite data analysis; reports generated by project team.	Allowed timely detection of deforestation alerts and contributed directly to emissions reduction.
Stakeholder engagement	2020	At least one stakeholder engagement campaign per year	Fully implemented	6 stakeholders meetings were held during the monitoring period	Field visit records; meeting notes; VVB confirmation during audit.	Raised awareness and reduced direct deforestation pressure from the main vector "James branch" and neighbors.
On-site surveillance activities	2022	Full year Project Area surveillance	Implemented in 2022 but after July	Since it occurred after July 30, 2022, it is not applicable to this monitoring period.	N/A	Since it occurred after July 30, 2022, it is not applicable to this monitoring period.
Strengthening of non-timber forest product (NTFP) management	Planned for post-verification	At least 1 action per year	To be implemented post-verification.	N/A	N/A	Future contribution expected through forest valorization and sustainable income.
Monitoring and evaluation of project activities	Planned for post-verification	At least 1 report per year	To be implemented post-verification.	N/A	N/A	Future support to project management and impact tracking.

5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 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)

As stated in section 3.4, step 2 of VM0015, the project adopts only one forest class as initial class. The Project baseline projections results indicate deforestation of approximately 10,962 hectares for the Project Area from July, 2020 to July, 2050 (Table 36) and 3,750 hectares for Leakage Belt (Table 37). The maps in Figures 31 and 32 (section 3.4 Baseline Scenario, step 4.2.4 of VM0015) show the spatial deforestation projection in the Reference Region and Project Area respectively.

Table 36. 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
Jul/20 – Jul/21	16	16	16
Jul/21 – Jul/22	21	21	37
Jul/22 – Jul/23	23	23	59
Jul/23 - Jul/24	17	17	76
Jul/24 - Jul/25	19	19	95
Jul/25 - Jul/26	6	6	101
Jul/26 - Jul/27	18	18	120
Jul/27 - Jul/28	6	6	125
Jul/28 - Jul/29	8	8	133
Jul/29 - Jul/30	12	12	145
Jul/30 - Jul/31	52	52	197
Jul/31 - Jul/32	43	43	241
Jul/32 - Jul/33	39	39	279
Jul/33 - Jul/34	57	57	337
Jul/34 - Jul/35	56	56	392
Jul/35 - Jul/36	42	42	434
Jul/36 - Jul/37	27	27	461
Jul/37 - Jul/38	36	36	497
Jul/38 - Jul/39	55	55	552
Jul/39 - Jul/40	84	84	636
Jul/40 - Jul/41	65	65	700
Jul/41 - Jul/42	62	62	762
Jul/42 - Jul/43	136	136	897
Jul/43 - Jul/44	71	71	968
Jul/44 - Jul/45	84	84	1,052
Jul/45 - Jul/46	74	74	1,126

Jul/46 - Jul/47	113	113	1,239
Jul/47 - Jul/48	67	67	1,306
Jul/48 - Jul/49	65	65	1,371
Jul/49 - Jul/50	91	91	1,462

Table 37. 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)
Jul/20 - Jul/21	0	0	0
Jul/21 - Jul/22	0	0	0
Jul/22 - Jul/23	0	0	0
Jul/23 - Jul/24	0	0	0
Jul/24 - Jul/25	4	4	4
Jul/25 - Jul/26	0	0	4
Jul/26 - Jul/27	5	5	9
Jul/27 - Jul/28	9	9	18
Jul/28 - Jul/29	9	9	27
Jul/29 - Jul/30	12	12	39
Jul/30 - Jul/31	10	10	49
Jul/31 - Jul/32	0	0	49
Jul/32 - Jul/33	3	3	52
Jul/33 - Jul/34	16	16	68
Jul/34 - Jul/35	4	4	72
Jul/35 - Jul/36	16	16	88
Jul/36 - Jul/37	5	5	93
Jul/37 - Jul/38	0	0	93
Jul/38 - Jul/39	21	21	114
Jul/39 - Jul/40	11	11	126
Jul/40 - Jul/41	37	37	163
Jul/41 - Jul/42	11	11	174
Jul/42 - Jul/43	36	36	210
Jul/43 - Jul/44	11	11	221
Jul/44 - Jul/45	20	20	241
Jul/45 - Jul/46	6	6	247
Jul/46 - Jul/47	3	3	251
Jul/47 - Jul/48	18	18	269
Jul/48 - Jul/49	26	26	294

Jul/49 - Jul/50	15	15	309

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

As stated in section 3.4, step 2 of VM0015, the project adopts only one anthropic vegetation as final class. The 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). The maps in Figures 31 and 32 (section 3.4 Baseline Scenario, step 4.2.4 of VM0015) show the spatial deforestation projection in the Reference Region and Project Area respectively. Table 38 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 38. 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	29,085	100	0	0%	29,085	100
Total area of each class fcl		**29,085**	**100**	**0**	**0%**	**29,085**	**100**

The projected area to be deforested is reported in Table 40 (for Project Area) and Table 41 (for leakage belt).

Table 39. 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
Jul/20 - Jul/21	16	16	16
Jul/21 - Jul/22	21	21	37
Jul/22 - Jul/23	23	23	59
Jul/23 - Jul/24	17	17	76
Jul/24 - Jul/25	19	19	95
Jul/25 - Jul/26	6	6	101
Jul/26 - Jul/27	18	18	120

Jul/27 - Jul/28	6	6	125
Jul/28 - Jul/29	8	8	133
Jul/29 - Jul/30	12	12	145
Jul/30 - Jul/31	52	52	197
Jul/31 - Jul/32	43	43	241
Jul/32 - Jul/33	39	39	279
Jul/33 - Jul/34	57	57	337
Jul/34 - Jul/35	56	56	392
Jul/35 - Jul/36	42	42	434
Jul/36 - Jul/37	27	27	461
Jul/37 - Jul/38	36	36	497
Jul/38 - Jul/39	55	55	552
Jul/39 - Jul/40	84	84	636
Jul/40 - Jul/41	65	65	700
Jul/41 - Jul/42	62	62	762
Jul/42 - Jul/43	136	136	897
Jul/43 - Jul/44	71	71	968
Jul/44 - Jul/45	84	84	1,052
Jul/45 - Jul/46	74	74	1,126
Jul/46 - Jul/47	113	113	1,239
Jul/47 - Jul/48	67	67	1,306
Jul/48 - Jul/49	65	65	1,371
Jul/49 - Jul/50	91	91	1,462

Table 40. 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
Jul/20 - Jul/21	0	0	0
Jul/21 - Jul/22	0	0	0
Jul/22 - Jul/23	0	0	0
Jul/23 - Jul/24	0	0	0
Jul/24 - Jul/25	4	4	4
Jul/25 - Jul/26	0	0	4
Jul/26 - Jul/27	5	5	9
Jul/27 - Jul/28	9	9	18

Jul/28 - Jul/29	9	9	27
Jul/29 - Jul/30	12	12	39
Jul/30 - Jul/31	10	10	49
Jul/31 - Jul/32	0	0	49
Jul/32 - Jul/33	3	3	52
Jul/33 - Jul/34	16	16	68
Jul/34 - Jul/35	4	4	72
Jul/35 - Jul/36	16	16	88
Jul/36 - Jul/37	5	5	93
Jul/37 - Jul/38	0	0	93
Jul/38 - Jul/39	21	21	114
Jul/39 - Jul/40	11	11	126
Jul/40 - Jul/41	37	37	163
Jul/41 - Jul/42	11	11	174
Jul/42 - Jul/43	36	36	210
Jul/43 - Jul/44	11	11	221
Jul/44 - Jul/45	20	20	241
Jul/45 - Jul/46	6	6	247
Jul/46 - Jul/47	3	3	251
Jul/47 - Jul/48	18	18	269
Jul/48 - Jul/49	26	26	294
Jul/49 - Jul/50	15	15	309

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)

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

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

The objective of this step is to obtain an estimate of the carbon density for the existing initial classes in the Project Area and Leakage Belt, which in the case of Juruá REDD+ Project consists in only one forest class. For estimation, the project used secondary data on aboveground carbon density and expansion factors from the literature. The source data and parameters, as well as the stepwise calculations are in accordance with VM0015 criteria, as shown below.

Data validity

According to the VM00015 methodology[4], average carbon stock density estimates for the LULC classes in project area and leakage belt can be obtained from data of local studies, as long as the data satisfy the following criteria:

1. The data is from up to 10 years prior to the project start date.

   The project use results published in 2011 by Salimon et al to estimate the average aboveground tree carbon density (project start date is 2020). We also used the study of Nogueira et al, published in 2008, to obtain expansion factors only (not carbon data), and a IPCC publication of 2006 to obtain a standard ratio of belowground biomass to aboveground biomass.

2. The Data was collected at multiple forest inventory plots.

   Salimon et al (2011) used 44 plots to estimate the average aboveground tree carbon density for several forest types across the Acre State in 2011. The measured DBH of each individual tree was converted to aboveground biomass by using the allometric equation developed by Brown (1997), which was adequate for forests in Acre, according to the study.

3. All trees above 30cm DBH are measured.

   Salimon et al (2011) study measured all trees above 10cm of DBH in each plot.

4. Inventory plots are representative of the classes they will be extrapolated.

   As indicated in section 1.13, topic "Vegetation", the Project Area consists of the forest typologies FAP+FAB, FAP+FAB+FD, FAP+FD+FAB and FAP-Alluvial. In Table 41 of Salimon et al (2011), the study presents the forest typologies of each inventory sample, providing carbon stock data for 8 different typologies. From these 8 typologies, four forest typologies are also found in the Project Area (FAB+FAP, FAP+FAB, FAP +FD and FAP-Alluvial), as Table 42 below shows.

Table 41. Selection of samples from the table 2 of Salimon et al (2011) study that are in the same forest typologies of the Project Area.

Forest class	Present in Project Area or Leakage Belt?	Sample Size (ha)	Number of trees
FAB	No	6	475
FAB + FAP	Yes	6	189
FAB + FAP	Yes	6	199
FAB + FAP	Yes	10	346
FAP	No	6	582
FAP	No	1	590
FAP	No	1	295
FAP	No	1	509
FAP	No	6	235
FAP + FAB	Yes	6	234

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FAP + FAB	Yes	6	309
FAP + FAB	Yes	6	206
FAP + FAB	Yes	6	333
FAP + FAB	Yes	1	421
FAP + FD	Yes	6	190
FAP + FD	Yes	6	195
FAP + FD	Yes	6	192
FAP + FD	Yes	6	187
FAP + FD	Yes	6	187
FAP + FD	Yes	6	228
FAP + FD	Yes	6	195
FAP + FD	Yes	6	661
FAP + FD	Yes	6	465
FAP + FD	Yes	6	369
FAP + FD	Yes	6	237
FAP + FD	Yes	6	256
FAP + FD	Yes	6	263
FAP + FD	Yes	6	157
FAP + FD	Yes	6	147
FAP + FD	Yes	6	116
FAP + FD	Yes	1	535
FAP + FD	Yes	1	268
FAP + FD	Yes	1	276
FAP + FD	Yes	1	686
FAP + FD	Yes	1	417
FAP + FD	Yes	1	325
FAP + FD	Yes	1	536
FAP-Alluvial	Yes	6	391
FAP-Alluvial	Yes	6	305
FD	No	1	481
FD	No	1	573
FD + FAS	No	1	535
FDS	No	1	309

5. To improve the accuracy of the forest class carbon stock average, the project used the typology classification from Salimon et al (2011) article with the corresponding forest typologies within the Project Area and Leakage Belt. We show later that the average carbon densities of the forest typologies found in the PA and LB are not statistically different, and therefore, we did not further stratify the forest class for calculation of emission factors, and used Salimon et al's carbon stock averages and standard deviations per forest typology only to improve precision of our estimates in the Project Area and Leakage Belt.

Table 42. Average carbon density of each forest typology in the Salimon et al (2011) study.

Forest typologies in the Project Area (PA) and Leakage Belt (LB)	Forest typologies in Salimon et al (2011)	Total sampled area (ha)	Number of plots	Area of the class in the PA	Area of the class in the LB	Area of the class in the Pa and LB	% of the forest class in the PA and LB
FAB + FAP	FAB + FAP	22	3	12,932	3,021	15,953	46.5%
FAP + FD + FAB	FAP + FD	109	24	3,527	188	3,715	10.8%
FAB + FAB + FD	FAP + FAB	31	6	7,572	7,022	14,594	42.5%
FAP Alluvial	FAP Alluvial	12	2	45	0	45	0.1%
Total		174	35	24,076	10,231	34,307	100.0%

<u>Demonstration of accuracy and conservatism of the estimates</u>

The project used the carbon factor of **0.44** for tropical forests, provided in Table 4.3 in Chapter 4 of the 2006 IPCC Guidelines (Aalde et al, 2006). For the root-shoot ratio (ratio of belowground to aboveground biomass), use used a value of **0.22**, which is the lower bound for the IPCC default for **tropical moist forest** (Table 4.4 of the 2006 IPCC Guidelines, Chapter 4). This is the most appropriate standard value for forests in Acre given the definitions in Table 4.1 of the IPCC Guidelines and climatic description of the project area in Section 1.3 (up to five-month dry season). As for aboveground biomass and deadwood biomass expansion factors, Nogueira et al (2008) reported for Open Forests in the Brazilian Amazon - the dominant forest type in Acre, including the Project Area and Leakage Belt (section 1.13) - the carbon of palms, lianas and non-tree biomass, but didn't provide confidence intervals, so a 30% conservativeness discount was applied to all carbon stocks, as recommended by VM0015[5] when using literature expansion factors for which no confidence interval accompanies the corresponding published estimate.

Table 43. Application of 30% discount on the expansion factors of Open Forest class from Nogueira et al (2008) study.

Source	Trees < 10 cm DBH	Palms	Lianas	Deadwood biomass	Other non-tree	Total
Open Forest Nogueira et al	0.04	0.086	0.031	0.137	0.002	0.296
30% discount	0.028	0.0602	0.0217	0.0959	0.0014	0.2072

[5] When defaults are used, the <u>lowest value</u> of the range given in the literature source (or the value reduced by 30%) must be used for the forest classes, and the <u>highest value</u> (or the value augmented by 30%) for non-forest classes.

Carbon stock calculation, sampling error and uncertainty assessment

In this section we show formulas for calculation of the average aboveground carbon density estimate for the initial forest class. Note again that there is only one forest class and thus, a single estimate. Forest typologies are used only to obtain the overall average, since the relative areas of each forest typology in Salimon et al (2011) and the project area and leakage belt differ. The distinction between the forest class and forest typology is made in reference to their respective subscrits: *cl* for forest class and *k* for forest typology.

An forest typology area-weighted average aboveground tree carbon density estimate for the initial forest class the Project Area and the Leakage Belt was calculated. For that, first the aboveground biomass average and standard deviation for each forest typology was calculated, as shown by the equations below:

Aboveground biomass average (in Mg C/ha) for each forest typology

$$\overline{Cab_k} = \frac{\sum_i Cab_{k,i}}{n_k}$$

Where:

$\overline{Cab_k}$: average aboveground carbon density (in Mg C/ha) of the forest typology *k*;
$Cab_{k,i}$: aboveground carbon density (in Mg C/ha) of sample *i* in forest typology *k*;
n_k: number of samples in the forest typology *k*.

Table 44. Average carbon density estimates found in Salimon et al (2011) for forest typologies in common with the Project area and Leakage Belt.

Forest typology in the Project Area (PA) and Leakage Belt (LB)	Forest typology in Salimon et al (2011)	Average aboveground biomass (Mg C / ha)	% of the forest class in the PA and LB
FAB + FAP	FAB + FAP	82.13	46.5%
FAP + FD + FAB	FAP + FD	110.84	10.8%
FAB + FAB + FD	FAP + FAB	103.55	42.5%
FAP Alluvial	FAP Alluvial	96.36	0.1%

Secondly, the standard deviation and standard error was calculated of each forest typology, as shown by the equations below.

Aboveground carbon standard deviation for each forest typology (σCab_{cl})

$$\sigma Cab_k = \sqrt{\frac{\sum(Cab_{k,i} - \overline{Cab_k})^2}{n_k - 1}}$$

Where:

σCab_k: standard deviation aboveground carbon density (in Mg C/ha) of the forest typology *k*;

$Cab_{k,i}$: aboveground carbon density (in Mg C/ha) of sample *i* in forest typology *k*;

n_k: number of samples in the forest typology *k*.

Standard error of the average carbon density for each forest typology

$$SE_k = \frac{\sigma Cab_k}{\sqrt{n_k}}$$

Where:

σCab_k: standard deviation of each forest typology

n_k: number of samples in the forest typology *k*.

Table 45. Standard deviation and standard error found in Salimon et al (2011) for forest typologies in common with the Project area and Leakage Belt.

Forest typology in the Project Area (PA) and Leakage Belt (LB)	Forest typology in Salimon et al (2011)	Number of samples used	Standard Deviation	Standard Error
FAB + FAP	FAB + FAP	3	8.99	5.19
FAP + FD + FAB	FAP + FD	24	45.73	9.34
FAB + FAB + FD	FAP + FAB	6	9.67	3.95
FAP Alluvial	FAP Alluvial	2	24.27	17.16

Finally, the estimate of the average aboveground carbon density (in Mg C/ha) and the statistical assessment was made for the forest class in the PA and LB, as shown by the equations below.

Aboveground carbon density for the forest class in the Project Area and Leakage Belt

$$\overline{Cab}_{cl} = \sum_k \overline{Cab}_k \times P_k$$

Where:

$\overline{Cab}_{cl}$: area-weighted average aboveground carbon density (in Mg C/ha) of the forest class *cl*. We consider only one forest class in the PA and LB;
$\overline{Cab}_k$: average aboveground carbon density (in Mg C/ha) of forest typology *k*;
P_k: Proportion of forest typology k in the PA and LB in relation to total forest area in these regions.

Standard error of the average carbon density estimate for the forest class in the Project Area and Leakage Belt

$$SE_{cl} = \sqrt{\sum_k SE_k^2 \times P_k^2}$$

Where:

SE_{cl}: standard error of aboveground carbon density estimate for the forest class *cl*. We consider only one forest class for the PA and LB;

P_k: Proportion of forest typology k in the PA and LB in relation to total forest area in these regions.

<u>90% confidence interval for the aboveground carbon density estimate for the forest class cl</u>

$$90\%CI_{cl} = \overline{Cab}_{cl} \pm t_{0,95;\, n-1} \times SE_{cl}$$

Where:

$90\%CI_{cl}$: 90% confidence interval for the average carbon density for forest class *cl.* We consider only one forest class for the PA and LB;

$\overline{Cab}_{cl}$*: Average carbon density of forest class cl;*

$t_{0,95;\, n-1}$: t-value

SE_{cl}: standard error of the average carbon density estimate for the forest class *cl*.

<u>Uncertainty estimate for forest class cl</u>

$$U\% = \frac{90\%CI_{cl}}{\overline{Cab}_{cl}} \times 100\%$$

Where:

$U\%$: Uncertainty estimate, as instructed by the VM0015 Methodology.

$90\%CI_{cl}$: 90% confidence interval for the average carbon density for forest class *cl.* We consider only one forest class for the PA and LB;

$\overline{Cab}_{cl}$*: Average carbon density of forest class cl;*

As stated in section 3.4, step 2, and in the formulas above, the project adopts only one forest class as the initial class. We did not further stratify the forest class into forest typology for the purpose of emission factor calculations, as the estimates of the average aboveground carbon density did not differ statistically using Salimon et al's data (Table 46).

Table 46. Confidence intervals of the average carbon density estimates for the different forest typologies found in the Project Area and Leakage Belt overlap.

Forest Typologies	Average aboveground biomass (Mg C / ha)	90% CI (sampling error)	Lower 90% CI Limit	Upper 90% CI Limit
FAB + FAP	82.13	15.15	66.98	97.29
FAP + FD + FAB	110.84	16.00	94.84	126.84
FAB + FAB + FD	103.55	7.95	95.59	111.50
FAP Alluvial	96.36	108.34	0.00	204.70
Overall	**94.4**	**5.26**	**89.11**	**99.63**

As can be seen in Table 47 above, the 90% CIs overlap. Thus, the average carbon densities of the different forest typologies are not statistically different. Therefore, forest typologies were only used to increase precision due to the unbalancing of the samples of Salimon et al (2011) in relation to forest typologies in the PA and LB. The calculated area-weighted average **aboveground biomass of trees >10cm DBH** for the Project Area and Leakage Belt is **94.4 Mg C/ha**, with an area-weighted standard error of **3.11.** Its calculated sampling error (90% CI's half-width) is **5.26 MgC/ha** and its uncertainty is thus **6%.**

Using this data and expansion factors, the calculated area-weighted average aboveground tree carbon dioxide equivalent stock density (hereafter called only "carbon density") for the project area and leakage belt is **346.0 $tCO2_{-e}$ ha^{-1}**, with an estimated sampling error (90% CI's half-width) of **19.3 $tCO2_{-e}$ ha^{-1}.** Conversion from MgC to tCO_{2e} was done by tCO_{2e} = MgC x 44/12.

Because we are using conservative expansion factors, their **uncertainty is considered equal to zero** and the uncertainties of the different carbon pools were calculated as proportional to the uncertainty of average aboveground tree biomass, as per VM0015. Table 47 shows the resulting estimates of average carbon dioxide density ($tCO2_{-e}ha^{-1}$) for aboveground, belowground and dead wood carbon pools, with their respective uncertainty estimates. We calculated the average total carbon stock density for the project area and leakage belt as **493.8 $tCO_{2-}eha^{-1}$** (Table 48), with an uncertainty of **5.7%**. All calculations use equations in the VM0015 and were documented and provided to the VVB.

Table 47. 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}
384.5	22.2	76.1	4.2	33.2	1.8	493.8	28.2

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 carbon stocks from local studies, so the post-deforestation carbon stock was obtained by verifiable sources (Salimon & Brown, 2000 ; Salimon et al, 2011), through a long-term study of the landscape and average anthropic composition in deforested areas of the Brazilian Amazon, specifically in the Acre State.

The references satisfy different quality indicators, such as:

1. The data was collected from verifiable secondary sources;

2. The data are from a period that accurately reflects current practice available for carbon stock determination in the region of the project;

3. The data is publicly available via website: https://www.redalyc.org/pdf/339/Secondary_forests_in_western_amazonia.pdf. Accessed on October 08, 2024; and https://www.sciencedirect.com/science/article/abs/pii/S0378112711002404. Accessed on October 08, 2024.

4. Available for independent assessment for VCSA and VVB.

According to a study carried out in the Acre State by Salimon and Brown (2000), the accumulation of aerial biomass can vary according to the year of abandonment, that is, depending on how long the secondary forest has been regenerating after deforestation. Thus, between 6 and 30 years, biomass can range from 32 Mg/ha (5.4 Mg/ha/year) to 90 Mg/ha (3 Mg/ha/year). Therefore, since secondary forests can have a wide range of biomass, we used average values from sites 6–30 years since abandonment, obtaining an average of 53.5 Mg/ha of accumulated biomass in secondary vegetation.

Salimon et al (2011) in a study for "Estimating state-wide biomass carbon stocks for a REDD plan in Acre State, Brazil", have considered an average of 16 Mg/ha of accumulated aerial biomass in pasture. The study does not mention whether the stock has significant variation over 20 years.

Based on the data obtained from the study and the previously mentioned assumptions, it was possible to estimate the post-deforestation carbon stock, considering the estimated average biomass for pastures and secondary forest, as shown in the table below:

Table 48 - The post-deforestation carbon stock, considering the estimated average biomass for pastures and secondary forest.

Carbon stock according to SALIMON & BROWN (2000)[1] and SALIMON et al (2011)[2]		
LU/LC	Biomass (t/ha)	Carbon (tC/ha)
Secondary vegetation[1]	53.5	24.1
Pasture[2]	16.0	7.2

The value of the post-deforestation average carbon stock under the project scenario was obtained considering the proportion of pasture and secondary forest area present in the reference region, as shown in the table below:

Table 49 - Post-deforestation average carbon stock under the project scenario was obtained considering the proportion of pasture and secondary forest area present in the reference region.

Area weighted average carbon stock after deforestation in the reference region

LU/LC	Area	%	Biomass (t/ha)	Carbon (tC/ha)	tCO2e	tCO2e/ha
Secundary vegetation	5,445	19%	291,308	128,175	469,976	86.3
Pasture	23,640	81%	378,240	166,426	610,227	25.8
Total	29,085	100%	669,548	294,601	1,080,203	37.1

A discount was considered due to an uncertainty of 20%, resulting in a value of **37.1 tCO_{2e} ha^{-1}**. This value has taken as the reference for the carbon stock of the <u>anthropogenic vegetation in the equilibrium class</u> that was expected to exist in the Project Area and Leakage Belt under the Project scenario, as shown in the table 50 and 51.

Table 50. Long-term average carbon stocks per hectare of post-deforestation LU/LC classes present in the reference region (Table 16 of VM0015 Methodology).

Project year *t*	Post deforestation class *fcl*											
	Name:	Anthropic vegetation in Equilibrium										
	ID_{fcl}	1										
	Average carbon stock per hectare + 90% CI											
	Cab_{icl}		Cbb_{icl}		Cdw_{icl}		Cl_{icl}		$Csoc_{icl}$		$Ctot_{icl}$	
	average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% 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}	tCO_2e ha^{-1}	tCO_2e ha^{-1}	tCO_2e ha^{-1}	tCO_2e ha^{-1}
Average to be used in calculations	-	-	-	-	-	-	-	-	-	-	37.1	-

Table 51. Area weighted long-term (20 years) average carbon stocks per zone z (Table 17 of VM0015 Methodology)

Zone	Area weighted long-term (20 years) average carbon stocks per zone z					
	Name:	Anthropic vegetation in Equilibrium				
	ID_{fcl}	1				
	Cab_z	Cbb_z	Cdw_z	Cl_z	$Csoc_z$	$Ctot_z$

	C stock	C stock	C stock	C stock	C stock	C stock
	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$
Zone 1						40.9

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 52 and Table 53 summarize how the carbon stock change factor was calculated.

Table 52. 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*	384.5	7.6	3.3	395.5
2	t*+1	0	7.6	3.3	10.9
3	t*+2	0	7.6	3.3	10.9
4	t*+3	0	7.6	3.3	10.9
5	t*+4	0	7.6	3.3	10.9
6	t*+5	0	7.6	3.3	10.9
7	t*+6	0	7.6	3.3	10.9
8	t*+7	0	7.6	3.3	10.9
9	t*+8	0	7.6	3.3	10.9
10	t*+9	0	7.6	3.3	10.9
11	t*+10	0	0	0	0
12	t*+11	0	0	0	0
13	t*+12	0	0	0	0
14	t*+13	0	0	0	0
15	t*+14	0	0	0	0
16	t*+15	0	0	0	0
17	t*+16	0	0	0	0
18	t*+17	0	0	0	0
19	t*+18	0	0	0	0
20	t*+19	0	0	0	0

21-T	t*+20…	0	0	0	0

Table 53. 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	4.1
3	t*+2	4.1
4	t*+3	4.1
5	t*+4	4.1
6	t*+5	4.1
7	t*+6	4.1
8	t*+7	4.1
9	t*+8	4.1
10	t*+9	4.1
11	t*+10	4.1
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…	0

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 55) and in the Leakage Belt (Table 58) in the following year, equation 10 on page 72 of VM0015 version 1.1, as presented:

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

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 54. 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
Jul/20 - Jul/21	6,396	6,396	6,396
Jul/21 - Jul/22	8,350	8,350	14,747
Jul/22 - Jul/23	9,358	9,358	24,104
Jul/23 - Jul/24	7,224	7,224	31,329
Jul/24 - Jul/25	8,294	8,294	39,623
Jul/25 - Jul/26	3,597	3,597	43,220
Jul/26 - Jul/27	8,252	8,252	51,472
Jul/27 - Jul/28	3,545	3,545	55,017
Jul/28 - Jul/29	4,566	4,566	59,583
Jul/29 - Jul/30	6,005	6,005	65,588
Jul/30 - Jul/31	22,123	22,123	87,711
Jul/31 - Jul/32	18,952	18,952	106,663
Jul/32 - Jul/33	17,332	17,332	123,994
Jul/33 - Jul/34	24,895	24,895	148,889
Jul/34 - Jul/35	24,604	24,604	173,493
Jul/35 - Jul/36	19,846	19,846	193,338
Jul/36 - Jul/37	13,961	13,961	207,300
Jul/37 - Jul/38	17,744	17,744	225,044
Jul/38 - Jul/39	25,827	25,827	250,870
Jul/39 - Jul/40	37,570	37,570	288,440
Jul/40 - Jul/41	30,308	30,308	318,748
Jul/41 - Jul/42	29,365	29,365	348,113
Jul/42 - Jul/43	58,895	58,895	407,008
Jul/43 - Jul/44	34,271	34,271	441,279
Jul/44 - Jul/45	39,453	39,453	480,732
Jul/45 - Jul/46	35,822	35,822	516,554
Jul/46 - Jul/47	52,042	52,042	568,596
Jul/47 - Jul/48	34,554	34,554	603,150
Jul/48 - Jul/49	34,112	34,112	637,262
Jul/49 - Jul/50	43,862	43,862	681,124

Table 55. 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
Jul/20 - Jul/21	0	0	0
Jul/21 - Jul/22	66	66	66
Jul/22 - Jul/23	151	151	217
Jul/23 - Jul/24	243	243	460
Jul/24 - Jul/25	311	311	771
Jul/25 - Jul/26	388	388	1,159
Jul/26 - Jul/27	414	414	1,573
Jul/27 - Jul/28	488	488	2,061
Jul/28 - Jul/29	511	511	2,573
Jul/29 - Jul/30	544	544	3,117
Jul/30 - Jul/31	591	591	3,708
Jul/31 - Jul/32	739	739	4,448
Jul/32 - Jul/33	833	833	5,280
Jul/33 - Jul/34	899	899	6,179
Jul/34 - Jul/35	1,065	1,065	7,244
Jul/35 - Jul/36	1,215	1,215	8,459
Jul/36 - Jul/37	1,360	1,360	9,819
Jul/37 - Jul/38	1,395	1,395	11,215
Jul/38 - Jul/39	1,518	1,518	12,732
Jul/39 - Jul/40	1,710	1,710	14,442
Jul/40 - Jul/41	2,005	2,005	16,448
Jul/41 - Jul/42	2,055	2,055	18,503
Jul/42 - Jul/43	2,129	2,129	20,632
Jul/43 - Jul/44	2,524	2,524	23,156
Jul/44 - Jul/45	2,581	2,581	25,737
Jul/45 - Jul/46	2,696	2,696	28,433
Jul/46 - Jul/47	2,824	2,824	31,257
Jul/47 - Jul/48	3,178	3,178	34,436
Jul/48 - Jul/49	3,306	3,306	37,742
Jul/49 - Jul/50	3,348	3,348	41,090

Table 56. 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
6,396	6,396
8,284	14,680
9,207	23,888
6,981	30,869

7,984	38,853
3,209	42,061
7,837	49,899
3,057	52,955
4,055	57,010
5,461	62,471
21,531	84,003
18,212	102,215
16,499	118,714
23,996	142,710
23,539	166,249
18,631	184,880
12,601	197,480
16,348	213,829
24,309	238,138
35,859	273,997
28,303	302,300
27,310	329,610
56,766	386,376
31,747	418,123
36,872	454,995
33,126	488,121
49,217	537,338
31,376	568,714
30,806	599,520
40,514	640,034

Table 57. 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
Jul/20 - Jul/21	0	0	0
Jul/21 - Jul/22	0	0	0
Jul/22 - Jul/23	0	0	0
Jul/23 - Jul/24	0	0	0
Jul/24 - Jul/25	1,670	1,670	1,670
Jul/25 - Jul/26	46	46	1,716
Jul/26 - Jul/27	2,000	2,000	3,717
Jul/27 - Jul/28	3,512	3,512	7,228
Jul/28 - Jul/29	3,925	3,925	11,154
Jul/29 - Jul/30	4,881	4,881	16,035
Jul/30 - Jul/31	4,546	4,546	20,581
Jul/31 - Jul/32	538	538	21,119
Jul/32 - Jul/33	1,604	1,604	22,723
Jul/33 - Jul/34	6,999	6,999	29,723
Jul/34 - Jul/35	2,263	2,263	31,985
Jul/35 - Jul/36	6,961	6,961	38,946

Jul/36 - Jul/37	2,850	2,850	41,796
Jul/37 - Jul/38	999	999	42,795
Jul/38 - Jul/39	9,073	9,073	51,868
Jul/39 - Jul/40	5,340	5,340	57,208
Jul/40 - Jul/41	15,548	15,548	72,756
Jul/41 - Jul/42	5,544	5,544	78,300
Jul/42 - Jul/43	15,689	15,689	93,989
Jul/43 - Jul/44	5,746	5,746	99,734
Jul/44 - Jul/45	9,727	9,727	109,461
Jul/45 - Jul/46	4,094	4,094	113,555
Jul/46 - Jul/47	2,897	2,897	116,453
Jul/47 - Jul/48	8,931	8,931	125,384
Jul/48 - Jul/49	11,849	11,849	137,232
Jul/49 - Jul/50	7,705	7,705	144,938

Table 58. 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
Jul/20 - Jul/21	0	0	0
Jul/21 - Jul/22	0	0	0
Jul/22 - Jul/23	0	0	0
Jul/23 - Jul/24	0	0	0
Jul/24 - Jul/25	0	0	0
Jul/25 - Jul/26	17	17	17
Jul/26 - Jul/27	17	17	35
Jul/27 - Jul/28	37	37	72
Jul/28 - Jul/29	73	73	145
Jul/29 - Jul/30	111	111	256
Jul/30 - Jul/31	159	159	414
Jul/31 - Jul/32	201	201	616
Jul/32 - Jul/33	201	201	817
Jul/33 - Jul/34	212	212	1,029
Jul/34 - Jul/35	279	279	1,308
Jul/35 - Jul/36	278	278	1,585
Jul/36 - Jul/37	342	342	1,927
Jul/37 - Jul/38	342	342	2,269
Jul/38 - Jul/39	309	309	2,578
Jul/39 - Jul/40	356	356	2,934
Jul/40 - Jul/41	356	356	3,290

Jul/41 - Jul/42	465	465	3,755
Jul/42 - Jul/43	509	509	4,264
Jul/43 - Jul/44	647	647	4,911
Jul/44 - Jul/45	624	624	5,535
Jul/45 - Jul/46	691	691	6,226
Jul/46 - Jul/47	652	652	6,878
Jul/47 - Jul/48	644	644	7,522
Jul/48 - Jul/49	717	717	8,238
Jul/49 - Jul/50	735	735	8,973

Table 59. 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
0	0
0	0
0	0
0	0
1,670	1,670
29	1,699
1,983	3,682
3,474	7,156
3,853	11,009
4,770	15,779
4,388	20,167
337	20,504
1,403	21,907
6,787	28,694
1,984	30,678
6,683	37,361
2,508	39,870
657	40,526
8,764	49,290
4,983	54,274
15,192	69,466
5,079	74,545
15,180	89,724
5,099	94,823
9,103	103,927
3,403	107,329
2,246	109,575

8,287	117,862
11,132	128,994
6,970	135,964

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.

5.2 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 43.

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

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)

The strategy for defining the Effectiveness Index factor is based on the project's potential to contain all deforestation and forest degradation in the project area, mainly through the following activities (detailed in Section 1.11):

- Improved property surveillance
- Deforestation monitoring using satellite images
- Strengthening the management of non-timber forest products

However, the project takes into account the possibility of losses in carbon stocks over time, whether due to climate change, social pressures, or changes in local governance. Thus, in order to account for these probabilities of loss, the project considered applying the project's initial non-permanence risk (11%) as a discount on the project's effectiveness. It is understood that with the implementation of project activities and the overall maturity of the project, it is expected that the project will become increasingly effective in preventing deforestation throughout its crediting period.

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 60.

Table 60. 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	Annual ΔCPAiPAt tCO_2e	Cumulative ΔCPAiPA tCO_2e	Annual ΔCUDdPAttCO_2e	Cumulative ΔCUDdPA CO_2e	Annual ΔCPSPAt tCO_2e	Cumulative ΔCPSPA tCO_2e
Jul/20 - Jul/21	0	0	0	0	704	704	704	704

Jul/21 - Jul/22	0	0	0	0	911	1,615	911	1,615
Jul/22 - Jul/23	0	0	0	0	1.013	2,628	1,013	2,628
Jul/23 - Jul/24	0	0	0	0	768	3,396	768	3,396
Jul/24 - Jul/25	0	0	0	0	878	4,274	878	4,274
Jul/25 - Jul/26	0	0	0	0	321	4,595	321	4,595
Jul/26 - Jul/27	0	0	0	0	784	5,378	784	5,378
Jul/27 - Jul/28	0	0	0	0	306	5,684	306	5,684
Jul/28 - Jul/29	0	0	0	0	365	6,049	365	6,049
Jul/29 - Jul/30	0	0	0	0	491	6,540	491	6,540
Jul/30 - Jul/31	0	0	0	0	1,938	8,478	1,938	8.478
Jul/31 - Jul/32	0	0	0	0	1,457	9,935	1,457	9,935
Jul/32 - Jul/33	0	0	0	0	1,320	11,255	1,320	11,255
Jul/33 - Jul/34	0	0	0	0	1,920	13,175	1,920	13,175
Jul/34 - Jul/35	0	0	0	0	1,648	14,823	1,648	14,823
Jul/35 - Jul/36	0	0	0	0	1,304	16,127	1,304	16,127
Jul/36 - Jul/37	0	0	0	0	882	17,009	882	17,009
Jul/37 - Jul/38	0	0	0	0	981	17,990	981	17,990
Jul/38 - Jul/39	0	0	0	0	1,459	19.448	1,459	19,448
Jul/39 - Jul/40	0	0	0	0	2,152	21,600	2,152	21,600
Jul/40 - Jul/41	0	0	0	0	1,415	23,015	1,415	23,015
Jul/41 - Jul/42	0	0	0	0	1,365	24,380	1,365	24,380
Jul/42 - Jul/43	0	0	0	0	2,838	27,219	2,838	27,219

Jul/43 - Jul/44	0	0	0	0	1,270	28,489	1,270	28,489
Jul/44 - Jul/45	0	0	0	0	1,475	29,964	1,475	29,964
Jul/45 - Jul/46	0	0	0	0	1,325	31,289	1,325	31,289
Jul/46 - Jul/47	0	0	0	0	1,477	32.765	1,477	32,765
Jul/47 - Jul/48	0	0	0	0	941	33,706	941	33,706
Jul/48 - Jul/49	0	0	0	0	924	34,631	924	34,631
Jul/49 - Jul/50	0	0	0	0	810	35,441	810	35,441

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 61 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 61. 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
Jul/20 - Jul/21	0	0	0	0	704	704	704	704	0	0
Jul/21 - Jul/22	0	0	0	0	911	1,615	911	1,615	0	0
Jul/22 - Jul/23	0	0	0	0	1,013	2,628	1,013	2,628	0	0
Jul/23 - Jul/24	0	0	0	0	768	3,396	768	3,396	0	0
Jul/24 - Jul/25	0	0	0	0	878	4,274	878	4,274	0	0
Jul/25 - Jul/26	0	0	0	0	321	4,595	321	4,595	0	0
Jul/26 - Jul/27	0	0	0	0	784	5,378	784	5,378	0	0
Jul/27 - Jul/28	0	0	0	0	306	5,684	306	5,684	0	0
Jul/28 - Jul/29	0	0	0	0	365	6,049	365	6,049	0	0
Jul/29 - Jul/30	0	0	0	0	491	6,540	491	6,540	0	0

Jul/30 - Jul/31	0	0	0	0	1,938	8,478	1,938	8,478	0	0
Jul/31 - Jul/32	0	0	0	0	1,457	9,935	1,457	9,935	0	0
Jul/32 - Jul/33	0	0	0	0	1,320	11,255	1,320	11,255	0	0
Jul/33 - Jul/34	0	0	0	0	1,920	13,175	1,920	13,175	0	0
Jul/34 - Jul/35	0	0	0	0	1,648	14,823	1,648	14,823	0	0
Jul/35 - Jul/36	0	0	0	0	1,304	16,127	1,304	16,127	0	0
Jul/36 - Jul/37	0	0	0	0	882	17,009	882	17,009	0	0
Jul/37 - Jul/38	0	0	0	0	981	17,990	981	17,990	0	0
Jul/38 - Jul/39	0	0	0	0	1,459	19,448	1,459	19,448	0	0
Jul/39 - Jul/40	0	0	0	0	2,152	21,600	2,152	21,600	0	0
Jul/40 - Jul/41	0	0	0	0	1,415	23,015	1.415	23,015	0	0
Jul/41 - Jul/42	0	0	0	0	1,365	24,380	1,365	24,380	0	0
Jul/42 - Jul/43	0	0	0	0	2,838	27,219	2,838	27,219	0	0
Jul/43 - Jul/44	0	0	0	0	1,270	28,489	1,270	28,489	0	0
Jul/44 - Jul/45	0	0	0	0	1,475	29,964	1,475	29,964	0	0
Jul/45 - Jul/46	0	0	0	0	1,325	31,289	1,325	31,289	0	0

Jul/46 - Jul/47	0	0	0	0	1,477	32,765	1,477	32,765	0	0
Jul/47 - Jul/48	0	0	0	0	941	33,706	941	33,706	0	0
Jul/48 - Jul/49	0	0	0	0	924	34,631	924	34,631	0	0
Jul/49 - Jul/50	0	0	0	0	810	35,441	810	35,441	0	0

5.3 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: "low-impact agricultural management" 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. As explained above, the Project will seek to prevent deforestation through the activities of "low-impact agricultural management" and "updating and supplementary studies".

Calculation of the Leakage Displacement Factor (DLF)

The REDD+ Juruá Project has mapped the three main deforestation agents in the region based on the historical deforestation analysis in the Reference Area. The following analysis outlines the actions the project will implement to prevent deforestation within the Project Area and avoid the displacement of predatory activities to the Leakage Belt.

I - Agent: Family Farmers in Settlement Projects

Relative Importance: Small family farmers are the main deforestation agents in the REDD+ Juruá Project area.

Actions with leakage prevention potential: Low-impact agricultural management and Activities of updates and complementary studies

Target audience: Local communities and residents surrounding the Project Area (direct impact) and small rural producers in settlement projects (indirect impact).

Activity Description: The Low-Impact Agricultural Management activity at Valparaíso is central to the Juruá REDD+ Project's strategy to prevent leakage. This activity include targeted training programs for local stakeholders and deforestation agents, aimed at promoting sustainable agricultural practices, reducing environmental impacts, and improving local incomes. By leveraging Valparaíso's infrastructure, the project ensures local communities can adopt sustainable practices, supporting long-term conservation and reducing deforestation risks.

Activities of updates and complementary studies aims to update and enhance the understanding of local stakeholders and deforestation agents, particularly their agricultural practices. By analyzing recent changes in land-use and deforestation dynamics, the project can adjust its strategies, such as low-impact agricultural management training, to local needs. The complementary studies will also identify new deforestation pressures and challenges in transitioning to sustainable practices, strengthening leakage prevention and improving engagement with local communities for long-term conservation success.

Expected result: Family farmers in settlements were responsible for 55.19% of the deforestation in the Reference Area, according to the analysis of deforestation dynamics from the historical reference period (2010-2020). The proposed activity, which directly and indirectly involves this agent, has the potential to prevent the displacement of this proportion of deforestation to the Leakage Belt.

II - Agent: Medium and Large Producers

Relative Importance: Medium and large-scale livestock producers contribute to 14.97% of the deforestation in the Reference Area and are composed of medium and large properties.

Actions with leakage prevention potential: Considering that the deforestation activities of these producers are planned and carried out within their properties, the REDD+ Juruá Project is unlikely to influence the deforestation dynamics in the private lands of established medium and large rural producers in the surrounding area. Therefore, the deforestation associated with this agent is unlikely to shift to the Leakage Belt as a result of the project's activities.

III - Agent: Land Occupiers (Posseiros)

Relative Importance: Land occupiers in the Reference Area primarily occupy vacant public lands (federal and unclaimed land) and are responsible for 29.79% of the deforestation in the region from 2010 to 2020.

Actions with leakage prevention potential: The REDD+ Juruá Project does not have specific actions to prevent the displacement of deforestation activities from these agents due to their operational characteristics. These agents are typically invaders, migrants, and often hostile to socio-environmental initiatives. Land occupiers accounted for 29.79% of the deforestation in the Reference Area. While the project may be effective in reducing deforestation within the Project Area, it lacks mechanisms to prevent 100% of leakage specifically caused by this agent.

Conclusion: Based on the deforestation dynamics in the Reference Area, the characteristics of potential deforestation agents, and the potential leakage prevention actions promoted by the project, it is understood that the REDD+ Juruá Project has a Leakage Displacement Factor (DLF) of 29.79%. This value represents the proportion of deforestation in the region that could be displaced to the Leakage Belt, particularly due to the activities of land occupiers. Therefore, in a conservative ex-ante estimation, the REDD+ Juruá Project expects that up to 29.79% of the deforestation that would occur within the Project Area could be displaced to the Leakage Belt.

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. 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 (%).

The ex-ante estimation of leakage due to activity displacement for the first fixed baseline period is found in Table 63 and the total ex-ante leakage is shown in Table 64.

Table 62. 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
Jul/20 - Jul/21	1,906	1,906	0	0
Jul/21 - Jul/22	2,468	4,373	0	0
Jul/22 - Jul/23	2,743	7,116	0	0
Jul/23 - Jul/24	2,080	9,196	0	0
Jul/24 - Jul/25	2,378	11,574	0	0
Jul/25 - Jul/26	956	12,530	0	0
Jul/26 - Jul/27	2,335	14,865	0	0
Jul/27 - Jul/28	911	15,775	0	0
Jul/28 - Jul/29	1,208	16,983	0	0
Jul/29 - Jul/30	1,627	18,610	0	0
Jul/30 - Jul/31	6,414	25,024	0	0
Jul/31 - Jul/32	5,425	30,450	0	0
Jul/32 - Jul/33	4,915	35,365	0	0
Jul/33 - Jul/34	7,148	42,513	0	0
Jul/34 - Jul/35	7,012	49,526	0	0
Jul/35 - Jul/36	5,550	55,076	0	0
Jul/36 - Jul/37	3,754	58,829	0	0
Jul/37 - Jul/38	4,870	63,700	0	0
Jul/38 - Jul/39	7,242	70,941	0	0
Jul/39 - Jul/40	10,682	81,624	0	0
Jul/40 - Jul/41	8,431	90,055	0	0
Jul/41 - Jul/42	8,136	98,191	0	0
Jul/42 - Jul/43	16,911	115,101	0	0
Jul/43 - Jul/44	9,457	124,559	0	0
Jul/44 - Jul/45	10,984	135,543	0	0
Jul/45 - Jul/46	9,868	145.411	0	0
Jul/46 - Jul/47	14,662	160,073	0	0
Jul/47 - Jul/48	9,347	169,420	0	0
Jul/48 - Jul/49	9,177	178,597	0	0
Jul/49 - Jul/50	12,069	190,666	0	0

Ex ante estimation of total leakage (Step 8.3 VM0015)

Table 63. 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
Jul/20 - Jul/21	0	0	0	0	1,906	1,906	0	0	1,906	1,906	0	0
Jul/21 - Jul/22	0	0	0	0	2,468	4,373	0	0	2,468	4,373	0	0
Jul/22 - Jul/23	0	0	0	0	2,743	7,116	0	0	2,743	7,116	0	0
Jul/23 - Jul/24	0	0	0	0	2,080	9,196	0	0	2,080	9,196	0	0
Jul/24 - Jul/25	0	0	0	0	2,378	11,574	0	0	2,378	11,574	0	0
Jul/25 - Jul/26	0	0	0	0	956	12,530	0	0	956	12,530	0	0
Jul/26 - Jul/27	0	0	0	0	2,335	14,865	0	0	2,335	14,865	0	0
Jul/27 - Jul/28	0	0	0	0	911	15,775	0	0	911	15,775	0	0
Jul/28 - Jul/29	0	0	0	0	1,208	16,983	0	0	1,208	16,983	0	0

Jul/29 - Jul/30	0	0	0	0	1,627	18,610	0	0	1,627	18,610	0	0
Jul/30 - Jul/31	0	0	0	0	6,414	25,024	0	0	6,414	25,024	0	0
Jul/31 - Jul/32	0	0	0	0	5,425	30,450	0	0	5,425	30,450	0	0
Jul/32 - Jul/33	0	0	0	0	4,915	35,365	0	0	4,915	35,365	0	0
Jul/33 - Jul/34	0	0	0	0	7,148	42,513	0	0	7,148	42,513	0	0
Jul/34 - Jul/35	0	0	0	0	7,012	49,526	0	0	7,012	49,526	0	0
Jul/35 - Jul/36	0	0	0	0	5,550	55,076	0	0	5,550	55,076	0	0
Jul/36 - Jul/37	0	0	0	0	3,754	58,829	0	0	3,754	58,829	0	0
Jul/37 - Jul/38	0	0	0	0	4,870	63,700	0	0	4,870	63,700	0	0
Jul/38 - Jul/39	0	0	0	0	7,242	70,941	0	0	7,242	70,941	0	0
Jul/39 - Jul/40	0	0	0	0	10,682	81,624	0	0	10,682	81,624	0	0
Jul/40 - Jul/41	0	0	0	0	8,431	90,055	0	0	8,431	90,055	0	0
Jul/41 - Jul/42	0	0	0	0	8,136	98,191	0	0	8,136	98,191	0	0
Jul/42 - Jul/43	0	0	0	0	16,911	115,101	0	0	16,911	115,101	0	0
Jul/43 - Jul/44	0	0	0	0	9,457	124,559	0	0	9,457	124,559	0	0
Jul/44 - Jul/45	0	0	0	0	10,984	135,543	0	0	10,984	135,543	0	0

Jul/45 - Jul/46	0	0	0	0	9,868	145,411	0	0	9,868	145,411	0	0
Jul/46 - Jul/47	0	0	0	0	14,662	160,073	0	0	14,662	160,073	0	0
Jul/47 - Jul/48	0	0	0	0	9,347	169,420	0	0	9,347	169,420	0	0
Jul/48 - Jul/49	0	0	0	0	9,177	178,597	0	0	9,177	178,597	0	0
Jul/49 - Jul/50	0	0	0	0	12,069	190,666	0	0	12,069	190,666	0	0

5.4 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 tree biomass will contribute 72.0% of the expected emissions in the baseline scenario, above ground non-tree biomass with 5.8%, below ground biomass with 15.4% and dead wood with 6.7%. 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 52 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 (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).

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 11%. The result is shown in Table 64 below (Table 36 of VM0015 Methodology version 1.1).

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

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

Where:

VCU_t: Number of Verified Carbon Units that can be traded in year t (tCO_2e);

$\Delta REDD_t$: Reduction of ex-post anthropogenic GHG emissions assigned to project's AUD activity in year t (tCO_2e);

VBC_t: Number of buffer credits deposited in the VCS buffer in year t ($t\ CO_2\text{-}e$);

$\Delta CBSLPA_t$: Sum of changes in baseline carbon stock in the Project Area in year t (tCO_2e);

$\Delta CPSPA_t$: 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 64. Ex-ante estimation of net anthropogenic GHG emission reductions (ΔREDDt) and Verified Carbon Units (VCUt) (Table 36 of VM0015 Methodology).

Project Year t	Baseline carbon stock changes		Ex-ante project carbon stock changes		Ex-ante leakage belt carbon stock changes		Ex-ante net GHG emissions reductions		Ex-ante VCUs tradable		Ex ante buffer credits	
	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	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	
31/Jul/20 – 31/Jul/21	6,396	6,396	704	704	1,906	1,906	3,787	3,787	3,161	3,161	626	626
31/Jul/21 – 31/Jul/22	8,284	14,680	911	1,615	2,468	4,373	4,905	8,692	4,094	7,255	811	1,437
31/Jul/22 – 31/Jul/23	9,207	23,888	1,013	2,628	2,743	7,116	5,452	14,144	4,550	11,805	901	2,339
31/Jul/23 – 31/Jul/24	6,981	30,869	768	3,396	2,080	9,196	4,134	18,278	3,450	15,255	683	3,022
31/Jul/24 – 31/Jul/25	7,984	38,853	878	4,274	2,378	11,574	4,727	23,005	3,945	19,201	782	3,804
31/Jul/25 – 31/Jul/26	3,209	42,061	321	4,595	956	12,530	1,932	24,937	1,614	20,815	318	4,121
31/Jul/26 – 31/Jul/27	7,837	49,899	784	5,378	2,335	14,865	4,719	29,655	3,943	24,758	776	4,897
31/Jul/27 – 31/Jul/28	3,057	52,955	306	5,684	911	15,775	1,841	31,496	1,538	26,296	303	5,200
31/Jul/28 – 31/Jul/29	4,055	57,010	365	6,049	1,208	16,983	2,482	33,978	2,076	28,372	406	5,606

31/Jul/29 – 31/Jul/30	5,461	62,471	491	6,540	1,627	18,610	3,343	37,321	2,796	31,168	547	6,152
31/Jul/30 – 31/Jul/31	21,531	84,003	1,938	8,478	6,414	25,024	13,179	50,500	11,024	42,192	2,155	8,308
31/Jul/31 – 31/Jul/32	18,212	102,215	1,457	9,935	5,425	30,450	11,330	61,830	9,487	51,679	1,843	10,151
31/Jul/32 – 31/Jul/33	16,499	118,714	1,320	11,255	4,915	35,365	10,264	72,094	8,594	60,273	1,670	11,820
31/Jul/33 – 31/Jul/34	23,996	142,710	1,920	13,175	7,148	42,513	14,928	87,022	12,499	72,773	2,428	14,249
31/Jul/34 – 31/Jul/35	23,539	166,249	1,648	14,823	7,012	49,526	14,879	101,901	12,471	85,244	2,408	16,657
31/Jul/35 – 31/Jul/36	18,631	184,880	1,304	16,127	5,550	55,076	11,777	113,677	9,871	95,114	1,906	18,563
31/Jul/36 – 31/Jul/37	12,601	197,480	882	17,009	3,754	58,829	7,965	121,642	6,676	101,790	1,289	19,852
31/Jul/37 – 31/Jul/38	16,348	213,829	981	17,990	4,870	63,700	10,497	132,140	8,807	110,597	1,690	21,542
31/Jul/38 – 31/Jul/39	24,309	238,138	1,459	19,448	7,242	70,941	15,609	147,748	13,095	123,693	2,514	24,056
31/Jul/39 – 31/Jul/40	35,859	273,997	2,152	21,600	10,682	81,624	23,025	170,774	19,317	143,010	3,708	27,764
31/Jul/40 – 31/Jul/41	28,303	302,300	1,415	23,015	8,431	90,055	18,456	189,230	15,498	158,508	2,958	30,721

31/Jul/41 – 31/Jul/42	27,310	329,610	1,365	24,380	8,136	98,191	17,809	207,039	14,955	173,463	2,854	33,575
31/Jul/42 – 31/Jul/43	56,766	386,376	2,838	27,219	16,911	115,101	37,017	244,056	31,085	204,549	5,932	39,507
31/Jul/43 – 31/Jul/44	31,747	418,123	1,270	28,489	9,457	124,559	21,020	265,076	17,667	222,216	3,352	42,860
31/Jul/44 – 31/Jul/45	36,872	454,995	1,475	29,964	10,984	135,543	24,413	289,489	20,519	242,735	3,894	46,753
31/Jul/45 – 31/Jul/46	33,126	488,121	1,325	31,289	9,868	145,411	21,933	311,421	18,434	261,170	3,498	50,252
31/Jul/46 – 31/Jul/47	49,217	537,338	1,477	32,765	14,662	160,073	33,079	344,500	27,827	288,997	5,251	55,503
31/Jul/47 – 31/Jul/48	31,376	568,714	941	33,706	9,347	169,420	21,088	365,588	17,740	306,737	3,348	58,851
31/Jul/48 – 31/Jul/49	30,806	599,520	924	34,631	9,177	178,597	20,705	386,292	17,418	324,155	3,287	62,138
31/Jul/49 – 31/Jul/50	40,514	640,034	810	35,441	12,069	190,666	27,635	413,927	23,267	347,422	4,367	66,505

6 MONITORING

6.1 Data and Parameters Available at Validation

Data/Parameter	fj(X,Y) - Expansion Factor
Data Unit	dimensionless
Description	Expansion factor to aboveground tree biomass to include the aboveground biomass of trees <10cm (0.04), obtained from the literature, discounted by 30% for conservativeness.
Source of data	Nogueira, E., P. Fearnside, B. Nelson, R. Barbosa, e E. Keizer. "Estimates of forest biomass in the Brazilian Amazon: New allometric equations and adjustments to biomass from wood-volume inventories." *Forest Ecology and Management* 256, nº 11 (novembro de 2008): 1853–67. https://doi.org/10.1016/j.foreco.2008.07.022.
Value applied	0.028
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

Data/Parameter	Carbon Fraction in biomass - CF
Data Unit	dimensionless
Description	Used to convert biomass values to carbon
Source of data	Aalde, Harald, Patrick Gonzalez, Michael Gytarsky, Thelma Krug, Werner Kurz, Stephen Ogle, John Raison, et al. "2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 4: Agriculture, Forestry and Other Land Use. Chapter 4: Forest Land." Em *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 4. IPCC. Acesso em 5 de julho de 2023. https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf.
Value applied	0.44

Justification of choice of data or description of measurement methods and procedures applied	Low bound of the CI for this parameter in the IPCC GPG's 2006 revision. This is the carbon fraction value for tropical forests in Table 4.3 of Chapter 4 of the IPCC GPG.
Purpose of Data	Calculating the average carbon density estimates Determination of the baseline scenario Calculating baseline emissions Calculating project emissions Leakage calculation
Comments	Refer to document: - VM0015_planilha de calculo_jurua

Data/Parameter	fj(X,Y) - Expansion Factor
Data Unit	dimensionless
Description	Sum of expansion factors for inclusion of non-tree aboveground biomass (lianas + palms + other non-tree components) obtained from the literature, discounted by 30% for conservativeness (Table "Application of 30% discount on the expansion factors of Open Forest class from Nogueira et al (2008) study").
Source of data	Nogueira, E., P. Fearnside, B. Nelson, R. Barbosa, e E. Keizer. "Estimates of forest biomass in the Brazilian Amazon: New allometric equations and adjustments to biomass from wood-volume inventories." *Forest Ecology and Management* 256, nº 11 (novembro de 2008): 1853–67. https://doi.org/10.1016/j.foreco.2008.07.022.
Value applied	0.0833
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	Value is the sum of the expansion factors for palms, lianas and other non-tree components. Refer to document: - VM0015_planilha de calculo_jurua

Data/Parameter	R
Data Unit	dimensionless

Description	Ratio of belowground to aboveground biomass: lower bound of the confidence interval for tropical deciduous forests, from Table 4.4 of the IPCC Guidelines (2006).
Source of data	Lower bound of the confidence invertal for this parameter extracted value for “Tropical Moist Deciduous Forests” from Table 4.4 of the 2006 IPCC Guidelines (Aalde et al, 2006).
Value applied	0.22
Justification of choice of data or description of measurement methods and procedures applied	When using default parameter values, the VM0015 Methodology recommends using the lower bound of the confidence interval of the parameter, if available, to ensure conservativeness.
Purpose of Data	Determination of the baseline scenario Calculating baseline emissions Calculating 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 emissions
Comments	dimensionless

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 secondary data and conservative expansion factors

Value applied	493,8 tCO2e/ha
Justification of choice of data or description of measurement methods and procedures applied	Aboveground biomass estimates were obtained from secondary data and expansion factors. Woody live aboveground carbon density was obtained from data published for open forests in Acre (Salimon, 2011), complemented with expansion factors non-tree components, palms and small trees published by Nogueira et al. (2008), conservativelly discounted by 30%. Finally, dead aboveground biomass was obtained using conservative estimates from the IPCC.
Purpose of Data	• Baseline scenario determination • Calculating baseline emissions • Calculating project emissions • Calculating leakage
Comments	Refer to document: - VM0015_planilha de calculo_jurua

6.2 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 and MapBiomas Alert
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	ΔCUFdPAt
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 and MapBiomas Alert
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	11%, 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	-

6.3 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 65. 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 and MapBiomas Alert	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 recovery occurs in year t	ha	Proper sources for forest fire detection and the scars caused to identify and classify affected areas	Whenever forest fires occur
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. 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. As mentioned above, monitoring will use qualified and scientifically recognized sources such as PRODES and MapBiomas Alert, which will be evaluated in order to meet the requirements of data quality and accuracy. The evaluation of these analyses and dates 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. In addition, an evaluation with independent imaging will be performed.

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 Environmental Investments S/A 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 EIRELI.

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 the responsibility of Biofílica Ambipar Environmental Investments S/A and Amazônia Agroindústria EIRELI. In section 1.11, the project provides a detailed description of the governance structure, explaining the roles and responsibilities of each entity involved in the project. This section clearly outlines how activities are coordinated and supervised, ensuring that all responsibilities are well defined. Additionally, the project emphasizes stakeholder involvement at each stage, ensuring that their contributions and responsibilities are integrated into planning and execution, promoting efficient and collaborative organization.

g) Procedures for handling non-conformances with the validated monitoring plan

As described in section 1.11, the project has established procedures to address non-conformances with the validated monitoring plan. Through continuous monitoring and evaluation, any deviation from expected results will be identified, allowing the project to take corrective measures as necessary. These procedures aim to ensure that the project remains in compliance with established standards and to mitigate unforeseen impacts. These observations, when relevant, will be presented in the respective verification process.

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 66. 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 within the Leakage Belt in year t	ha	Qualified and scientifically recognized sources such as PRODES and MapBiomas Alert	Annual
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 Environmental Investments S/A 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 EIRELI.

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 Environmental Investments S/A and Amazônia Agroindústria EIRELI.

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 67. 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 Environmental Investments S/A 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 EIRELI.

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 Environmental Investments S/A and Amazônia Agroindústria EIRELI.

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 10 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 10 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.

6.3.1 Sampling approaches

The Juruá REDD+ Project employs various sampling approaches across different methodologies to ensure the accurate estimation and monitoring of key parameters. Below, we consolidate the sampling methods used throughout the project and reference their detailed descriptions in the respective sections of this document:

Forest Carbon Stock Estimation:

Parameter: Forest Carbon Stock (Above-ground biomass).

Methodology:

Sampling plots were designed following a stratified random sampling approach, representing the diverse forest typologies within the project area.

The forest inventory employed circular plots (radius: 20 meters) with measurements of tree diameter at breast height (DBH) > 10 cm and tree height.

Biomass estimates were derived using allometric models specific to the Amazon biome, as detailed in Section 5.1 (Baseline Emissions).

Reference: Sampling plots are representative of the forest classes and were extrapolated using the study by Salimon et al. (2011).

Purpose: To estimate carbon stocks and support calculations for baseline emissions and subsequent monitoring updates.

Satellite Image Analysis:

Parameter: Land Use and Land Cover Change (LUCC).

Methodology:

Satellite images from the PRODES system and MapBiomas Alert were classified and interpreted using systematic sampling to validate deforestation polygons.

The classification process included representative sampling of areas within the project boundary and Leakage Belt to ensure accuracy.

Reference: Details of the interpretation and classification methodology are presented in Section 3.4 (Baseline Scenario).

Purpose: To detect and analyze LUCC dynamics and validate baseline assumptions.

Deforestation Monitoring Validation:

Parameter: Detection of Unplanned Deforestation.

Methodology:

Monitoring employs systematic sampling of remote sensing data to validate the accuracy of deforestation alerts from satellite systems (PRODES and MapBiomas Alert).

Purpose: To ensure the accuracy and reliability of deforestation detection during the monitoring period.

To ensure clarity and traceability, this section consolidates all sampling approaches used throughout the project while referencing their detailed descriptions in other sections of the PDD. This approach ensures consistency and avoids redundancy, while meeting the requirements for transparency in monitored parameters.

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

Data / Parameter	ABSLPAt
Unit	ha
Description	Annual area of deforestation in the project area at year t
Data source	PRODES and MapBiomas Alert
Description of applied measurement methods and procedures	Monitoring of forest cover in the Project Area through analysis of satellite images. The PRODES and MapBiomas Alert data were assessed considering the Project Area boundary
Monitoring/Recording Frequency	Annual
Applied Value	Jul/2020 – Jul/2021: 0 ha Jul/2021 – Jul/2022: 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	Jul/2020 – Jul/2021: 0 tCO2e Jul/2021 – Jul/2022: 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	Jul/2020 – Jul/2021: 0 ha Jul/2021 – Jul/2022: 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	Jul/2020 – Jul/2021: 0 tCO2e Jul/2021 – Jul/2022: 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	Jul/2020 – Jul/2021: 0 ha Jul/2021 – Jul/2022: 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	tCO2e
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	Jul/2020 – Jul/2021: 0 tCO2e Jul/2021 – Jul/2022: 0 tCO2e
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	ΔCLPMLKt
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	Jul/2020 – Jul/2021: 0 tCO2e Jul/2021 – Jul/2022: 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	Jul/2020 – Jul/2021: 0 tCO2e Jul/2021 – Jul/2022: 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 and MapBiomas Alert
Description of the measurement methods and procedures applied	Monitoring of forest cover in the Leak Belt through satellite image analysis. The PRODES and MapBiomas Alert data was evaluated considering the boundary of the Leak Belt
Monitoring/Recording Frequency	Annual
Applied Value	Jul/2020 – Jul/2021: 0 ha Jul/2021 – Jul/2022: 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 leakage
Calculation method	The Forest Cover Reference Mark Map was updated by map algebra
Comments	-

Data / Parameter	ΔCADLKt
Unit	tCO2e
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	Jul/2020 – Jul/2021: 0 tCO2e Jul/2021 – Jul/2022: 0 tCO2e
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	11%
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	-

7.2 Baseline Emissions

The calculated carbon estimate for the above and below ground stocks considered the averages of calculated values for managed forest and primary forest which was 104.9 tC/ha for the above ground reservoir (97.0 tC/ha for tree reservoir and 7.9 tC/ha for non-tree reservoir), 20.8 tC/ha for the below ground reservoir and 9.1 tC/ha for dead wood. To determine the reduced emissions, the stock estimated was multiplied by 3.6667 (44/12), because 1 kg of C equals 3.66667 kg of CO2 (mass of CO2 = 44 and the mass of C = 12; 44/12 = 3.66667). Considering that, the carbon stocks per hectare applied the following values: 384.5 tCO2e/ha (± 22.2 tCO2e/ha) for the above ground reservoir (355.7 tCO2e/ha ± 19.8 tCO2e/ha for tree reservoir and 28.8 tCO2e/ha ± 2.3 tCO2e/ha for non-tree reservoir), 76.1 tCO2e/ha (± 4.2 tCO2e/ha) for the below ground reservoir and 33.2 tCO2e/ha (± 1.8 tCO2e/ha) for dead wood.

Table 68. 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	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI
$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$	$tCO_2e\ ha^{-1}$
384.5	22.2	76.1	4.2	33.2	1.8	493.8	28.2

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 accumulated deforestation of 139 hectares in the Project Area) (Table 69) and 0 hectares in the Leakage Belt, considering the first and second project years (Table 70).

Table 69. Annual areas of unplanned deforestation from baseline in the Project Area for the monitored period (first and second project years).

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
Jul/20 – Jul/21	0	16	16
Jul/21 – Jul/22	0	21	37

Table 70. Annual areas of unplanned deforestation from baseline in the Leakage Belt for the monitored period (first and second project years).

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
Jul/20 – Jul/21	0.8	0	0
Jul/21 – Jul/22	0	0	0

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 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:

$\Delta CBSLPA_t$: Total change in baseline carbon stock within the Project Area in year t (tCO_2-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 first and second project years was 20.708 tCO2e. No emissions are expected in the baseline scenario for the leakage belt, as shown in Table 71.

Table 71. 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	$\Delta CBSPLA_{icl,t}$	$\Delta CBSPA_{icl}$	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
Jul/20 – Jul/21	6,396	6,396	6,396	Jul/20 - Jul/21	0	0	0	6,396	6,396
Jul/21 – Jul/22	8,350	8,350	14,747	Jul/21 - Jul/22	66	66	66	8,284	14,680

Table 72. 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	
iclID >	1	$\Delta CBSLK_{iclt,t}$	$\Delta CBSLK_{icl}$	IDsays>	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
Jul/20 – Jul/21	0	0	0	Jul/20 - Jul/21	0	0	0	0	0
Jul/21 – Jul/22	0	0	0	Jul/21 - Jul/22	0	0	0	0	0

7.3 Project Emissions

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 73. 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
Jul/20 – Jul/21	0	493.8	0	0
Jul/21 – Jul/22	0	493.8	0	0

Emissions due to planned timber harvesting activities

As expected, there were no emissions associated with timber harvesting activities. 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 74. 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
Jul/20 – Jul/21	0	493.8	0	0
Jul/21 – Jul/22	0	493.8	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 75. 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
Jul/20 – Jul/21	0	493.8	0	0
Jul/21 – Jul/22	0	493.8	0	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 64 and Table 65, respectively).

Table 76. 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
Jul/20 – Jul/21	0	493.8	0	0
Jul/21 – Jul/22	0	493.8	0	0

Table 77. 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
Jul/20 – Jul/21	0	493.8	0	0
Jul/21 – Jul/22	0	493.8	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 78. 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		Total Carbon stock change in the project case	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	ΔCPDdPAt	ΔCPDdPA	ΔCPAiPAt	ΔCPAiPA	ΔCFCdPAt	ΔCFCdPAt	ΔCCFCiPAt	ΔCFCiPA	ΔCPSPAt	ΔCPSPA
	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e
Jul/20 – Jul/21	0	0	0	0	0	0	0	0	0	0

Jul/21 – Jul/22	0	0	0	0	0	0	0	0	0	0

Emissions due to unplanned and unavoided deforestation

For analysis of land use and land cover changes, the Juruá REDD+ Project is based on two main activities: monitoring deforestation through satellite images and patrimonial surveillance. The monitoring of deforestation, specifically in the Project Area and in the Leakage Belt, was done using data from the Program for Monitoring the Brazilian Amazon Forest by Satellites (PRODES) conducted by the National Institute for Space Research (INPE) together with data from MapBiomas Alert, produced by MapBiomas , with subsequent analysis of the accuracy of the combined product using high resolution satellite images from the Planet platform.

PRODES has been annually monitoring deforestation in the Legal Amazon since 1988. It currently uses satellite images from LANDSAT 8/OLI (30 meters spatial resolution and 16 days revisit rate), CBERS 4 and IRS-2, in a combination that seeks to minimize the problem of cloud cover and ensure interoperability criteria (PRODES-INPE, 2022). The PRODES estimates are considered reliable by national and international scientists (Kintish, 2007). The project has the collaboration of the Ministry of Environment (MMA) and the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA). The images that are used for PRODES monitoring are made available by the providers already orthorectified, with system geometric correction refined using control points and digital terrain elevation models. This corresponds to the highest level of geometric correction and means that the images are ready to be used without the need for further processing (SOUZA et. al., 2019). The annual PRODES monitoring period runs from August 01 of the previous year to July 31 of the current year.

The methodology used by PRODES to identify the deforestation polygons in the Legal Amazon is divided into three main steps:

1. Image selection phase: The selection of images occurs starting in August and one looks for images with less cloud cover and acquisition date closer to the dry season in the Amazon.

2. Deforestation polygon mapping phase: Trained specialists perform photointerpretation of the images, identifying and delimiting the polygons of deforested areas. They observe three main points in the image to help identify affected areas: tone, texture, and context.

3. Phase of the calculation of the annual deforestation rate: The estimate of the annual deforestation rate occurring within the year monitored by PRODES is done.

In relation to MapBiomas Alert, the methodology and interval of analysis are different from PRODES, and consists of a system for validation and refinement of deforestation alerts with high resolution satellite images from Planet (3.7m). On the Mapbiomas Alert platform, alerts are published from several detection systems, such as DETER (Real-time Deforestation Detection) of INPE, GLAD (Global Land Analysis & Discovery), from the University of Maryland, SAD (Deforestation Alert System), from Imazon and SIRAD-X (Extraordinary Sirad), for all biomes in Brazil. On this Platform, for each alert published, detailed reports are made available openly and free of charge.

Map Accuracy Evaluation

The Planet images, with a spatial resolution of 4.77m obtained by a constellation formed from hundreds of Dove satellites, were used to perform the accuracy analysis. These images are free and made available by the Norwegian Government. It is the result of a partnership between the Norwegian Ministry of Climate and Environment with Kongsberg Satellite Saervices (KSAT) and its partners Airbus and Planet, to provide universal access to high resolution satellite monitoring of the tropics to support efforts to stop the destruction of the world's rainforests (Planet6, Royal Norwegian Embassy in Brasilia7).

The analysis period of forest cover conversion in the Project Area and Leakage Belt was from 31 July 2020 to 30 July 2022. As mentioned above, PRODES 2021 covered the period from August 1, 2020, to July 31, 2021, and PRODES 2022 covered the period from August 1, 2021, to July 31, 2022. Therefore, the only period not covered by PRODES was from July 1, 2020, to July 31, 2020, and MapBiomas Alert data were used to complement PRODES, allowing the identification of deforestation polygons occurred throughout the monitored period. The data of PRODES were acquired from TerraBrasilis website and the data of MapBiomas Alert, on the platform of MapBiomas Alert.

The only classes found within these limits were: forest and deforestation. Within the Project Area, no forest cover conversion records were identified, but there were changes within the Leakage Belt. Thus, the accuracy of the data from PRODES and MapBiomas Alert was performed, based on the visual evaluation of the classes using as reference the satellite images of high spatial resolution acquired in the Planet Basemaps Viewer platform. Six scenes with an August 2022 acquisition date were downloaded from the monitored area and with low cloud coverage, which are already georeferenced, and then a mosaic was made with all the scenes using geoprocessing software.

A distribution of 550 points was randomly made in the monitored area, and then the visual interpretation between two classes: forest and deforestation. Figure 39 demonstrates the methodology adopted to evaluate the accuracy of PRODES and MapBiomas Alert mapping.

PRODES Classification (2021) **Planet Images (08/2021)**

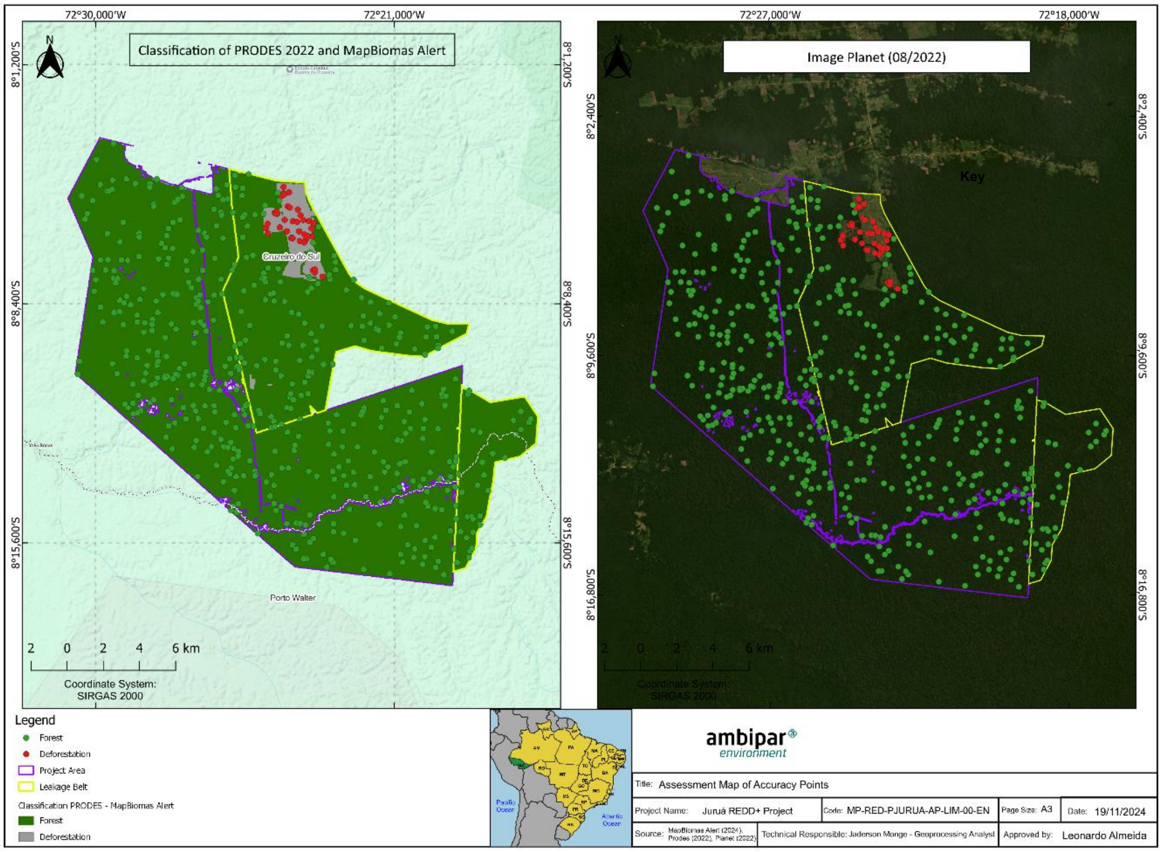

Figure 40. Assessment map of accuracy points.

With the reference points and the land use and land cover map of the monitoring period, it was possible to evaluate the accuracy of the monitoring data through the confusion matrix analysis (Table 79) according to Congalton and Green (2019). The confusion matrix was made based on the 550 random points, whereby, 511 points fell in the forest class and 39 in the deforestation class. The overall accuracy of the monitoring data for the land use and land cover classes in the monitored area was 100%, as the user and producer accuracies of each class were also 100%, exceeding the minimum of 80% that is required by VM0015.

Table 79. Confusion matrix generated to evaluate PRODES and MapBiomas Alert data for the period July 2020 to July 2022.

		PRODES/MapBiomas x PLANET				
		Reference		Total	User accuracy	Omission Error
		Forest	Deforestation			
Classified	Forest	**511**	0	511	100.00%	0.00%
	Deforestation	0	**39**	39	100.00%	0.00%
Total		511	39	**550**		

Producer accuracy	100.00%	100.00%			
Omission Error	0.00%	0.00%			
Map Accuracy					100%

Total unplanned deforestation in the Project Area during this monitoring period is 0 hectares, according to PRODES (2022) and MapBiomas Alert data. The data for the monitored period (first and second project years) is shown in Table 80 below.

Table 80. 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
Jul/20 – Jul/21	0	0	0	16
Jul/21 – Jul/22	0	0	0	21

The total change in carbon stock due to unplanned and unavoided deforestation in the Project Area over this monitoring period is presented in Table 81.

Table 81. 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
Jul/20 – Jul/21	0	0	0	Jul/20 – Jul/21	0	0	0	0	0
Jul/21 – Jul/22	0	0	0	Jul/21 – Jul/22	0	0	0	0	0

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 82.

Table 82. 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
Jul/20 – Jul/21	0	0	0	0	0	0	0	0
Jul/21 – Jul/22	0	0	0	0	0	0	0	0

7.4 Leakage

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.

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.

According to PRODES and MapBiomas Alert data, a total of 44.52 hectares of deforestation were identified within the Leakage Belt during the monitoring period. This deforestation occurred in two distinct areas, both situated within a private rural property that is legally registered in Brazil's official land tenure database, SIGEF, maintained by the National Institute of Colonization and Agrarian Reform (INCRA).

The first area, located in the northern part near the Leakage Belt boundary, borders the settlement known as “PDS Jamil Jereissati” and consists of a single deforestation polygon measuring 0.79 hectares. As outlined in Section 3.4 of the Baseline Scenario, family farmers in these settlements account for 48.11% of deforestation in the Reference Region from 2010 to 2020, and they are identified as a primary deforestation agent in Step 3 of VM0015.

The second area is situated more centrally within the private property and contains multiple deforestation polygons, which appear to be linked to the same deforestation agent. Notably, one of these polygons has an environmental infraction notice issued by the Brazilian Institute of the Environment and Renewable

Resources (IBAMA), the federal authority responsible for environmental oversight. Public records from IBAMA indicate that the landowner received a notice for deforesting over one hundred hectares without the required legal permissions – theses deforestations occurred not only during this monitoring period.

This infraction clearly demonstrates that the deforestation in this central region of the property was not a result of the displacement of agents that the Juruá REDD+ Project aims to contain. Consequently, the monitoring of the Leakage Belt has shown that, aside from the 0.79-hectare polygon in the north, the deforestation observed does not qualify as leakage, as it does not reflect an increase in deforestation beyond the baseline caused by shifts in deforestation patterns from the Avoided Project Area (AP) to the Leakage Belt.

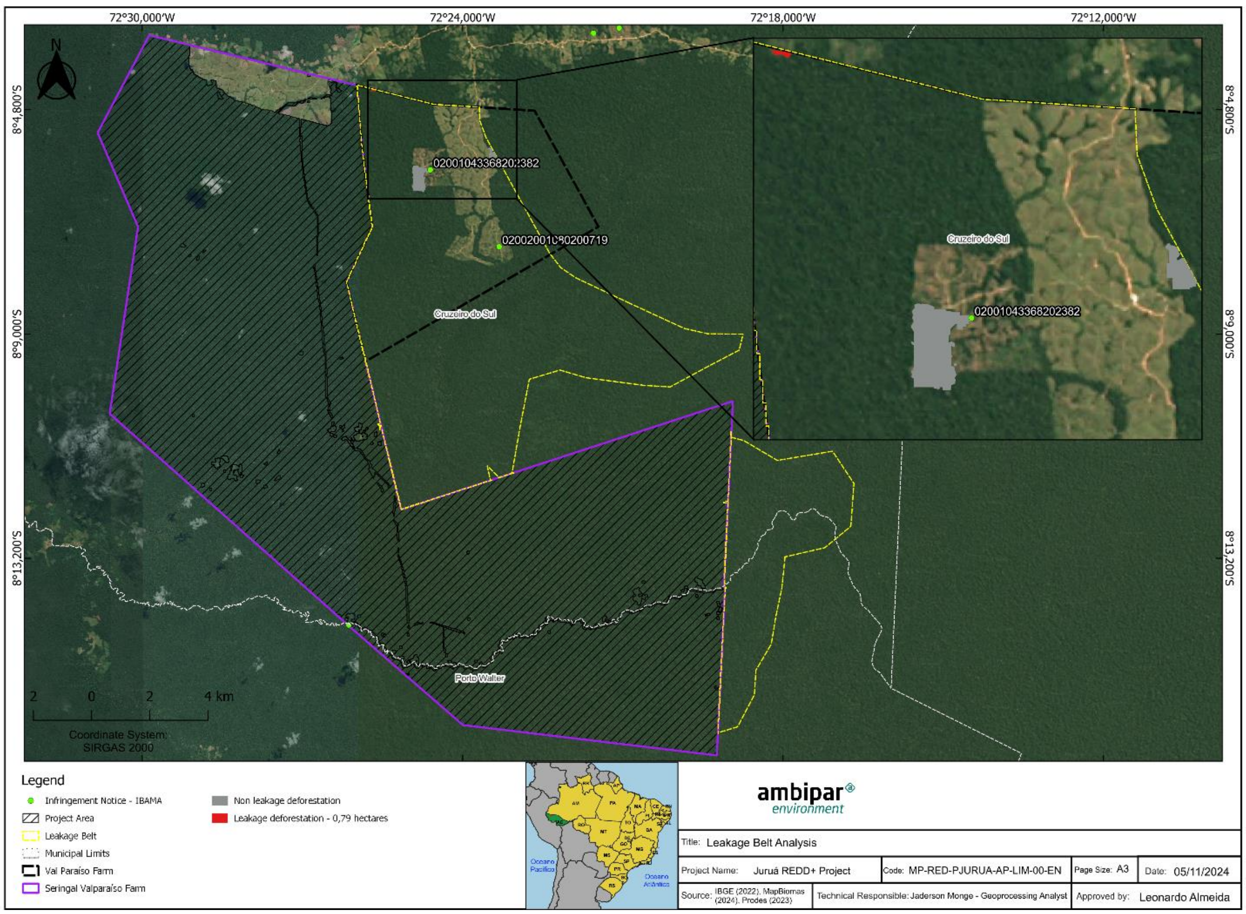

Figure 41. Map of potential for change from forest to anthropogenic vegetation (deforestation risk) in the Reference Region.

Annual deforested areas within the monitored Leakage Belt results are shown in Table 83.

Table 83. Annual deforested areas in each zone within the monitored Leak Belt (Table 13.c. VM0015).

		Baseline

Established area after deforestation per Zone within the Leak Belt		Total deforestation monitored in the Leak Belt		
IDz>	1			
Name>	Zone 1	Annual	Cumulative	Annual
Project year t	ha	ha	ha	ha
Jul/20 – Jul/21	0.8	0.8	0.8	0
Jul/21 – Jul/22	0	0	0.8	0

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:

$\Delta CBSLLK_t$: Total changes in carbon stock due to unplanned and unavoided deforestation in the Leakage Belt in year t;

$AUDLK_{icl,y}$: Unplanned deforested area in the initial forest class icl in year t in the Leakage Belt within the project scenario;

$\Delta Ctot_{icl,Ac}$: 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);

$AUDLK_{fcl,y}$: Area of the final non-forest class fcl in year t in the Leakage Belt after unplanned deforestation within the project scenario;

$\Delta Ctot_{fcl,Ac}$: 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 84.

Table 84. Ex-post carbon stock change in the Leak Belt area (table 21.c.2. 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
Jul/20 - Jul/21	313	313	313	Jul/20 - Jul/21	0	0	0	313	313
Jul/21 - Jul/22	9	9	322	Jul/21 - Jul/22	3	3	3	5	318

The total ex-post changes of carbon stock in the Leak Belt due to displacement activities in this monitoring period are presented in Table 85.

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 first and second project years 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 85. 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
Jul/20 – Jul/21	36	36	313	313	313	313
Jul/21 – Jul/22	1	37	5	318	5	318

Total estimated ex-post leakage

The total leakage estimates are presented in the Table 86.

Table 86. 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 $\Delta CADLKt$ tCO2-e	cumulative $\Delta CADLK$ tCO2-e	annual $\Delta CLPMLKt$ tCO2e	cumulative $\Delta CLPMLK$ tCO2e	annual $\Delta CLKt$ tCO2e	cumulative ΔCLK tCO2e
Jul/20 – Jul/21	313	313	0	0	313	313
Jul/21 – Jul/22	5	318	0	0	5	318

7.5 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 11%. The calculated reductions of ex-post GHG emissions are presented in Table 88.

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

Where:

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

$\Delta CBSLPAt$: 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);

$\Delta CPSPAt$: 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);

$\Delta CLKt$: 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 (tCO2e);

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

$\Delta CBSLPAt$: Sum of changes in baseline carbon stock in the Project Area in year t (tCO2e);

$\Delta CPSPAt$: Sum of ex-post changes in carbon stock in the Project Area in year t (tCO2e);

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 87. 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		Net GHG emission reductions or removals (tCO2e)		VCUs eligible for Issuance		Buffer pool allocation	
	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
2020 31/Jul/2020 – 31/Jul/2021	6,396	6,396	0	0	313	313	6,083	6,083	5,380	5,380	704	704
2021 31/Jul/2021 – 31/Jul/2022	8,284	14,680	0	0	5	318	8,279	14,362	7,367	12,747	911	1,615

Table 88. Percent difference between estimated emissions and avoided emissions by the project during the monitored period.

Ex-ante emissions reductions/removals	Achieved emissions reductions/removals	Percent difference	Justification for the difference
8,692	14,362	-65%	During the monitored period, a much smaller area of unplanned deforestation was identified than expected in the baseline. In addition, small leakage was detected in this monitored period. As a

			consequence, during the monitored period, a negative percentage difference was identified for the project, where more emissions were avoided in the monitored period than expected in the baseline.

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APPENDIX 1: VM0015 METHODOLOGICAL PROCEDURES FOR DEFORESTATION MODELING

The methodological procedures for deforestation modeling in the Juruá REDD+ Project was shared with the VVB.