



AMAZONAS APD GROUPED PROJECT



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Prepared by	BrCarbon Serviços Ambientais LTDA

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1 PROJECT DETAILS

1.1. Summary Description of the Project

The Amazonas APD Grouped Project (hereafter called GPD) aims the forest conservation on private properties located in Amazonas State (AM), a Brazilian state inside the Legal Amazon, that is understood as a socio-political oriented territorial division created by the Brazilian government in 1950 for strategic planning and social and economic development policies implementation.

The Amazonas State has 1,559,255.881 Km² of territory, and its capital is the city of Manaus. The State has 2.53 hab/km² as demographic density; a population of 3,941,613 habitants, 0.7 as Human Development Index (which is considered high, however, there are enormous inequalities between the 62 municipalities), and R\$ 965 as monthly household income per capita.

The GPD's main goal is to create positive economic incentives to landowners for the rainforest conservation in private areas, through income generation from carbon credits commercialization. According to National Law 12,651, the Brazilian Forest Code, landowners must conserve 80% of the forest cover and 35% of the Cerrado areas on properties located in the Legal Amazon. In this way, the areas with forest cover exceeding this percentage can be legally converted to other land uses for commercial activities, such as cattle raising or agricultural projects, with the authorization of the responsible environmental agency in each state.

The landowners who decide to join the initiative, by giving up their right to clear their forest areas legally will be able to access financial resources from the carbon voluntary market, becoming brCarbon partners. The partnership between brCarbon (hereafter called BRC) and landowners will result in legal protection of forests, forest monitoring by satellite images, carbon stocks inventory, property surveillance, wildfire monitoring, prevention, and firefighting activities, threatened species protection, and social engagement activities with traditional communities living inside the project area.

BRC will be responsible for the development, implementation, monitoring, and certification of the project instances. The landowner's counterpart is to allow project activities to be implemented in their areas, in addition to freely committing to their long-term conservation.

In this way, BRC expects to escalate the climate impact promoted by the implementation of carbon projects, bringing positive net benefits to communities and biodiversity. The GPD two initial project activity instances (PAI#1 and PAI#2) implementation will result in the direct conservation of 26,060.64 hectares of forest in 2 private properties and will generate 5,765,427 VCUs over the 10 years baseline and annual average of 576,542.7 VCUs. Since this is a grouped project with a 100-year lifespan, the total VCUs over the baseline and lifetime period will be consistently updated during each periodic verification to include new PAIs.

1.2. Audit History

The following table presents the audit chronogram for this project, from the **Project Start Date** to **1st Monitoring Period**.

Table 1 – Audit chronogram of Amazonas APD GPD.

Audit type	Period	Program	Validation/verification body name	Number of years
Validation date	21/07/2023	VCS	KBS Certification Services Limited	Project Start Date
1 st Monitoring	21/07/2023 -31/12/2023	VCS	KBS Certification Services Limited	1

1.3. Sectoral Scope and Project Type

The table below presents the relevant information for AFOLU project, such as Sectoral Scope, AFOLU project category and Project Activity Type.

Table 2 – Sectoral scope and project activity type

Sectoral scope	14
AFOLU project category ¹	Reduced Emissions from Deforestation and Degradation (REDD)
Project activity type	Avoiding Planned Deforestation (APD)

1.4. Project Eligibility

1.4.1. General eligibility

According to VCS v4.5, REDD is an eligible AFOLU project category: “Eligible REDD activities are those that reduce net GHG emissions by reducing deforestation and/or degradation of forests. Deforestation is the direct, human-induced conversion of forest land to non-forest land. Degradation is the persistent reduction of canopy cover and/or carbon stocks in a forest due to human activities such as animal grazing, fuelwood extraction, timber removal or other such activities, but which does not result in the conversion of forest to non-forest land (which would be classified as deforestation), and qualifies as forests remaining as forests, such as set out under the IPCC 2003 Good Practice Guidance. The project area shall meet an internationally accepted definition of forest, such as those based on UNFCCC host-country thresholds or FAO definitions and shall qualify as forest for a minimum of 10 years before the project start date. The definition of forest may include mature forests, secondary forests, and degraded forests. Under the VCS Program, secondary

¹ See Appendix 1 of the VCS Standard

forests are forests that have been cleared and have recovered naturally and that are at least 10 years old and meet the lower bound of the forest threshold parameters at the start of the project. Forested wetlands, such as floodplain forests, peatland forests and mangrove forests, are also eligible provided they meet the forest definition requirements mentioned above.”

The VCS v4.5 also states that: “Eligible REDD activities include Avoiding Planned Deforestation (APD): This category includes activities that reduce net GHG emissions by permanently stopping or reducing deforestation on forest lands that are legally authorized and documented for conversion. Planned deforestation encompasses activities where a forest system would have been cleared and replaced by a different forest system with a lower carbon stock and where the recovery of timber was not the primary objective of the initial forest clearance.”

This GPD meets all VCS v.4.5 eligibility criteria, since the project area was defined in accordance with the forest benchmark map (Figure 1), considering the accumulated deforestation over a 10-year historical series (2014-2023), in private areas susceptible to vegetation suppression in accordance with the law in force in Brazil. Section 3.4 provides additional information on the topic. Please refer to section 1.5 below for the eligibility criteria for the inclusion of new project activity instances.

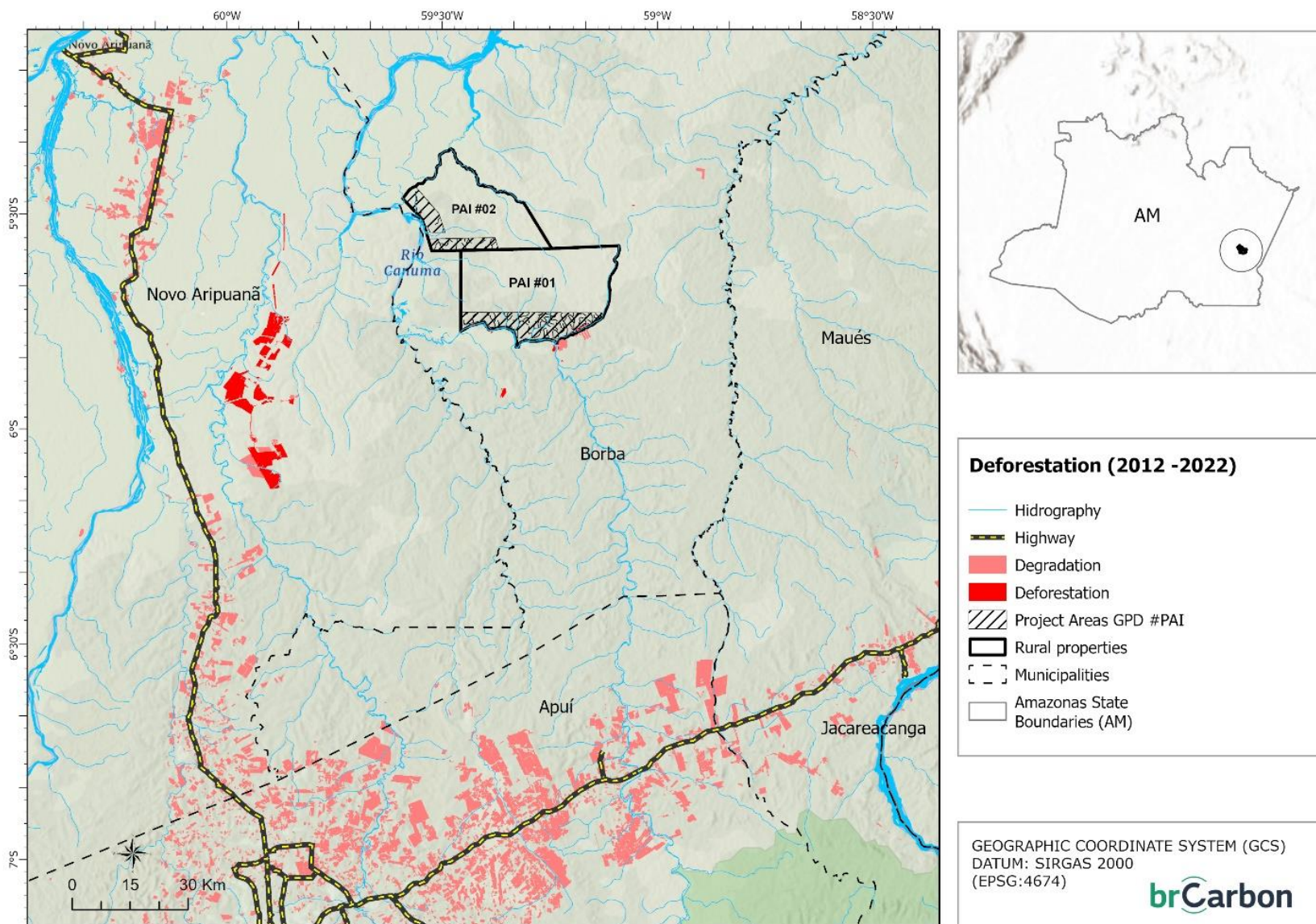


Figure 1 - Eligible areas in PAI#1 and PAI#2.

1.4.2. AFOLU project eligibility

Not applicable. All the information regarding AFOLU project eligibility was demonstrated in section 1.4.1 above.

1.4.3. Transfer project eligibility

Not applicable.

1.5. Project Design

- ☐ Single location or installation
- ☐ Multiple locations or project activity instances (but not a grouped project)
- ☒ Grouped Project

1.5.1. Grouped Project Design

This project is designed as a Grouped Project, that allows the expansion of the project scope by inclusion of new project activity instances (PAIs) after its validation. The inclusion of new PAIs takes place at the time of each verification event. A set of eligibility criteria for the inclusion of new PAIs is described in the section below.

According to VCS v4.5, grouped projects shall meet the following criteria.

“3.6.8 The project proponent shall include in a singular project all project activity instances within ten kilometers of another instance of the same project activity and with the same project proponent (i.e., instances of the same project activity may not be spread across more than one project if they are within ten kilometers of each other).”

In compliance with 3.6.8, it is incumbent upon the project proponent to amalgamate all instances of the project activity situated within a ten-kilometer radius of another instance of the same project activity and under the same project proponent into a unified project.

“3.6.9 Where a capacity limit applies to a project activity included in the project, no project activity instance shall exceed such limit. Further, no single cluster of project activity instances shall exceed the capacity limit”.

Criteria 3.6.9 is not applicable. There is no capacity limit applicable to the project activity type (APD) considered in the grouped project, since the BRC team will be present in the Project Location and can add as many human resources as necessary to fill the area.

“3.6.10 Grouped projects shall specify one or more clearly defined geographic areas within which project activity instances may be developed. Such geographic areas shall be specified using geodetic polygons as set out in Section 3.11 below. Geographic areas with no initial project activity

instances shall not be included in the project unless it can be demonstrated that the same (or at least as conservative) baseline scenario and rationale for the demonstration of additionality is applicable to such an area as a geographic area that does include initial project activity instances.”

The GPD assumes only one wide geographic area known as the Amazonas state (1,559,255.881 Km²). The project activity instances might encompass any private properties legally constituted, with forest cover surplus considering the thresholds established by the federal law. In other words, the GPD can include any private properties with more than 80% of forest cover in Amazon biome or 35% in Cerrado biome, that in a baseline scenario would be legally suppressed in up to 20% or 65% of the native vegetation for economic purpose, respectively. The GPD considers all forest types as per Brazilian forest definition, including three categories of Cerrado (“Savana Florestada” and “Savana Arborizada”).

“3.6.11 Determination of baseline scenario and demonstration of additionality are based upon the initial project activity instances. The initial project activity instances are those that are included in the project description at validation and shall include all project activity instances currently implemented on the issue date of the project description. The initial project activity instances may also include any instances of the project activity that have been planned and developed to a sufficient level of detail to enable their assessment at validation.”

Regarding baseline and additionality, it is assumed that all private properties in this geographic area are subject to the same legal framework and similar deforestation agents and drivers as those identified for PAIs #1-2. All landowners within the Legal Amazon have the right to convert up to 20% of the forest area (or 65% of the Cerrado) in their private properties for economic purposes. In this context business-as-usual is livestock, sometimes followed by soybean, cotton or corn production. Specific assessment on baseline scenario and additionality will be done for each new activity instance included in the project scope after its validation.

“3.6.12 As with non-grouped projects, grouped projects may incorporate multiple project activities (see Section 3.6.1 – 3.6.3 for more information on multiple project activities). Where a grouped project includes multiple project activities, the project description shall designate which project activities may occur in each geographic area.”

The only project activity considered in the project scope for which carbon credits generation is attributable and that is related to the methodology adopted in the project design in all project activity instances is avoiding planned deforestation.

To avoid planned deforestation BRC will sign long-term conservation agreements with landowners. Complementary activities related to leakage mitigation, social and biodiversity related activities and monitoring activities are described in section 1.12 and 6.3.

“3.6.13 The baseline scenario for a project activity shall be determined for each designated geographic area, in accordance with the methodology applied to the project. Where a single baseline scenario cannot be determined for a project activity over the entirety of a geographic area, the

geographic area shall be redefined or divided such that a single baseline scenario can be determined for the revised geographic area or areas.”

Only one wide geographic area is considered for this grouped project once the baseline scenario for avoided planned deforestation activity in Legal Amazon is the same, and all private properties are subjected to the same regulatory framework. Please refer to sections 3.4.

“3.6.14 The additionality of the initial project activity instances shall be demonstrated for each designated geographic area, in accordance with the methodology applied to the project. Where the additionality of the initial project activity instances within a particular geographic area cannot be demonstrated for the entirety of that geographic area, the geographic area shall be redefined or divided such that the additionality of the instances occurring in the revised geographic area or areas can be demonstrated.”

Only one wide geographic area is considered for this grouped project, once the additionality approach for avoided planned deforestation activity in the Legal Amazon is the same and all private properties are subjected to the same regulatory framework and similar deforestation agents and drivers. For additional information, please refer to sections 3.5.

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

The relevant factors for the baseline scenario determination and demonstration of additionality of a given project activity instance are the same for the entire geographic area. Any legally constituted private properties within Amazon biome, with more than 80% of forest cover (or 35% for Cerrado) is eligible for this grouped project.

“3.6.16 Grouped projects shall include one or more sets of eligibility criteria for the inclusion of new project activity instances. At least one set of eligibility criteria for the inclusion of new project activity instances shall be provided for each combination of project activity and geographic area specified in the project description. Where grouped projects include multiple baseline scenarios or demonstrations of additionality, such projects will require at least one set of eligibility criteria for each combination of baseline scenario and demonstration of additionality specified in the project description. A set of eligibility criteria shall ensure that new project activity instances:

- 1) *Meet the applicability conditions set out in the methodology applied to the project.*

All PAIs under the GPD must meet the applicability conditions set out in the methodology VM0007 v1.7. Regarding PAIs #1 and #2, the applicability conditions are met as demonstrated:

- The 2 initial PAIs have no areas registered under the CDM or under any other GHG program.

- All lands included in the PAIs #1 and #2 are qualified as native primary forest, according to the Brazilian forest definition.
- Baseline deforestation and forest degradation in the project area fall within the category “Planned deforestation/degradation”.
- Leakage avoidance activities in the PAIs #1 and #2 do not include agricultural lands that are flooded to increase production, nor livestock production through use of feed-lots and/or manure lagoons.
- The baseline scenario for all the PAIs applied under this GPD are based in the legal conversion of forest lands to non-forest lands, according to the applicable law.

2) *Use the technologies or measures specified in the project description.*

Sections 1.12 and 5.3 define the technologies and measures available. The GHG emissions reductions will be caused by the signing of long-term forest conservation agreements with landowners in all PAIs. Complementary activities related to the reduction of planned deforestation, leakage mitigation, social and biodiversity related activities and monitoring activities are also described in section 1.12 and 6.3.

3) *Apply the technologies or measures in the same manner as specified in the project description.*

Any new PAI will apply the same technologies or measures specified in this document. Small adjustments are allowed to accommodate new PAI specificities. Any adjustment will be reported, described, and must not overestimate the project climate.

4) *Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.*

The grouped project assumes the Amazonas state as a unique wide geographic area, taking into consideration that all private properties within the Amazon biome are subject to the same legal framework. New PAIs must follow the same baseline approach described in section 3.4.

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

Considering that the grouped project refers to avoidance planned deforestation (APD) in areas where the forest suppression is permitted by law, all the subsequent project activity instances submitted under this GPD, must follow the same additionality approach presented in section 3.5 for PAIs #1 and #2. It means that the plausible baseline scenarios will not differ from the three scenarios identified in the additionality analysis, as follow:

a. Forest cover maintenance of 20% of the property in Amazon biome and 65% in Cerrado, where the land use conversion is allowed by law, i.e.: through conservation activities resulting from incentives other than the REDD APD project.

b. Legal deforestation of 20% of the property in Amazon biome and 65% in Cerrado, (deforestation with permits), where the land use conversion is allowed by law for i.e.: pasture (cattle raising) and agriculture.

c. Illegal deforestation of 20% of the property in Amazon biome and 65% in Cerrado, (deforestation without permits), where the land use conversion is allowed by law, for pasture (cattle raising) and agriculture purposes or simply for real estate speculation.

In reference to inclusion of new project activity instances:

“3.6.17 Grouped projects provide for the inclusion of new project activity instances subsequent to the initial validation of the project. New project activity instances shall:

1) Occur within one of the designated geographic areas specified in the project description.

The GPD has assumed only one wide geographic area, where PAIs can occur. This geographic area encompasses all the private properties legally constituted in the Amazonas state that encircles Amazon biome, with surplus of forest cover, as per the federal law 12.651, from May 2012.

2) Conform with at least one complete set of eligibility criteria for the inclusion of new project activity instances.

The set of eligibility criteria for the inclusion of a new project activity instances, is the following:

a. Regularized rural properties within the Legal Amazon with forest coverage greater than 80% in Amazon biome and 35% in Cerrado;

b. A landowner must have signed a long-term forest conservation agreement with the BRC;

c. New PAIs, must have a valid vegetation suppression license approved by the state environmental agency, or at least a submission protocol to this agency (as required by the VMD0006 v1.2), to obtain the deforestation permits, according to the federal law 12.651.

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

This document was prepared based on the joint PD and monitoring report VCS template and covers PAIs #1 and #2. New project activity instances will be included in the project scope in new monitoring reports. Technical, financial, and geographic information related to demonstration of compliance with the set of eligibility criteria here defined will be present in section 3.3 of the next monitoring reports.

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

Evidence of project ownership is defined as the second eligibility criteria, as mentioned in item 2 above.

- 5) *Have a start date that is the same as or later than the grouped project start date.*

According to the VCS start date definition, the start date of each activity instance will be the date of the protection plan implementation commencement which, in its turn, according to VMD0006 v1.2, is dependent on the issuance (or issuance request) of a legal permit for deforestation to the relevant government department. At this moment, the protection plan, represented by the project area long-term conservation agreement, is being implemented for PAIs #1 and #2. In this sense, it is characterized that the start date of a new project activity instance will always be later than or equal to the start date of the grouped project.

- 6) *Only be eligible for crediting from the later of start date of the project activity instance or the start of the verification period in which they were added to the grouped project, through to the end of the total project crediting period.*

The crediting period of a new PAI will be defined according to the specific PAI baseline, which in its turn will be determined in function of the area potentially deforested and the rate of planned deforestation, following VMD0006 v1.2 criteria. For more information on baseline determination, see section 3.4.

- 7) *Not be or have been enrolled in another VCS project.*

No enrollment in other VCS projects will be guaranteed with a thorough legal and technical analysis, in addition to the registration of all credits and reports on VERRA's platform.

- 8) *Adhere to the clustering and capacity limit requirements for multiple project activity instances set out in 3.6.8 – 3.6.9.*

All clustering and capacity limits will be adhered, as presented on item 3.6.8 and 3.6.9 above.

1.6. Project Proponent

Table 3 presents the Project Proponent of Amazonas APD GPD. Presents the Organization name, contact person, address, telephone number and e-mail.

Table 3 – Project Proponent of Amazonas APD GPD.

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

1.7. Other Entities Involved in the Project

Table 4 presents other entities involved on Amazonas APD GPD project, besides the organization name, contact person, address, telephone number and e-mail.

Table 4 – Other Entities Involved on Amazonas APD GPD.

Organization name	Incorporadora Manicoré LTDA
Role in the project	Landowner of instance PAI #1
Contact person	Mr. Rogerio Oliveira
Title	Manager
Address	Av. Eduardo Ribeiro, 549, Bairro Centro, Cidade de Manicoré, AM, ZIP CODE: 69280-000
Telephone	+55 (69) 9969-1707
Email	luizrogerio_oliveira@me.com / rogerio@gerflor.eng.br / flavio@madbatista.com.br

Organization name	(1) Mr. Marcelo Abreu Ribeiro / (2) Mr. Álvaro Abreu Ribeiro / (3) Mrs. Paola Abreu Ribeiro De Souza Leão / (4) Mrs. Patrícia Abreu Ribeiro Noto
Role in the project	Landowner of instance PAI #2
Contact person	(1) Marcelo Abreu Ribeiro / (2) Alvaro Abreu Ribeiro / (3) Paola Abreu Ribeiro De Souza Leão / (4) Patrícia Abreu Ribeiro Noto
Title	Landowners
Address	Rua Oscar Rodrigues Alves, 55, Sala 76, Araçatuba/SP ZIP CODE: 16010-330
Telephone	+55 18 99143 4310 (Mr. Marcelo Abreu Ribeiro)
Email	(1) marcelao@me.com / (2) aar357@gmail.com / (3) paola.ribeiro@terra.com.br / (4) patnoto@me.com

1.8. Ownership

The project ownership in accordance with the VCS Program requirements on project ownership are the Project Proponent – BRCarbon – and the PAI#1's Landowner – **Incorporadora Manicoré** and instance PAI #2's Landowners (**1 - Mr. Marcelo Abreu Ribeiro / 2 - Mr. Álvaro Abreu Ribeiro / 3 - Mrs. Paola Abreu Ribeiro De Souza Leão / 4 - Mrs. Patrícia Abreu Ribeiro Noto**).

As previously presented in sections 1.6 and 1.7, these are the two entities that have the legal right to control and operate project or program activities.

BRCarbon has a legal agreement signed with the landowners, Incorporadora Manicoré and PAI #2's Landowners (APPENDIX_I-LEGAL_AGREEMENTS). The landowners have the property of the land on project are being developed, as can be found on ANNEX_I-LAND_TENURE.

1.9. Project Start Date

The project's start date and its justification is summarized in the following table.

Table 5 – Project Start Date for Amazonas APD GPD.

Project start date	21-July-2023
Justification	The agreements between BRCarbon and Landowner was celebrated on 21-July-2023

1.10. Project Crediting Period

The project crediting period is summarized on following table:

Table 6 – Project Crediting Period for Amazonas APD GPD.

Crediting period	☐ Seven years, twice renewable ☐ Ten years, fixed ☒ Other – a hundred years (state the selected crediting period and justify how it conforms with the VCS Program requirements)
Start and end date of first or fixed crediting period	21 st July 2023 to 20 th July 2123

The GPD will generate GHG emission reductions eligible for issuance as VCUs for 100 years. The crediting period starts on July 21st, 2023, and ends on July 20th, 2123. This approach is considered due to the project group character that allows the inclusion of new PAIs in the project scope over the project lifetime.

PAIs #1-2 will generate GHG emission reductions eligible for issuance as VCUs for 10 years, that is, the first baseline period. A legal agreement (APPENDIX_I-LEGAL_AGREEMENTS) was signed with the landowner to continue the management practices that will lead to the project area conservation for at least 40 years, thus, the project activity instances longevity is 40 years. New PAIs will have different crediting period starting dates, based on the deforestation permits issued by the responsible environmental agencies in each state.

1.11. Project Scale and Estimated GHG Emission Reductions or Removals

The grouped project is to be considered as a large-scale project as more than 300,000 tons CO₂e of GHG emissions reductions will be generated per year, as presented on Table 7.

- ☐ < 300,000 tCO₂e/year (project)
- ☒ ≥ 300,000 tCO₂e/year (large project)

Table 7 - Estimated GHG emission reductions (Table 02 from APPENDIX_II-CALCULUS_TABLE – “Consolidate Results”).

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO ₂ e)
21-July-2023 to 30-November-2023	505,872
01-January-2024 to 31-December-2024	521,577
01-January-2025 to 31-December-2025	537,281
01-January-2026 to 31-December-2026	552,986
01-January-2027 to 31-December-2027	568,690
01-January-2028 to 31-December-2028	584,395
01-January-2029 to 31-December-2029	600,099
01-January-2030 to 31-December-2030	615,804
01-January-2031 to 31-December-2031	631,509
01-January-2032 to 31-December-2032	647,213
Total estimated ERRs during the first or fixed crediting period	5,765,427
Total number of years	10
Average annual ERRs	576,542.7

1.12. Description of the Project Activity

The GPD aims the forest conservation on private properties located in the Amazonas state. Its primary goal is to preserve the Amazon native vegetation through income generation for landowners, from carbon credits commercialization.

This grouped project works by avoiding deforestation in private properties, that in the absence of the project activities would have part of its forest cover legally suppressed, as allowed by the national law 12,651. According to this law, a landowner can get permit to suppress up to 20% of forest or 65% of the Cerrado within its rural property, to implement commercial activities, such as cattle raising and agriculture.

In this sense, the main project activity is the execution of long-term agreements with landowners for the conservation of native vegetation cover in areas subjected to legal suppression in Amazonas state. Complementary activities will be related to leakage mitigation, the promotion of positive net benefits to communities, biodiversity conservation¹ and the project monitoring.

The list below describes the project activities specifically and related to climate, community, and biodiversity objectives (project axis). The project activities type, and implementation status can vary among PAIs depending on contextual aspects.

Legal Protection: this project activity consists of signing long-term conservation agreements with private landowners in the Legal Amazon. The agreements are made for 40 years and imply landowners' commitment to the conservation of specific forest areas on their properties. In other words, by signing the agreement, landowners undertake not to carry out activities that involve the forest conversion to other land uses, such as livestock or agriculture, for the project lifetime. Agreements can be renewed for up to 100 years. BRC will be responsible for the project development, the implementation of the project activities, the project monitoring and the validation and verification of the grouped project.

Forest Surveillance: deforestation, forest degradation and burn scars will be monitored through satellite images associated with ground truth verifications annually. Land use change maps and orbital imagery will be collected from PRODES2 & DETER3/INPE4, GLOBAL FOREST WATCH and FIRMS/NASA. The burnt area is measured according to $\Delta NBR6$ spectral index and verified with high spatial resolution satellite imagery from Sentinel-2, along with ground truth verifications.

Forest Biomass Inventory: aboveground biomass in trees will be estimated through permanent plots systematically installed over the project area, and when feasible LiDAR data collected through drone surveys. Reliable techniques using drone-LiDAR metrics used a wall-to-wall method from ground-based forest inventory in a modeling approach. Non-tree biomass component and below-ground biomass on tree and non-tree component will be indirectly estimated through secondary data and default values for conversion factors from peer-review studies and reputable information sources. Dead wood and litter will be estimated from direct measurement in the same permanent plots. Biomass estimates are considered fixed during the first baseline period.

Biomass will be re-measured within a 10-year interval. Carbon stock change in every pool will be estimated by stock difference method. Estimates will be considered within a 90% confidence interval. New estimates shall take precedence over previous estimates where outside (i.e. greater than or less than) the 90% confidence interval of the previous estimates. For a complete description of forest biomass inventory methods BRC will present standard operational procedures in the next version of this document.

Sustainable Forest Management: forest management operations can be carried out in the project area if Forest Stewardship Council (FSC) certified. Responsible forest management is an economic alternative appropriate to the Amazon region and compatible with the conservation of forest cover in the project area. The FSC certification ensures the use of reduced impact logging techniques, mitigating initial losses in carbon stocks, enabling the natural regeneration of the forest and the restoration of carbon stocks to the initial levels in the medium-long term. The impacts of forest management, GHG emissions associated with the forest management activity and forest regeneration will be assessed in accordance with the project's monitoring plan and in consideration of VMD0007 v1.6 criteria. In these cases, BRC will also offer consultancy services to adapt the forest management plan, training for workers involved in the forest management operation and other necessary to comply with the FSC standard.

Wildfire Prevention and Fire Fighting: wildfires in tropical forests are associated with human activity and occur with greater frequency, intensity and severity in drier years and degraded forests. Such conditions can be significantly present in the project area, which will depend on the level of territory occupation and the occurrence of climatic anomalies, such as El Niño. Thus, to protect carbon stocks in the project area, the project will work with environmental education and training on land management, fire brakes implementation, formation, and equipment of fire brigades and possibly, with the implementation of monitoring towers equipped with cameras capable of detecting smoke. Environmental education and land management training activity will be related to fire ecology and good practices in preparing areas for cultivation, with focus on preventing the fire spread into forests. The training and the equipment of voluntary fire brigades will be focused on combat actions. The monitoring towers will serve the purpose of reducing the response time of the brigade members, increasing their efficiency in fighting forest fires. The cameras attached to the monitoring towers can detect smoke patterns within a radius of 15 km in less than 3 minutes, triggering a signal with the location of the fire spot automatically to a control center, which can then alert and mobilize the brigades for combat.

Leakage mitigation: considering the project scope, leakage can be understood as the legal deforestation attributable to landowners (project participants) in other areas of their property (outside the project scope). Thus, leakage mitigation actions will be related to leakage monitoring, estimation of GHG emissions attributable to activity shifting and deduction of the project's net GHG emissions reduction in a specific monitoring period. This project activity will also be associated with advocacy with landowners focusing on the reduction of GHG emissions due to activity shifting leakage in future monitoring periods.

Digital inclusion: in many cases the existing communities within the project area live in isolated conditions, without access to means of communication and far travel days to the nearest city. This puts them in a vulnerable condition, negatively affecting their economy, health, education, citizenship, and well-being. This project activity is focused on installation of base stations for the provision of internet and an internet access point in schools, more than that, there will be proper training on a good use of this tool.

Education: articulation with public authorities to support Educational Programs. BRC will work to establish public-private partnerships and invest in educational programs to increase their scope and effectiveness, benefiting communities within the project area. Installation or renovation of schools. Purchase of scholar equipment. Lectures on the environment, forests, environmental services, biodiversity, environmental conservation, sustainable forest management, climate change, carbon cycle, environmental legislation, labor legislation, associations, among others, will be promoted in person or remotely at specific events.

Health: articulation with public authorities to support Itinerant Health Programs. BRC will work to establish public-private partnerships and invest in health programs to increase their scope and effectiveness, benefiting communities within the project area. Installation or renovation of health posts.

Sanitation: promotion of environmental sanitation through the implementation of ecological toilets/pits (eg: EMBRAPA pit, pit with bananas, biodigester pit, dry toilet, etc.).

Training: training will be offered to communities in different areas of knowledge: forest inventory, sustainable forest management (timber and non-timber forest products), forest fire fighting, solid waste management, associations.

Employment: community representatives will be hired to advise BRC's work in the field. The hiring will be done on a daily paid basis for the elaboration of a specific service. Services may vary depending on the activity in question. Examples of services can be given such as field guide, forestry worker, forestry inventory worker, bricklayer, carpenter, etc.

Access to clean water: potability analysis, chlorine, fencing of springs (to prevent the animals' access to water), acquisition of pumps, hydraulic rams' implementation, among other strategies more appropriated to the field.

1.13. Project Location

The GPD is in the Amazon Biome's and has a comprehensive geographical boundary whose objective is to encompass all rural properties with native vegetation subjected to legal suppression for the implementation of agricultural projects, mainly related to pastures or annual crops in the Amazonas state.

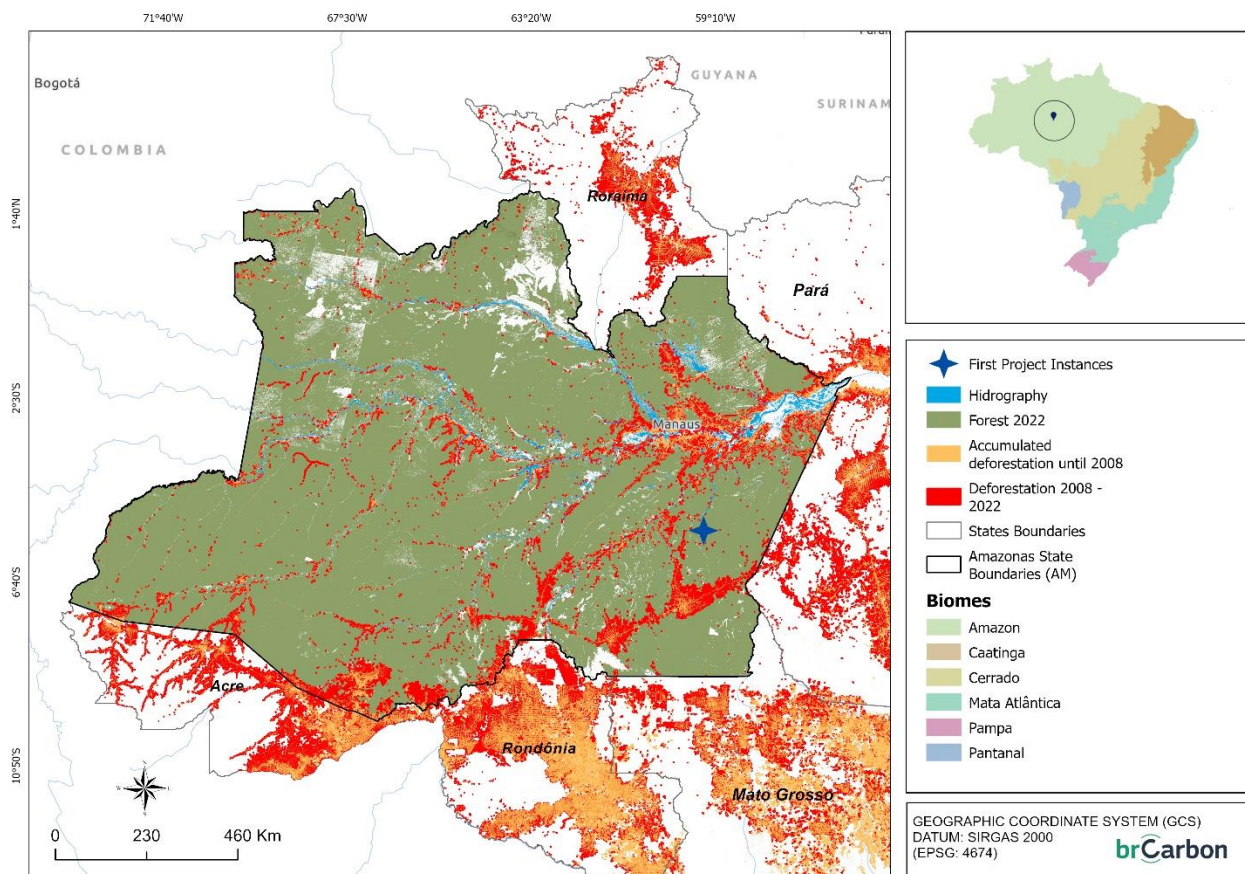


Figure 2 – Map of Project Location.

The PAI#1 and PAI#2 are located in the Borba municipality, of Amazonas state (Figure 2). The following table shows the properties names and a centroid geographical coordinate by project activity instance (Table 8). Coordinates are also submitted separately as a KML file (APPENDIX_III-GIS_DATABASE).

Table 8 - Geodetic coordinates of Project Instances.

PAI	Property name	Geodetic coordinate (Lat. Long.)	
#01	Fazenda Cabaça	-5.677015	-59.280850
#02	Fazenda Pacová	-5.500502	-59.432091

1.14. Conditions Prior to Project Initiation

The conditions prior to project initiation are the same as those identified in the baseline scenario, that is, agricultural projects in planning or implementation stages for which deforestation authorizations have been issued by or requested to the responsible environmental agency of Amazonas state (APPENDIX_IV-BASELINE_DEFORESTATION_PERMITS). Figure 3 shows the expansion of cattle raising and agriculture activities in the PAIs #1 and #2 region in the past 31 years.

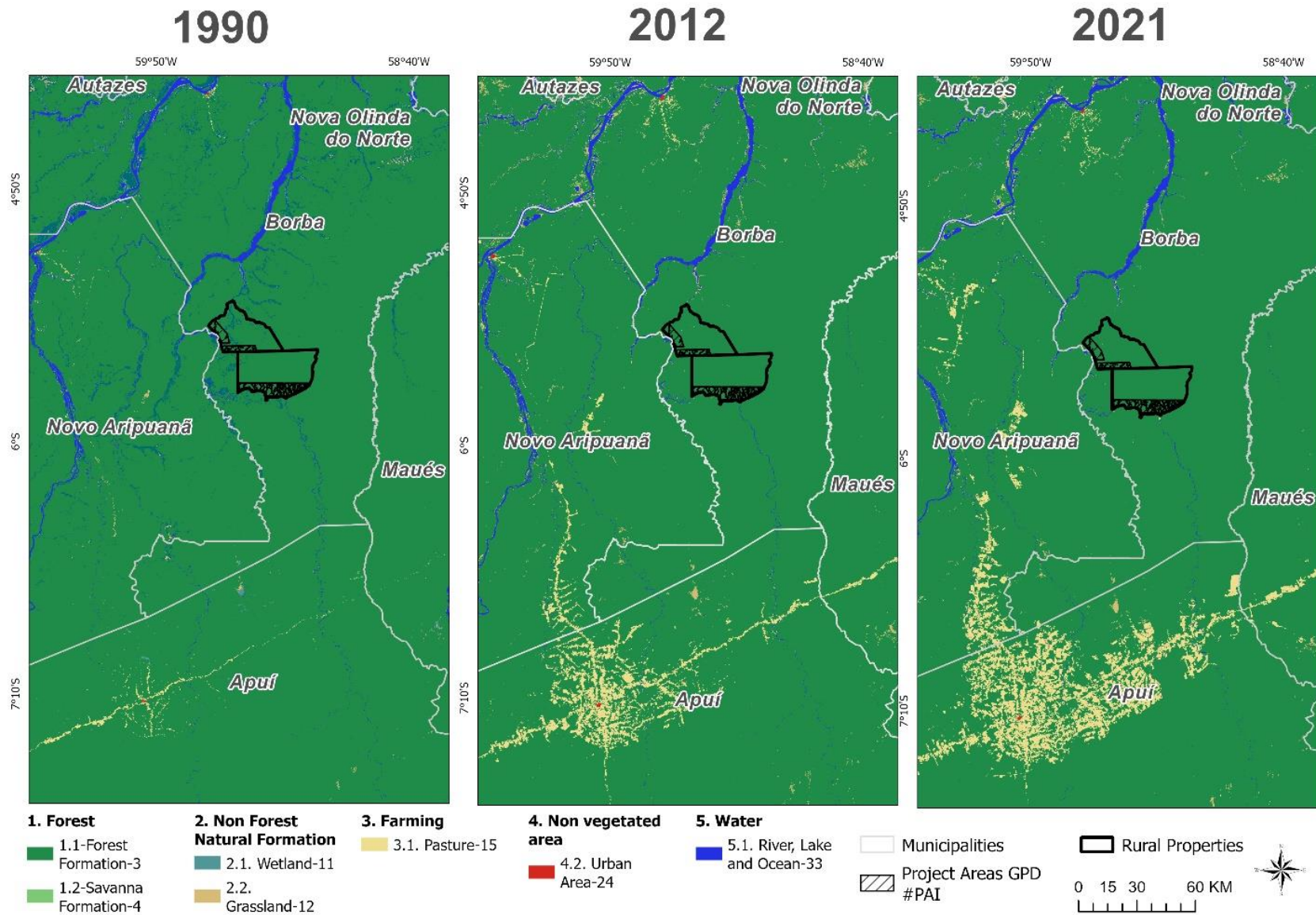


Figure 3 - Condition Prior to Project Initiation.

Information on the climate, hydrology, topography, soils, vegetation, and ecosystems can be found below.

1.14.1. Climate

According to the Köppen-Geiger classification (Figure 4) the properties climate falls under Group A (Humid Tropical Climate), specifically the Af (Wet Equatorial Climate) subtype. This climate is marked by consistently high temperatures throughout the year, with monthly temperature variations typically less than 3°C (37°F). The limited radiative cooling during the evening can be attributed to the abundance of solar radiation, cloud cover, and high humidity. Additionally, this climate experiences year-round plentiful precipitation, frequent formation of cumulus and cumulonimbus clouds (thunderstorms) in the early afternoons due to intense surface heating and high humidity. The presence of the Intertropical Convergence Zone contributes to the high, constant, and evenly distributed monthly precipitation, resulting in annual amounts usually exceeding 1500 mm.

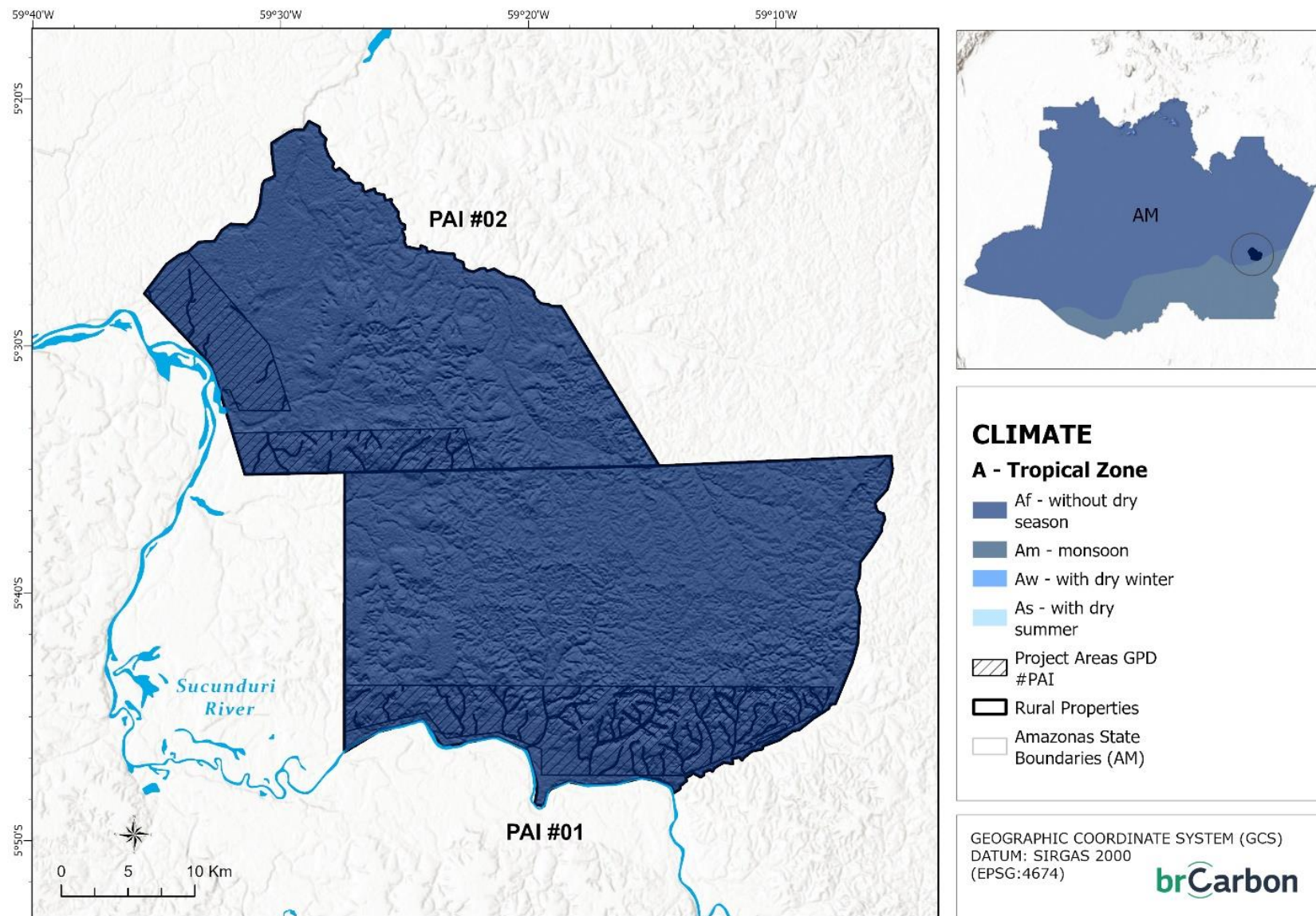


Figure 4 - Climate on Project Properties

1.14.2. Soils

The primary soil types found in the project properties are categorized as Latossolo Amarelo Distrófico (Figure 5). These soils exhibit a high clay texture, low inherent fertility, and elevated levels of aluminum toxicity. The soils found on plateaus are clayey, while those on slopes are clayey and covered by a sandy layer, which is associated with Podzólico Amarelo soils in the lower third of the topo sequence. Deposits of white quartz sand are found in areas near watercourses. The Latosols under the forest canopy have good drainage but are vulnerable to compaction when exposed. The nutrient content and cation exchange capacity are low. Base saturation is below 10%, and pH ranges from 3.7 to 4.7 (H₂O). Aluminum saturation is above 90%. The cation exchange capacity ranges from 1.5 to 2.5 meq. Phosphate is present in quantities below 4ppm.

The project properties also have the presence of Latossolo Vermelho-Amarelo Distrófico, which are associated with flat, smoothly undulating, or wavy terrain. They occur in well-drained environments, being very deep and uniform, which favors the percolation of water. Despite being considered a dystrophic soil, Latossolos Vermelho-Amarelos Distróficos can still have moderate natural fertility and are able to support the growth of a variety of vegetation.

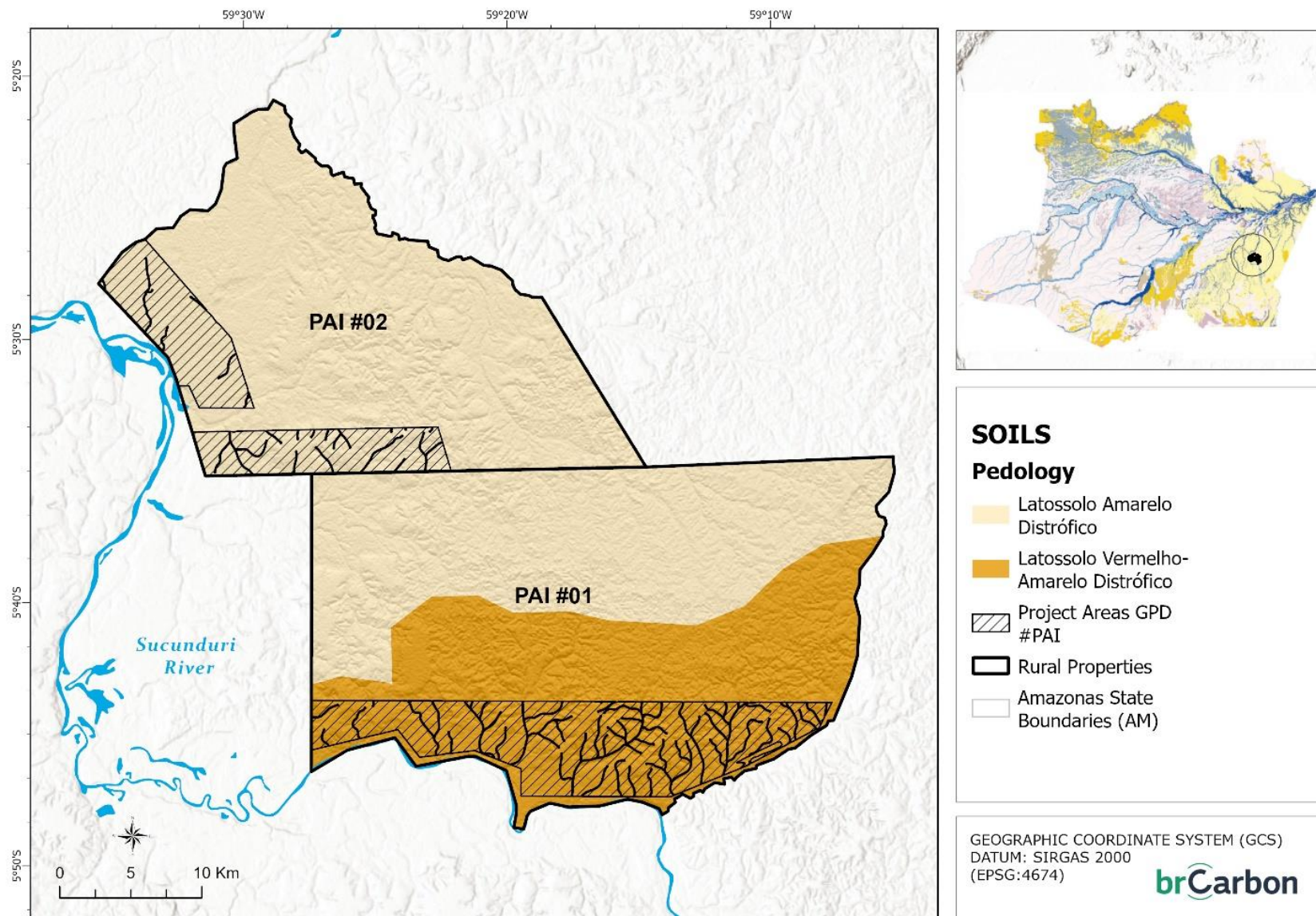


Figure 5 - Soil Types on Project Properties.

1.14.3. Topography

The topography is determinant in several processes of natural and anthropic origin, and therefore, is a fundamentally important factor in environmental modeling. Several authors have suggested that these factors are the major determinants in the distribution of plant species and the structure of their communities, at local and regional scales (SCHIETTI et al., 2007).

Topography data came from INPE's TOPODATA Program and it were generated in a 30m resolution for the whole of Brazil from the SRTM data (Shuttle Radar Topography Mission).

Altitude data were used in relation to sea level, slope % and the land classification shape proposed by EMBRAPA for the entire national territory. Figure 6 below illustrates the variation of altitude (meters) in the Project region, which predominates vast domain of land with modest altitudes, less than 146 m.

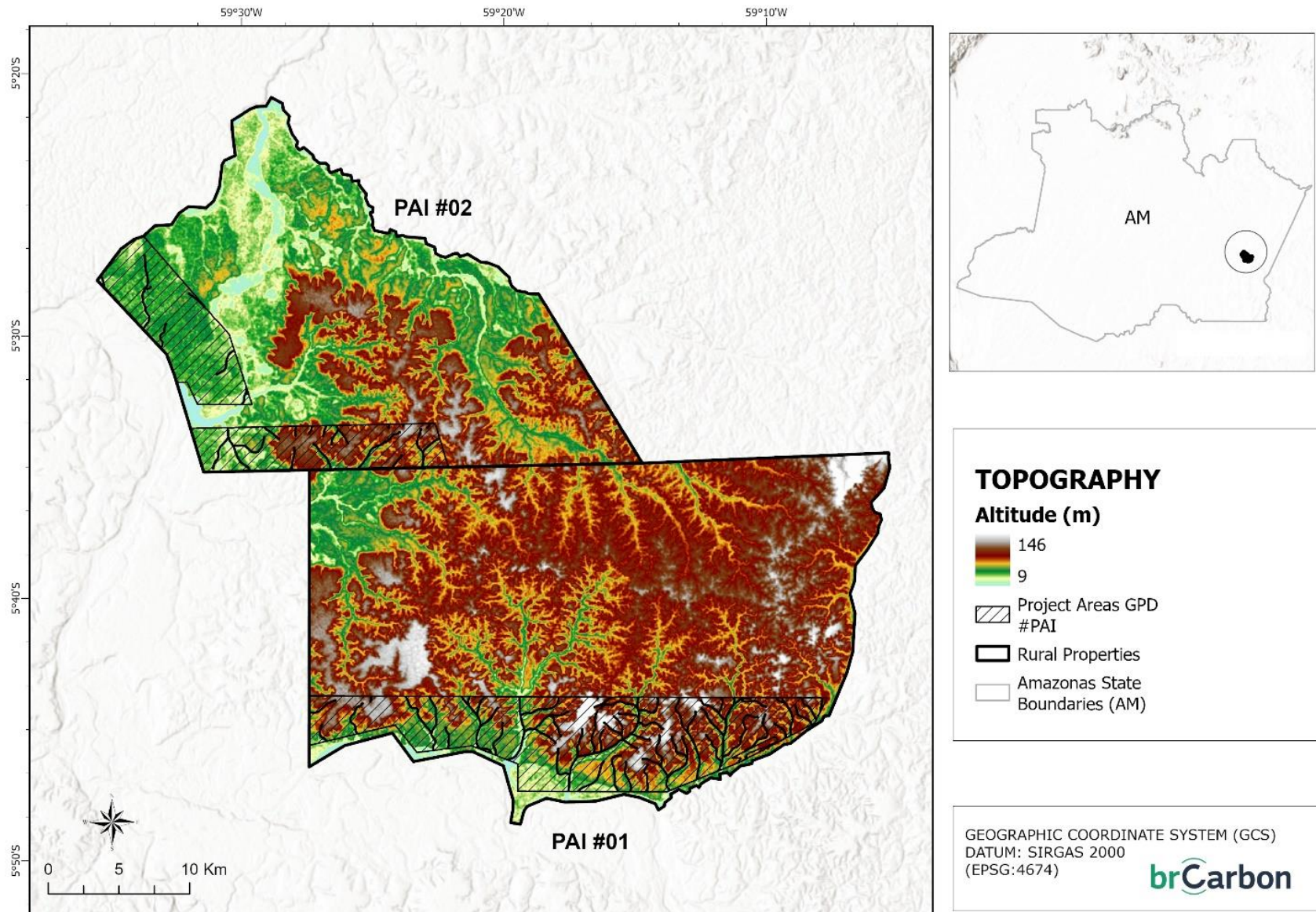


Figure 6 - Topography on the Project Properties.

1.14.4. Slope

The relief of PAI #01 varies from Plan to Strong Wavy with a predominance Wavy relief according to EMBRAPA classification (1989). The average slope in the instance area is 8,8%, ranging from 0.2% to 44,1%.

In PAI #02 soft wavy type is predominant, with areas with wavy relief. The mean slope in the instance area is 7.2%, ranging from 0.3% to 39% (Figure 7).

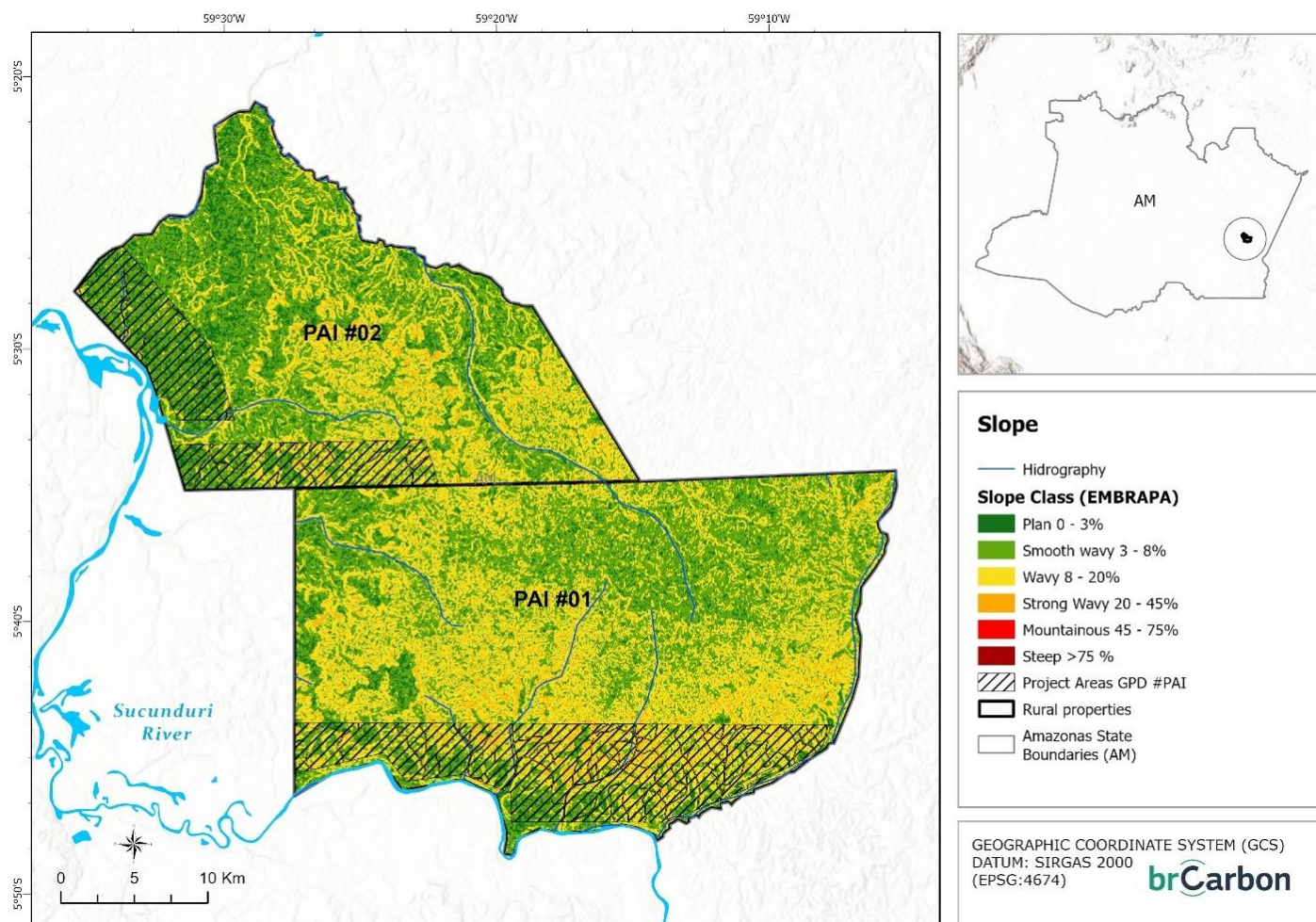


Figure 7 - Slope on the Project Properties.

1.14.5. Vegetation

All PAIs are inserted in the Amazon Biome, where a diversity in the vegetation types associated with edaphoclimatic variations can be observed. Dense Ombrophyllous Forests (humid forests) are predominant, while pioneer formations are also found, as can be found on Figure 8. They are characterized by the dominance of perennial species, presenting green leaves throughout the year due to the high rainfall and solar radiation incidence near the Equator.

Among the Ombrophyllous Forests, variations in forest types associated with local edaphoclimatic specificities are identified, strongly influenced by the weather, soil types and distance from large rivers. Three types of forest were identified along PAIs #1-2: Dense, Alluvial Submontane and Lowland. A portion of pioneer forest was also found.

1. Dense Ombrophyllous Forests: Submontane (Ds), Alluvial (Da) and Lowlands (Db)
2. Pioneers Forests: (Pa)

The Dense Ombrophyllous Forests are also known as tropical rain forests. It has dense vegetation in all strata, occurs in regions of the Amazon biomes and coastal zone of the Atlantic Forest where the biologically dry period is practically non-existent.

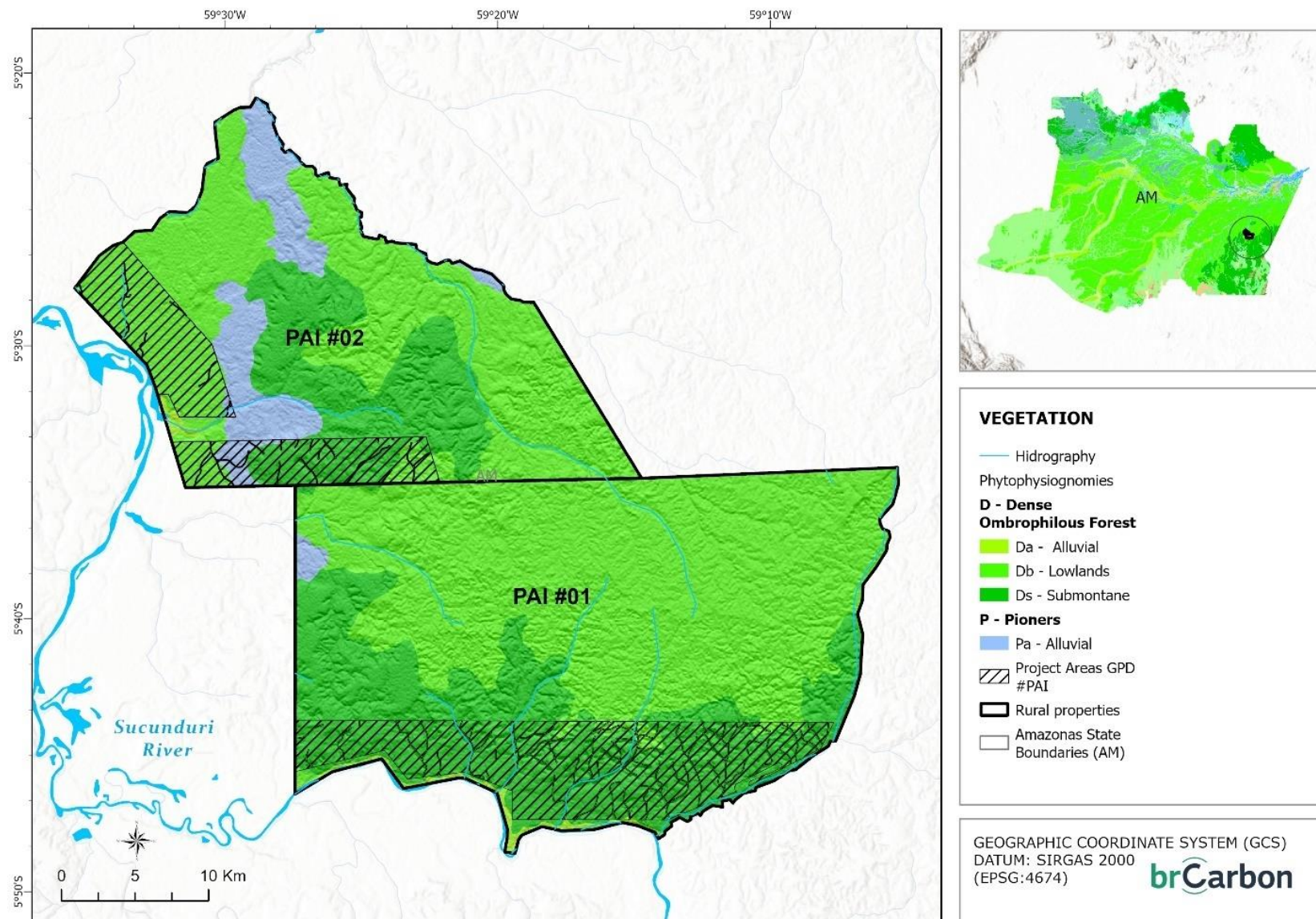


Figure 8 - Vegetation on the Project Properties.

The vegetation of PAIs #1 - #2 is predominantly Lowland Ombrophyllous Forest (Ds), which accounts for 60.4% of the area with approximately 514.2 tCO₂ -e ha⁻¹, followed by Submontane Ombrophyllous Forest (Ds), representing 32.7% of the area and approximately 493.1 tCO₂ -e ha⁻¹ (Table 9).

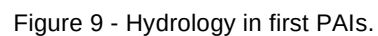
Table 9 - PAI #1 and #2 Vegetation.

Forest Type	PAI #1 Area (ha)	PAI #2 Area (ha)	General Area (ha)	Coverage (%)
Open Dense Ombrophyllous (Db)	51.014,53	31.884,33	82.898,86	60,4%
Dense Ombrophyllous Submontane (Ds)	30.313,45	14.629,99	44.943,44	32,7%
Alluvial Dense Ombrophyllous (Da)	955,80	342,37	1.298,17	1%
Alluvial pioneer (Pa)	501,41	7.649,37	8.150,78	5,9%
Total	82.785,19	54.506,10	137.291,25	274.582,54

1.14.6. Hydrology

The project areas are inside the Urarir-Canum Basin. The main river that passes close to the properties is the Sucunduri River, which serves as a route for the transportation of food and goods by large boats during the flood season. The river is also known for its sport fishing, which attracts a lot of visitors and tourists, where the main fish to be found is the Tucunar.

The following Figure 9 presents hydrology in first PAIs.



1.14.7. Deforestation

Recent data from INPE (INPE, 2022) reveals that the accumulated deforestation in the Legal Amazon reached 85,295 km² over the past decade (2013-2022). Notably, the annual deforestation is alarmingly high, with 13,000 km² of losses in 2021 and 11,000 km² of losses in 2022.

As of now, nearly 20% of the Brazilian Amazon's forest cover has been lost, and an additional 33% is experiencing degradation. The state of Amazonas has shown a particularly concerning trend in deforestation rates. It accounted for 17.8% of the total Amazon deforestation in 2021 and increased to 22.4% in 2022. This represents a significant surge in deforestation within the state, with a 55% increase from 2020 to 2021 (INPE ,2021), followed by an additional rise of 12.5% from 2022 to 2023.

The Figure 10 highlight the escalating challenge of deforestation in the Amazon, particularly in the state of Amazonas, underscoring the urgent need for effective conservation strategies.

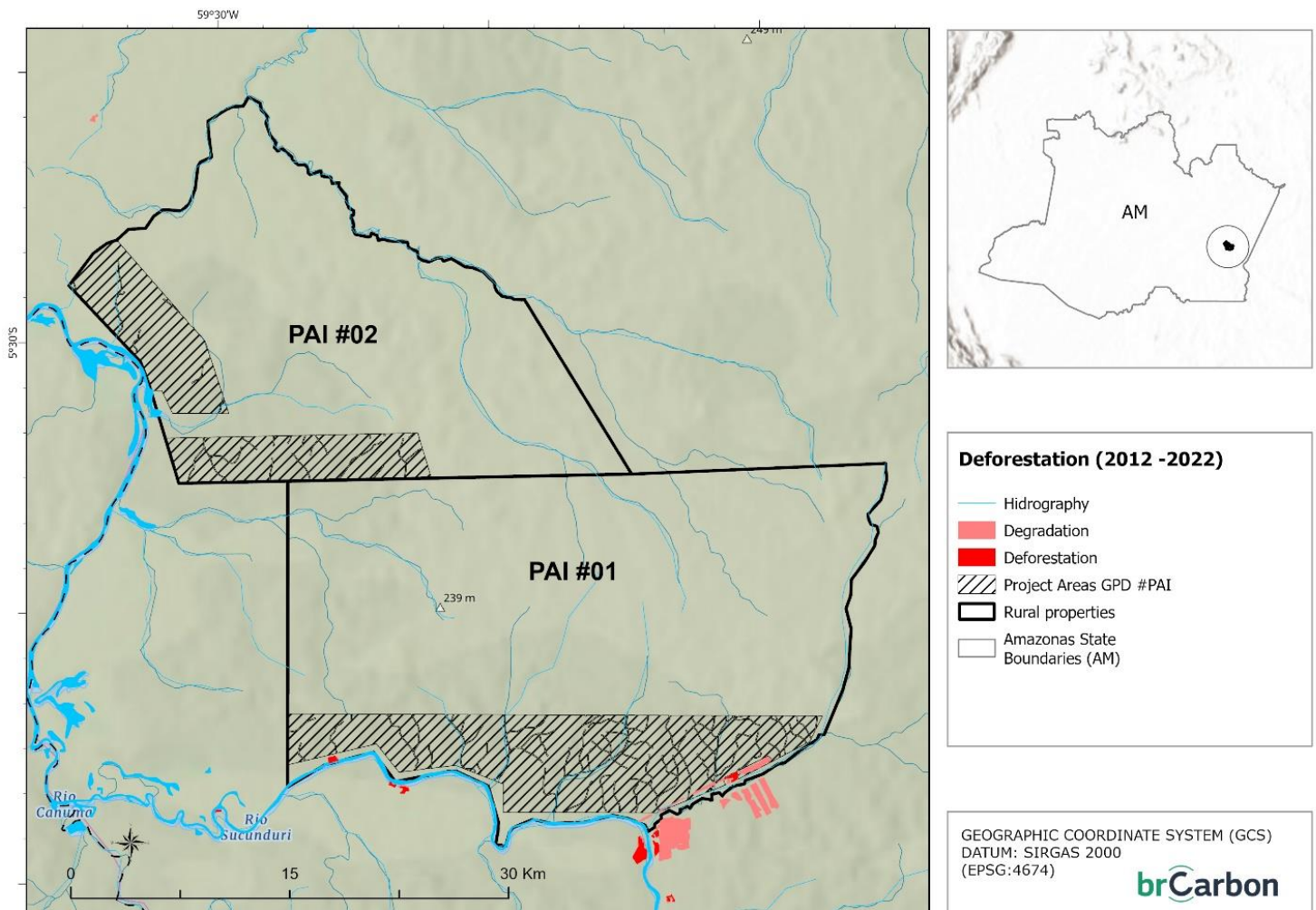


Figure 10 – Deforestation in first PAIs.

1.14.8. AFOLU projects

- Ecosystem type:

The ecosystem present on the project location can be described as a Terrestrial, or Forest, Ecosystem, more specifically a Tropical Rainforest with a predominance of Dense Ombrophyllous Forest with Open Alluvial and Open Lowland subtypes, and the soil types are mainly composed of Latossolos. The project will be developed in the Amazon Forest, a region known for its high biodiversity and its high levels of biomass stockage, besides the historical lack of state action regarding sustainable production and the support for local communities.

- Current and historical land-use:

The conditions prior to project initiation are the same as those identified in the baseline scenario, that is, agricultural projects in planning or implementation stages for which deforestation authorizations have been issued by or requested to the responsible environmental agency of Amazonas state.

- Present and prior environmental conditions of the project area:

Based on spatial data from global climate mapping at a spatial resolution of 0.5°, the predominant climate type identified in the project area was Af – Tropical wet climate, meaning it doesn't have a dry season.

Tropical climates exhibit consistently elevated temperatures throughout the year, particularly at sea level and low elevations. Average temperatures remain at 18 °C (64.4 °F) or above for all 12 months, accompanied by generally abundant annual precipitation. Unlike regions with distinct seasons, tropical climates lack a true winter.

In a tropical wet climate, precipitation levels remain consistently high, with an average of at least 60 mm throughout every month. Typically found within a 10° latitude of the equator, this climate type lacks natural seasons characterized by significant variations in temperature and moisture.

1.15. Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project proponent is committed to meet all applicable Brazilian laws and applicable regulations. On this sense, BRC follow consultant lawyers to observe local laws and applicable regulations. The following laws, statutes or regulatory frameworks are the most relevant to the project activities. The presentation order will follow the governance level, from National laws to municipality laws and other regulatory frameworks and follow chronology.

For all project activity instances, verified or under verification process, the Project proponent is already committed to meet all applicable Brazilian laws and regulations applicable to worker rights, as can be seen below. Furthermore, have informed all workers about their rights, before hiring as its described in the Brazilians Labors Laws.

1.15.1. Relevant Law and Regulations Related to Worker's Rights

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

Labor Federal Law (Consolidate of Working Laws ("CLT")): Decree-Law N. ° 5,452, of May 1st of 1943. This decree gives more clarification on the subjects: i) Hourly, daily, weekly, and monthly work hours, ii) Employment of minors and women, iii) Establishes a minimum wage, iv) Worker safety and safe working environments, v) Defines penalties for employer's non-compliance, vi) Establishes a judicial work-related process for addressing all worker related issues. **FEDERAL LAW** N° 5,889, June 8th of 1973 (Establishes Regular Norms for Rural Workers). This is a complementary law to the 1943 decree, once prior to 1973, rural workers did not have the same rights as urban workers. In 1973, this law was established to specify the equality between urban and rural workers, along with compensation for overtime.

Complementary Law 123/2006 of December 14th, 2006. Establishes the National Statute of Microenterprise and Small Business; change devices of the Laws in 8,212 and 8,213, both dated July 24th, 1991, of the Consolidation of Labor Laws - CLT, approved by Decree-Law no. 5,452 of 1st of May 1943, of Law no. 10,189, of February 14th of 2001, of the Complementary Law in the 63, of January 11th, 1990; and revokes the Laws in the 9,317 of the 5th of December 1996, and 9,841 of October 5th, 1999. Art. 3 For the purposes of this Complementary Law, are considered micro-enterprises or companies small business company, simple society, the individual company of limited liability and the entrepreneur who refers to art. 966 of the Law in 10,406 of the 10th of January 2002 (Civil Code), duly registered in the Registry of Merchant Companies or in the Civil Registry of Legal Entities.

1.15.2. Federal Legal Instruments

In a wide overview of legal aspects, the project observes the principles established in the **Federal Constitution**, as per **article 225**, by contribution to ecologically well-balanced environment, and **article 224**, paragraph 1 (I) and (III) by contribution to conservation and restoration of essential ecological processes, while supporting the preservation of attributes beyond the legal environment requirements.

The GPD is also encompassed by principles established in the **National Environmental Policy - Law No. 6,938 from August 31st, 1981**, which declares the objectives of conservation, improvement and recovery of environmental quality that is conducive to life, having among its principles the protection of ecosystems with the conservation of relevant areas (**article 2, item IV**) and the protection of areas threatened by degradation (**item IX**).

Regarding the land use national policy, the most important regulatory framework is the **Forest Code, law 12,651, from May 2012**. This law states not only the forest category that must be conserved inside the private properties, but also the maximum area of native vegetation that can be converted in other land uses for economic purposes. The GPD was assembled to promote conservation in areas that in the absence of the project activities, would be legally deforested (20% in Amazon biome, 65% in Cerrado) to accommodate commercial activities, as cattle rising and agriculture, as per the **article 12** of the **Forest Code, law 12,651**.

All PAIs were implemented in accordance with existing legal requirements, including those assumed in the most plausible baseline scenario, as presented in section 3.5.

The project is also in straight line with the Federal Law no. 12,187, of December 29, 2009, which instituted the National Climate Change Policy, the State Law 2,308 from October 2010 which instituted the State System of Incentives for Environmental Services – SISA and the Incentive Program for Environmental Services - ISA Carbon, the state Law no. 1,904, of June 5, 2007, which instituted the Ecological Economic Zoning of the State of Acre - ZEE/AC and the guidelines of the State Policy for the Valorization of Forest Environmental Assets.

The project is also in line with Law 14,119/21, which defines concepts, objectives, guidelines, actions, and criteria for the implementation of the **National Policy for Payment for Environmental Services (PNPSA)**, institutes the **National Register of Payment for Environmental Services (CNPSA)** and the **Federal Program for Payment for Environmental Services (PFPSA)** and provides on payment contracts for environmental services.

According to the **Law 14,119/21** carbon sequestration is considered an ecosystem service with relevant benefits to society in terms of maintenance, recovery, or improvement of environmental conditions (**Art.2, § II**) and the **Federal Program for Payment for Environmental Services (PFPSA)** will promote actions of maintenance of areas covered by native vegetation that would be subject to suppression authorization for alternative use of the soil (**Art. 7, § VII**).

The project is also based on the **Federal Laws number 5,197, from January 3rd of 1967**, that regulates fauna protection and provides other provisions, **and law number 9,605, from February 12nd of 1998**, that provides for criminal and administrative sanctions derived from the environment's harmful conduct and activities, and other provisions.

Finally, despite not encompassing indigenous areas, or natural areas used for these people, BRC has performed social engagement process and free, prior, and informed consent protocols with riverine communities, as per the **Convention no. 169** of the **ILO and the United Nations Declaration on the Rights of Indigenous People**. This population participated in the project assembling since its beginning, as will be presented in the Community section of CCB GPD and complementary social reports.

1.15.3. Amazonas State Legal Instruments

State Law number 1,532, from 1982 – regulation of the State Politics of Prevention and Control of pollution, Improvement and Environment Recuperation, and of the Natural Resources Protection.

State Law number 3,525, from 2010 - Provides the creation of the Council of Sustainable Development of People and Traditional Communities of the Amazonas State – CDSPCT/AM, in the organizational structure of the State Secretariat of the Environment and Sustainable Development.

State Law number 3,785, from 2012 - Provides for environmental licensing in the Amazon State.

State Law number 4,222, from 2015 - Institutes the State Technical Register of Potentially Polluting Activities or Users of Environmental Resources, member of the National Environmental System - SISNAMA, the Environmental Control and Inspection Fee (TCFA/AM) in accordance with Federal Law n. 6,938, of August 31, 1981, and its amendments, and gives other measures.

State Law number 4,457, from 2017 – Institutes the State Policy of Solid Waste in Amazonas/AM and gives another providence.

Complementary Law number 187, from 2018 – Disciplines the execution of the article 220 of the State Constitution, that institutes the State Council of Environment of the Amazonas State (CEMAAM) and dispose of the State Fund of Environment (FEMA) and gives other measures.

Ordinance number 41,863, from 2020 - This Decree establishes norms for the execution of the State Policy on Solid Waste.

CERH-AM Normative Resolution number 001, from 2016 – The Internal Regulations of the State Council of Water Resources are instituted in the form of the Annex to this Normative Resolution.

Ordinary **State Law number 5,695, from 2021** - Amends, as specified, Law No. 4,222, of October 8, 2015, which "Institutes the State Technical Register of Potentially Polluting Activities or Users of Environmental Resources, part of the National Environmental System - SISNAMA, the Control Fee and Environmental Inspection (TCFA/AM) in accordance with Federal Law No. 6,938, of August 31, 1981, and its amendments, and makes other provisions", and makes other provisions.

State Law number 5,755, from 2021 - Provides the reorganization of the Council for the Sustainable Development of Traditional Peoples and Communities of the State of Amazonas, established by Law No. 3,525, of July 15, 2010, and other measures.

State Law number 5,491, from 2021 - Amends the caput of art. 12, the sole paragraph of art. 13, § 1 of art. 14 and sole paragraph of art. 15 of LAW No. 3,785, of July 24, 2012, which "Provides for environmental licensing in the State of Amazonas, Revokes Law No. 3,219, of December 28, 2007, and makes other provisions."

Ordinary State Law number 6,014, from 2022 - Institutes an administrative term, intended for analysis and decision regarding the granting or renewal of environmental licensing, in compliance with Complementary Law No. 140/2011 and CONAMA Resolution No. 237/97.

State Law number 6,052, from 2022 – Recognizes the contribution of indigenous peoples to the preservation of forests, culture, folklore, customs, legends, gastronomy, handicrafts, and language.

1.16. Double Counting and Participation under Other GHG Programs

1.16.1. No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

1.16.2. Registration in Other GHG Programs

Is the project registered or seeking registration under any other GHG programs?

☐ Yes ☒ No

1.16.3. Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

☐ Yes ☒ No

1.17. Double Claiming, Other Forms of Credit, and Scope 3 Emissions

1.17.1. No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the VCS Program Definitions for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

1.17.2. No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the VCS Program Definitions for definition of GHG-related environmental credit system.

☐ Yes☒ No

1.17.3. Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.12 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☐ Yes☒ No

1.18. Sustainable Development Contributions

1.18.1. Sustainable Development Contributions Activity Description

This GPD contributes mainly and directly to UN SDG 13 goal, which is focused on combating and mitigating climate change and its impact. Furthermore, the GPD activities will comply with other Sustainable Development Goals, such as UN SDG 1, which aims to decrease the proportion of population living below the international poverty line, and the UN SDG 15, which is related to the protection and the promotion of sustainable use of terrestrial ecosystems, sustainable forest management, fighting desertification, halting, and reversing land degradation and halting biodiversity loss. The maintenance of living forests, per se, helps to combat climate change, while the social activities related to the project contribute to shrink the poverty at the territory, and as it happens with the climate issue, by maintaining the forest alive, we contribute with biodiversity sustainability.

Further than that, the existence of the project and its activities are a natural step towards contributing to other Sustainable Development Goals, such as improving health and wellbeing, improving educational outcomes and many other SDG issues, once they are all connected as a huge web.

The GPD will also pass through validation stage of CCB standard, and some monitoring parameters that are directly connected to the project activities will be implemented, especially the goals 1, 13 and 15. It is necessary to highlight that the forest cover will be monitored year by year, serving as an impact indicator to SDG 13. Furthermore, all the monitoring results will be reported through the monitoring reports in both standards, VCS and CCB.

1.18.2. Sustainable Development Contributions Activity Monitoring

Project activities, focusing on forest conservation agreements with landowners and supporting native vegetation cover, also integrate social initiatives like community training and local employment. These efforts promote biodiversity conservation and reduce GHG emissions, contributing to climate action (SDG 13). Socially, by providing education on sustainable practices and supporting local economies, the project aims to alleviate poverty (SDG 1) and enhance resilience against climate-related impacts. Activities align with national sustainable development priorities by addressing environmental protection, poverty reduction, and climate change mitigation.

Evidence of the project's SD contributions, including technical and financial details, is documented as appendices in this report, covering the current monitoring period's activities.

Table 10 - Sustainable Development Contributions

Row number	SDG target	SDG indicator	Net impact on SDG indicator	Current project contributions	Contributions over project lifetime
1)	1.1	1.1.1 Proportion of population below the international poverty line	Implemented activities to decrease	planned	The project intends to increase the participants' total daily income from 1.20 USD/day to 2.57 USD/day, bringing them above the international poverty line.
2)	3.2	3.3.3 Malaria incidence per 1,000 population	Implemented activities to decrease	Traditionally the incidence of Malaria increases through deforestation, thus prevent it is the main path to decrease disease incidence	Lowered the malaria incidence per 1,000 by distributing additional bed nets and conducted malaria prevention workshops.
3)	13.0	Tons of greenhouse gas emissions avoided or removed	Implemented activities to increase	By conserving 1000 ha of tropical rainforest, Project has prevented the release of more than 724 thousand tons of CO ₂ e into the atmosphere during the monitoring period.	The project will prevent the release of more than 28 million tons of CO ₂ e into the atmosphere during the lifetime.
5)	6.1	Proportion of the rural population that have easy access to a safe water supply	Implemented activities to increase	planned	The project aims to provide potable water.

Row number	SDG target	SDG indicator	Net impact on SDG indicator	Current project contributions	Contributions over project lifetime
6)	15.1	15.1.2 - Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	Implemented activities to increase	By avoiding the deforestation of 1000 ha of forest, the project promoted habitat protection for hundreds of terrestrial and freshwater species.	The project will avoid the deforestation and protect 26,060.64 ha of tropical forests through its lifetime.

1.19. Additional Information Relevant to the Project

1.19.1. Leakage Management

Considering that the project activities will be focused on reducing GHG emissions caused by planned deforestation, the leakage management plan will consider other private areas of the same property as the GPD landowners.

1.19.2. Commercially Sensitive Information

For all project activity instances, already verified or under verification process, it is to be considered as commercially sensitive information any contract signed between the PP and landowners, trade, financial, commercial, scientific, technical, or other information, whose disclosure could reasonably be expected to result in a material financial loss or gain, compromising the contractual terms, deals or other negotiations stated by the project proponent.

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

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

1.19.3. Further Information

Not applicable. No further information to be shared.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1. Stakeholder Engagement and Consultation

2.1.1. Stakeholder Identification

BRC has a protocol to identify and engage stakeholders (see more on APPENDIX_V-SOCIAL_ENGAGEMENT_PROTOCOL) and it is divided into four stages, being the first one the Stakeholder Identification. This stage is by itself divided into three steps: 1) Territorial and sociopolitical survey of project's area; 2) Prior mapping of interested parts; and 3) Presentation visits and recognition of interested actors.

After following these steps, the BRC team analysis the proximity and relevance of the stakeholders mapped using the Venn diagram tool to define who and which institution will be participant of the project.

Table 11 describe the process used to identify stakeholders.

Table 11 – Stakeholder Identification

Stakeholder Identification	Describe the process(es) used to identify stakeholders likely impacted by the project. List the stakeholders identified.
Legal or customary tenure/access rights	There are no communities inside the project area, which means there are no tenure conflict.
Stakeholder diversity and changes over time	So far, the stakeholders mapped are from different spheres and groups, as indigenous people, traditional population, and institutions.
Expected changes in well-being	The project activities are going to impact the population's live through improvements of educational, health, productive, and social system, including the maintenance of good life based on a healthy ecosystem around.
Location of stakeholders	Because of other carbon projects presence around the project's area (PAIs#1-2), to avoid double benefits to few communities, and following an internal protocol, BRC is going to develop actions at communities with some distance from project area, and the first space mapped were the Indigenous Land of Coatá-Laranjal. But, not just them, the few families living isolated just in front of the project's area will be benefited by the project activities.
Location of resources	Through the first approach to the population was possible to map that the families who lives near by the project area uses other resources around, but they don't access the project area, while the population of the Indigenous Land uses the resources inside their regulated territory.

2.1.2. Stakeholder Consultation and Ongoing Communication

Table 12 describe the process used to Stakeholder Consultation.

Table 12 – Stakeholder Consultation

Date of stakeholder consultation	10 to 17 of July - 2023
Stakeholder engagement process	Before to go to the territory, the BRC team contacted the indigenous institutions as National Foundation of Indigenous Peoples - FUNAI and the Indigenous Health Department - SESAI (the main institutions presented at the territory) to ask permission to contact the residents of Indigenous Land of Coatá-Larnajal, and plan a properly visit at the Indigenous Land, protocoling the projects intends, contacting and explaining the project before going to the communities. And because of that the excursions limited it's stopping by just to the central community, as requested by their leaders, to chat just with their representants. With the traditional population resident near by the project area, the approach was different, there wasn't any institution to contact beforehand, and they are not organized as the indigenous people, which made the BRC team to visit one by one of the families to communicate the start of the project and starting the social survey to map the potential activities to be developed.
Consultation outcome	Once there are no residents within the project area, the consent is attributed to the landowner, following the property Brazilian law. In this sense, the communities and families who is going to be benefited by the project activities do not need to respond a FPIC, they just need to be interested to participate, if provoked by the PP. It does not mean that there are no explanations about the interests, potentials, and risks of the project to them, on the contrary, BRC intends to be transparent and clear with it intends on the region, the project, and the population.
Ongoing communication	BRC has its own protocol to keep a direct contact line between communities and the company, through a WhatsApp system and a cell phone line. But, not just that, our team goes regularly to the territory to make a lot of different activities, as social meetings, technical activities, and other demands, and the team always stops with the residents and beneficiaries to keep them aware of any activities, and it is done with the institutions as well present on the territory.
Stakeholder input	Despite the necessity of new visits to the territory, the BRC team has already taken some inputs from the indigenous leaders, and the traditional population who lives around the project's area. Indigenous Land: Support to improve educational infrastructure. Development of sustainable productive chains (manioc flour, Brazilian nuts, Açaí, Andiroba, Copaíba). Foster the indigenous health system.

Water quality.

Traditional communities (Localities):

Access to energy.

Water quality.

Development of sustainable productive chains (Andiroba, Copaíba).

Support to guarantee access to educational services.

Support to guarantee access to health services.

2.1.3. Free Prior and Informed Consent

Table 13 describe the process used during Free Prior and Informed Consent

Table 13 – Free Prior and Informed Consent

Obtaining consent	Inside the project area are no communities. It means that FPIC was not necessary to apply, the consent to develop the project is only related to the landowner. But, beside it, BRC has as practice to inform and consult the residents of region around if they have any interest in participating in the project, showing them the advantages, the risks, and the need to be part of it.
Outcome of FPIC	As mentioned above, there is no need for FPIC's application, the project area is private property with no residents inside (except the landowner's employees). But all the contact made with communitarians in the region are following the steps of transparency and clearness in a way to respect their free wills and necessities. And to do it properly the PP is contacting the institutions related to the region beforehand.

2.1.4. Grievance Redress Procedure

Table 14 – Grievance Redress Procedure that will be implemented in the future.

Development process	The very first channel to any grievance and comments to the project is the Verra's website, where the project is available to public comments. Further than that, BRC has its own way to deal with conflicts which can arise between the PP and the stakeholders. For it there are two main tools: regular Public Meetings, where the beneficiaries have a chance to show their opinion about the project activities; and the BRC Direct Channel (APPENDIX_VI-ALO_BRC_COMMUNICATION_FLOWCHART), a communicational tool which the beneficiaries can contact the BRC team directly, being responded in previewed period, as stipulated at BRC procedures. If these tools do not work the PP has another strategy, which involve three steps: 1) the own BRC team goes to the territory to have directly conversations with the ones involved in the conflict; 2) the BRC makes an active search for appropriated people who is able and legitime to mediate the conflict – someone external to it; 3) in the last step, if necessary, the Public Justice system is contacted to solve the problem in juridical way.
Grievance redress procedure	Not developed yet.

Table 15 – Grievances Received.

Grievances received	Resolution and outcome
There were no grievances received till now.	---

2.1.5. Public Comments

Table 16 – Received Public Comments.

Comments received	Actions taken
There were no comments received till now.	---

2.2. Risks to Stakeholders and the Environment

	Risks identified	Mitigation or preventative measure taken
Risks to stakeholder participation	No risk identified	Any project that involves people has associated risks. However, it has not yet been properly defined by the BRC team, only with the development of the project will it be possible to measure the main risks.
Working conditions	No risk identified	Any project that involves people and working has associated risks. However, it has not yet been properly defined by the BRC team, only with the development of the project will it be possible to measure the main risks.
Safety of women and girls	No risk identified	Any project that involves people, mainly women and girls, in a male society, has associated risks. However, it has not yet been properly defined by the BRC team, only with the development of the project will it be possible to measure the main risks.
Safety of minority and marginalized groups, including children	No risk identified	Any project that involves people, especially minorities and marginalized groups, has associated risks. However, it has not yet been properly defined by the BRC team, only with the development of the project will it be possible to measure the main risks.
Pollutants (air, noise, discharges to water, generation of waste, release of hazardous materials)	No risk identified	The project seeks to maintain an environment healthy and free of pollution area, so the project has no identified risks to the environment through its activities.

2.3. Respect for Human Rights and Equity

2.3.1. Labor and Work

Table 17 – Labor and Work Rights Assessment

Discrimination and sexual harassment	BRC has its Code of Ethics and Ethics Committee (APPENDIX_VII-ETHICS_AND_CONDUITE_CODE) to ensure that no type of discrimination, sexual harassment or any other type of harassment will be tolerated by the company and its workers. And, as already mentioned, the BRC has a Contact Channel between the company and communities to guarantee a space for grievances of any kind of issue. Demonstrate that no discrimination or sexual harassment has occurred or will occur.
Management experience	The BRC's management team has a multidisciplinary formation (APPENDIX_VIII-REQUIRED_TECHNICAL_SKILLS) composed of forest engineers, environmental engineers, biologists, and sociologists. And it has more than fifteen years of experience in AFOLU carbon project, including methodological tools, community engagement, biodiversity assessment, carbon measurement and monitoring, in addition PD and MR elaboration. The BRC's social staff has the skills necessary to implement and develop activities of social engaging.
Gender equity in labor and work	The BRC staff is made up of 39% women and 61% men, among the workers there are gays and lesbians. BRC salaries follow a pre-established standard – a table, which defines salaries based on the level and role that the professional occupies in the company, not related with gender or any other kind of social differences.
Human trafficking, forced labor, and child labor	As mentioned above, BRC has its Code of Ethics and Ethics Committee that governs the company's practices. This code is related to Brazilian laws, such as the Child and Adolescent Statute and international agreements, such as the Convention of Forced Labour of ILO and others. This guide ensures internal and external controls in project development.

2.3.2. Human Rights

The PP has its own protocols to be applied to all its activities and relations. These documents are based on national legislation as the Decree 7037 from December 2009, which regulates the National Program of Human Rights, international conventions as ILO 169 (both regulations can be observed on ANNEX_II-HUMAN_RIGHTS_LEGISLATION and other rules, regulations and accords which Brazil is signatory. Further than that, BRC team is aware about social demands, and uses the documents and guidelines created by social organizations and territories to implement any activity in the ground, therefore, all the local consult protocols are respected and followed as demanded by the population. Beyond that, there are yet the external audits which the project is under evaluation.

2.3.3. Indigenous Peoples and Cultural Heritage

As pointed in the topic above, BRC has as practice the respect of self-determination of the people, what is directly related to cultural issues, in this sense any activity developed in the ground must follow all international and national regulations, and to it the BRC must add the local demands and cultural characteristics of each people. Beyond that, as already mentioned, before any contact is made with Indigenous People, BRC follows its own protocol to contact the representative institutions of these people.

2.3.4. Property Rights

In Table 18 below, the property rights associated with the PAIs are presented. These rights delineate the privileges and responsibilities related to the ownership, management, and utilization of resources within the scope of the project. The clarity and definition of these property rights are paramount to ensuring the effective implementation of the project, providing the foundation for robust and transparent governance. This set of property rights aims to promote operational efficiency, sustainability, and equity in the development and execution of the project at hand.

Table 18 – Property Rights

Rights to territories and resources	The BRC AMAZONAS APD GROUPED PROJECT is starting with 02 properties owned by two private or companies' persons. BRC has conducted a rigorous land tenure due diligence with the legal staff team and all the proprieties meets the internal requirements and the VCS and CCB standards regarding to proof the rights of the carbon credits. It's important to highlight that exists an internal check list that requires to the landowner a total of fifteen documents and each propriety that are part of a robust internal Due Diligence regarding the land tenure and carbon rights. It has a specific legal report according to the juridic feasibility, that are available on BRC's database. The documents received by BRC from the properties and both juridic and physical persons are shown on ANNEX_I-LAND_TENURE
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	and ANNEX_III-LANDOWNERS. In the case of these two properties are no customary tenure or demands to access the territory by the communitarians who lives around.
Respect for property rights	As the territories of the project are consolidated private property there are no conflicts between customary and right holders of the region. Anyway, the PP protocols, per se, require attention and actions to preserve the property rights of the people who lives around.

2.3.5. Benefit Sharing

The description and Table 19 below encompass all the information about benefit sharing.

Table 19 – Benefit Sharing

Where the project impacts property rights as described in Section 2.4.4 above, use the table below to describe the project's benefit sharing agreement.	As shown above, there are no major questions about property rights.
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2.4. Ecosystem Health

Table 20 depicts the risks identified for the ecosystem, with the current assessment indicating no identified risks at this juncture. This absence of identified risks underscores the initial evaluation's resilience, suggesting that, as of now, the ecosystem remains relatively stable and unthreatened. Regular and thorough risk assessments will continue to be conducted to promptly identify and address any potential challenges that may emerge, ensuring the ongoing health and sustainability of the ecosystem under the project scope.

Table 20 – Ecosystem Risks Identification

Risks identified		Mitigation or preventative measure taken
Impacts on biodiversity and ecosystems	No risk identified	No risk was identified since all project activities are designed to promote ecosystem and biodiversity conservation by avoiding forest deforestation and degradation.
Soil degradation and soil erosion	No risk identified	No risk was identified since all project activities are designed to promote ecosystem and biodiversity conservation by avoiding forest deforestation and degradation.
Water consumption and stress	No risk identified	No risk was identified since the project activities do not involve the consumption of high levels of water.

Usage of fertilizers	No risk identified	No risk was identified since no project activities will require the use of any kind of fertilizers
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2.4.1. Rare, Threatened, and Endangered species

Is the project located in or adjacent to habitats for rare, threatened, or endangered species?

☒ Yes

☐ No

Table 21 – Rare, Threatened, and Endangered Species Identification

Species and habitat	Demonstrate that the project will not adversely impact habitats for rare, threatened, or endangered species.
Species found within the project area that are classified as threatened by the IUCN Red List (EN – Endangered, CR – Critically Endangered). For evidence, please refer to the Fauna Survey reports available at Appendix III - Biodiversity Pteroglossus bitorquatus – EN Pteronura brasiliensis – EN Inia geoffrensis – EN Sotalia fluviatilis – EN	The project will not adversely impact habitats for rare, threatened, or endangered species since all project activities are designed to promote ecosystem and biodiversity conservation by avoiding forest deforestation and degradation.

2.4.2. Introduction of species

N/A; the project activities will not include planting or introducing any species.

2.4.3. Ecosystem conversion

N/A; the project does not align with ARR, ALM, WRC or ACoGS categories.

3 APPLICATION OF METHODOLOGY

3.1. Title and Reference of Methodology

The following list references the methodology, modules and tools that have been and are going to be used in the project scope.

Table 22 – Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Ver
Methodology	VM0007	VM0007 REDD+ Methodology Framework (REDD+MF)	1.6
Module	VMD0001	VMD0001 Estimation of carbon stocks in the above- and below ground biomass in live tree and non-tree pools (CP-AB)	1.2
Module	VMD0002	VMD0002 Estimation of carbon stocks in the dead wood pool (CP-D)	1.1
Module	VMD0003	VMD0003 Estimation of carbon stocks in the litter pool (CP-L)	1.1
Module	VMD0004	VMD0004 Estimation of stocks in the soil organic carbon pool (CP-S)	1.1
Module	VMD0005	VMD0005 (CP-W) Estimation of carbon stocks in the long-term wood products pool	1.2
Module	VMD0011	VMD0011 Estimation of emissions from market-effects (LK-ME)	1.2
Module	VMD0013	VMD0013 Estimation of greenhouse gas emissions from biomass and peat burning (E-BPB),	1.3
Module	VMD0015	Methods for monitoring of greenhouse gas emissions and removals (M-REDD)	2.3
Module	VMD0016	VMD0016 Methods for Stratification of the Project Area (X-STR)	1.3
Tool	VT0001	VT0001 Tool for the demonstration and assessment of additionality in VCS agriculture, forestry, and other land use (AFOLU) project activities (T-ADD)	3.0
Tool	AFOLU Non-Permanence Risk Tool	AFOLU Non-Permanence Risk Tool	4.2
Tool	CDM Tool for testing significance of GHG emissions in A/R CDM project activities (T-SIG)	CDM Tool for testing significance of GHG emissions in A/R CDM project activities (T-SIG)	1.0

3.2. Applicability of Methodology

The list below references the methodology, modules and tools that have been and are going to be used in the project scope, in addition to providing information on applicability conditions and the respective justifications of compliance for each module, tool, or methodology.

Table 23 – Applicability of Methodology

Methodology ID	Applicability condition	Justification of compliance
VM0007	Land in the project area has qualified as forest for at least the 10 years prior to the project start date.	Land classification was made by DETER/PRODES
VM0007	Baseline deforestation and forest degradation in the project area fall within one or more of the following categories: Unplanned deforestation (VCS category AUDD); Planned deforestation/degradation (VCS category APD); Degradation through extraction of wood for fuel (fuelwood and charcoal production) (VCS category AUDD)	Baseline deforestation and forest degradation in the project area falls under Planned deforestation/degradation (VCS category APD)
VMD0001, VMD0002	This module is applicable to all forest types and age classes.	The project aims to reduce non-tree aboveground biomass by reducing degradation.
VMD0003	This module is applicable to all forest types and age classes	Module applied on lands qualified as forest for at least the 10 years prior to the project start date.
VMD0004	This module is applicable to non-organic soils under all forest types and age classes.	Project area is mainly composed of Latosols and Argisols.
VMD0005	This module is applicable to all cases where wood is harvested for conversion to wood products for commercial markets, for all forest types and age classes.	
VMD0011	This module is applicable for calculating market-effects leakage from projects that are anticipated to reduce levels of wood harvest substantially and permanently. When project activities result in reductions in wood harvest, it is likely that production could shift to other areas of the country to compensate for the reduction, including activity shifting to forested peatland that is drained as a consequence of project implementation. This tool shall be used in countries where wood harvest happens on forested peatland regardless of the absence of peatland within the project boundary.	When project activities result in reductions in wood harvest, it is likely that production could shift to other areas of the country to compensate for the reduction, including activity shifting to forested peatland that is drained as a consequence of project implementation.

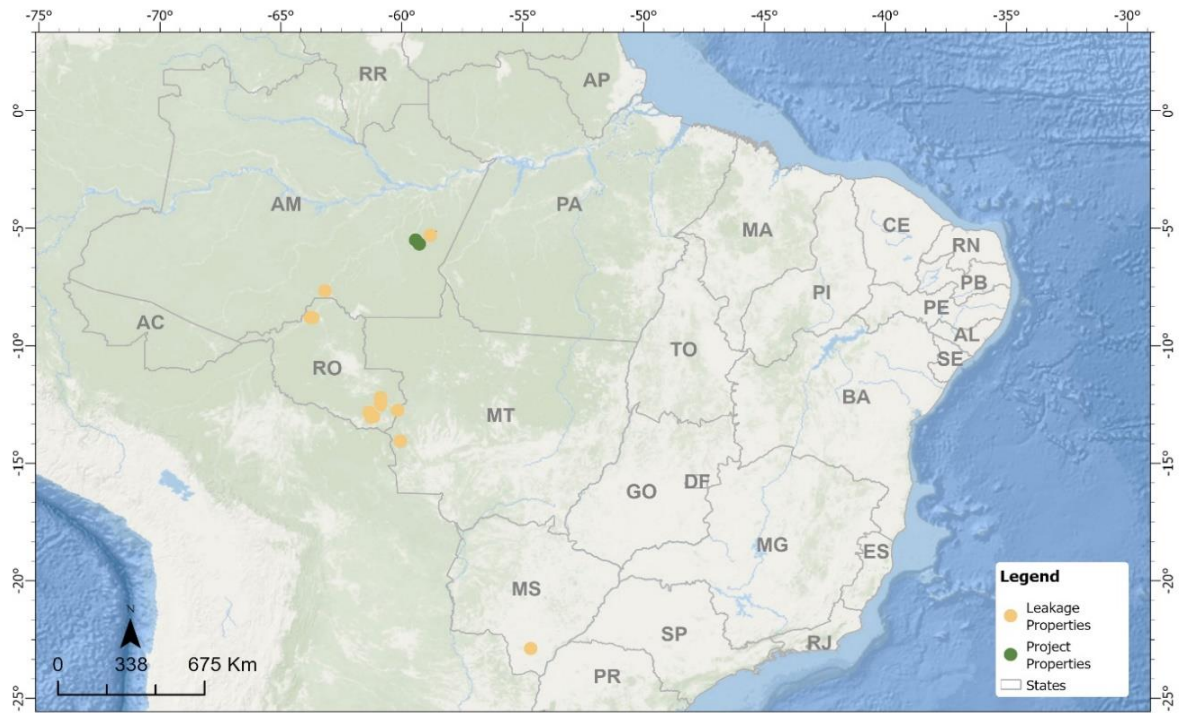
Methodology ID	Applicability condition	Justification of compliance
VMD0013	This module is applicable to REDD project activities with emissions from biomass burning and REDD-WRC project activities with emissions from biomass and/or peat burning. This module is also applicable to RWE and ARR-RWE project activities with emissions from peat burning.	The GPD meets the applicability conditions of this module due the fact that it is characterized as a REDD project and the VMD0013 is applicable to REDD project activities with emissions from biomass burning. The GHG emissions from fires in the baseline and project scenario will be calculated using this module.
VMD0015	Emissions from logging may be omitted if it can be demonstrated the emissions are de minimis using tool T-SIG or Appendix 1 of REDD-MF	Some of the Grouped Project areas will have logging operations and the GPD will analysis the GHG emissions significance, if the emissions are de minimis, according to the T-SIG, it will be omitted
VMD0015	If emissions from logging are not omitted as de minimis, logging may only take place within forest management areas that possess and maintain a Forest Stewardship Council (FSC) certificate for the years when the selective logging occurs.	In the GPD forest management areas that will not be omitted as de minimis, the areas will need to be certified against FSC (Forest Stewardship Council) standard
VMD0015	Logging operations may only conduct selective logging that maintains a land cover that meets the definition of forest within the project boundary	This condition will be assessed since we comply with the Forest Code, law 12,651, from May 2012
VMD0015	All trees cut for timber extraction during logging operations must have a DBH greater than 30 cm	This condition will be assessed since we comply with the Forest Code, law 12,651, from May 2012
VMD0015	During logging operations, only the bole/log of the felled tree may be removed. The top/crown of the tree must remain within the forested area	This condition will be assessed since we comply with the Forest Code, law 12,651, from May 2012
VMD0015	The logging practices cannot include the piling and/or burning of logging slash	This condition will be assessed since we comply with the Forest Code, law 12,651, from May 2012
VMD0015	Volume of timber harvested must be measured and monitored.	BRC team will be measuring and monitoring any kind of degradation in the project area during the project's lifetime

Methodology ID	Applicability condition	Justification of compliance
VMD0016	For peatland rewetting and conservation project activities this module must be used to delineate non-peat versus peat and to stratify the peat according to peat depth and soil emission characteristics, unless it can be demonstrated that the expected emissions from the soil organic carbon pool or change in the soil organic carbon pool in the project scenario is de minimis,	This module is mandatory because the different forest types existing in the project area characterize different strata. The GPD used the aboveground biomass stratification only for pre-deforestation forest classes, and all the strata are the same in the baseline and the project scenario. The post-deforestation land uses were not stratified, following this module requirements

3.3. Project Boundary

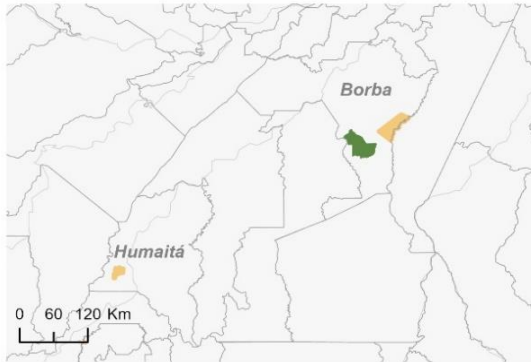
3.3.1. Geographical Boundaries

PAIs #1-2 are in the municipality of Borba in Amazonas. The properties total area is 137,291.25 ha, of which 26,060.64 ha (19%) has been delimited as the project area. The project activity contains more than one discrete area of land. Spatial limits for the project area and properties within the project scope are defined in the maps below.



(a) Amazonas Properties

(b) Rondonia Properties



(c) Mato Grosso Properties



(d) Mato Grosso do Sul Properties

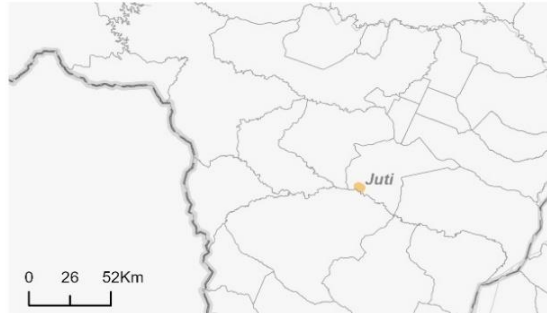
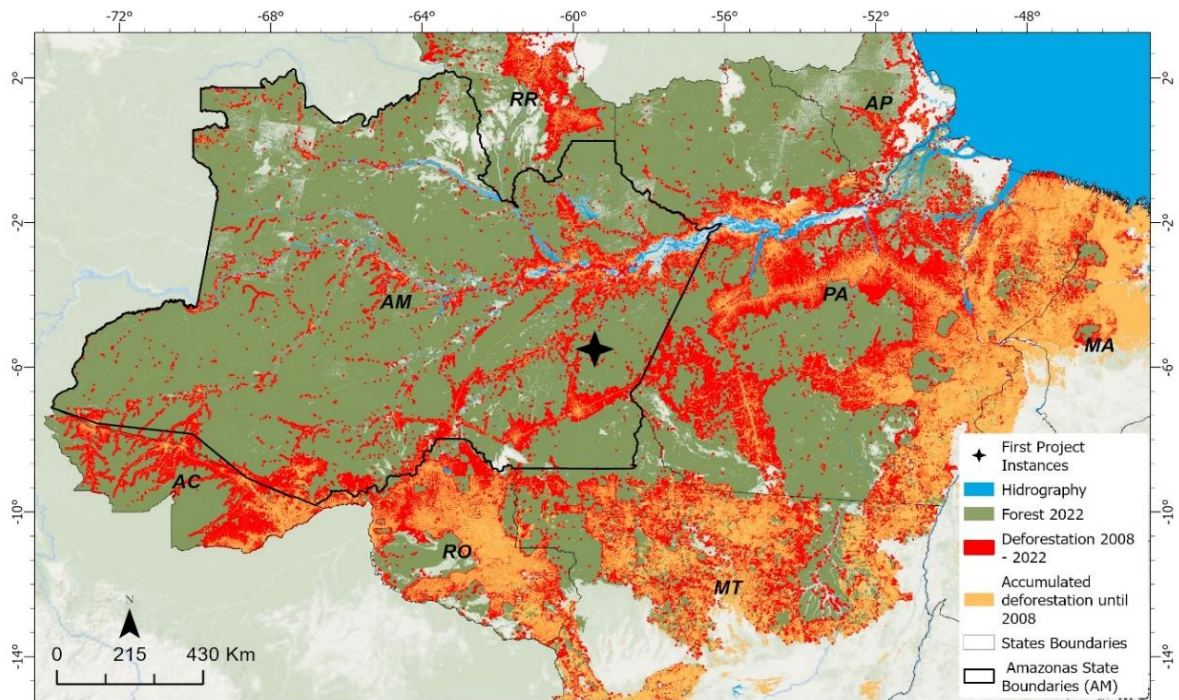
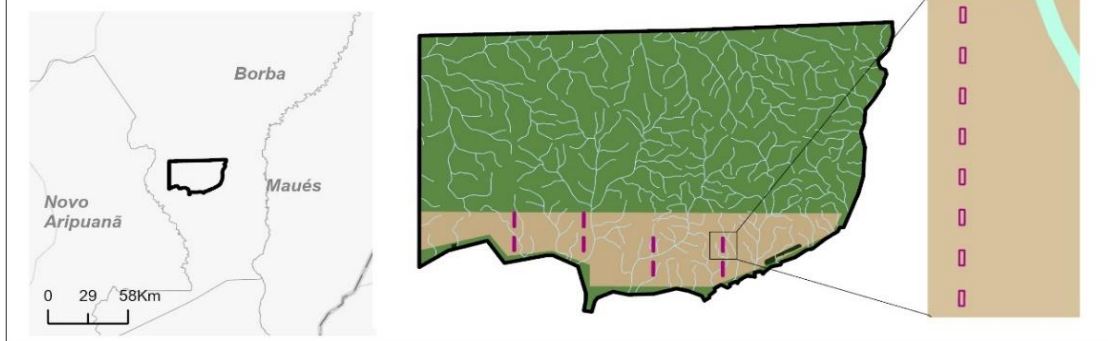


Figure 11 – Project and leakage boundaries. PAIs #1-2, spatial limits.



(a) PAI #01 | Cabaça



(b) PAI #02 | Pacová

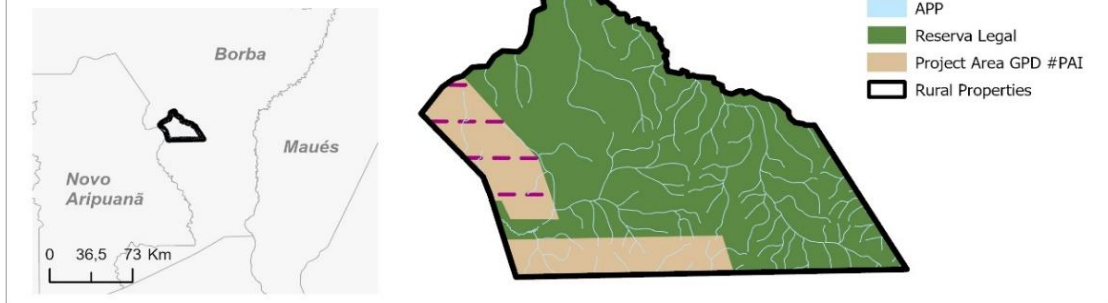


Figure 12 – Historical deforestation of Legal Amazon, including Amazonas state. Field plot measurements within PAIs #1-2.

The table below lists the names of the project activity instances, their IDs, total land area and landholder/user rights details.

Table 24 – PAIs spatial features

ID	Property name	Property area	Project area	SICAR number
PAI#01	Cabaça	82,785.19	15,449.60	AM-1300805-DADF.E560.9B8A.49CB.B9F3.ED82.6DB2.10FD
PAI#02	Pacova	54,506.10	10,611.04	AM-1300805-FD7C.784D.8E10.4DEE.8B55.9FEE.6B0C.2F6C

3.3.2 Temporal Boundaries

A historical reference period from 2013 to 2022 was used to define project eligibility, and deforestation and forest degradation rates for ex-ante estimates of GHG emissions in the project scenario, following VM0007 v1.7, section 5.2.1 and VMD0015 v2.2, section 2 criteria. The GPD crediting period start and end date are defined in section 1.9. The baseline emissions are presented in Table 56 for the first 10-year period after the project starting date in sections 4.1 and 4.4.

3.3.3 Carbon Pools

Table 25 – Carbon pools.

Pool	Included?	Justification/Explanation
Aboveground tree biomass	Included	Major carbon pool that will significantly decrease in the baseline scenario in the case of deforestation or forest degradation
Aboveground nontree woody biomass	Included	Inclusion is optional per VMD0001 v1.2, section 04. Part of the forest types in the project area are characterized by the occurrence of bamboo, vines, and shrubs
Belowground tree biomass	Included	Major carbon pool that will significantly decrease in the baseline scenario in the case of deforestation or forest degradation
Belowground nontree vegetation	Included	Inclusion is optional per VMD0001 v1.2, section 04. Part of the forest types in the project area are characterized by the occurrence of bamboo, vines, and shrubs

Pool	Included?	Justification/Explanation
Dead wood	Included	Inclusion is optional in the case stocks are not greater in the baseline than in the project scenario, per VMD0002 v1.1, section 04.
Harvested wood products	Included	Inclusion of the harvested wood pool as part of the project boundary is mandatory when the process of the deforestation involves timber harvesting for commercial markets, as per VM0007 v1.7, table 04
Litter	Included	Inclusion is optional per VMD0003 v1.1, section I.
Soil organic carbon	Not included	Inclusion is optional in the case stocks are not greater in the baseline than in the project scenario, per VM0004 v1.1.

A standard operational procedure for aboveground biomass, Litter and Dead Wood inventory and field data collect was elaborated (APPENDIX_IX-CARBON_POOLS). The document is based on VMD0001 v1.2, VMD0002 v1.1, VMD0003 v1.1, and VMD0005 v1.1 modules and shows all steps, equations, default values and references for the estimates of all reservoirs considered. Wood is harvested for conversion to wood products for commercial markets in the baseline case.

3.3.4 Sources of GHG Emissions

Table 26 – Sources of GHG Emissions

Source		Gas	Included?	Justification/Explanation
Baseline	Burning of woody biomass	CO ₂	Included	Carbon stock decreases due to burning are accounted as carbon stock change.
		CH ₄	Included	Fire is used as an instrument for converting the forest to pasture or other land use in the baseline scenario. In the process of legal forest suppression, commercial wood is extracted, and the remaining woody material is felled and burned on site. Non-CO ₂ gases are expected to be emitted due to woody biomass burning in the baseline scenario.
		N ₂ O	Included	
	Combustion of fossil fuels	CO ₂	Excluded	Carbon and non-CO ₂ emissions from harvesting equipment, log transport, and primary forest product manufacturing in the baseline scenario can be conservatively excluded according to VM0007 v1.7, table 7.
		CH ₄	Excluded	
		N ₂ O	Excluded	
	Use of fertilizers	CO ₂	Excluded	The use of fertilizers in the alternative land use (pasture) is not a common practice in the Brazilian Biome Carbon and Non-CO ₂ emissions from use of fertilizers in the baseline scenario can be conservatively excluded according to VM0007 v1.7, table 7.
		CH ₄	Excluded	
		N ₂ O	Excluded	
Project	Burning of woody biomass	CO ₂	Included	Carbon stock decreases due to burning are accounted as carbon stock change. Burning in the project scenario occurs due to unplanned, unavoidable deforestation, usually associated with the cattle raising or agriculture activities performed by family farmers (squatters) who live in the project area.
		CH ₄	Included	Fire is used by family farmers (squatters) who live in the project area as an instrument for converting the forest to pasture or other land uses in the project scenario. Non-CO ₂ gases emitted from woody biomass burning will be included if unplanned, unavoidable deforestation occurs in each monitoring period.
		N ₂ O	Included	
	Combustion	CO ₂	Excluded	

	of fossil fuels	CH ₄	Excluded	Carbon and non-CO ₂ emissions from harvesting equipment, log transport, and primary forest product manufacturing in the project scenario shall be excluded as it was conservatively excluded in the baseline scenario, following VM0007 v1.7, table 7.
		N ₂ O	Excluded	
	Use of fertilizers	CO ₂	Excluded	Carbon and non-CO ₂ emissions from use of fertilizers shall be excluded in the project scenario as it were conservatively excluded in the baseline scenario following VM0007 v1.7, table 7
		CH ₄	Excluded	
		N ₂ O	Excluded	

3.4. Baseline Scenario

Baseline scenario was set according to VMD0006 v1.4 criteria. This module provides a stepwise approach for estimating GHG emissions related to planned deforestation. In this section, the annual area of land to be deforested will be calculated.

3.4.1. Agent of Planned Deforestation

The company M.I. INCORPORADORA LTDA (represented by Moacir Batista) and the family group (Alvaro Abreu, Marcelo Abreu, Patrícia Abreu, and Paola Abreu) are identified as the agents of planned deforestation in the baseline considering the current GPD scope (PAIs #1 and #2), which is considered as the “simplest scenario” per VMD0006 v1.4, section 5.1.1.

3.4.2. Area of Deforestation

The area of deforestation (A_{planned,i}) is defined according to an immediate site-specific threat of deforestation, which is demonstrated by documentary proof of the following:

- 1) Legal permissibility for deforestation: according to the Federal Law n° 12,651/2012, Art. 12 every rural property must maintain an area with native vegetation coverage, as a “Legal Reserve”, without prejudice to the application of the rules on the “Permanent Preservation Areas”, observing minimum percentages in relation to the property area. For properties located in the legal Amazon, in forested areas, this percentage is equal to 80%. So, the legal permissibility for deforestation in the Legal Amazon is 20% of a property at maximum.
- 2) Suitability of project area for conversion to alternative non-forest land use: a series of operations in a GIS environment is performed to determine the project area suitability for the baseline activity (Figure 13). Primary data about the properties is

obtained on the Rural Environmental Registry System (SICAR). After that, areas protected by law (legal reserve and permanent preservation areas) are excluded from the property spatial limits. The information feature generated is later overlaid with INPE data to exclude areas deforested until 10 years before the project start date and degraded forests. Deforestation is considered based on PRODES project data (GIS database), while forest degradation is mapped using DETER service data from 2016 to 2020 (GIS database). Areas deforested in up to 10 years before the GPD start date are disregarded to comply with the methodology applicability conditions. Then, a visual classification is carried out based on high spatial resolution images from Sentinel (2020), on a scale of 1: 10,000 (GIS database), to refine this product and perform the classification accuracy assessment with an overall target precision of 90%.

After this stage, using high resolution digital terrestrial topographic maps (SRTM) areas with a slope greater than 25° were likewise excluded from the project area. This specific threshold is determined by Brazilian legislation and serves to determine protected areas. This topographic criterion is related to the forest ecological functions (i.e.: avoid landslides) and, therefore, with the suitability for conversion to alternative non-forest land use.

Then, the suitability of the project area for conversion to alternative non-forest land use is assessed according to the soil and climate in the region. The soils are identified from Thematic Vectorial Pedology base in the scale of 1:250,000 developed by IBGE (2021). Climate data were obtained from the nearest meteorological stations in the INMET database (GIS database), located in the municipality of Novo Aripuanã, Amazonas estate. Considering a 10-year historical series, the mean temperatures are 24°C and 34.3°C. Regarding precipitation: the rainiest month in Borba is February, with an average of 254 millimeters of rainfall. The least rainy month in Borba is August, with an average of 57 millimeters of rainfall. According with Baeta & Souza (1997) the best conditions to the cattle are in terms of temperature in a range between 10-27°C and some studies show that the precipitation is beneficial to the cattle while refreshing the animal's surface and improving the meat productivity per animal Medeiros & Vieira (1997). The soils and climate are considered appropriate for the activities provided for in the baseline scenario in all PAIs, which is corroborated by the presence of cattle in the project areas and surrounding properties.

Finally, access to relevant markets is assessed as the last relevant criterion for suitability of the project area for conversion. This aspect is analyzed according to the main economic activity in the region, the logistics network used for the production flow and the existing production chains. Production in the project area (PAIs #1-2) can be drained by the Madeira River.

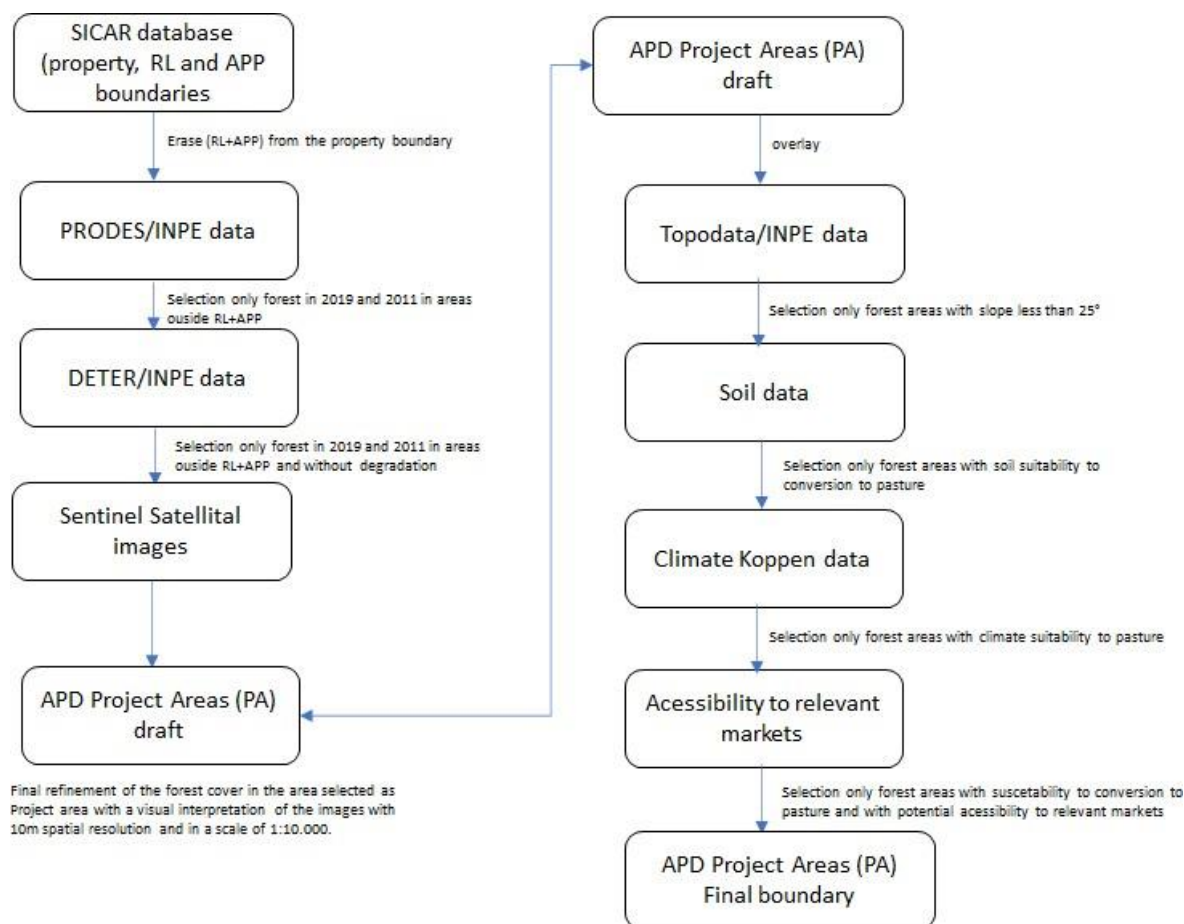


Figure 13 - Suitability of project area for baseline activity.

- 3) Government approval for deforestation to occur: the intention to deforest within the project area is demonstrated by recent approval from relevant government department for conversion of forest to an alternative land use or documentation that a request for approval has been filed with the relevant government department for permission to deforest and convert to alternative land use, following VMD0006 v1.4, section 5.1.2 requirements. Each property under the GPD scope represents a PAI. Each PAI has its specific related documents (APPENDIX_IV-BASELINE_DEFORESTATION_PERMITS). The existence of these documents represents an eligibility criterion for the inclusion of a new PAI in the scope of the project throughout the project lifetime.

In general, deforestation permits are requested for areas smaller than 1000 ha in Brazil. This common practice occurs because procedures are simplified for this deforestation scale. The implementation of agricultural projects bigger than 1,000 ha depends on the preparation of an environmental impact study (EIA) and the respective environmental impact report (RIMA), to be submitted for approval by the competent state agency, in compliance with the Federal requirements established in the paragraph XVII, Art. .2 of CONAMA Resolution n ° 01 of January 23, 1986,

amended by CONAMA Resolution n ° 11, of March 18, 1986. This common practice is also influenced by the short validity period of a deforestation permit and the high costs of the suppression operation, which also drives landowners to choose to suppress small patches of forest each year, rather than great areas.

- 4) Intention to deforest: the intention to deforest is demonstrated by the existence of valid and verifiable land use management plan for deforesting the project area, called Forestry Exploration Project (PEF, in Portuguese) (APPENDIX_IV-BASELINE_DEFORESTATION_PERMITS). A PEF is necessary to request deforestation authorization from the responsible government agency in each state. The Brazilian environmental law establishes the general requirements for forest suppression, leaving specific regulation to states. Protocols and documents can vary between states and therefore between PAIs. The intention to deforest can also be demonstrated by the history of deforestation in other lands of the same landowners in the case of PAIs #1 and #2 (Fig. 12).

3.4.3. Rate of deforestation

The deforestation rates (D%planned,i) are defined according to valid verifiable plans (APPENDIX_IV-BASELINE_DEFORESTATION_PERMITS). These plans show the area to be deforested in a spatially explicit manner and an associated execution schedule. The table below presents the planned deforestation rates in each PAI in the baseline scenario, in accordance with the exploration plans. The GPD baseline is therefore aligned with common practices in Brazil.

Table 27 – Planned Deforestation Rates

PAI#	Name	Annual deforestation rate (ha/yr)
1	Cabaça	277.74
2	Pacová	404.34

3.4.4. Likelihood of Deforestation

The likelihood of deforestation (L-Di) is set to be 100%, according to the VMD0006, v1.4, section 5.1.4 criteria. The private properties (ANNEX_I-LAND_TENURE) under GDP scope are not under government control and are not zoned for deforestation.

3.4.5. Risk of Abandonment

The risk of abandonment is considered based on proxy areas by the same class of deforestation agent in a 10-year interval. The map below shows the location of proxy areas around PAIs and similarity with the forest types and climate Koppen classification. Proxy areas are in red polygons around PAI#01 and PAI#02 in Amazonas with spatial similarity. The geographical proximity of these private properties demonstrates similar forest types, Koppen's climate classes and terrestrial and fluvial transportation networks. All proxies were selected in the geographic political boundaries at municipality level, Borba- AM.

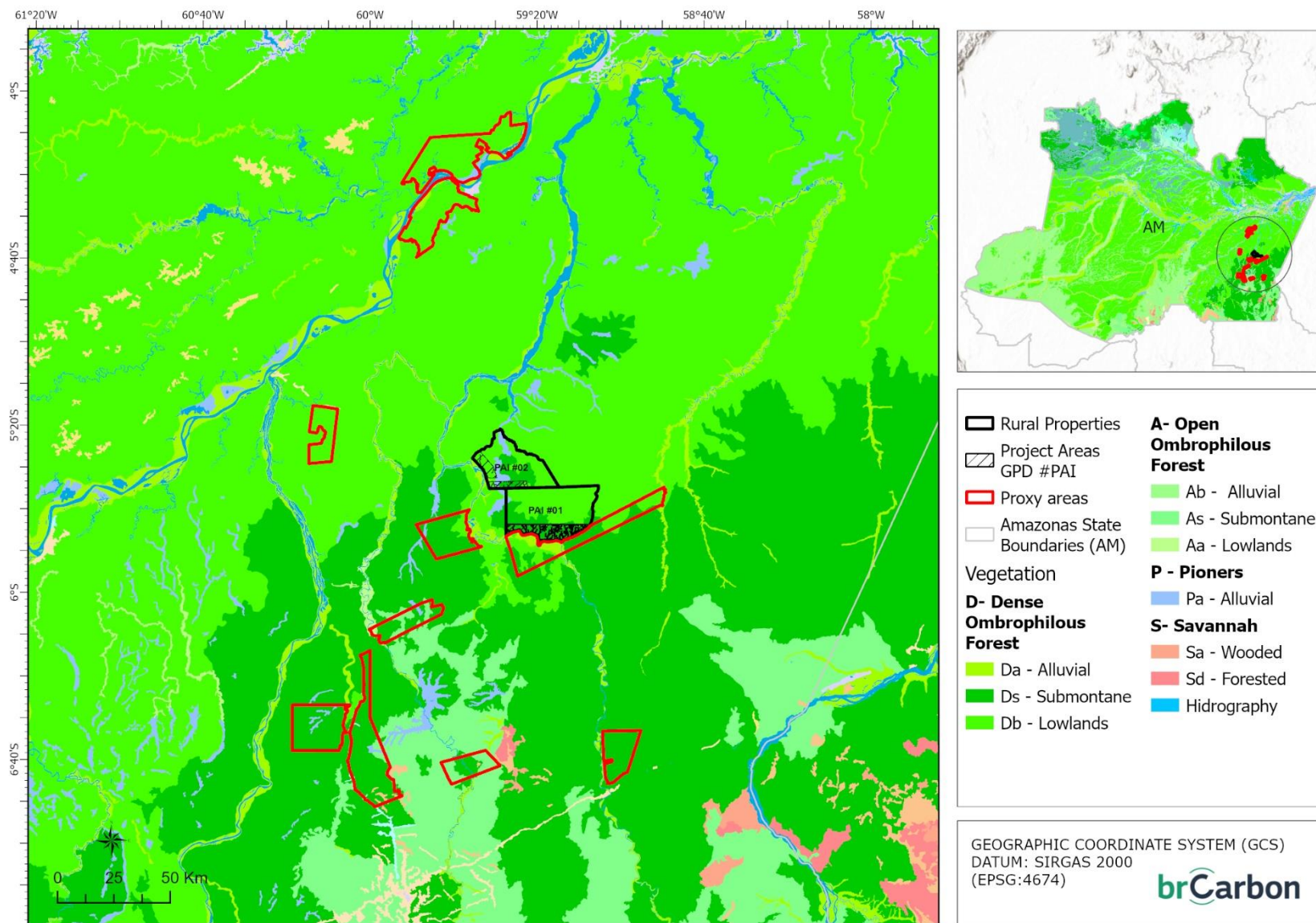


Figure 14 – Vegetation on Proxy Areas

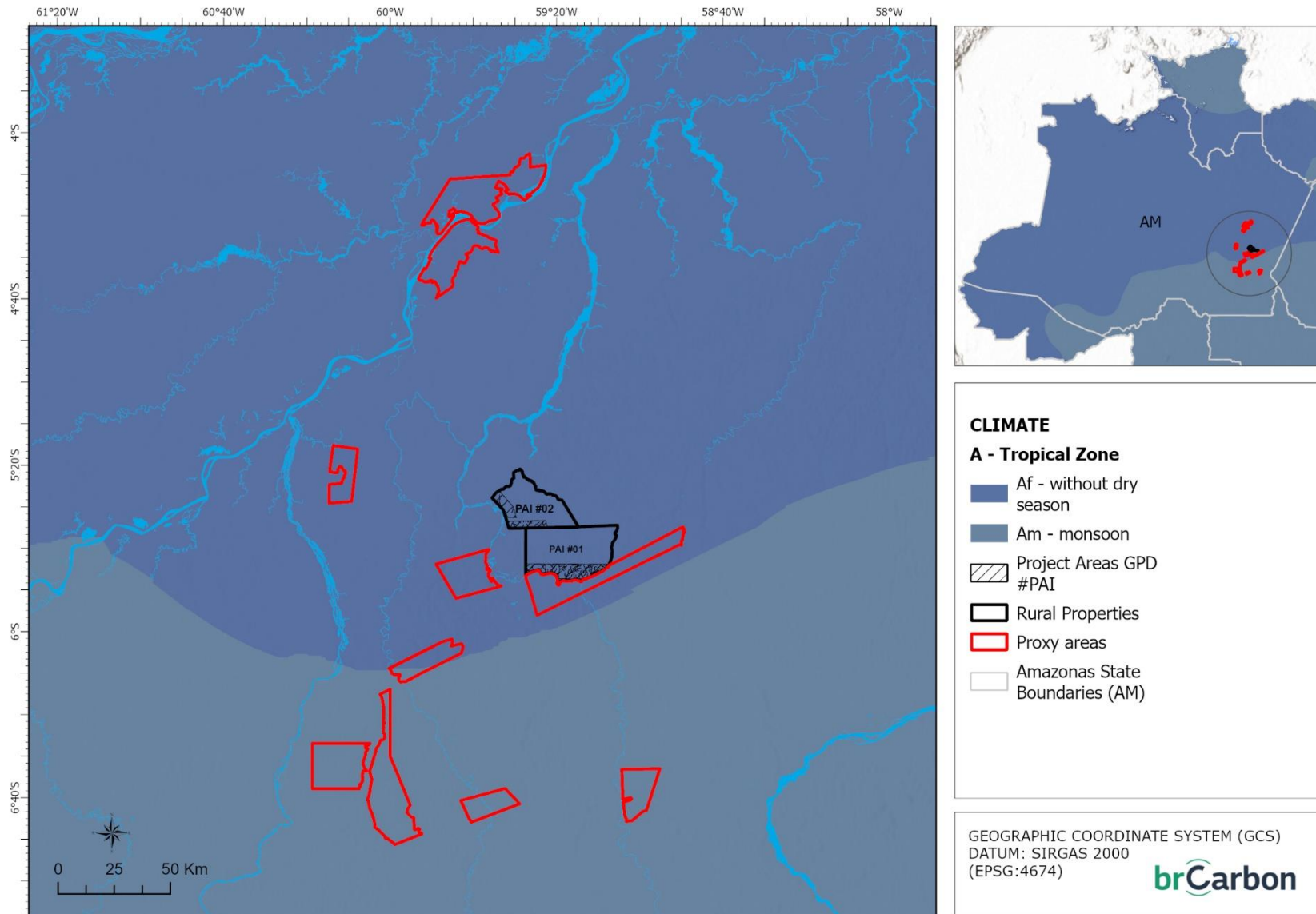


Figure 15 – Climate on Proxy Areas

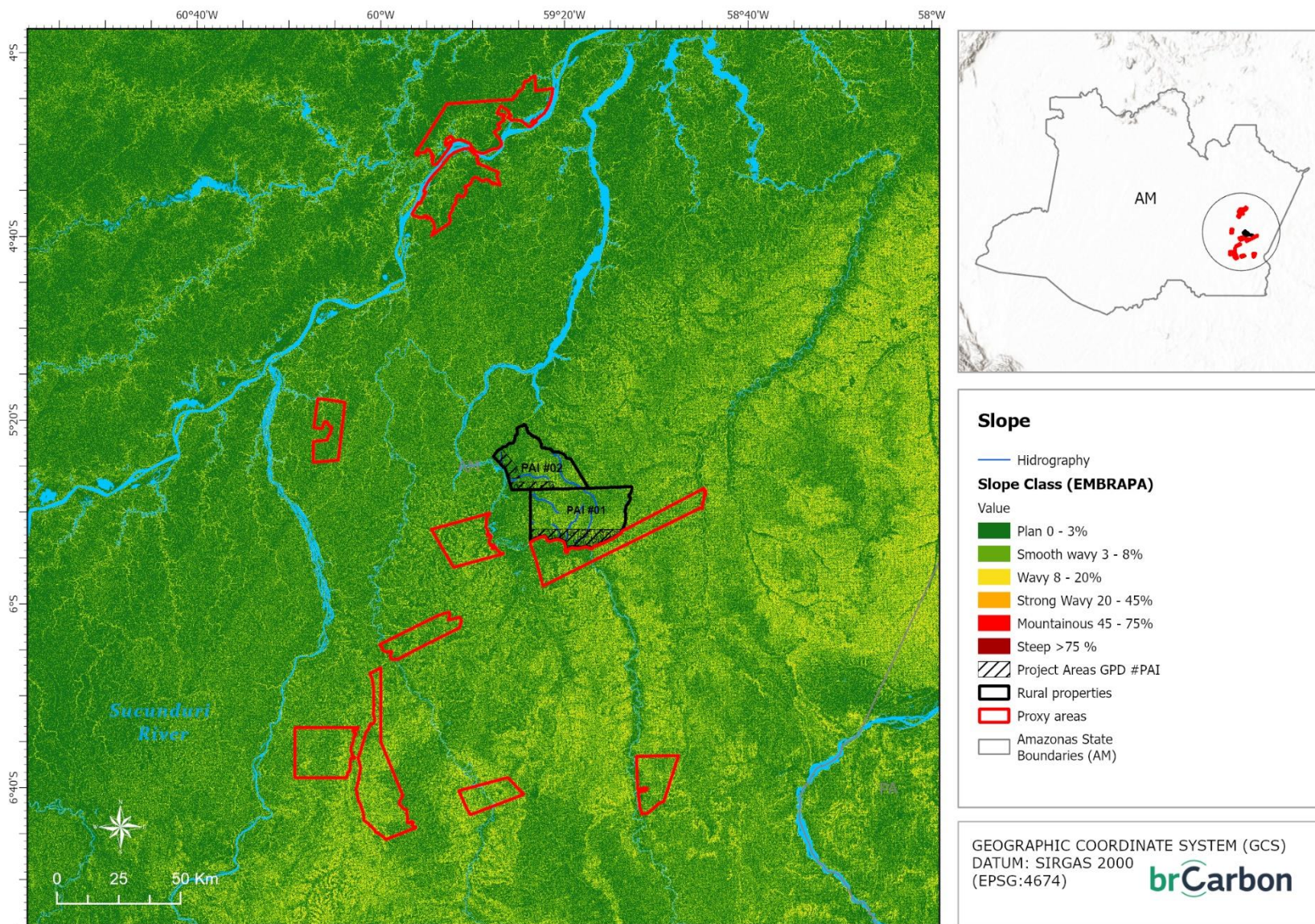


Figure 16 – Slope on Proxy Areas

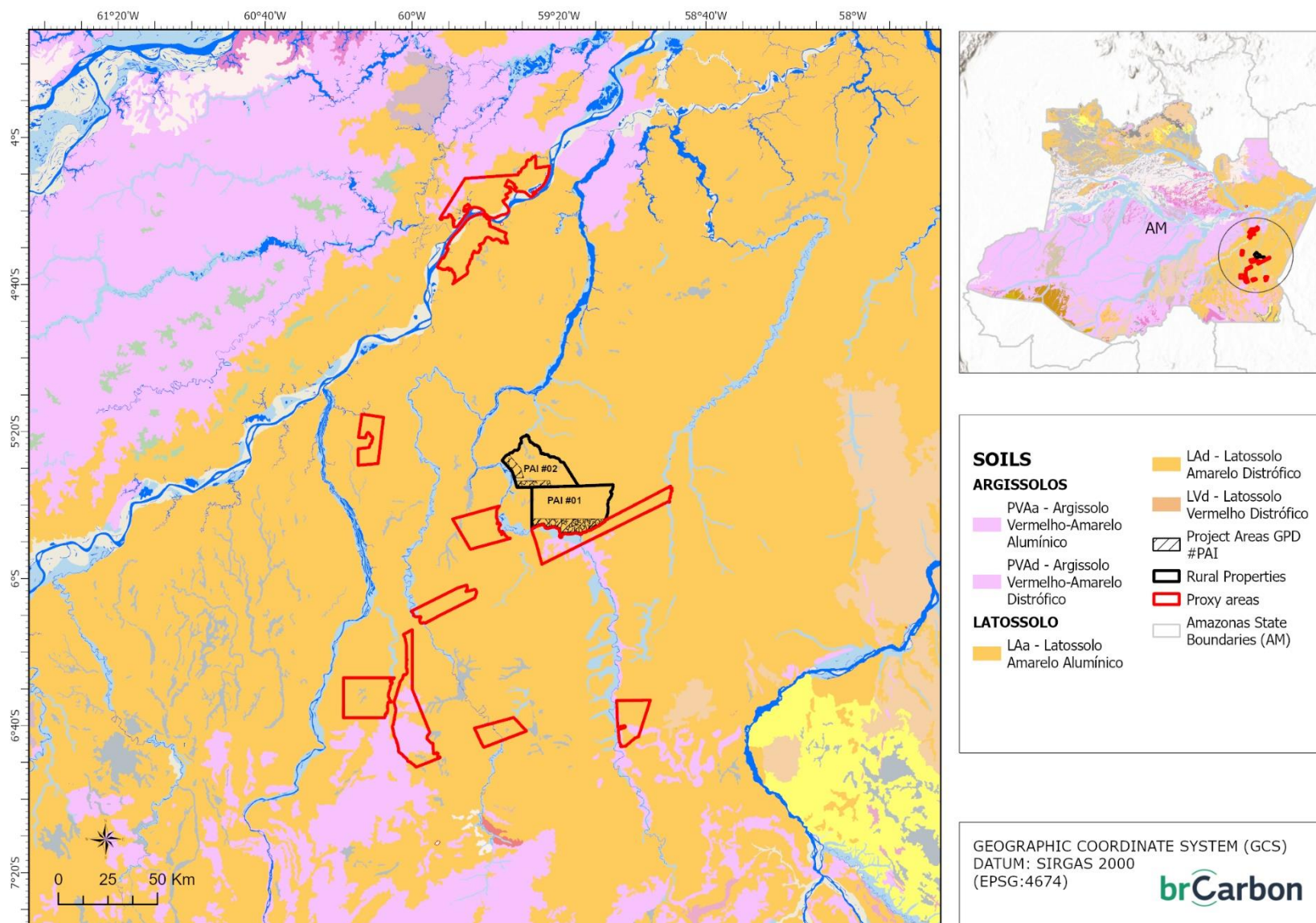


Figure 17 – Soils on Proxy Areas

The table below shows the similarity between proxy areas and of the proprieties where the PAIs are located compare relative area in forest types and slope classes in each propriety and proxy areas.

Table 28 – Forest types and slope classes similarity between proprieties where the PAIs are located and proxy .

Soils	Properties		Proxy Areas	
	Area	Percentage	Area	Percentage
Latossolo Amarelo Distrófico (LAd)	133434.93	97%	330260.28	80%
Argissolo Vermelho-Amarelo Distrófico (PVAd)		0%	58074.20	14%
Espodossolo Ferrihumilúvicos Vértico (ESKo)	1914.80	1%	3184.88	1%
Gleissolo Háplico Ta Distrófico (GXvd)		0%	1610.09	0%
Gleissolo Háplico Ta Eutrófico (GXve)	1625.39	1%	9953.87	2%
Neossolo Flúvico Tb Distrófico (RYbd)		0%	11275.74	3%
Vegetation				
Alluvial Dense Ombrophylous Forest (Da)	1296.96	1%	17497.09	4%
Dense Ombrophilous Forest (Db, Ds)	127733.45	93%	360475.00	87%
Open Ombrophylous Forest (As, Aa)		0%	24031.11	6%
Pionner formation with water influence (Pa)	8142.19	6%	8045.85	2%
Savana (Sp)		0%	2180.70	1%
Secondary Vegetation		0%	101.45	0%
Agriculture		0%	1962.70	0%
Climate				
Tropical (Af)	137212.38	100%	252758.25	61%
Tropical (Am)		0%	164754.20	39%
Slope				
Mountainous	4.52	0%	68.84	0%
Plan	10274.53	7%	50191.73	12%
Smooth Wavy	65308.60	48%	199534.10	48%
Steep		0%	0.56	0%
Strong wavy	5131.30	4%	20363.04	5%
Wavy	56493.70	41%	147356.36	35%

The figure below shows the land cover transitions and historical deforestation and degradation in the period analyzed and allows us to conclude that the deforested areas are not abandoned in the region. The maps illustrate the changes in land use and transitions between the years 2011 and 2021, showcasing the expansion of deforestation in the area. Although some adjacent properties have not yet shown signs of deforestation during this period, they represent the new frontier of this activity in the region. Clear evidence of this trend is the deforestation event adjacent to PAI#01 in 2022, which led to the emissions of the Project (Figure 10, Section 1.14.7). This deforestation was subsequently mitigated through a collaborative agreement forged between the landowner and adjacent stakeholders, demonstrating a proactive approach promoted thanks to the existence of the Carbon Project.

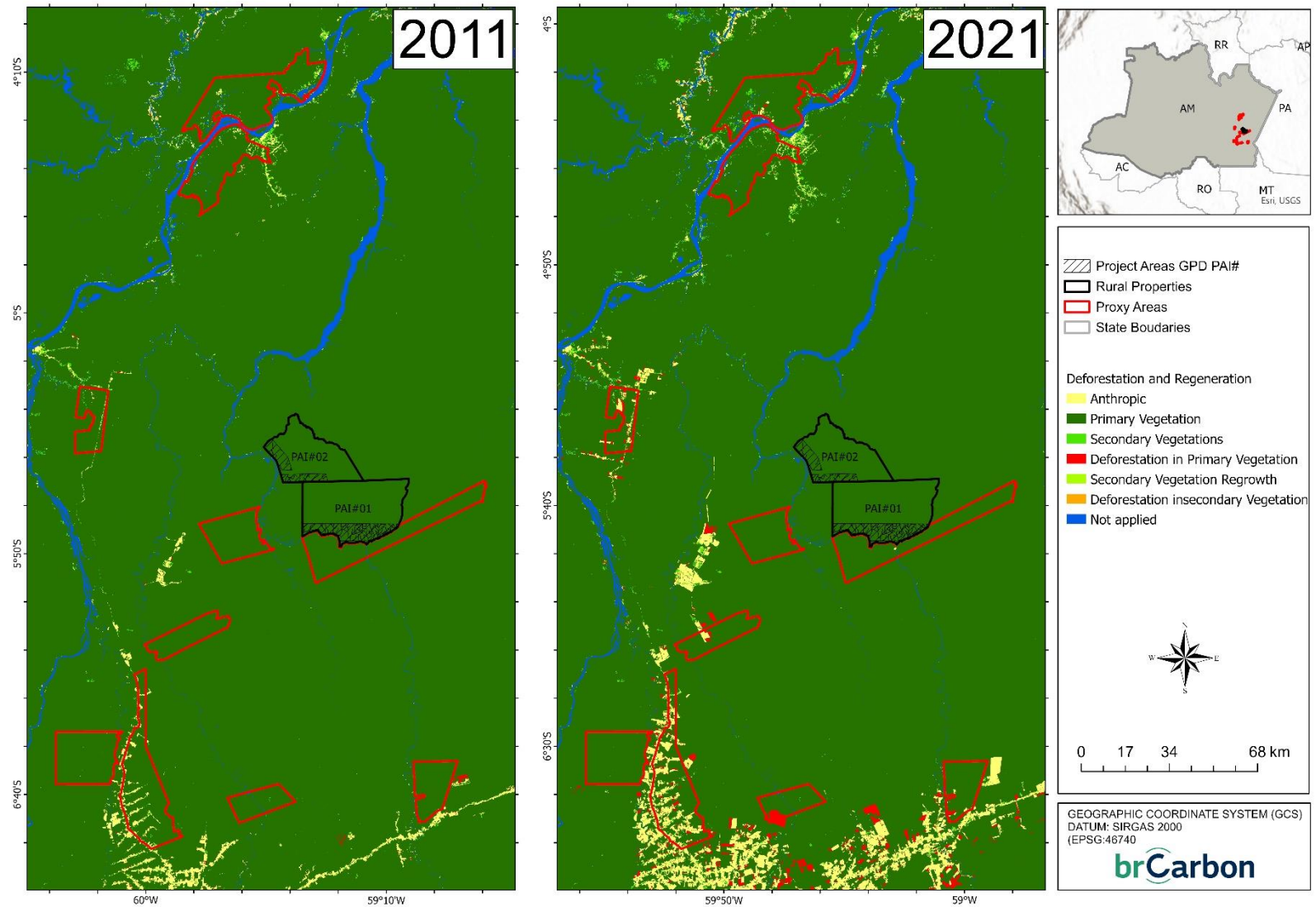


Figure 18 – Mapbiomas land use and land cover transitions in proxy areas

3.4.6. Annual Area of Deforestation

The annual area of deforestation in the baseline case is determined according to VMD0006 v1.4 equation 5. See section 5.1.1 (“Deforestation and Baseline Scenario”) for details on the topic.

3.5. Additionality

GPD additionality was assessed according to VT0001 v3.0. This tool is adapted from the CDM Tool for the demonstration and assessment of additionality in A/R CDM project activities and provides a stepwise approach to demonstrate and assess additionality for AFOLU project activities. The following sections present the results of each step.

3.5.1. Regulatory Surplus

- 1) Is the project registered or seeking registration in an UNFCCC Annex 1 or Non-Annex 1 country?
- 2) ☒ Annex 1 country ☐ Non-Annex 1 country
- 3) Are the project activities mandated by any law, statute, or other regulatory framework?
- 4) ☐ Yes ☒ No
- 5) If the project is located inside a Non-Annex 1 country and the project activities are mandated by a law, statute, or other regulatory framework, are such laws, statutes, or regulatory frameworks systematically enforced?
- 6) ☐ Yes ☒ No

3.5.2. Additionality Methods

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

The deforestation frontier is advancing towards the state of Amazonas, expanding south along the BR-230 and BR-319 highways. This deforestation originates in the micro-region in the east of the state, known as the Madeira River Micro-region. This area covers the municipalities of Apuí, Novo Aripuanã, Humaitá, Manicoré and, finally, Borba, where project areas are located. (Figure 19 – Observed deforestation during the periods 1988-2011 and 2012-2022.).

According to the National Institute for Space Research (INPE), deforestation in the state of Amazonas has been steadily increasing every year, and the Rio Madeira micro-region is following the same trend, as shown in Figure 19. This data highlights the micro-region's significant contribution to deforestation in the state, which follows the same trend as deforestation in the forest, since it is the front line of this problem, spreading to the rest of the state.

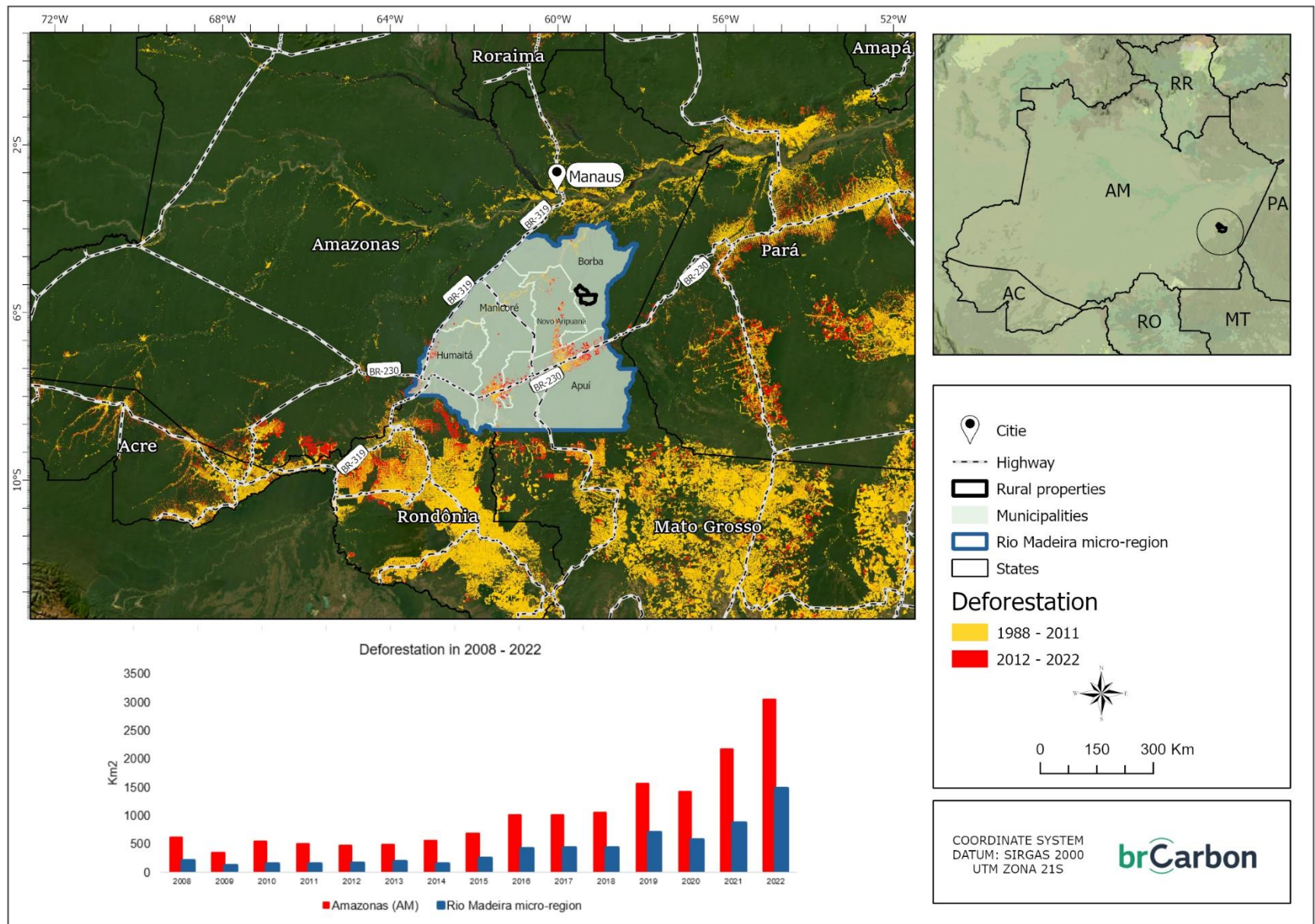


Figure 19 – Observed deforestation during the periods 1988-2011 and 2012-2022.

Based in the economic and political trends and the regional business as usual activity, three credible alternative land use scenarios were identified for the project areas within each property under this GPD (Outcome of VT0001 v3.0 sub-step 1a):

a. Forest cover maintenance of 20% of the property, where land use conversion is allowed by law, i.e.: through conservation activities resulting from incentives other than the REDD APD project.

b. Legal deforestation of 20% of the property (deforestation with permits), where the land use conversion is allowed by law i.e.: forest suppression for pasture (cattle raising) and agriculture.

c. Illegal deforestation of 20% of the property (deforestation without permits), where the land use conversion is allowed by law i.e.: forest suppression for pasture (cattle raising) and agriculture purposes or simply for real estate speculation.

The maintenance of forest cover without financial incentives (scenario “a”) is possible but unlikely, due to direct costs of surveillance, wildfires, and the opportunity cost associated with the property economic use where law allows forest suppression. In addition, the maintenance of the rural property depends on the annual payment of a series of fees and taxes, which creates the need to give some economic use to the property under the penalty of economic losses, or even the loss of the property itself for agrarian reform initiatives.

The identified deforestation agent has a history of deforestation in other lands for economic purposes, and valid and verifiable plans for deforesting the project area (APPENDIX_IX-ADDITIONALITY), which makes scenario “b” realistic and credible.

Illegal deforestation is a common practice throughout the GPD geographic area (Amazonas), which makes scenario “c” realistic and credible.

Scenarios “a” and “b” follow applicable laws and regulations in the country. Scenario “c” presents illegal activities, resulting from systematic lack of enforcement of applicable laws and regulations (Outcome of VT0001 v3.0 sub-step 1b). Recent studies published by different institutions support the thesis that most deforestation observed in Brazil today is illegal (Azevedo et al., 2020; Valdiones et al., 2019).

Scenario “b” is considered the most plausible baseline scenario because the land is expected to be converted to non-forest land in the baseline case and the conversion is legally authorized and documented, following VM0007 v1.6, table 01 decision tree criteria for project activity type. VMD0006 v2.2, in its turn, presents a stepwise approach for the justification and determination of scenario “b” (see section 3.4) (Outcome of VT0001 v3.0 sub-step 1c). All PAIs under the GPD refer to areas that would be legally deforested for cattle raising or croplands in the absence of the REDD project activity.

The plausibility of the baseline scenario can be corroborated by the deforestation rates and the progression of the cattle herd over the historical reference period of 2008-2022 in the Rio Madeira micro-region. (Figure 20 - Deforestation and cattle herd in Rio Madeira micro-region and Borba (AM) (2008 – 2022).).

Deforestation in this region also shows an increase in the number of cattle, thus demonstrating the cycle of deforestation in the Amazon. This dynamic is evident in the municipality of Borba, where the project areas are located. In 2022, there was a 155% increase in deforestation compared to 2021, accompanied by a 19% increase in the number of cattle compared to the previous year. When comparing this same relationship with the municipalities of the Madeira River micro-region, where deforestation and head of cattle increased by 2.25 in both cases, it illustrates that in Borba the pressure and conversion of deforested areas for livestock production is more accelerated in relation to the region in which it is located. This data points directly to a correlation between the increase in deforestation and the growth in cattle farming.

When analyzing the remaining forest in properties registered in SIGEF (Land Management System of the Brazilian government), it was decided to select properties whose total area resembled those participating in the project, respecting the mean and standard deviation of $65,000 \pm 40,000$ hectares. Therefore, properties with areas ranging from 25,000 to 105,000 hectares were chosen, considering the dimensions of the properties involved in the project. Based on this filter, a total of 118 properties in the state of Amazonas were selected for the evaluation of the percentage of remaining forest. It was found that within this set, 76.2% of the properties exhibit some level of deforestation. The average percentage of deforested area was $15.0 \pm 21.7\%$. Developing this analysis for the microregion of the Madeira River, a set of 45 properties was identified. Of these, 94.0% showed some degree of deforestation, with an average percentage of deforestation in these properties reaching $8.5 \pm 15.1\%$.

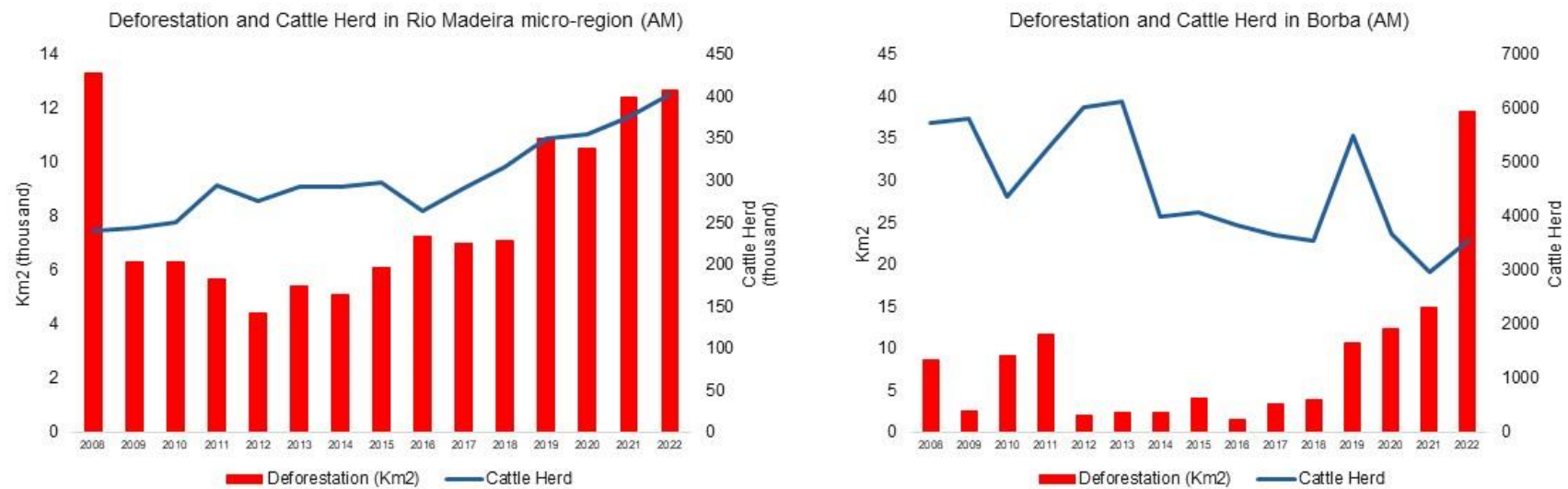


Figure 20 - Deforestation and cattle herd in Rio Madeira micro-region and Borba (AM) (2008 – 2022).

3.5.2.2. Investment analysis

The proposed project activity is economically MORE attractive than any agriculture project, and no financial benefits other than VCS related income are expected for the project proponent due to the project implementation (see section 1.12). Even though, a financial analysis of the project scenario and the baseline scenario can be found in APPENDIX_XI-INVESTMENT_ANALYSIS. The tables below show summarized estimated costs associated with the VCS AFOLU project for the first year (Table 29) and the baseline period (Table 30) (Outcome of VT0001 v3.0 sub- steps 2a, 2b).

Table 29 – Project's Costs

Costs (1 st year)	USD
Administrative	\$ 97,226.45
Project activity implementation	\$ 17,487.16
Monitoring	\$ 24,216.33
Certification	\$ 42,704.08
Logistics	\$ 29,276.49
Sub total	\$ 168,206.43
Fees and taxes	\$ 215,409.01
Total	\$ 383,615.44

Table 30 – Project costs per year.

Costs (1 st Baseline period)	USD
Year 01	\$ 383.615
Year 02	\$ 483.548
Year 03	\$ 468.517
Year 04	\$ 442.823
Year 05	\$ 457.553
Year 06	\$ 496.465
Year 07	\$ 457.862
Year 08	\$ 474.529
Year 09	\$ 491.767

Costs (1 st Baseline period)	USD
Year 10	\$ 564.302
Total	\$ 4.720.981

3.5.2.3. Barrier analysis

A barrier analysis was performed as an extension of investment analysis. The list below shows the most relevant barriers that would prevent the implementation of the type of proposed project activity without the revenue from the sale of VCUUs (Outcome of VT0001 v3.0 sub-step 3a):

- Investment barriers: financial flows for the conservation of private areas are insignificant in Brazil.
- Institutional barriers: lack of enforcement of forest or land-use-related legislation is typical in the GPD geographic region.
- Barriers related to local tradition: local customs and market conditions favor cattle raising as a livelihood for local communities.
- Barriers due to social conditions and land-use practices: widespread illegal practices are well known in the GPD geographic region.

The identified barriers are not preventing the implementation of scenario “c”. On the contrary, the lack of financial resources for conservation, effective public policies to reduce deforestation and promote sustainable socioeconomic development, associated with the inherent difficulty of public authorities in containing illegal activities drives unbridled and illegal deforestation in Brazil (Outcome of VT0001 v3.0 sub-step 3b).

3.5.2.4. Common Practice Analysis

Currently in Brazil there are few legal, regulated, and operating mechanisms or policies capable of effectively avoid legal deforestation within private properties. Common practice analysis was hereby elaborated in consideration of three specific selected mechanisms/policies, the Environmental Reserve Quota – CRA, the ecological ICMS and the REM program in the state of Amazonas.

Despite being foreseen in the 2012 Brazilian forest code, CRAs mechanism was only regulated in December 2018. Environmental Reserve Quotas are titles that represent an area covered by native vegetation on a property with an “excess of Legal Reserve” that can be acquired by landowners with a “deficit of Legal Reserve” in the same biome, to regularize the rural property. One title represents 1 ha with preserved forest cover. As these titles can be commercialized, the mechanism could be understood as an initiative like a REDD APD project, however, essential differences between them can be noted. As CRAs can only be traded in the same biome and to

specific stakeholders, the regulatory framework is different from the one relevant to carbon projects. Furthermore, as the forest cover in the Amazon biome exceeds 80%, the demand for titles becomes low, which results in low supply. This effect can be evidenced by the number of titles available on the market. In a search conducted on the main CRAs transaction platform, only 111 properties were found for the entire Amazon biome, offering their surplus of native vegetation remnants for “Legal Reserve compensation” in other properties. Notwithstanding, the fact that they are offered in the market does not mean that the transaction (or payment for the forest surplus) has been made. As a result, it can be argued that the impacts of this mechanism are limited in the Amazon biome. Furthermore, the CRA mechanism does not consider the forest carbon stocks, but only the forest cover, therefore not serving the purpose of offsetting GHG emissions. Thus, it is concluded that, despite being similar, the CRA mechanism presents essential distinctions in relation to carbon projects.

3.6. Methodology Deviations

Not applicable. No methodological deviations have taken place nor are planned for this GPD. If any deviations occur in the future, they will be described in the following Monitoring Reports.

4 IMPLEMENTATION STATUS

4.1. Implementation Status of the Project Activity

During the monitoring period, BRCarbon measurement team has conducted forest and fauna inventories at the first two project activity instances (PAIs). This involved trees measurements and field surveys with camera traps and species identification.

In July 2023, the social team embarked on an initial visit to the territory to identify potential communities for project activities and engage with stakeholders, including the Coatá-Laranjal Indigenous Land leaders, families living around the properties, the National Foundation of Indigenous Peoples (FUNAI), and the Indigenous Health Secretariat (SESAI). A follow-up visits in January 2024 aimed to announce the audit and further understand the territory and its stakeholders. Concurrently, the team surveyed nearby communities, pinpointing those suitable for socio-economic diagnostics and initial social actions to bolster project security. Soon, the PP commits to incorporating the CCB standard into the scope of this project to broaden the impact on both communities and the biodiversity and climate influenced by project activities.

The geoprocessing team conducted a deforestation survey using DETER (INPE) data and found deforestation occurring in PAI#01. This data was verified with Sentinel 2 satellite images and went through details of the forest degradation process. Deforestation prior to the project start date was deducted directly from the project area, whereas the deforestation after the project start date was computed as project emissions totaling 58,887.51 tCO₂e.

The outputs described represent verifiable targets for the first 10 years of the project, considering their current scope and may vary over time, with the inclusion of new PAIs. This report pertains to the first validation and verification period of the Amazonas APD grouped project, meaning all previously mentioned project activities that are planned will continue to be carried out throughout the project's entire lifetime.

5 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1. Baseline Emissions

Baseline emissions are estimated according to VMD0006 v1.4. This module allows to estimate GHG emissions related to planned deforestation on forest lands that are legally authorized and documented to be converted to non-forest land. These areas would be deforested in the absence of the REDD project activity and converted to pasture for cattle rising, as presented in the Additionality section.

5.1.1. Deforestation in the baseline Scenario

The annual area of baseline planned deforestation ($AA_{planned,i,t}$) is calculated according to VMD0006 BL-PL v1.4 equation 5:

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

Where:

$AA_{planned,i,t}$	Annual area of baseline planned deforestation for stratum i at time t; ha.
$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum i during year t.
$A_{planned,i}$	Total area of planned deforestation over the baseline period for stratum i; ha.
$L-D_i$	Likelihood of deforestation for stratum i; %.

The total area of planned deforestation over the first baseline period ($A_{planned,i,t}$), in each PAI (Table 31 - Total and annual area of planned deforestation over the baseline scenario in all PAIs (Table 14 from Appendix II – “Calculus Table” - Consolidated Results).Table 31), is determined according to what is recognized as an immediate site-specific threat of deforestation, which, in its turn, is a function of the legal permissibility for deforestation, the suitability of the project area for conversion to alternative non-forest land use, the government approval for deforestation and a management plan for deforesting the project area. For a complete discussion over $A_{planned,i,t}$ determination, refer to section 3.4. The projected annual proportion of land that will be deforested in stratum i during year t. ($D\%_{planned,i,t}$) is determined according to vegetation suppression authorizations issued by the

competent environmental agencies in each state (APPENDIX_IV-BASELINE_DEFORESTATION_PERMITS). These authorizations should be understood as verifiable plans where the actual annual deforestation proportion is known and documented. As only private areas are under the scope of this GPD, L-D_i is set to be 100%, according to the VMD0006 v1.4 requirements.

Table 31 - Total and annual area of planned deforestation over the baseline scenario in all PAIs (Table 14 from Appendix II – “Calculus Table” - Consolidated Results).

Year	AA _{planned,i,t}						Total (ha)
	PAI#01			PAI#02			
	Ds	Db	Total	Ds	Db	Total	
2023	500	0	500	0	500	500	1,000
2024	500	0	500	0	500	500	1,000
2025	500	0	500	0	500	500	1,000
2026	500	0	500	0	500	500	1,000
2027	500	0	500	0	500	500	1,000
2028	500	0	500	0	500	500	1,000
2029	500	0	500	0	500	500	1,000
2030	500	0	500	0	500	500	1,000
2031	500	0	500	0	500	500	1,000
2032	500	0	500	0	500	500	1,000
AA _{planned,i,t}	5,000	0	5,000	0	5,000	5,000	10,000

5.1.2. Carbon Stock Change per Reservoir in the Baseline Scenario

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

5.1.1.1. Aboveground Tree Biomass

The baseline carbon stock change in aboveground tree biomass ($\Delta C_{AB_tree,i}$) is calculated according to the difference between the forest carbon stock in aboveground tree biomass ($C_{AB_tree,bsl,i}$) and the post-deforestation carbon stock in aboveground tree biomass ($C_{AB_tree,post,i}$), according to VMD0006 v1.4, equation 6:

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

Where:

$\Delta C_{AB_tree,i}$	Baseline carbon stock change in aboveground tree biomass in stratum i ; t CO ₂ -e ha ⁻¹ .
$C_{AB_tree,bsl,i}$	Forest carbon stock in aboveground tree biomass in stratum i ; t CO ₂ -e ha ⁻¹ .
$C_{AB_tree,post,i}$	Post-deforestation carbon stock in aboveground tree biomass in stratum i ; t CO ₂ -e ha ⁻¹ .
i	1, 2, 3, ...M strata.

Table 32 - Baseline carbon stock change in aboveground tree biomass (t CO₂-e ha⁻¹). (Table 15 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	$C_{AB_tree,bsl,i}$	$C_{AB_tree,post,i}$	$\Delta C_{AB_tree,i}$
Ds	514,20	0,1	514,09
Db	493,15	0,1	493,04

Forest carbon stock in aboveground tree biomass ($C_{AB_tree,bsl,i}$) is estimated through field measurements in sample fixed area plots employing representative random sampling per strata, following VMD0001 v1.2 requirements. Post-deforestation carbon stock in aboveground tree biomass ($C_{AB_tree,post,i}$) is taken from peer reviewed literature (Silva Neto et al., 2012). For more information about the sampling design, allometric equations adopted and associated SOPs, refer to APPENDIX_IX-CARBON_POOLS.

5.1.1.2. Belowground Tree Biomass

The baseline carbon stock change in belowground tree biomass ($\Delta C_{BB_tree,i}$) is calculated according to the difference between the forest carbon stock in belowground tree ($C_{BB_tree,bsl,i}$) and the post-deforestation carbon stock in belowground tree biomass ($C_{BB_tree,post,i}$), according to VMD0006 v1.4, equation 8:

$$\Delta C_{BB_tree,i} = C_{BB_tree,bsl,i} - C_{BB_tree,post,i}$$

Where:

$\Delta C_{BB_tree,i}$	Baseline carbon stock change in belowground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{BB_tree,bsl,i}$	Forest carbon stock in belowground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{BB_tree,post,i}$	Post-deforestation carbon stock in belowground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
i	1, 2, 3, ...M strata.

Table 33 - Baseline carbon stock change in belowground tree biomass (t CO₂-e ha⁻¹). (Table 16 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	$C_{BB_tree,bsl,i}$	$C_{BB_tree,post,i}$	$\Delta C_{BB_tree,i}$
Ds	159.40	0.02	159.38
		0.02	159.38
Db	152.88	0.02	152.85
		0.02	152.85

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

5.1.1.3. Aboveground Non-Tree Biomass

The baseline carbon stock change in aboveground non-tree biomass ($\Delta C_{AB_non-tree,i}$) is calculated according to the difference between the forest carbon stock in aboveground non-tree biomass in stratum i ($C_{AB_non-tree,bsl,i}$) and the post-deforestation carbon stock in aboveground non-tree biomass in stratum i ($C_{AB_non-tree,post,i}$), according to VMD0006 v1.4, equation7:

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

Where:

$\Delta C_{AB_non-tree,i}$	Baseline carbon stock change in aboveground non-tree biomass in stratum i; tCO ₂ -e ha ⁻¹
$C_{AB_non-tree,bsl,i}$	Forest carbon stock in aboveground non-tree vegetation in stratum i; tCO ₂ -e ha ⁻¹ .
$C_{AB_non-tree,post,i}$	Post-deforestation carbon stock in aboveground non-tree vegetation in stratum i; tCO ₂ -e ha ⁻¹ .
i	1, 2, 3, ...M strata.

Table 34 - Baseline carbon stock change in aboveground non-tree biomass (t CO₂-e ha⁻¹). (Table 17 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	C _{AB_non-tree,bsl,i}	C _{AB_non-tree,post,i}	ΔC _{AB_non-tree,i}
Ds	27.25	15.00	12.26
Db	26.14	15.00	11.14

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

5.1.1.4. Belowground Non-Tree Biomass

The baseline carbon stock change in belowground non-tree biomass (ΔC_{BB_non-tree,i}) is calculated according to the difference between the forest carbon stock in belowground non-tree (C_{BB_non-tree,bsl,i}) and the post-deforestation carbon stock in belowground non-tree biomass (C_{BB_non-tree,post,i}), according to VMD0006 v1.4, equation 9:

$$\Delta C_{BB,non-tree,i} = C_{BB,non-tree,bsl,i} - C_{BB,non-tree,post,i}$$

Where:

ΔC _{BB_non-tree,i}	Baseline carbon stock change in belowground non-tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
C _{BB_non-tree,bsl,i}	Forest carbon stock in belowground non-tree biomass in stratum i t CO ₂ -e ha ⁻¹ .
C _{BB_non-tree,post,i}	Post-deforestation carbon stock in belowground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
i	1, 2, 3, ...M strata.

Table 35 - Baseline carbon stock change in belowground non-tree biomass (t CO₂-e ha⁻¹). (Table 18 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	C _{BB_non-tree,bsl,i}	C _{BB_non-tree,post,i}	ΔC _{BB_non-tree,i}
Ds	5.45	3.00	2.45
Db	5.23	3.00	2.23

Forest carbon stock in belowground non-tree biomass ($C_{BB_tree,bsl,i}$) is calculated through root-to-shoot ratios taken from peer reviewed literature (IPCC 2006, VMD0001, CP-AB). Post-deforestation carbon stock in belowground tree biomass ($C_{BB_non-tree,post,i}$) is taken from peer reviewed literature (Silva Neto et al., 2012).

5.1.1.5. Deadwood

The baseline carbon stock change in deadwood ($\Delta C_{DW,i}$) is calculated according to the difference between the fdesorest carbon stock in deadwood ($C_{DW,i}$) and the post-deforestation carbon stock in deadwood ($C_{DW,post,i}$), according to VMD0006 v1.4 equation 10:

$$\Delta C_{DW,i} = C_{DW,bsl,i} - C_{DW,post,i}$$

Where:

$\Delta C_{DW,i}$ Baseline carbon stock change in dead wood in stratum i; t CO₂-e ha⁻¹.

$C_{DW,bsl,i}$ Forest carbon stock in dead wood in stratum i; t CO₂-e ha⁻¹.

$C_{DW,post,i}$ Post-deforestation carbon stock in dead wood in stratum i; t CO₂-e ha⁻¹.

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

Table 36 - Baseline carbon stock change in deadwood (t CO₂-e ha⁻¹). (Table 19 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	$C_{DW,bsl,i}$	$C_{DW,post,i}$	$\Delta C_{DW,i}$
Ds	8.19	-	8.19
Db	15.35	-	15.35

Forest carbon stock in dead wood ($C_{DW,bsl,i}$) is estimated based on field measurements of fixed area plots, considering standing dead trees and lying dead wood, according to VMD0002 v1.1 criteria. Post-deforestation carbon stock in deadwood ($C_{DW,post,i}$) is set as zero as the project area is expected to be systematically burned every year in the baseline scenario. For more information about the sampling design, allometric equations adopted and associated SOPs, refer to APPENDIX_IX-CARBON_POOLS.

5.1.1.6. Litter

The baseline carbon stock change in litter ($\Delta C_{LI,i}$) is calculated according to the difference between the forest carbon stock in litter ($C_{LI,i}$) and the post-deforestation carbon stock in litter in stratum I ($C_{LI,post,i}$), according to VMD0006 v1.4 equation 11:

$$\Delta C_{LI,i} = C_{LI,bsl,i} - C_{LI,post,i}$$

Where:

$\Delta C_{LI,i}$	Baseline carbon stock change in litter in stratum i; t CO2-e ha-1.
$C_{LI,bsl,i}$	Forest carbon stock in litter in stratum i; t CO2-e ha-1.
$C_{LI,post,i}$	Post-deforestation carbon stock in litter in stratum i; t CO2-e ha-1.
i	1, 2, 3, ...M strata.

Table 37 - Baseline carbon stock change in litter (t CO2-e ha-1). (Table 20 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	$C_{LI,bsl,i}$	$C_{LI,post,i}$	$\Delta C_{LI,i}$
Ds	8.88	-	8.88
Db	8.88	-	8.88

Forest carbon stock in litter ($C_{LI,bsl,i}$) is estimated based on field measurements of fixed area plots, according to VMD0003 v1.1 criteria. Post-deforestation carbon stock in litter ($C_{LI,post,i}$) is set as zero as the project area is expected to be systematically burned every year in the baseline scenario. For more information about the sampling design, allometric equations adopted and associated SOPs, refer to APPENDIX_IX-CARBON_POOLS.

5.1.1.7. Soil Organic Carbon

The baseline carbon stock change in soil organic carbon ($\Delta C_{SOC,i}$) is calculated according to the difference between the forest carbon stock in soil organic ($C_{SOC,bsl,i}$) and the post- deforestation carbon stock in soil organic carbon ($C_{SOC,PD-BSL,i}$), according to VMD0006 v1.4, equation 12:

$$\Delta C_{SOC,i} = C_{SOC,bsl,i} - C_{SOC,PD-BSL,i}$$

Where:

$\Delta C_{SOC,i}$	Baseline carbon stock change in soil organic carbon in stratum i; t CO2- e ha ⁻¹ .
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$C_{SOC,bsl,i}$	Forest carbon stock in soil organic carbon in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{SOC,PD-BSL,i}$	Post-deforestation carbon stock in soil organic carbon in stratum i; t CO ₂ -e ha ⁻¹ .
i	1, 2, 3, ...M strata.

Table 38 - Baseline carbon stock change in soil organic carbon (t CO₂-e ha⁻¹) (Table 21 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	$C_{SOC,bsl,i}$	$C_{SOC,PD-BSL,i}$	$\Delta C_{SOC,i}$
Ds	132.48	119.23	13.25
Db	196.86	177.17	19.69

Forest carbon stock in soil organic carbon ($C_{SOC,bsl,i}$) is estimated based on field measurements of fixed area plots, according to VMD0004 v1.1 criteria. Post-deforestation carbon stock in soil organic carbon ($C_{SOC,PD-BSL,i}$) is assumed to be the long-term average stocks on the land following deforestation, and calculated based on land-use factors according to VMD0004 v1.1 criteria. For more information about the sampling design, allometric equations adopted and associated SOPs, refer to APPENDIX_IX-CARBON_POOLS.

5.1.1.8. Wood Products

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

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

Where:

$C_{WP,i}$	Carbon stock entering the wood products pool from stratum i; t CO ₂ -e ha ⁻¹ .
$C_{XB,ty,i}$	Mean stock of extracted biomass carbon by class of wood product ty from stratum i; t CO ₂ -e ha ⁻¹ .
WW_{ty}	Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product ty; dimensionless.

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

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

The wood waste (WW_{ty}) is taken from peer reviewed literature (Veríssimo et al. 1992). The mean stock of extracted biomass carbon by class of wood product ($C_{XB,ty,i}$) is calculated according to VMD0005 v1.2 equation 1:

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

Where:

$C_{XB,ty,i}$ Mean stock of extracted biomass carbon by class of wood product ty from stratum i; tCO₂-e ha⁻¹.

A_i Total area of stratum i; ha.

$V_{ex,ty,j}$ Volume of timber extracted from within stratum i (does not include slash left onsite) by species j and wood product class ty; m³.

D_j Mean wood density of species j; t d.m.m⁻³.

CF Carbon fraction; Dimensionless.

j 1, 2, 3, ... S tree species

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

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Ratio of molecular weight of CO₂ to carbon, t CO₂-e t C⁻¹.

Total area (A_i) equal to the project area ($A_{\text{planned},i}$). The volume of timber extracted ($V_{\text{ex},ty,j}$) is taken from pre-exploratory inventories or forest exploration plans (APPENDIX_IV-BASELINE_DEFORESTATION_PERMITS). The mean wood density (D_j) is taken from peer reviewed literature (Reyes et al., 1992). Carbon fraction of biomass is taken from peer reviewed literature (Zanne et al., 2009).

The carbon entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years ($C_{WP100,i}$) is calculated according to VMD0005 v1.2 equation 3:

$$C_{WP100,i} = C_{WP,i} - C_{WP,i} * (1 - SLF_p) * (1 - Of_p)$$

Where:

$C_{WP100,i}$	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum i ; t CO ₂ -e ha ⁻¹ .
$C_{WP,i}$	Carbon stock entering wood products pool at time of deforestation from stratum i ; t CO ₂ - e ha ⁻¹ .
SLF_{ty}	Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product ty ; dimensionless.
Of_{ty}	Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product ty ; dimensionless.
ty	Wood product class – defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o).
i	1, 2, 3, ...M strata.

Table 39 - Carbon stocks in the long-term wood products pool. (Table 22 from Appendix II – “Calculus Table” - Consolidated Results).

PAI	Stratum (i)	$C_{WP,i}$	$C_{WP100,i}$
PAI#01	Ds	0	0

	Db		
PAIs #02	Ds	0	0
	Db		0

The fraction of wood products that will be emitted to the atmosphere within 5 years (SLF_y) and between 5 and 100 years (OF_y) of timber harvest is taken from peer reviewed literature (Brown et al. 1998).

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

The net carbon stock changes in all pools in the baseline ($\Delta C_{BSL,i,t}$) is calculated according to the following equation 13 from VMD0006 v1.4:

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

Where:

$\Delta C_{BSL,i,t}$	Sum of the baseline carbon stock change in all terrestrial pools in stratum i in year t, t CO ₂ -e.
$AA_{planned,i,t}$	Annual area of baseline planned deforestation for stratum i in year t; ha.
$C_{WP100,i}$	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum i; t CO ₂ -e ha ⁻¹ .
$\Delta C_{AB_tree,i}$	Baseline carbon stock change in aboveground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
$\Delta C_{BB_tree,i}$	Baseline carbon stock change in belowground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
$\Delta C_{AB_non-tree,i}$	Baseline carbon stock change in aboveground non-tree biomass in stratum i; tCO ₂ -e ha ⁻¹ .

$\Delta C_{BB_non-tree,i}$	Baseline carbon stock change in belowground non-tree biomass in stratum i; tCO ₂ -e ha ⁻¹ .
$\Delta C_{WP,i}$	Baseline carbon stock change in wood products in stratum i; tCO ₂ -e ha ⁻¹ .
$\Delta C_{DW,i}$	Baseline carbon stock change in dead wood in stratum i; tCO ₂ -e ha ⁻¹ .
$\Delta C_{LI,i}$	Baseline carbon stock change in litter in stratum i tCO ₂ -e ha ⁻¹ .
$\Delta C_{SOC,i}$	Baseline carbon stock change in soil organic carbon in stratum i; tCO ₂ -e ha ⁻¹ .
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the projected start of the project activity.

Table 40 - Net carbon stock changes in all pools in the baseline period in all PAIs (t CO₂-e) . (Table 23 from Appendix II – “Calculus Table” - Consolidated Results).

Year	$\Delta C_{BSL,i,t}$		$\Delta C_{BSL,i,t}$	
	PAI#01	PAI#02	Total	Cumulative
2023	276.443	265.544	541.987	541.987
2024	285.275	274.557	559.833	1.101.819
2025	294.107	283.571	577.679	1.679.498
2026	302.940	292.585	595.525	2.275.022
2027	311.772	301.599	613.371	2.888.393
2028	320.604	310.612	631.217	3.519.610
2029	329.437	319.626	649.063	4.168.672
2030	338.269	328.640	666.909	4.835.581
2031	347.101	337.654	684.755	5.520.336
2032	355.933	346.667	702.601	6.222.936

5.1.4. Non-CO₂ Emissions in the Baseline Scenario

The greenhouse gas emissions as a result of deforestation activities within the project boundary is estimated according to VMD0006 v1.4 equation 15:

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

Where:

$GHG_{BSL,E}$	Greenhouse gas emissions as a result deforestation activities within the project boundary in the stratum i in year t; t CO ₂ -e.
$E_{FC,i,t}$	Net CO ₂ e emission from fossil fuel combustion in stratum i in year t; t CO ₂ -e.
$E_{BiomassBurn,i,t}$	Non-CO ₂ emissions due to biomass burning in stratum i in year t; t CO ₂ - e.
$N_2O_{direct-N,i,t}$	Direct N ₂ O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t; t CO ₂ -e.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the REDD VCS project activity.

Net CO₂e emission from fossil fuel combustion ($E_{FC,i,t}$) and nitrogen application ($N_2O_{direct-N,i,t}$) in the baseline scenario are conservatively excluded (see section 3.3.4).

Non-CO₂ emissions due to biomass burning ($E_{BiomassBurn,i,t}$) are calculated according to VMD0013 v1.3, equation 1:

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

Where:

$E_{biomassburn,i,t}$	Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO ₂ , CH ₄ , N ₂ O) (t CO ₂ e).
$A_{burn,i,t}$	Area burnt for stratum i in year t (ha).
$B_{i,t}$	Average aboveground biomass stock before burning stratum i, year (t d.m.ha-1).
$COMF_i$	Combustion factor for stratum i (unitless).

$G_{g,i}$	Emission factor for stratum i for gas g (kg t ⁻¹ d.m. burnt).
GWP_g	Global warming potential for gas g (t CO ₂ /t gas g).
g	1, 2, 3 ...G greenhouse gases including carbon dioxide ¹ , methane and nitrous oxide (unitless).
i	1, 2, 3 ...M strata (unitless).
t	1, 2, 3, ...t* time elapsed since the start of the project activity (years).

The area burnt ($A_{burn,i,t}$) equal to annual area of baseline planned deforestation in the baseline case ($AA_{planned,i,t}$). Combustion and emission factors are default values taken by IPCC (2006). Global warming potential is a default factor from the latest IPCC assessment report.

The average aboveground biomass stock before burning is calculated according to VMD0013 v1.3, equation 2²:

$$B_{i,t} = (C_{AB_{tree,i,t}} + C_{DWi,t} + C_{LI,i,t}) * 12/44 * (1/CF)$$

Where:

$B_{i,t}$	Average aboveground biomass stock before burning for stratum i, year t (tonnes d.m. ha ⁻¹).
$C_{AB_tree,i,t}$	Carbon stock in aboveground biomass in trees in stratum i in year t (t CO ₂ e ha ⁻¹).
$C_{AB_non-tree,i,t}$	Carbon stock in aboveground biomass in non-trees in stratum i in year t (t CO ₂ e ha ⁻¹).
$C_{DWi,t}$	Carbon stock in dead wood for stratum i in year t (t CO ₂ e ha ⁻¹).
$C_{LI,i,t}$	Carbon stock in litter for stratum i in year t (t CO ₂ e ha ⁻¹).
12/44	Inverse ratio of molecular weight of CO ₂ to carbon (t CO ₂ e t C ⁻¹).

² Adjusted to reflect methodological deviation.

CF	Carbon fraction of biomass (t C t ⁻¹ d.m).
i	1, 2, 3 ...M strata (unitless).
t	1, 2, 3, ... t* time elapsed since the start of the project activity (years).

Table 41 - Non-CO2 emissions in the baseline case. (Table 24 from Appendix II – “Calculus Table” - Consolidated Results).

Year					GHG _{BSL,E}
	PAI#01		PAI#02		
	Ds	Db	Ds	Db	
2023	500	-	-	500	35,021
2024	500	-	-	500	35,021
2025	500	-	-	500	35,021
2026	500	-	-	500	35,021
2027	500	-	-	500	35,021
2028	500	-	-	500	35,021
2029	500	-	-	500	35,021
2030	500	-	-	500	35,021
2031	500	-	-	500	35,021
2032	500	-	-	500	35,021

5.1.5. Net GHG emissions in the Baseline Scenario

The baseline net GHG emissions for planned deforestation is determined according to VMD0006 BL-PL v1.4 equation 1:

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

Where:

$\Delta C_{BSL,planned}$	Net greenhouse gas emissions in the baseline from planned deforestation up to year t*; t CO2-e.
--------------------------	---

$\Delta C_{BSL,i,t}$	Net carbon stock changes in all pools in the baseline stratum i in year t ; t CO ₂ -e.
$GHG_{BSL-E,i,t}$	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i in year t ; t CO ₂ -e yr ⁻¹ .
i	1, 2, 3, ...M strata.
t	1, 2, 3, ... t^* years elapsed since the projected start of the project activity.

Table 42 - Net GHG emissions in the baseline from planned deforestation in the baseline period in all PAIs (t CO₂-e). (Table 25 from Appendix II – “Calculus Table” - Consolidated Results).

Year	$\Delta C_{BSL,planned}$		$\Delta C_{BSL,planned}$	$\Delta C_{BSL,planned}$
	PAI#01	PAI#02	Total	Cumulative
2023	294.192	282.816	577.008	577.008
2024	303.024	291.830	594.854	1.171.861
2025	311.856	300.843	612.700	1.784.561
2026	320.689	309.857	630.546	2.415.107
2027	329.521	318.871	648.392	3.063.498
2028	338.353	327.885	666.238	3.729.736
2029	347.185	336.898	684.084	4.413.820
2030	356.018	345.912	701.930	5.115.750
2031	364.850	354.926	719.776	5.835.525
2032	373.682	363.939	737.622	6.573.147

5.2. Project Emissions

Project GHG emissions will be considered according to VMD0015 v2.3. Ex-ante estimates are made considering deforestation and forest degradation projections for the project area. Ex-post estimates are based on monitored data throughout the project lifetime.

5.2.1. Deforestation in the Project Scenario

The area of recorded deforestation is obtained from PRODES project (GIS database). Deforestation projections were made as a function of the historical deforestation rate observed in

the project area between 2013 and 2022, for ex-ante estimates. Deforestation in the project area will be monitored ex-post according to PRODES data.

Table 43 - Projected deforestation in the project area (ex-ante) (ha). (Table 26 from Appendix II – “Calculus Table” - Consolidated Results).

Year	ADefPA,u,i,t			
	PAI#01		PAI#02	
	Ds	Db	Ds	Db
2023	1.5	1.5	0	0
2024	1.5	1.5	0	0
2025	1.5	1.5	0	0
2026	1.5	1.5	0	0
2027	1.5	1.5	0	0
2028	1.5	1.5	0	0
2029	1.5	1.5	0	0
2030	1.5	1.5	0	0
2031	1.5	1.5	0	0
2032	1.5	1.5	0	0

Net carbon stock changes in all pools in the project case is calculated according to VMD0015 v2.3, equation 05:

$$\Delta C_{pools,Def,i,t} = C_{BSL,i} - C_{P,post,i} - C_{WP,i}$$

Where:

$\Delta C_{pools,Def,u,i,t}$	Net carbon stock changes in all pools as a result of deforestation in the project case in land use u in stratum i at time t; t CO2-e ha-1.
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i; t CO2-e ha-1.
$C_{P,post,u,i}$	Carbon stock in all pools in post-deforestation land use u in stratum i; t CO2- e ha-1.
$C_{WP,i}$	Carbon stock sequestered in wood products ²⁸ from harvests in stratum i; t CO2-e ha-1.
u	1, 2, 3, ... U post-deforestation land uses.
i	1, 2, 3, ... M strata.
t	1, 2, 3, ... t* years elapsed since the start of the REDD project activity.

Carbon stocks in all pools before ($C_{BSL,i}$) and after ($C_{P,post,u,i}$) the deforestation event are estimated as part of the procedures used to set up the baseline and remain fixed until the first baseline revalidation. Carbon stock sequestered in wood products ($C_{WP,i}$) is set as zero in the project scenario in ex-ante estimates and will be monitored ex-post, based on post exploration reports.

Table 44 - Net carbon stock changes in all pools in the project case (ex-ante) (t CO₂-e ha⁻¹) (Table 27 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	$C_{BSL,i}$	$C_{P,post,u,i}$	$C_{WP,i}$	$\Delta C_{pools,Def,u,i,t}$
Ds	855,85	195,30	0,00	660,55
Db	898,48	122,38	0,00	776,10

Net carbon stock change as a result of deforestation in the project area in the project case is calculated according to VMD0015 v2.3, equation 03:

$$\Delta C_{P,DefPA,i,t} = \sum_{u=1}^U (A_{DefPA,u,i,t} * \Delta C_{pools,Def,u,i,t})$$

Where:

$\Delta C_{P,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t; t CO ₂ -e.
$A_{DefPA,u,i,t}$	Area of recorded deforestation in the project area stratum i converted to land use u at time t; ha.
$\Delta C_{pools,Def,u,i,t}$	Net carbon stock changes in all pools in the project case in land use u in stratum i at time t; t CO ₂ -e ha ⁻¹ .
u	1,2,3, U post-deforestation land uses.
i	1, 2, 3 ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the REDD project activity.

Table 45 - Net carbon stock change as a result of deforestation in the project case (ex-ante) (t CO₂-e) (Table 28 from Appendix II – “Calculus Table” - Consolidated Results).

Year	$\Delta C_{P,DefPA,i,t}$		$\Delta C_{P,DefPA,i,t}$	$\Delta C_{P,DefPA,i,t}$
	PAI#01	PAI#02	Total	Cumulative
2023	2.153	-	2.153	2.153

2024	2.153	-	2.153	4.305
2025	2.153	-	2.153	6.458
2026	2.153	-	2.153	8.610
2027	2.153	-	2.153	10.763
2028	2.153	-	2.153	12.915
2029	2.153	-	2.153	15.068
2030	2.153	-	2.153	17.220
2031	2.153	-	2.153	19.373
2032	2.153	-	2.153	21.525

5.2.2. Forest Degradation in the Project Scenario

GHG emissions related to forest degradation are considered in function of timber, fuelwood and charcoal collection and selective logging activity in the project area in the project case, according to VMD0015 v2.3, equation 07:

$$\Delta C_{P,Deg,i,t} = \Delta C_{P,DegW,i,t} + \Delta C_{P,SelLog,i,t}$$

Where:

$\Delta C_{P,Deg,i,t}$	Net carbon stock change as a result of degradation in the project area in the project case in stratum i in year t; t CO2-e.
$\Delta C_{P,DegW,i,t}$	Net carbon stock change as a result of degradation through extraction of trees for illegal timber or fuelwood and charcoal in the project area in the project case in stratum i in year t; t CO2-e.
$\Delta C_{P,SelLog,i,t}$	Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum i in year t; t CO2-e.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the project activity.

5.2.2.1. Timber, Fuelwood and Charcoal Collection in the Project Scenario

There is no forecast for Timber, Fuelwood, and Charcoal Collection. The owner does not intend to carry out forest management in the area, and no community use of these products has

been identified within the project areas during the social surveys. However, using temporal satellite images was possibly to identify some degradation events and predict potential emissions in the base scenario, according to VMD0015 v2.2, equation 08:

$$\Delta C_{P,DegW,i,t} = A_{DegW,i} * \frac{C_{DegW,i,t}}{APi}$$

Where:

$\Delta C_{P,DegW,i,t}$	Net carbon stock changes as a result of degradation in stratum i in the project area in year t; t CO2-e.
$A_{DegW,i}$	Area potentially impacted by degradation processes in stratum i; ha.
$C_{DegW,i,t}$	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i in year t; t CO2-e.
APi	Total area of degradation sample plots in stratum i; ha.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the project activity.

Table 46 - Net carbon stock change as a result of degradation in the project case (ex-ante) (t CO2-e) (Table 29 from Appendix II – “Calculus Table” - Consolidated Results).

Year	$\Delta C_{P,DegW,i,t}$		$\Delta C_{P,DegW,i,t}$	$\Delta C_{P,DegW,i,t}$
	PAI#01	PAI#02	Total	Cumulative
2023	-	-	-	-
2024	-	-	-	-
2025	-	-	-	-
2026	-	-	-	-
2027	-	-	-	-
2028	-	-	-	-
2029	-	-	-	-
2030	-	-	-	-
2031	-	-	-	-
2032	-	-	-	-

5.2.2.2. Selective Logging in the Project Scenario

GHG emissions due to selective logging in the project scenario are set as zero in ex-ante estimates and monitored ex-post, based on post exploration reports. Ex-post estimates are made based on the GHG emissions arising in the logging gap, logging infrastructure and the carbon stock in wood products pool, according to VMD0015 v2.3, equation 09:

Where:

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

$\Delta C_{P,SelLog,i,t}$	Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum i in year t; t CO2-e.
$C_{LG,i,t}$	Actual net project emissions arising in the logging gap in stratum i in year t; t CO2-e.
$C_{LR,i,t}$	Actual net project emissions arising from logging infrastructure in stratum i in year t; t CO2-e.
$C_{WP,i,t}$	Carbon stock in wood products pool from stratum i, in year t; tCO2-e.
t	1, 2, 3, ...t years elapsed since the start of the project activity.

5.2.2.4.1. GHG emissions arising from the logging gap

Emissions arising in the logging gap are calculated according to VMD0015 v2.3, equation10:

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

Where:

$C_{LG,i,t}$	Actual net project emissions arising in the logging gap, in stratum i in year t; t CO2-e.
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$C_{EXT,z,i,t}$	Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t; t CO ₂ -e.
$LDF_{z,i}$	Logging damage factor for logging stratum z, in stratum i; t C m ⁻³ .
$V_{EXT,z,i,t}$	Volume extracted from logging stratum z, in stratum i in year t; m ³ .
Z	1, 2, 3, ...Z logging strata.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t years elapsed since the start of the project activity.

Logging damage factor value used is default according to VMD0015 v2.3, step 02. Volume extracted from logging is taken from post exploration reports.

The biomass of the total volume extracted from within each logging stratum is calculated according to VMD0015 v2.3, equation 11:

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

Where:

$C_{EXT,z,i,t}$	Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t; t CO ₂ -e.
$V_{EXT,j,z,i,t}$	The volume of timber extracted of species j for logging stratum z, in stratum i in year t; m ³ .
D_j	Basic wood density of species j; t d.m.m ⁻³ .
CF_j	Carbon fraction of biomass for tree species j; t C t ⁻¹ d.m.

The volume of timber extracted of all species is taken from post exploration reports. Basic wood density of all species is taken from the tropical wood density database (Fearnside et al.,1997). Carbon fraction of biomass for tree species is default according to IPCC (2006).

5.2.2.4.2. GHG emissions arising through the logging infrastructure

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

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

Where:

$C_{LR,i,t}$	Actual net project emissions arising from logging infrastructure in stratum i in year t; t CO ₂ -e.
$\Delta C_{SKID,i,t}$	Change in carbon stock resulting from skid trail creation in stratum i in year t; tCO ₂ -e.
$\Delta C_{ROAD,i,t}$	Change in carbon stock resulting from logging road creation in stratum i in year; t CO ₂ -e.
$\Delta C_{DECKS,i,t}$	Change in carbon stock resulting from logging deck creation in stratum i in year t; t CO ₂ -e.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t years elapsed since the start of the project activity.

5.2.2.2.2.1. GHG emissions arising from skid trail creation

GHG emissions from the creation of skid trails is estimated by multiplying the total length of skid trails created and a skid trail emission factor, according to VMD0015 v2.3, equation 13:

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

Where:

$\Delta C_{SKID,i,t}$	Change in carbon stock resulting from skid trail creation in stratum i in year t; t CO ₂ -e.
$L_{SKID,i,t}$	Length of skid trails in stratum i in year t; m.

S_{Ki}	Skid trail emissions factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum i; t CO ₂ -e m ⁻¹ .
t	1, 2, 3, ...t* years elapsed since the start of the project activity.

The length of skid trails is taken from forest exploration maps. These maps contain information about all felled trees, primary and secondary roads, and skid trails. Skid trail emissions factor is calculated according to VMD0015 v2.2, equation 14:

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

Where:

S_{Ki}	Skid trail emission factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum i; t t CO ₂ -e m ⁻¹ .
$C_{dest,i}$	Mean live carbon stock of trees and non-tree biomass assumed to be killed per unit area in creation of skid trail in stratum i; t CO ₂ -e ha ⁻¹ .
$\Delta C_{SOC_sk,i}$	Carbon stock change in organic carbon resulting from skid trail creation in stratum i; t CO ₂ -e ha ⁻¹ .
W_{SKID}	Mean width of skid trails in stratum i; m.

Mean live carbon stock of trees and non-tree biomass assumed to be killed is calculated taking in consideration the average carbon stock of trees below the maximum diameter tree³ that can be within the path of a skid trail, following VMD0015 v2.2, step 02 criteria, and equation 15:

³ The maximum diameter tree is considered in function of inventory data for that annual production unit.

$$C_{dest,i} = C_{AB_{tree_{dest},i}} + C_{BB_{tree_{dest},i}} + C_{AB_{non-tree,i}} + C_{BB_{non-tree,i}}$$

Where:

$C_{dest,i}$	Mean live carbon stock of trees and non-tree biomass assumed to be killed per unit area in creation of skid trail in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{AB_tree_dest,i}$	Carbon stock in aboveground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{BB_tree_dest,i}$	Carbon stock in belowground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{AB_non-tree,i}$	Carbon stock in aboveground non-tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{BB_non-tree,i}$	Carbon stock in belowground non-tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
1/10,000	Conversion of units from hectares to m ² .
i	1, 2, 3, ...M strata.

Mean width of skid trails is determined in function of the machinery used at the project site. This value will vary among PAIs.

Carbon stock change in organic carbon resulting from skid trail creation is calculated according to VMD0015 v2.3, equation 09:

$$\Delta C_{SOC_{sk,i}} = C_{SOC,i,t=0} - (C_{SOC,i,t=0} * F_{LU} * F_{MG} * F_i)$$

Where:

$\Delta C_{SOC_sk,i}$	Carbon stock change in soil organic carbon resulting from skid trail creation in stratum i; t CO ₂ -e ha ⁻¹ .
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$C_{SOC,i,t=0}$	Mean carbon stock in soil organic carbon for stratum i, in year t=0; t CO ₂ e ha ⁻¹ .
F_{LU}	Land use factor after conversion; dimensionless.
F_{MG}	Management factor after conversion; dimensionless.
F_i	Input factor after conversion; dimensionless.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the projected start of the project activity.

Initial mean carbon stock in soil organic carbon is measured in laboratory through primary data collected in the field, following VMD0004 v1.1 criteria (APPENDIX_IX-CARBON_POOLS.). Land use, management and input factors are default values given by IPCC (2006).

5.2.2.2.2. GHG emissions resulting from roads creation

GHG emissions resulting from the creation of roads are calculated according to VMD0015 v2.3, equation 17:

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

Where:

$\Delta C_{ROAD,i,t}$	Change in carbon stock resulting from logging road creation in stratum i in year t; t CO ₂ -e.
$A_{ROAD,i,t}$	Area of roads in stratum i in year t; ha.
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i; t CO ₂ -e ha ⁻¹ .
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the project activity.

Area of roads is taken from post exploration reports and post-harvest maps that are based on measurements made on GIS environment. Carbon stock in all pools in the baseline case are estimated as part of the baseline procedures.

5.2.2.2.3. GHG emissions resulting from logging decks creation

GHG emissions resulting from the creation of logging decks are calculated according to VMD0015 v2.3, equation 18:

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

Where:

$\Delta C_{DECKS,i,t}$	Change in carbon stock resulting from logging deck creation in stratum i in year t; t CO2-e.
$A_{DECKS,i,t}$	Area of logging decks in stratum i in year t; ha.
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i; t CO2-e ha ⁻¹ .
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the project activity.

The area of logging decks is taken from post exploration reports and post-harvest maps that are based on field measurements. Carbon stock in all pools in the baseline case are estimated as part of the baseline procedures.

5.2.3. Natural Disturbance in the Project Scenario

Natural disturbance projections are made as a function of the historical wildfires rate observed in the project area between 2018 and 2022, for ex-ante estimates. The area of recorded wildfires is obtained from DETER service (GIS database).

Table 47 - Area potentially impacted by natural disturbances (wildfire) (ex-ante) (ha) (Table 30 from Appendix II – “Calculus Table” - Consolidated Results).

Year	ADistPA,q,i,t			
	PAI#01		PAI#02	
	Ds	Db	Ds	Db
2023	0	0	0	0
2024	0	0	0	0
2025	0	0	0	0
2026	0	0	0	0
2027	0	0	0	0
2028	0	0	0	0
2029	0	0	0	0

2030	0	0	0	0
2031	0	0	0	0

For ex-post estimates, the area impacted by natural disturbance is measured according to DETER database and verified at the field with direct observations. The area impacted by natural disturbance is proportionally reduced to reflect previous firewood/charcoal extraction, in ex-post estimates, according to VMD0015 v2.3, equation 19:

$$DegradationDisturbanceReductionFactor = \left(\frac{FG_{BSL,i,t} * D_{mn}}{0,9} \right) * CF * \frac{44}{12} / (A_i * C_{BSL,i})$$

Where:

DDRF	Factor by which $A_{dist,q,i,t}$ is reduced to reflect the impact of the baseline degradation on available stocks for reduction due to disturbance; dimensionless.
$FG_{BSL,i,t}$	Average volume of fuelwood gathered in the project area in the baseline scenario in stratum i in year t ; m ³ .
D_{mn}	Mean wood density of species harvested for fuelwood or charcoal production; t d.m.m-3.
CF	Carbon fraction of dry matter; t C t d.m.-1.
A_i	Area of stratum i ; ha.
$C_{BSL,i}$	Carbon stock in all pools in the baseline in stratum i ; t CO ₂ -e ha-1.
i 1, 2, 3, ...	M strata.
t 1, 2, 3, ...	t^* years elapsed since the projected start of the project activity.

The average volume of fuelwood gathered in the project area is estimated based on a Participatory Rural Appraisal (PRA). Basic wood density of all species is taken from the tropical wood density database (Fearnside et al., 1997). Carbon fraction of biomass for dry matter is default according to IPCC (2006). Carbon stock in all pools in the baseline is calculated according to baseline procedures.

In the case the natural disturbance monitored is also related to wildfires, the area of natural disturbance is equal to the sum of the areas of all burn scars perceived in an annual basis, following VMD0015 v2.3, equations 22 and 21, respectively presented:

$$A_{burn,q,i,t} = A_{DisPA,q,i,t}$$

$$A_{burn,q,i,t} = \sum_{q=1}^Q A_{burn,q,i,t}$$

Where:

$A_{DistPA,q,i,t}$	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, in year t; ha.
$A_{burn,q,i,t}$	Area burnt in post-natural disturbance stratum q in stratum i, in year t; ha.
q	1, 2, 3, ...q post-natural disturbance strata where the natural disturbance included fire.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the project activity.

Wildfires are measured according to ΔNBR^4 spectral index and verified with high spatial resolution satellite imagery from Sentinel, along with ground verifications. GHG emissions from fires are calculated according to VMD0013 v1.3.

Net carbon stock changes in pools as a result of natural disturbance is calculated according to VMD0015 v2.3, equation 23:

$$\Delta C_{P,Dist,q,i,t} = C_{BSL,i} - C_{P,Dist,q,i} - C_{WP,q,i}$$

Where:

$\Delta C_{P,Dist,q,i,t}$	Net carbon stock changes in pools as a result of natural disturbance in the project case in post-natural disturbance stratum q in stratum i in year t; t CO ₂ -e ha ⁻¹ .
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i; t CO ₂ -e ha ⁻¹ .

⁴ Normalized Burn Index.

$C_{P,Dist,q,i}$	Carbon stock in pools in post-natural disturbance strata q in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{WP,q,i}$	Carbon stock sequestered in wood products from harvests following natural disturbance in post-natural disturbance stratum q, in stratum i; t CO ₂ -e ha ⁻¹ .
q	1, 2, 3, ...q post-natural disturbance strata.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the project activity.

Table 48 - Net carbon stock changes in all pools as a result of natural disturbance in the project case (ex -ante) (t CO₂-e ha⁻¹) (Table 31 from Appendix II – “Calculus Table” - Consolidated Results).

Stratum (i)	CBSL,i	CP,Dist,q,i,t	CWP,q,i	ΔCp,dist,q,i,t
Ds	855.85	256.76	0	599.10
Db	898.48	269.54	0	628.94

Carbon stock in all pools in the baseline case is calculated as part of the procedures to estimate baseline GHG emissions. Carbon stock in pools in post-natural disturbance strata is measured following a standard operational procedure for biomass inventory (APPENDIX_IX-CARBON_POOLS.), which is based on VMD0001 v1.2, VMD0002 v1.1, VMD0003 v1.1 and VMD0004 v1.1 criteria. Carbon stock sequestered in wood products from harvests following natural disturbance in post-natural disturbance stratum is calculated according to VMD0005 v1.2 in the case of use of wood from the stratum where the disturbances of natural cause occurred. Carbon stock changes in all pools as a result of natural disturbance is calculated according to VMD0015 v2.3, equation 24:

$$C_{P,Dist,q,i} = C_{AB_{tree,i}} + C_{BB_{tree,i}} + C_{AB_{non-tree,i}} + C_{BB_{non-tree,i}} + C_{DW,i} + C_{SOC,i}$$

Where:

$C_{P,Dist,q,i}$	Carbon stock in all pools in post-natural disturbance q in baseline stratum i; t CO ₂ -e ha ⁻¹ .
$C_{AB_{tree,i}}$	Carbon stock in aboveground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .

$C_{BB_tree,i}$	Carbon stock in belowground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{AB_non-tree,i}$	Carbon stock in aboveground non-tree vegetation in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{BB_non-tree,i}$	Carbon stock in belowground non-tree vegetation in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{DW,i}$	Carbon stock in dead wood in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{LI,i}$	Carbon stock in litter in stratum i; t CO ₂ -e ha ⁻¹ .
$C_{SOC,i}$	Mean stock in soil organic carbon in stratum i; t CO ₂ -e ha ⁻¹ .
q	1, 2, 3, ...Q post-natural disturbance strata.
i	1, 2, 3, ...M strata.

Herbaceous non-tree vegetation is considered as de minimis in all instances, following VMD0015 v2.3 step 02 criteria.

GHG emissions resulted from areas undergoing natural disturbance are calculated according to VMD0015 v2.3, equation 20:

$$\Delta C_{P,DistPA,i,t} = \sum_{q=1}^Q (A_{DistPA,q,i,t} * \Delta C_{P,Dist,q,i,t})$$

Where:

$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i in year t; t CO ₂ -e.
$A_{DistPA,q,i,t}$	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, in year t; ha.

$\Delta_{CP,Dist,q,i,t}$	Net carbon stock changes in pools as a result of natural disturbance in post-natural disturbance stratum q in stratum i in year t; t CO ₂ -e ha ⁻¹ .
q	1, 2, 3, ...Q post-natural disturbance strata.
i	1, 2, 3, ...M strata.

Table 49 - Net carbon stock change in all pools as a result of natural disturbances in the project case (ex-ante) (t CO₂-e ha⁻¹). (Table 32 from Appendix II – “Calculus Table” - Consolidated Results).

Year	$\Delta_{CP,DistPA,i,t}$		$\Delta_{CP,DistPA,i,t}$	$\Delta_{CP,DistPA,i,t}$
	PAI#01	PAI#02	Total	Cumulative
2023	0	0	0	0
2024	0	0	0	0
2025	0	0	0	0
2026	0	0	0	0
2027	0	0	0	0
2028	0	0	0	0
2029	0	0	0	0
2030	0	0	0	0
2031	0	0	0	0
2032	0	0	0	0

5.2.4. Non-CO₂ Emissions in the Project Scenario

Non-CO₂ emissions occurring within the project boundary will be calculated according to VMD0015 v2.3 equation 30.

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

Where:

$GHG_{P,E,i,t}$	Greenhouse gas emissions as a result of deforestation activities within the project area in the project case in stratum i in year t; t CO2-e.
$E_{FC,i,t}$	Emission from fossil fuel combustion in stratum i within the project area in year t; t CO2-e.
$E_{BiomassBurn,i,t}$	Non-CO2 emissions due to biomass burning in stratum i in year t; t CO2- e.
$N_2O_{direct-N,i,t}$	Direct N2O emission as a result of nitrogen application on the alternative land use in stratum i within the project area in year t; t CO2-e.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the start of the REDD VCS project activity.

GHG emissions from fossil fuels and nitrogen application were conservatively excluded following VM0007 v1.7, table 06, criteria. Non-CO2 emissions due to biomass burning are calculated according to VMD0013 v1.3, equation 1:

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

Where:

$E_{biomassburn,i,t}$	Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO2, CH4, N2O) (t CO2e).
$A_{burn,i,t}$	Area burnt for stratum i in year t (ha).
$B_{i,t}$	Average aboveground biomass stock before burning stratum i, year (t d.m. ha ⁻¹).

COMF _i	Combustion factor for stratum i (unitless).
G _{g,i}	Emission factor for stratum i for gas g (kg t ⁻¹ d.m. burnt).
GWP _g	Global warming potential for gas g (t CO ₂ /t gas g).
g	1, 2, 3 ...G greenhouse gases including carbon dioxide ¹ , methane and nitrous oxide (unitless).
i	1, 2, 3 ...M strata (unitless).
t	1, 2, 3, ...t* time elapsed since the start of the project activity (years).

In ex-ante estimates, the area burnt ($A_{burn,i,t}$) equal to deforestation in project case ($A_{DefPA,u,i,t}$), plus natural disturbances area ($A_{DistPA,q,i,t}$). Combustion and emission factors are default values taken by IPCC (2006). Global warming potential is a default factor from the latest IPCC assessment report.

In ex-post estimates, the area burnt is measured according to ΔNBR^{31} spectral index and verified with high spatial resolution satellite imagery from Sentinel, along with ground verifications. Combustion and emission factors are default values taken by IPCC (2006). Global warming potential is a default factor from the latest IPCC assessment report.

The average aboveground biomass stock before burning is calculated according to VMD0013 v1.2, equation 2:

$$B_{i,t} = (C_{AB_{tree,i,t}} + C_{DW_{i,t}} + C_{LI,i,t}) * \frac{12}{44} * (1/CF)$$

Where:

B _{i,t}	Average aboveground biomass stock before burning for stratum i, year t (tonnes d.m. ha ⁻¹).
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$C_{AB_tree,i,t}$	Carbon stock in aboveground biomass in trees in stratum i in year t ($t\ CO_2e\ ha^{-1}$).
$C_{DWi,t}$	Carbon stock in dead wood for stratum i in year t ($t\ CO_2e\ ha^{-1}$).
$C_{LI,i,t}$	Carbon stock in litter for stratum i in year t ($t\ CO_2e\ ha^{-1}$).
12/44	Inverse ratio of molecular weight of CO_2 to carbon ($t\ CO_2e\ t\ C^{-1}$).
CF	Carbon fraction of biomass ($t\ C\ t^{-1}\ d.m.$).
i	1, 2, 3 ...M strata (unitless).
t	1, 2, 3, ... t^* time elapsed since the start of the project activity (years).

Carbon stocks in aboveground biomass in trees, dead wood and litter are determined following baseline procedures and are fixed throughout the initial baseline period (10 years). Carbon fraction is a default value taken by IPCC (2006).

Table 50 - Non- CO_2 emissions in the project case (ex-ante) ($t\ CO_2e$). (Table 33 from Appendix II – “Calculus Table” - Consolidated Results).

Year	A _{burn,i,t}				GHG _{BSL,E}
	PAI#01		PAI#02		
	Ds	Db	Ds	Db	
2023	0.0	0.0	0.0	0.0	0.0
2024	0.0	0.0	0.0	0.0	0.0
2025	0.0	0.0	0.0	0.0	0.0
2026	0.0	0.0	0.0	0.0	0.0
2027	0.0	0.0	0.0	0.0	0.0
2028	0.0	0.0	0.0	0.0	0.0
2029	0.0	0.0	0.0	0.0	0.0
2030	0.0	0.0	0.0	0.0	0.0
2031	0.0	0.0	0.0	0.0	0.0
2032	0.0	0.0	0.0	0.0	0.0

5.2.5. Net GHG emissions in the Project Scenario

The net GHG emissions in the project case is equal to the sum of stock changes due to deforestation and forest degradation plus the total GHG emissions minus any eligible forest carbon stock enhancement, according to VMD0015 v2.3, equation 01:

$$\Delta C_{WPS-REDD} = \sum_{t=1}^{t^*} \sum_{i=1}^M (\Delta C_{P,DefPA,i,t} + \Delta C_{P,Deg,i,t} + \Delta C_{P,DistPA,i,t} + GHG_{P-E,i,t} - \Delta C_{P,Enh,i,t})$$

Where:

$\Delta C_{WPS-REDD}$	Net GHG emissions in the REDD project scenario up to year t^* ; t CO ₂ -e.
$\Delta C_{P,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project area in the project case in stratum i in year t; t CO ₂ -e.
$\Delta C_{P,Deg,i,t}$	Net carbon stock change as a result of degradation in the project area in the project case in stratum i in year t; t CO ₂ -e.
$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum i in year t; t CO ₂ -e.
$GHG_{P-E,i,t}$	Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum i in year t; t CO ₂ -e.
$\Delta C_{P,Enh,i,t}$	Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline2 in stratum i in year t; t CO ₂ -e.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ... t^* years elapsed since the start of the project activity.

Carbon stock enhancement is conservatively assumed to be zero in all strata, following VMD0015 v2.3 step 02 criteria.

Table 51 - Net GHG emissions in the REDD project scenario (ex-ante) (t CO₂-e). (Table 34 from Appendix II – “Calculus Table” - Consolidated Results).

Year	$\Delta C_{WPS-REDD}$		$\Delta C_{WPS-REDD}$	$\Delta C_{WPS-REDD}$
	PAI#01	PAI#02	Total	Cumulative
2023	2.152,51	-	2.153	2.153
2024	2.152,51	-	2.153	4.305
2025	2.152,51	-	2.153	6.458
2026	2.152,51	-	2.153	8.610
2027	2.152,51	-	2.153	10.763
2028	2.152,51	-	2.153	12.915
2029	2.152,51	-	2.153	15.068
2030	2.152,51	-	2.153	17.220
2031	2.152,51	-	2.153	19.373
2032	2.152,51	-	2.153	21.525

5.3. Leakage Emissions

The Leakage Emissions in the context of a REDD+ project refer to the unintended consequences of the project that lead to increased emissions outside the project boundaries. REDD+ projects are designed to mitigate emissions by preventing deforestation and degradation. Leakage in this context typically involves activities that might be displaced to other areas due to the implementation of the REDD+ project, resulting in increased emissions in those areas. The methodologies may include the use of emission factors, baseline scenarios, and leakage factors to estimate the likelihood and magnitude of emissions that could occur outside the project boundaries.

5.3.1. Leakage (ex-ante)

GHG emissions due to leakage are based on activity shifting and market-effects leakage throughout the project lifetime. Leakage emissions are determined according to VM0007 v1.7 section 8.4.2 equation 4⁵:

$$\Delta C_{LK-REDD} = \Delta C_{LK-AS,planned} + \Delta C_{LK-ME}$$

Where:

$\Delta C_{LK-REDD}$

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

⁵ Adjusted to reflect project scope.

$\Delta C_{LK-AS,planned}$

Net GHG emissions due to activity shifting leakage for projects preventing planned deforestation up to year t^* – from Module LK-ASP (t CO₂e).

 ΔC_{LK-ME}

Net GHG emissions due to market-effects leakage up to year t^* – from Module LK-ME (t CO₂e).

Table 52 - Net GHG emissions due to leakage from the REDD project activity (t CO₂-e). (Table 35 from Appendix II – “Calculus Table” - Consolidated Results).

Year	$\Delta C_{LK-AS,planned}$	ΔC_{LK-ME}	$\Delta C_{LK-REDD}$
2023	0	-	-
2024	0	-	-
2025	0	-	-
2026	0	-	-
2027	0	-	-
2028	0	-	-
2029	0	-	-
2030	0	-	-
2031	0	-	-
2032	0	-	-

5.3.2. Activity Shifting Leakage

GHG leakage emissions due to activity shifting from forest lands that are legally authorized and documented to be converted to non-forest land are estimated following VMD0009 v1.3 criteria.

All PAIs in this GDP will use the procedure presented in VMD0009 v1.3, part 01, in the case where a specific deforestation agent has been identified.

GHG emissions due to leakage are defined according to VMD0009 v1.3, equation 01:

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

Where:

$\Delta C_{LK-AS,planned}$	Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation up to year t^* (t CO _{2e}).
$LKA_{planned,i,t}$	The area of activity shifting leakage in stratum i in year t (ha).
$\Delta C_{BSL,i}$	Net carbon stock changes in all pre-deforestation pools in baseline stratum i (t CO _{2e} ha ⁻¹).
$GHG_{LK,E,i,t}$	Greenhouse gas emissions as a result of leakage of avoiding deforestation activities in stratum i in year t (t CO _{2e}).
i	1, 2, 3, ...M strata (unitless).
t	1, 2, 3, ... t^* time elapsed since the start of the project activity (years).

Potential activity shifting is estimated based on the total area of deforestation across all the lands managed by the identified deforestation agent (including the projected baseline deforestation within the project boundaries). The predicted deforestation within the project boundary is subtracted from the deforestation across all the land managed by the deforestation agent. This subtraction gives the expected deforestation if no leakage occurs. If this expected deforestation is subtracted from the total area of monitored deforestation in the leakage belt the result is the area of leaked deforestation.

In this sense the leakage belt is defined as the total legally sanctionable deforestation area managed by the deforestation agent outside the project boundary. The area of activity shifting leakage can be understood as a subset of the leakage belt or the whole leakage belt, which will vary depending on the case.

The area of activity shifting leakage is determined according to VMD0009 v1.3, equation 06:

$$LKA_{planned,i,t} = A_{defLK,i,t} - NewR_{i,t}$$

Where:

$LKA_{planned,i,t}$	The area of activity shifting leakage in stratum i in year t (ha).
$NewR_{i,t}$	New calculated forest clearance by the baseline agent of the planned deforestation in stratum i in year t where no leakage is occurring (ha).

$A_{defLK,i,t}$	The total area of monitored deforestation by the baseline agent of the planned deforestation in stratum i in year t (ha).
i	1, 2, 3, ... M strata (unitless).
t	1, 2, 3, ... t^* time elapsed since the start of the project activity (years).

New calculated forest clearance by the baseline agent of the planned deforestation can be calculated according VMD0009 v1.3, equation 04 or 05, respectively presented below:

$$NewR_{i,t} = (D\%_{planned,i,t,OP} * A_{planned,i,OP})$$

Where:

$NewR_{i,t}$	New calculated forest clearance in stratum i in year t by the baseline agent of the planned deforestation where no leakage is occurring (ha).
$D\%_{planned,i,t,OP}$	Projected annual proportion of land that will be deforested outside the project boundary in stratum i in year t (percent).
$A_{planned,i,OP}$	Total area of planned deforestation outside the project boundary over the baseline period for stratum i (ha).
i	1, 2, 3, ... M strata (unitless).

$$NewR_{i,t} = WoPR_{i,t} - (D\%_{planned,i,t} * A_{planned,i})$$

Where:

$NewR_{i,t}$	New calculated forest clearance in stratum i in year t by the baseline agent of the planned deforestation where no leakage is occurring (ha).
$WoPR_{i,t}$	Deforestation by the baseline agent of the planned deforestation in stratum i in year t in the absence of the project (ha).

$D\%_{\text{planned},i,t}$	Projected annual proportion of land that will be deforested in project stratum i in year t (percent).
$A_{\text{planned},i}$	Total area of planned deforestation over the baseline period for project stratum i (ha).
i	1, 2, 3, ... M strata (unitless).
t	1, 2, 3, ... t^* time elapsed since the projected start of the project activity (years).

Equation 04 is used when an identified deforestation agent has made public a business plan or similar documentation containing data suited for estimating a conversion rate over the baseline period. Equation 05 is used when the conversion rate must be estimated. In the case of equation 05 is used, the projected annual proportion of land that will be deforested is the same used to set the baseline, while the deforestation provoked by the identified deforestation agent is calculated by VMD0009 v1.3, equation 01 or 02, respectively presented below:

$$WoPR_{i,t} = a + b * t$$

Where:

$WoPR_{i,t}$	Deforestation by the baseline agent of the planned deforestation in the absence of the project in stratum i in year t (ha).
a	Estimated intercept of the regression line (ha).
b	Slope of the linear regression (ha yr ⁻¹).
t	1, 2, 3, ... t^* time elapsed since the projected start of the project activity (years).

$$WoPR_{i,t} = \sum_{ag=1}^{ag} \frac{HistHa_{i,ag}}{5}$$

Where:

$WoPR_{i,t}$	Deforestation by the baseline agent of the planned deforestation in the absence in stratum i in year t (ha). Note that the same area of deforestation will be applied for each year of the baseline period.
$HistHa_{i,ag}$	Number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years prior to project implementation in stratum i by agent ag within the country (ha).
i	1, 2, 3, ...M strata (unitless).
ag	1, 2, 3, ...agents of deforestation (unitless).
t	1, 2, 3, ... t^* time elapsed since the projected start of the project activity (years).

Equation 01 is used when the results of the analysis must produce a statistically significant regression with a $p \leq 0.05$ and an adjusted r^2 of ≥ 0.75 . The regression is calculated based on the deforested by the deforestation agent each year over the previous five years within the country. Where no statistically significant regression can be found, equation 02 is used.

GHG emissions as a result of leakage of avoiding deforestation activities is calculated according to by VMD0009 v1.3, equation 07:

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

Where:

$GHG_{LK,E,i,t}$	Greenhouse gas emissions as a result of leakage of avoiding deforestation activities in stratum i in year t (t CO ₂ e).
$E_{biomassburn,i,t}$	Non-CO ₂ emissions due to biomass burning in stratum i in year t (t CO ₂ e).
$N_2O_{direct-N,i,t}$	Direct N ₂ O emission as a result of nitrogen application on the alternative land use in stratum i in year t (t CO ₂ e).
i	1, 2, 3, ...M strata (unitless).
t	1, 2, 3 ... t^* time elapsed since the start of the project activity (years).

Non-CO₂ emissions due to biomass burning in the area of activity shifting leakage is calculated according to same procedures used to estimate baseline GHG emissions due to biomass burning. Non-CO₂ emissions due to nitrogen application are not part of the project scope.

Considering the current project scope, $A_{defLK,i,t}$ will always be zero, as there are no forested areas subject to legal suppression across all the lands managed by the identified deforestation agent disregarding the project boundary (see section 1.19.1). In this sense, GHG emissions due to activity shifting for avoiding planned deforestation are set to zero in ex-ante and ex-post estimates.

5.3.3. Market Effects Leakage

GHG emissions from market effects are calculated according to VMD0011 v1.2 equation 1:

$$\Delta C_{LK-ME} = LK_{MarketEffects,timber} + LK_{MarketEffects,FW/C}$$

Where:

ΔC_{LK-ME}	Net greenhouse gas emissions due to market- effects leakage; t CO ₂ -e.
$LK_{MarketEffects,timber}$	Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO ₂ -e.
$LK_{MarketEffects,FW/C}$	Total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets; t CO ₂ -e.

Market-Effects Leakage Through Decreased Timber Harvest is estimated according to VMD0011 v1.2 equation 2:

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

Where:

$LK_{MarketEffects,timber}$	Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO ₂ -e.
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LF_{ME}	Leakage factor for market-effects calculations; dimensionless.
$AL_{T,i}$	Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO2-e.
i	1, 2, 3, ... M strata.

The leakage factor for market-effects calculations is 0,2. The table below compares the values of PMP_i and PML_{FT} in different forest typologies by state in the legal Amazon. It is possible to conclude that a higher proportion of the total biomass of commercial species is merchantable in the displacement forest than in the project forests. In this sense a smaller area would have to be harvested and lower emissions would result.

Summed emissions from timber harvest potentially displaced through implementation of carbon project is estimated according to VMD0011 v1.2 equation 3:

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

Where:

$AL_{T,i}$	Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO2-e.
$C_{BSL,XBT,i,t}$	Carbon emission due to displaced timber harvests in the baseline scenario in stratum i in time t; t CO2-e.
i	1, 2, 3, ... M strata.

Carbon emission due to displaced timber harvests in the baseline scenario is calculated according to VMD0011 v1.2 equation 4:

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

Where:

$C_{BSL,XBT,i,t}$	Carbon emission due to timber harvests in the baseline scenario in stratum i at time t ; t CO ₂ -e.
$V_{BSL,EX,i,t}$	Volume of timber projected to be extracted from within the project boundary during the baseline in stratum i at time t ; m ³ .
D_{mn}	Mean wood density of commercially harvested species; t d.m.m ⁻³ . The value must be the same as that used in the module CP-W if this pool is included in the baseline.
CF	Carbon fraction of biomass for commercially harvested species j ; t C t d.m. ⁻¹ . The value must be the same as that used in the module CP-W if this pool is included in the baseline.
LDF	Logging damage factor; t C m ⁻³ (default 0.53 t C m ⁻³ for broadleaf and mixed forests; 0.25 t C m ⁻³ for coniferous forests).
LIF	Logging infrastructure factor; t C m ⁻³ (default 0.29 t C m ⁻³).
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the projected start of the REDD project activity.

Market Effects Leakage Through Decreased Harvest of Fuelwood and Charcoal Sold into Regional and/or National Markets are calculated according to VMD0011 v1.2 equation 5:

$$LK_{MarketEffects,FW/C} = \sum_{i=1}^M (LF_{ME} * AL_{\frac{FW}{C},i})$$

Where:

$LK_{MarketEffects,FW/C}$	Total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets; t CO ₂ -e.
LF_{ME}	Leakage factor for market effects calculations; dimensionless.
$AL_{FW/C,i}$	Summed emissions from fuelwood/charcoal harvests in stratum i in the baseline case potentially displaced through implementation of carbon; t CO ₂ -e.

Summed emissions from fuelwood/charcoal harvests in the baseline case potentially displaced through project implementation is calculated according to VMD0011 v1.2 equation 6:

$$AL_{\frac{FW}{C},i} = \sum_{t=1}^t C_{BSL,XBFWC,i,t}$$

Where:

$AL_{FW/C,i}$	Summed emissions from fuelwood/charcoal harvests in stratum i in the baseline case potentially displaced through implementation of carbon; tCO ₂ -e.
$C_{BSL,XBFWC,t}$	Carbon emission due to displaced fuelwood/charcoal harvests in stratum i in the baseline scenario at time t; t CO ₂ -e.
A_i	The area of stratum i in which harvesting of fuelwood and/or production of charcoal is anticipated in the baseline scenario; ha.
i	1, 2, 3, ...M strata.
t	1, 2, 3, ...t* years elapsed since the projected start of the REDD project activity.

Carbon emission due to displaced fuelwood/charcoal harvests in the baseline scenario is calculated according to VMD0011 v1.2 equation 7:

$$C_{BSL,XBFWC,i} = [(FG_{BSL,i,t} * D_{mn} * CF) - (FG_{P,i,t} * D_{mn} * CF)] * \frac{44}{12}$$

Where:

$C_{BSL,XBFWC,i,t}$	Likely carbon emission due to displaced fuelwood/charcoal harvests in the baseline scenario in stratum i at time t; t CO ₂ -e
$FG_{BSL,t}$	Average projected annual volume of fuelwood to be gathered in the project area in the baseline scenario in stratum i at time t; m ³ yr ⁻¹

$FG_{P,i,t}$	Volume of fuelwood gathered in the project area and in areas designated by the project for leakage prevention (i.e. fuelwood plantations) according to monitoring results in stratum i at time t; $m^3.yr^{-1}$.
D_{mn}	Mean wood density of commercially harvested species; $t\ d.m.m^{-3}$.
CF	Carbon fraction of biomass for commercially harvested species j; $t\ C\ t^{-1}d.m.$
i	1, 2, 3, ...MB strata in the baseline scenario.
t	1, 2, 3, ...t* years elapsed since the projected start of the REDD project activity.

Table 53 - Net greenhouse gas emissions due to market- effects leakage (t CO₂-e). (Table 37 from Appendix II – “Calculus Table” - Consolidated Results)

Year	$V_{BSL,EX,i,t}$	$FG_{BSL,t}$	$LK_{MarketEffects,timber}$	$LK_{MarketEffects,FW/C}$	ΔC_{LK-ME}
2023	22,300	5,000	-	-	-
2024	22,300	5,000	-	-	-
2025	22,300	5,000	-	-	-
2026	22,300	5,000	-	-	-
2027	22,300	5,000	-	-	-
2028	22,300	5,000	-	-	-
2029	22,300	5,000	-	-	-
2030	22,300	5,000	-	-	-
2031	22,300	5,000	-	-	-
2032	22,300	5,000	-	-	-

5.4. Estimated GHG Emission Reductions and Carbon Dioxide Removals

Net GHG emission reduction estimates are based in VM0007 v1.7 equation 2:

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

Where:

NER_{REDD}	Total net GHG emission reductions of the REDD project activity up to year t (t CO ₂ e).
$\Delta C_{BSL-REDD}$	Net GHG emissions in the REDD baseline scenario up to year t* (t CO ₂ e).
$\Delta C_{WPS-REDD}$	Net GHG emissions in the REDD project scenario up to year t* - from Module M-REDD (t CO ₂ e).
$\Delta C_{LK-REDD}$	Net GHG emissions due to leakage from the REDD project activity up to year t*(t CO ₂ e).

Specific procedures for the quantification of the net GHG emissions in the REDD baseline scenario, the net GHG emissions in the REDD project scenario and GHG emissions due to leakage can be found in sections 6.1, 6.2 and 6.3, respectively.

Table 54 - Total net GHG emission reductions of the REDD project activity (t CO₂e) (ex-ante). (Table 38 from Appendix II – “Calculus Table” - Consolidated Results)

Year	Estimated baseline emissions or removals	Estimated project emissions or removals	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals
	(tCO ₂ e)	(tCO ₂ e)	$\Delta C_{LK-REDD}$	(tCO ₂ e)
	$\Delta C_{BSL-REDD}$	$\Delta C_{WPS-REDD}$		NER_{REDD}
2023	577.008	2.153	-	574.855,09
2024	594.854	2.153	-	592.701
2025	612.700	2.153	-	610.547
2026	630.546	2.153	-	628.393
2027	648.392	2.153	-	646.239
2028	666.238	2.153	-	664.085
2029	684.084	2.153	-	681.931
2030	701.930	2.153	-	699.777
2031	719.776	2.153	-	717.623
2032	737.622	2.153	-	735.469
Total	6.573.147	21.525	-	6.551.622

5.4.1. Calculation of AFOLU Pooled Buffer Account Contribution

The number of credits to be held in the AFOLU pooled buffer account is determined as a percentage of the total carbon stock benefits. For this project, this is equal to the net GHG emissions in the baseline minus the net emissions in the project case. Leakage emissions do not factor into the buffer calculations. Buffer is calculated through the new Verra’s platform (Project Hub), and the calculations commonly employed are presented below:

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

Where:

$Buffer_{Planned}$	Buffer withholding for avoiding planned deforestation project activities; t CO ₂ e.
$\Delta C_{BSL,planned}$	Net greenhouse gas emissions in the baseline from planned deforestation up to year t*; t CO ₂ -e.
$E_{FC,i,t}$	Net CO ₂ e emission from fossil fuel combustion in stratum i in year t; t CO ₂ -e.
$N_2O_{direct\ i,t}$	Direct N ₂ O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t; t CO ₂ -e.
$Buffer\%$	Buffer withholding percentage (percent).

Buffer withholding percentage is calculated according to AFOLU Non-Permanence Risk Tool v4.2 (ANNEX_IV-NON-PERMANENCE_RISK_TOOL_V4.2). The overall non-permanence risk rating is presented in the table below:

Table 55 - Overall Risk Rating. (Table from ANNEX_IV-NON-PERMANENCE_RISK_TOOL_V4.2)

Risk Category		Rating
a)	Internal Risk	0
b)	External Risk	6
c)	Natural Risk	3.5
Overall Risk Rating (a + b + c)		12

5.4.2. Uncertainty Analysis

VMD0017 v2.2 is used to perform an uncertainty analysis under the GPD scope. This module combines uncertainty information and conservative estimates and produces an overall uncertainty estimate of the total net GHG emission reductions. The estimated cumulative net anthropogenic GHG emission reductions will be adjusted at each point in time to account for uncertainty as indicated in Module X-UNC. Module X-UNC calculates an adjusted value for NERREDD+ for any point in time.

Uncertainty in baseline estimations were estimated through an assessment of deforestation rates, stocks in carbon pools and carbon stock changes.

The uncertainty in baseline rate of deforestation is set as zero ($Uncertainty_{BSL,RATE} = 0$), as the deforestation rates are based on actual deforestation plans, following VMD0017 v2.2, section 5.1.1 criteria.

Uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline scenario is estimated according to VMD0017 v2.2 equation 5:

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

Where:

$Uncertainty_{REDD-BSL,SS}$	Total uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline scenario (%).
$U_{REDD-BSL,SS,i}$	Percentage uncertainty in the combined carbon stocks and greenhouse gas sources in stratum i in the REDD baseline scenario (%).
$E_{REDD-BSL,SS,t,i}$	Sum of combined carbon stocks and GHG sources in the REDD baseline scenario (t CO ₂ -e).
i	1, 2, 3, ... M strata (unitless).

The percentage uncertainty in the combined carbon stocks and greenhouse gas sources were calculated as the 95% confidence interval half width as a percentage of the mean.

Total Uncertainty in REDD baseline scenario is estimated according to VMD0017 v2.2 equation 6:

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

Where:

$Uncertainty_{REDD-BSL,t^*}$	Cumulative uncertainty in REDD baseline scenario up to year t^* (%).
$Uncertainty_{REDD-BSL,RATE,t^*}$	Cumulative uncertainty in the baseline rate of deforestation up to year t (%).
$Uncertainty_{REDD-BSL,SS}$	Total uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline scenario (%).
t	1, 2, 3, ... t^* time elapsed since the start of the project activity (years).

As $Uncertainty_{REDD-BSL,RATE,t^*}$ is set to be zero, $Uncertainty_{REDD-BSL,t^*}$ is equal to $Uncertainty_{REDD-BSL,SS}$. The uncertainty in REDD project scenario is estimated according to VMD0017 v2.2 equation 13:

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

Where:

$Uncertainty_{REDD-WPS}$	Total uncertainty in the REDD project scenario (%).
$U_{REDD-WPS,SS,i}$	Percentage uncertainty in the combined carbon stocks and greenhouse gas sources in stratum i in the REDD project scenario (%).
$E_{REDD-WPS,SS,t,i}$	Sum of combined carbon stocks and GHG sources multiplied by the area of stratum i (A_i) in the REDD project scenario (t CO ₂ e).
i	1, 2, 3, ... M strata (unitless).

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

The total error in the REDD+ project activity is therefore calculated by VMD0017 v2.2 equation 21⁶.

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

Where:

$NER_{REDD+ERROR}$	Cumulative uncertainty for the REDD+ project activities up to year t^* (%).
$Uncertainty_{REDD-BSL,t^*}$	Cumulative uncertainty in REDD baseline scenario up to year t (%).
$Uncertainty_{REDD-WPS}$	Total uncertainty in the REDD project scenario (%).
$\Delta C_{BSL-REDD,t^*}$	Net GHG emissions in the REDD baseline scenario up to year t^* (t CO ₂ e).
$\Delta C_{WPS-REDD,t^*}$	Net GHG emissions in the REDD project scenario up to year t^* (t CO ₂ e).
t	1, 2, 3, ... t^* time elapsed since the project start (year).

Deductions are made in the case total error in the REDD+ project activity exceeds 15% of NER_{REDD} at the 95% confidence level according to VMD0017 v2.2 equation 21⁷:

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

Where:

$Adjusted_NER_{REDD+}$	Total net GHG emission reductions of the REDD+ project activities up to year t^* adjusted to account for uncertainty (t CO ₂ e).
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⁶ Here suitable not to show values related to WRC project activities, which were not included in the scope of this project.

⁷ Here suitable not to show factors related to ARR or WRC project activities, which were not included in the scope of this project.

NER_{REDD} Total net GHG emission reductions of the REDD project activity up to year t* (tCO₂e).

NER_{REDD+_ERROR} Cumulative uncertainty for the REDD+ (REDD and WRC) project activities up to year t* (%).

Table 56 - Total net GHG emission reductions of the REDD+ project activities up to year t*adjusted to account for uncertainty (t CO₂e) (ex-ante). (Table 40 from Appendix II – “Calculus Table” - Consolidated Results)

Year	NER _{REDD}	NER _{REDD+_ERROR}	Adjusted_NER _{REDD+}
2023	574.855	28.154	574.855
2024	592.701	29.025	592.701
2025	610.547	29.896	610.547
2026	628.393	30.766	628.393
2027	646.239	31.637	646.239
2028	664.085	32.508	664.085
2029	681.931	33.379	681.931
2030	699.777	34.249	699.777
2031	717.623	35.120	717.623
2032	735.469	35.991	735.469
Total	6.551.622	320.725	6.551.622

5.4.3. Calculation of Verified Carbon Units

Total number of Verified Carbon Units (VCUs) generated by the project activity implementation is estimated (ex-ante) according to VM0007 v1.7 equations 18 and 19⁸:

$$VCU_t = Adjusted_NER_{REDD+} - Buffer_{Planned}$$

Where:

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

Adjusted_NER_{REDD+} Total net GHG emission reductions of the REDD+ project activity up adjusted to account for uncertainty (t CO₂e).

Buffer_{Planned} Buffer withholding for avoiding planned deforestation project activities (t CO₂e).

⁸ Here suitable to reflect ex-ante estimates.

Table 57 - Number of Verified Carbon Units (VCU) (ex-ante). (Table 41 from Appendix II – “Calculus Table” - Consolidated Results)

Year	Adjusted_NER _{REDD+}	Buffer _{Planned}	VCU _t
2023	574.855	68.983	505.872
2024	592.701	71.124	521.577
2025	610.547	73.266	537.281
2026	628.393	75.407	552.986
2027	646.239	77.549	568.690
2028	664.085	79.690	584.395
2029	681.931	81.832	600.099
2030	699.777	83.973	615.804
2031	717.623	86.115	631.509
2032	735.469	88.256	647.213
Total	6.551.622	786.195	5.765.427

To estimate the number of Verified Carbon Units (VCUs) for the monitoring period $T = t_2 - t_1$, was used the following equation:

$$VCU_t = (Adjusted_NER_{REDD+,t_2} - Adjusted_NER_{REDD+,t_1}) - Buffer_{Total}$$

Where:

VCU_t	Number of Verified Carbon Units at year $t = t_2 - t_1$ (VCU).
Adjusted_NER_{REDD+,t2}	Total net GHG emission reductions of the REDD+ project activity up to year t_2 and adjusted to account for uncertainty (t CO ₂ e).
Adjusted_NER_{REDD+,t1}	Total net GHG emission reductions of the REDD+ project activity up to year t_1 and adjusted to account for uncertainty (t CO ₂ e).
Buffer_{Total}	Total permanence risk buffer withholding (t CO ₂ e).

Table 59 below describes all emission estimations for the project baseline period, including any buffer pool allocation.

Table 58 - Estimated Total Verified Carbon Units (VCUs) during baseline period (ex-ante)

Vintage period	Estimated baseline	Estimated project	Estimated leakage	Estimated buffer pool	Estimated reduction VCUs (tCO ₂ e)	Estimated removal	Estimated total VCU
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	emissions (tCO ₂ e)	emissions (tCO ₂ e)	emissions (tCO ₂ e)	allocation (tCO ₂ e)		VCUs (tCO ₂ e)	issuance (tCO ₂ e)
21-Jul-2023 to 31-Dec-2023	577.008	2.153	-	68.983	574.855	0	505.872
01-Jan-2024 to 31-Dec-2024	594.854	2.153	-	71.124	592.701	0	521.577
01-Jan-2025 to DD-MMM-2025	612.700	2.153	-	73.266	610.547	0	537.281
01-Jan-2026 to 31-Dec-2026	630.546	2.153	-	75.407	628.393	0	552.986
01-Jan-2027 to 31-Dec-2027	648.392	2.153	-	77.549	646.239	0	568.690
01-Jan-2028 to 31-Dec-2028	666.238	2.153	-	79.690	664.085	0	584.395
01-Jan-2029 to 31-Dec-2029	684.084	2.153	-	81.832	681.931	0	600.099
01-Jan-2030 to 31-Dec-2030	701.930	2.153	-	83.973	699.777	0	615.804
01-Jan-2031 to 31-Dec-2031	719.776	2.153	-	86.115	717.623	0	631.509
01-Jan-2032 to 31-Dec-2032	737.622	2.153	-	88.256	735.469	0	647.213
Total	6.573.147	21.525	-	786.195	6.551.622	0	5.765.427

6 MONITORING

6.1. Data and Parameters Available at Validation

Data / Parameter	$AA_{planned,i,t}$
Data unit	ha
Description	Annual area of baseline planned deforestation for stratum i in year t.
Source of data	Calculated based on VMD0006 v1.4 equation 5.
Value applied:	See the values applied in table 31.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on total area of planned deforestation over the baseline period for stratum I ($A_{planned,i}$), the projected annual proportion of land that will be deforested in stratum i during year t ($D\%_{planned,i,t}$) and the Likelihood of deforestation for stratum I ($L-D_i$) according to VMD0006 v1.4 equation 5.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$A_{planned,i}$
Data unit	Ha
Description	Total area of planned deforestation over the fixed baseline period for stratum i.
Source of data	Remote Sensing data.
Value applied:	See values in table 31.

Justification of choice of data or description of measurement methods and procedures applied	Determined according to what is recognized as an immediate site-specific threat of deforestation, which, in its turn, is a function of the legal permissibility for deforestation, the suitability of the project area for conversion to alternative non-forest land use, the government approval for deforestation and a management plan for deforesting the project area. See section 3.4 for a complete description of measurement methods and procedures applied.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$D_{\text{planned},i,t}$
Data unit	% year-1
Description	Projected annual proportion of land that will be deforested in stratum i at year t.
Source of data	Data obtained from forestry exploration plans submitted to the environmental agency responsible for issuing permits for vegetation suppression in each state.
Value applied:	See the values applied in table 27.
Justification of choice of data or description of measurement methods and procedures applied	Where a valid verifiable plan exists for rate at which deforestation is projected to occur, this rate must be used, according to VMD0006 v1.4, section 5.1.3 criteria.
Purpose of Data	Determination of baseline scenario.
Comments	-

Data / Parameter	$L-D_i$
Data unit	%
Description	Likelihood of deforestation in stratum i.

Source of data	Analysis of Land Tenure.
Value applied:	100%
Justification of choice of data or description of measurement methods and procedures applied	L-Di is equal to 100% for all planned deforestation areas that are not both under Government control and zoned for deforestation, according to VMD0006 v1.4, section 5.1.4.
Purpose of Data	Determination of baseline scenario.
Comments	-

Data / Parameter	$\Delta C_{AB_tree,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Baseline carbon stock change in aboveground tree biomass in stratum i; t CO ₂ -e ha ⁻¹ .
Source of data	Calculated based on VMD0006 v1.4 equation 6.
Value applied:	See the values applied in table 32.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the forest carbon stock in aboveground tree biomass in stratum I ($C_{AB_tree,bsl,i}$) and the post-deforestation carbon stock in aboveground tree biomass in stratum I ($C_{AB_tree,post,i}$), according to VMD0006 v1.4 equation 6.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{BB_tree,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Baseline carbon stock change in belowground tree biomass in stratum i.

Source of data	Calculated based on VMD0006 v1.4 equation 8.
Value applied:	See the values applied in table 33.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the forest carbon stock in aboveground tree biomass in stratum I ($C_{AB_tree,bsl,i}$) and the post-deforestation carbon stock in aboveground tree biomass in stratum I ($C_{AB_tree,post,i}$); according to VMD0006 v1.4 equation 8.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{AB_non-tree,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Baseline carbon stock change in aboveground non-tree biomass in stratum i.
Source of data	Calculated based on VMD0006 v1.4 equation 7.
Value applied:	See the values applied in table 34.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on forest carbon stock in aboveground non-tree vegetation in stratum ($C_{AB_non-tree,bsl,i}$) and Post-deforestation carbon stock in aboveground non-tree vegetation in stratum i ($C_{AB_non-tree,post,i}$); according to VMD0006 v1.4 equation 7.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{BB_non-tree,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Baseline carbon stock change in belowground non-tree biomass in stratum i.

Source of data	Calculated based on VMD0006 v1.4 equation 9
Value applied:	See the values applied in table 35.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on forest carbon stock in belowground non-tree vegetation in stratum ($C_{BB_nontree,bsl,i}$) and post-deforestation carbon stock in belowground non-tree vegetation in stratum i ($C_{BB_nontree,post,i}$), according to VMD0006 v1.4 equation 9.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{DW,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Baseline carbon stock change in dead wood in stratum i.
Source of data	Calculated based on VMD0006 v1.4 equation 10.
Value applied:	See the values applied in table 36.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on forest carbon stock in deadwood in stratum ($C_{DW,bsl,i}$) and post-deforestation carbon stock in deadwood in stratum i ($C_{DW,post,i}$), according to VMD0006 v1.4 equation 10.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{L,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Baseline carbon stock change in litter in stratum i.
Source of data	Calculated based on VMD0006 v1.4 equation 11.

Value applied:	See the values applied in table 37.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on forest carbon stock in litter in stratum ($C_{LI,bsl,i}$) and post-deforestation carbon stock in litter in stratum i ($C_{LI,post,i}$), according to VMD0006 v1.4 equation 11.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{SOC,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Baseline carbon stock change in soil organic carbon in stratum i.
Source of data	Calculated based on VMD0006 v1.4 equation 12.
Value applied:	See the values applied in table 38.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on forest carbon stock in soil organic carbon in stratum ($C_{SOC,bsl,i}$) and post-deforestation carbon stock in soil organic carbon in stratum i ($C_{SOC,PD-BSL,i}$), according to VMD0006 v1.4 equation 12.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{AB_tree,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Carbon stock in aboveground biomass in trees in the baseline in stratum i
Source of data	Forest inventory with field data and direct measurement. The mean carbon stock in aboveground tree biomass per unit area per

	stratum is estimated using sample fixed area plots and regional allometric equation for tree component.
Value applied:	See the values applied in table 32.
Justification of choice of data or description of measurement methods and procedures applied	Forestry Inventory is performed according to VMD0001 v1.2 and VMD0016 v1.3 criteria.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{BB_tree,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Carbon stock in belowground biomass in trees in the baseline in stratum i
Source of data	Calculated based on VMD0001 v1.2, equation 5.
Value applied:	See the values applied in table 33.
Justification of choice of data or description of measurement methods and procedures applied	Calculated from carbon stock in aboveground biomass in trees in the baseline in stratum i ($C_{AB_tree,i}$) and root to shoot ratios (R), according to VMD0001 v1.2, equation 5.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	R
Data unit	Dimensionless
Description	Root to shoot ratio appropriate to forest type.
Source of data	Nogueira (2008).

Value applied:	Dense forest = 0.31; Open forest = 0.1
Justification of choice of data or description of measurement methods and procedures applied	Eco-region-specific root to shoot ratio is used for accuracy.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{AB_nontree,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Carbon stock in aboveground non-tree vegetation in the baseline in stratum i. Non-tree vegetation includes palms and vines. Trees with DBH lower than 10cm and shrubs were not considered.
Source of data	Estimated based on carbon stock in aboveground biomass in trees in the baseline in stratum i ($C_{AB_tree,i}$) and previously published data (Nogueira et al., 2008), following VMD0001 v1.2, section 4, part 5 criteria.
Value applied:	See the values applied in table 34.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions.
Comments	Values applied represents the percentage of the carbon stock in aboveground biomass in trees in the baseline in stratum I, found by Nogueira et al. (2008) for the same forest types in the same region.

Data / Parameter	$C_{BB_nontree,i}$
Data unit	t CO ₂ e.ha ⁻¹

Description	Carbon stock in belowground non-tree vegetation in the baseline in stratum i. Non-tree vegetation includes palms and vines. Trees with DBH lower than 10cm and shrubs were not considered.
Source of data	Calculated based on VMD0001 v1.2, equation 13.
Value applied:	See the values applied in table 35.
Justification of choice of data or description of measurement methods and procedures applied	Calculated from carbon stock in aboveground non-tree biomass in the baseline in stratum i ($C_{AB_nontree,i}$) and root to shoot ratios (R), according to VMD0001 v1.2, equation 13.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{DW,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Carbon stock in dead wood in the baseline in stratum i.
Source of data	Calculated based on VMD0002 v1.1, equation 9.
Value applied:	See the values applied in table 36.
Justification of choice of data or description of measurement methods and procedures applied	Calculated from biomass of standing dead wood in stratum i (BSD_{Wi}), biomass of lying dead wood in stratum (BLD_{Wi}) and carbon fraction of dry matter in dead wood (CF_{dw}), according to VMD0002 v1.1, equation 9.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{LI,i}$
Data unit	t CO ₂ e.ha ⁻¹

Description	Carbon stock in litter in the baseline in stratum i
Source of data	Calculated based on VMD0003 v1.1, equation 1.
Value applied:	See the values applied in table 37.
Justification of choice of data or description of measurement methods and procedures applied	Calculated from of litter in sample plot sp in stratum I ($B_{LI,sp,i}$), carbon fraction (CF) and total area of all sample plots in stratum i according to VMD0003 v1.1, equation 1.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{SOC,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Mean carbon stock in soil organic carbon in the baseline in stratum i.
Source of data	Calculated based on VMD0004 v1.1, equation 2.
Value applied:	See the values applied in table 38.
Justification of choice of data or description of measurement methods and procedures applied	Calculated from soil organic carbon of the sample in sample plot sp, stratum i; determined in the laboratory in g C/100 g soil (fine fraction <2 mm) ($C_{SOCsample,sp,i}$), bulk density of fine (<2 mm) fraction of mineral soil in sample plot sp, stratum i; determined in the laboratory in g fine fraction cm ⁻³ total sample volume ($BD_{sample,sp,i}$) and depth to which soil sample is collected in sample plot sp in stratum I ($Dep_{sample,sp,i}$), according to VMD0004 v1.1, equation 2.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{wp,i}$
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Data unit	t CO ₂ e.ha ⁻¹
Description	Baseline carbon stock change in in wood products in stratum i
Source of data	Calculated based on VMD0005 v1.2 equation 2
Value applied:	See the values applied in table 39.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on mean stock of extracted biomass carbon by class of wood product ty from stratum I ($C_{XB,ty,i}$) and the wood waste (the fraction immediately emitted through mill inefficiency by class of wood product) (WW_{ty}), according to VMD0005 v1.2 equation 2.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{XB,ty,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Mean stock of extracted biomass carbon by class of wood product ty from stratum i.
Source of data	Calculated based on VMD0005 v1.2 equation 1.
Value applied:	PAI#1: 16,23; PAI#2: 16,23
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on volume of timber extracted from stratum i (does not include slash left onsite) by species j and wood product class ty ($V_{ex,ty,j}$), mean wood density of species j (D_j), carbon fraction (CF) and the total area of stratum (A_i), according to VMD0005 v1.2 equation 1.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	D_j
Data unit	t d.m.m ⁻³ .
Description	Mean wood density of species j.
Source of data	Wood Density Tropical Database.
Value applied:	Fearnside et al., 1997.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	CF
Data unit	Dimensionless
Description	Carbon fraction
Source of data	Carbon Fraction (CF), default value from IPCC 2006
Value applied:	0.47
Justification of choice of data or description of measurement methods and procedures applied	Default factor calculated by Brazilian central Amazon.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	SLF _{ty}
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Data unit	Dimensionless
Description	Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product ty.
Source of data	Winjun et al., 1998
Value applied:	0.2
Justification of choice of data or description of measurement methods and procedures applied	Default value suggested by VMD0005 v1.2.
Purpose of Data	Calculation of baseline emissions.
Comments	-

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

Data / Parameter	CWP _{100,i}
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Data unit	t CO ₂ -e ha ⁻¹
Description	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum i.
Source of data	Calculated based on VMD0005 v1.2 equation 3.
Value applied:	See the values applied in table 39.
Justification of choice of data or description of measurement methods and procedures applied	Estimated base on carbon stock entering wood products pool at time of deforestation from stratum I ($C_{WP,i}$), fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product t_y (SLF_{t_y}), and Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product t_y (OF_{t_y}).
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{AB_tree,post,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Post-deforestation carbon stock in aboveground tree biomass in stratum i.
Source of data	Secondary data from peer-reviewed literature (Silva Neto et al., 2012).
Value applied:	See the values applied in table 32.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	C _{AB_non-tree,post,i}
Data unit	t CO ₂ e.ha ⁻¹
Description	Post-deforestation carbon stock in aboveground non-tree biomass in stratum i.
Source of data	Secondary data from peer-reviewed literature (Silva Neto et al., 2012).
Value applied:	See the values applied in table 34.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions.
Comments	

Data / Parameter	C _{BB_non-tree,post,i}
Data unit	t CO ₂ e.ha ⁻¹
Description	Post-deforestation carbon stock in belowground non-tree biomass in stratum i.
Source of data	Secondary data from peer-reviewed literature (Silva Neto et al., 2012).
Value applied:	See the values applied in table 35.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$C_{DW,post,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Post-deforestation carbon stock in dead wood in stratum i.
Source of data	-
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$C_{LI,post,i}$
Data unit	t CO ₂ e.ha ⁻¹
Description	Post-deforestation carbon stock in litter in stratum i.
Source of data	-
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$C_{SOC,PD-BSL,i}$
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Data unit	t CO ₂ -e ha ⁻¹
Description	Mean post-deforestation stock in soil organic carbon in the post deforestation stratum i
Source of data	See the values applied in table 38.
Value applied:	Calculated based on VMD0004 v1.1, equation 3.
Justification of choice of data or description of measurement methods and procedures applied	Calculated from mean carbon stock in soil organic carbon for stratum I ($C_{SOC,i,t}=0$), land use factor before conversion (FLU), management factor before conversion (FMG) and input factor before, according to VMD0004 v1.1, equation 3.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	GHG _{BSL-E,i,t}
Data unit	t CO ₂ e.yr ⁻¹
Description	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i in year t.
Source of data	Calculated based on VMD0006 v1.4 equation 15.
Value applied:	See the values applied in table 41.
Justification of choice of data or description of measurement methods and procedures applied	Calculated based on the non-CO ₂ emissions due to biomass burning in stratum i in year t ($EBiomassBurn,i,t$), according to VMD0006 v1.4 equation 15.
Purpose of Data	Calculation of baseline emissions.
Comments	Net CO ₂ e emission from fossil fuel combustion in stratum i in year t (EFC,i,t) and direct N ₂ O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t ($N2O_{direct-N,i,t}$) are conservatively excluded from the project scope and the calculation of the baseline estimates following VM0007 v1.6 section 5.4 criteria.

Data / Parameter	$E_{\text{BiomassBurn},i,t}$
Data unit	t CO ₂ e
Description	Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO ₂ , CH ₄ , N ₂ O).
Source of data	Calculated based on VMD0013 v1.3 equation 1.
Value applied:	See the values applied in table 42.
Justification of choice of data or description of measurement methods and procedures applied	Calculated based on area burnt for stratum i in year t ($A_{\text{burn},i,t}$), average aboveground biomass stock before burning stratum i, in year t ($B_{i,t}$), combustion factor for stratum i (unitless) (COMF_i), emission factor for stratum i for gas g (Gg_i) and the Global warming potential for gas g (GWP_g), according to VMD0013 v1.3 equation 1. .
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$A_{\text{burn},i,t}$
Data unit	ha
Description	Area burnt for stratum i in year t.
Source of data	Equal to $AA_{\text{planned},i,t}$ in the baseline case.
Value applied:	See the values applied in table 50.
Justification of choice of data or description of measurement methods and procedures applied	For the calculation of baseline emissions, the burned area is considered equivalent to the annual deforested area, assuming that all deforestation is preceded by a fire to clear the land in the baseline case.
Purpose of Data	Calculation of baseline emissions.

Comments	-
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Data / Parameter	$B_{i,t}$				
Data unit	tonnes d.m. ha ⁻¹				
Description	Average aboveground biomass stock before burning for stratum i, year t.				
Source of data	Calculated based on VMD0013 v1.3 equation 2.				
Value applied:	PAI#1 - Ds	PAI #1 - Db	PAI #2 - Ds	PAI #2 - Db	
	324,11	300,36	251,45	268,88	
Justification of choice of data or description of measurement methods and procedures applied	Calculated based on carbon stock in aboveground biomass in trees in stratum i in year t ($C_{AB_tree,i,t}$), Carbon stock in dead wood for stratum i in year t ($C_{DW,i,t}$), Carbon stock in litter for stratum i in year t ($C_{L,i,t}$) and Carbon fraction of biomass (CF), according to VMD0013 v1.3 equation 2.				
Purpose of Data	Calculation of baseline emissions.				
Comments	-				

Data / Parameter	$COMF_i$				
Data unit	Dimensionless				
Description	Combustion factor for stratum i .				
Source of data	IPCC (2006)				
Value applied:	0.45				
Justification of choice of data or description of measurement methods and procedures applied	Default values in Table 2.6 of IPCC, 2006.				

Purpose of Data	Calculation of baseline emissions.
Comments	The combustion factor is a measure of the proportion of the fuel that is actually combusted, which varies as a function of the size and architecture of the fuel load (i.e., a smaller proportion of large, coarse fuel such as tree stems will be burnt compared to fine fuels, such as grass leaves), the moisture content of the fuel and the type of fire (i.e., intensity and rate of spread).

Data / Parameter	Gg _i
Data unit	kg t ⁻¹ d.m. burnt
Description	Emission factor for stratum i for gas g
Source of data	IPCC (2006)
Value applied:	CH ₄ =6.8; N ₂ O=0.2
Justification of choice of data or description of measurement methods and procedures applied	Default values in Table 2.6 of IPCC, 2006
Purpose of Data	Calculation of baseline emissions.
Comments	Defaults can be found in Volume 4, Chapter 2, of the IPCC 2006 Inventory Guidelines in table 2.5 (see Appendix 8: emission factors for various types of burning for CH ₄ and N ₂ O).

Data / Parameter	GWP _g
Data unit	Dimensionless
Description	Global warming potential for gas g.
Source of data	Fifth Assessment Report (AR5) IPCC (2006)
Value applied:	CH ₄ =28; N ₂ O=265

Justification of choice of data or description of measurement methods and procedures applied	Default factor from the latest IPCC Assessment Report.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{BSL,i,t}$
Data unit	t CO ₂ e
Description	Net carbon stock changes in all pools in the baseline stratum i in year t.
Source of data	Calculated based on VMD0006 v1.4 equation 1.
Value applied:	See the values applied in table 40.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the annual area of baseline planned deforestation for stratum i in year t ($AA_{planned,i,t}$), the baseline carbon stock change in aboveground tree biomass in stratum I ($\Delta C_{AB_tree,i}$), the baseline carbon stock change in belowground tree biomass in stratum I ($\Delta C_{BB_tree,i}$), the baseline carbon stock change in aboveground non-tree biomass in stratum ($\Delta C_{AB_non-tree,i}$), the baseline carbon stock change in belowground non-tree biomass in stratum I ($\Delta C_{BB_non-tree,i}$), the baseline carbon stock change in wood products in stratum I ($\Delta C_{WP,i}$), the baseline carbon stock change in dead wood in stratum I ($\Delta C_{DW,i}$), the baseline carbon stock change in litter in stratum I ($\Delta C_{LI,i}$) and the baseline carbon stock change in soil organic carbon in stratum I, according to VMD0006 v1.4 equation 4.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{BSL,planned}$
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Data unit	t CO ₂ e
Description	Net greenhouse gas emissions in the baseline from planned deforestation.
Source of data	Calculated based on VMD0006 v1.4 equation 1.
Value applied:	See the values applied in table 42.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the net carbon stock changes in all pools in the baseline ($\Delta C_{BSL,i,t}$) and GHG emissions as a result of deforestation activities within the project boundary in the baseline stratum i in year t ($GHG_{BSL-E,i,t}$), according to equation 1 from VMD0006 v1.4.
Purpose of Data	Calculation of baseline emissions.
Comments	-

6.2. Data and Parameters Monitored

Data / Parameter	$A_{DefPA,i,u,t}$
Data unit	ha
Description	Area of recorded deforestation in the project area in stratum i converted to land use u in year t.
Source of data	Remote sensing imagery (Sentinel 2, Landsat 8), PRODES and DETER database.
Description of measurement methods and procedures applied	Annual deforestation is measured in GIS using remote sensing techniques and reported with spatial explicit data by raster and shapefile evidence.
Frequency of monitoring/recording	Annual

Value applied:	Ex-ante: See the values applied in table 43. Ex-post: See the values applied in table 66.
Monitoring equipment	Landsat 8 OLI, Sentinel MSI
QA/QC procedures applied	Accuracy assessment of PRODES classification was performed by comparing the forest and deforestation class of the land cover map for 2022 with a set of 200 points stratified by class and randomly distributed over the reference region. The reference data used for this step comes from the visual interpretation of high spatial resolution image. The global accuracy of the mapping for the different classes of land cover presented values above 99% for all three classes in each year analyzed. The overall accuracy of the forest cover reference map (2022) was 97%. See more details in the APPENDIX_XII-FOREST_BENCHMARK_CLASSIFICATION.
Purpose of data	Calculation of project emissions
Calculation method	Classified images with information about the area of annual deforestation in Brazil are downloaded from PRODES websites and clipped with the project area spatial limits. Images from Sentinel are downloaded from ESA or Google Earth Engine.
Comments	-

Data / Parameter	$C_{P,post,u,i}$
Data unit	t CO ₂ -e
Description	Carbon stock in all pools in post-deforestation land use u in stratum i.
Source of data	Calculated according to VMD0015 v2.2, equation 06
Description of measurement methods and procedures applied	Calculated based on carbon stock in aboveground tree biomass in stratum I ($C_{AB_tree,i}$), carbon stock in belowground tree biomass in stratum I ($C_{BB_tree,i}$), carbon stock in aboveground non-tree vegetation in stratum I ($C_{AB_non-tree,i}$), carbon stock in belowground non-tree vegetation in stratum I ($C_{BB_non-tree,i}$), carbon stock in dead wood in stratum I ($C_{DW,i}$), carbon stock in litter in stratum I (CLi,i), mean post-deforestation stock in soil organic carbon in the post

	deforestation stratum I ($CSOC,PD-BSL,i$), according to VMD0015 v2.2, equation 06.
Frequency of monitoring/recording	10 years (in each baseline revalidation)
Value applied:	Ex-ante: See the values applied in table 44. Ex-post: For this monitoring period the same value applied in the ex-ante, see table 44.
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 05.
Comments	-

Data / Parameter	CWP,i
Data unit	t CO ₂ -e ha ⁻¹
Description	Carbon stock sequestered in wood products from harvests in stratum i
Source of data	Post exploratory reports
Description of measurement methods and procedures applied	See section 4.1.2.8.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-

QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 05.
Comments	

Data / Parameter	$\Delta C_{pools,Def,u,i,t}$
Data unit	t CO2-e
Description	Net carbon stock changes in all pools as a result of deforestation in the project case in land use u in stratum i at time t.
Source of data	Calculated according to VMD0015 v2.2, equation 05.
Description of measurement methods and procedures applied	Calculated based on carbon stock in all pools in the baseline case in stratum I ($C_{BSL,i}$), carbon stock in all pools in post-deforestation land use u in stratum I ($C_{P,post,u,i}$) and carbon stock sequestered in wood products from harvests in stratum I ($C_{WP,i}$), according to VMD0015 v2.2, equation 05.
Frequency of monitoring/recording	10 years (in each baseline revalidation)
Value applied:	Ex-ante: See the values applied in table 44. Ex-post: equal to ex ante, see the values applied in table 44.
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 05.
Comments	-

Data / Parameter	$\Delta C_{P,DefPA,i,t}$
Data unit	t CO ₂ -e
Description	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t.
Source of data	Calculated according to VMD0015 v2.2, equation 03
Description of measurement methods and procedures applied	Calculated based on the area of recorded deforestation in the project area stratum i converted to land use u at time t ($A_{DefPA,u,i,t}$) and the net carbon stock changes in all pools in the project case in land use u in stratum i at time t ($\Delta C_{pools,Def,u,i,t}$), according to VMD0015 v2.2, equation 03.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 45. Ex-post: See the values applied in table 67.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 03.
Comments	-

Data / Parameter	$A_{DegW,i}$
Data unit	ha
Description	Area potentially impacted by degradation processes in stratum i
Source of data	Measured

Description of measurement methods and procedures applied	The area subject to degradation is delineated based on an access buffer from all access points, such as roads and rivers or previously cleared areas, to the project area, with a width equal to the distance of degradation penetration.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: N/A Ex-post: N/A
Monitoring equipment	DETER data, Remote Sensing data (Sentinel), GIS software's and field survey.
QA/QC procedures applied	Orbital imaging steps will be supervised by a professional with more than ten years of experience remote sensing in tropical forests. In addition, field survey will be adopted to effect and guarantee quality imaging at extremely high spatial resolution. All Digital Image Processing (PDI) steps will be internally rechecked. The orbital imaging results will be compared with data collected in the field for validation, where such quality assurance and control procedures will be led by forest inventory specialists from the BRC team (see Appendix 07).
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 08.
Comments	Ex-ante estimates of net carbon stock changes as a result of degradation in stratum i in the project area in year t ($\Delta C_{P,DegW,i,t}$) were made based on participatory rural appraisals (PRA), though the number of families and the average consumption of wood.

Data / Parameter	$C_{DegW,i,t}$
Data unit	t CO ₂ -e.ha ⁻¹
Description	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i in year t .

Source of data	Estimated through diameter of stumps directly measured in the field.
Description of measurement methods and procedures applied	The diameter of all tree stumps is measured and conservatively assumed to be the same as the DBH. The above and below ground carbon stock of each harvested tree are estimated using the same allometric regression equation and root to shoot ratio used for estimating the carbon pool in trees in the baseline scenario
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 46. Ex-post: See the values applied in table 70.
Monitoring equipment	Diameter tape.
QA/QC procedures applied	See SOP for biomass inventory (Appendix 07).
Purpose of data	Calculation of project emissions.
Calculation method	Calculated through allometric equation used for estimating the carbon pool in trees in the baseline scenario.
Comments	Ex-ante estimates were made based on PRAs, which considered the amount of wood used for firewood, construction of houses and boats per family.

Data / Parameter	AP_i
Data unit	ha
Description	Total area of degradation sample plots in stratum i.
Source of data	Ground measurement.
Description of measurement methods and procedures applied	Sampling plots covering 3% of A_{degWi}

Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 13.83 Ex-post: 58.16 (PAI#2-5)
Monitoring equipment	Tape measure, GPS.
QA/QC procedures applied	See SOP for biomass inventory (Appendix 07).
Purpose of data	Calculation of project emissions.
Calculation method	Fixed area plots covering 3% of the $A_{DegW,i}$ in the monitoring period.
Comments	-

Data / Parameter	$\Delta C_{P,DegW,i,t}$
Data unit	t CO ₂ -e
Description	Net carbon stock changes as a result of degradation in stratum i in the project area in year t.
Source of data	Calculated according to VMD0015 v2.2, equation 08.
Description of measurement methods and procedures applied	Calculated based on area potentially impacted by degradation processes in stratum I ($A_{DegW,i}$) and biomass carbon of trees cut and removed through degradation process from plots measured in stratum i in year t ($C_{DegW,i,t}$) and total area of degradation sample plots in stratum I (AP_i), according to VMD0015 v2.2, equation 08.
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: See the values applied in table 46. Ex-post: See the values applied in table 71.
Monitoring equipment	N/A

QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 08.
Comments	-

Data / Parameter	$\Delta C_{P, SelLog, i, t}$
Data unit	t CO ₂ -e
Description	Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum i in year t.
Source of data	Calculated according to VMD0015 v2.2, equation 09.
Description of measurement methods and procedures applied	Calculated based on actual net project emissions arising in the logging gap in stratum i in year t ($C_{LG, i, t}$), actual net project emissions arising from logging infrastructure in stratum i in year t ($C_{LR, i, t}$) and the carbon stock in wood products pool from stratum i, in year t ($C_{WPI, t}$), according to VMD0015 v2.2, equation 09.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	See section 4.2
Comments	-

Data / Parameter	$C_{LG,i,t}$
Data unit	t CO ₂ -e
Description	Actual net project emissions arising in the logging gap, in stratum i in year t;
Source of data	Calculated according to VMD0015 v2.2, equation 10
Description of measurement methods and procedures applied	Calculated based on biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t ($C_{EXT,z,i,t}$), logging damage factor for logging stratum z, in stratum i ($L_{DFz,i}$) and volume extracted from logging stratum z, in stratum i in year t ($V_{EXT,z,i,t}$), according to VMD0015 v2.2, equation 10.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	See VMD0015 v2.2, equation 10 at section 4.2.
Comments	-

Data / Parameter	$C_{EXT,z,i,t}$
Data unit	t CO ₂ -e
Description	Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t.

Source of data	Calculated according to VMD0015 v2.2, equation 11.
Description of measurement methods and procedures applied	Calculated based on the volume of timber extracted of species j for logging stratum z, in stratum i in year t ($V_{EXT,j,z,i,t}$), the basic wood density of species j (D_j) and the carbon fraction of biomass (CF), according to VMD0015 v2.2, equation 11.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	The volume of timber extracted of all species is taken from annual operating plan. Basic wood density of all species is taken from the tropical wood density database (Annex 12). Carbon fraction of biomass for tree species is default according to IPCC (2006). See VMD0015 v2.2, equation 11 at section 4.2.
Comments	-

Data / Parameter	$LDF_{z,i}$
Data unit	t C m ⁻³
Description	Logging damage factor for logging stratum z, in stratum i
Source of data	VMD0015 v2.2
Description of measurement methods and procedures applied	Default data
Frequency of monitoring/recording	-

Value applied:	0.67
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	-

Data / Parameter	$V_{EXT,z,i,t}$
Data unit	m ³
Description	Volume extracted from logging stratum z, in stratum i in year t.
Source of data	Post exploration reports.
Description of measurement methods and procedures applied	-
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	-

Data / Parameter	$C_{LR,i,t}$
Data unit	t CO ₂ -e
Description	Actual net project emissions arising from logging infrastructure in stratum i in year t.
Source of data	Calculated according to VMD0015 v2.2, equation 12.
Description of measurement methods and procedures applied	Calculated based on change in carbon stock resulting from skid trail creation in stratum i in year t ($\Delta C_{SKID,i,t}$), Change in carbon stock resulting from logging road creation in stratum i in year t ($\Delta C_{ROAD,i,t}$) and the Change in carbon stock resulting from logging deck creation in stratum i in year t ($\Delta C_{DECKS,i,t}$), according to VMD0015 v2.2, equation 12
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	See VMD0015 v2.2, equation 12 at section 4.2.
Comments	-

Data / Parameter	$\Delta C_{SKID,i,t}$
Data unit	t CO ₂ -e
Description	Change in carbon stock resulting from skid trail creation in stratum i in year t.

Source of data	Calculated according to VMD0015 v2.2, equation 13.
Description of measurement methods and procedures applied	Calculated based on the Length of skid trails in stratum i in year t ($L_{SKID,i,t}$) and the Skid trail emissions factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum I (SK_i), based on VMD0015 v2.2, equation 13.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	The length of skid trails is taken from forest exploration maps. These maps contain information about all felled trees, primary, secondary and skid trails. Skid trail emissions factor is calculated according to VMD0015 v2.2, equations 14. See VMD0015 v2.2, equation 13 and 14 at section 4.2.
Comments	-

Data / Parameter	$L_{SKID,i,t}$
Data unit	m
Description	Length of skid trails in stratum i in year t.
Source of data	Forest exploration maps and associated GIS files.
Description of measurement methods and procedures applied	Measured in GIS.

Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	Forest exploration maps contain information about all felled trees, primary and secondary roads, and skid trails.

Data / Parameter	SK_i
Data unit	$t\ CO_2-e.m^{-1}$
Description	Skid trail emission factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum i .
Source of data	Calculated according to VMD0015 v2.2, equation 14
Description of measurement methods and procedures applied	Calculated based on mean live carbon stock of trees and non-tree biomass assumed to be killed per unit area in creation of skid trail in stratum I ($C_{dest, i}$), the carbon stock change in organic carbon resulting from skid trail creation in stratum I ($\Delta C_{SOC_{sk,i}}$) and the Mean width of skid trails in stratum I (W_{SKID}) according to VMD0015 v2.2, equation 14.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0

Monitoring equipment	-
QA/QC procedures applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	Mean live carbon stock of trees and non-tree biomass assumed to be killed is calculated taking in consideration the average carbon stock of trees below the maximum diameter tree that can be within the path of a skid trail, following VMD0015 v2.2, step 02 criteria, and equation 15. Mean width of skid trails is determined in function of the machinery used at the project site. This value will vary among PAIs. See VMD0015 v2.2, equation 14 and 15 at section 4.2.

Data / Parameter	$C_{dest, i}$
Data unit	t CO ₂ -e
Description	Mean live carbon stock of trees and non-tree biomass assumed to be killed per unit area in creation of skid trail in stratum i.
Source of data	Calculated according to VMD0015 v2.2, equation 15.
Description of measurement methods and procedures applied	Calculated based on Carbon stock in aboveground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail in stratum I ($C_{AB_tree_dest,i}$), carbon stock in belowground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail in stratum I ($C_{BB_tree_dest,i}$), Carbon stock in aboveground non-tree biomass in stratum I ($C_{AB_non-tree,i}$) and the Carbon stock in belowground non-tree biomass in stratum I ($C_{BB_non-tree,i}$), based on VMD0015 v2.2, equation 15.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0

	Ex-post:0
Monitoring equipment	N/A
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	Mean live carbon stock of trees and non-tree biomass assumed to be killed is calculated taking in consideration the average carbon stock of trees below the maximum diameter tree that can be within the path of a skid trail, following VMD0015 v2.2, step 02 criteria, and equation 15. See VMD0015 v2.2, equation 14 and 15 at section 4.2.
Comments	-

Data / Parameter	$\Delta C_{SOC_sk,i}$
Data unit	t CO ₂ -e
Description	Carbon stock change in soil organic carbon resulting from skid trail creation in stratum i
Source of data	Calculated according to VMD0015 v2.2, equation 09
Description of measurement methods and procedures applied	Calculated based on mean carbon stock in soil organic carbon for stratum i, in year t=0 ($C_{SOC,i,t=0}$), the Land use factor after conversion; dimensionless (FLU), the management factor after conversion (FMG) and the Input factor after conversion (FI), according to VMD0015 v2.2, equation 09.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-

QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	Initial mean carbon stock in soil organic carbon is measured in laboratory through primary data collected in the field, following VMD0004 v1.0 criteria (see appendix 07 – SOP). Land use, management and input factors are default value given by IPCC (2006). See VMD0015 v2.2, equation 09 at section 4.2.
Comments	-

Data / Parameter	W_{skid}
Data unit	m
Description	Mean width of skid trails in stratum i
Source of data	Based on the Skidder type model.
Description of measurement methods and procedures applied	Interview with the responsible for the forest management operations at the PAI.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	-

Data / Parameter	$\Delta C_{SOC_sk,i}$
Data unit	t CO ₂ -e ha ⁻¹
Description	Carbon stock change in soil organic carbon resulting from skid trail creation in stratum i.
Source of data	Calculated according to VMD0015 v2.2, equation 09.
Description of measurement methods and procedures applied	Estimates are made based on Mean carbon stock in soil organic carbon for stratum I ($C_{SOC,i,t=0}$), Land use factor after conversion (FLU), Management factor after conversion (FMG), and Input factor after conversion (FI), according to VMD0015 v2.2, equation 09.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	Calculated according to VMD0015 v2.2, equation 09.
Comments	-

Data / Parameter	F_{LU}
Data unit	Dimensionless
Description	Land use factor after conversion.
Source of data	IPCC, (2006).

Description of measurement methods and procedures applied	Default value.
Frequency of monitoring/recording	-
Value applied:	Grasslands: See the applicable values in table 6.2 of the Volume 4, Chp 6, IPCC (2006); Croplands: See the applicable values in tables 5.5 and 5.10 of the Volume 4, Chp 5, IPCC (2006);
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	-

Data / Parameter	F _{MG}
Data unit	Dimensionless
Description	Management factor after conversion.
Source of data	IPCC, (2006).
Description of measurement methods and procedures applied	Default value.
Frequency of monitoring/recording	-
Value applied:	Grasslands: See the applicable values in table 6.2 of the Volume 4, Chp 6, IPCC (2006); Croplands: See the applicable values in tables 5.5 and 5.10 of the Volume 4, Chp 5, IPCC (2006);

Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	-

Data / Parameter	F_l
Data unit	Dimensionless
Description	Input factor after conversion.
Source of data	IPCC, (2006).
Description of measurement methods and procedures applied	Default value.
Frequency of monitoring/recording	-
Value applied:	Grasslands: See the applicable values in table 6.2 of the Volume 4, Chp 6, IPCC (2006); Croplands: See the applicable values in tables 5.5 and 5.10 of the Volume 4, Chp 5, IPCC (2006);
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	-

Data / Parameter	$\Delta C_{ROAD,i,t}$
Data unit	t CO ₂ -e
Description	Change in carbon stock resulting from logging road creation in stratum i in year t
Source of data	Calculated according to VMD0015 v2.2, equation 17
Description of measurement methods and procedures applied	Calculated based on the area of roads in stratum i in year t ($A_{ROAD,i,t}$) and the carbon stock in all pools in the baseline case in stratum I ($C_{BSL,i}$), according to VMD0015 v2.2, equation 17.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	Area of roads is taken from post-harvest assessment reports and post-harvest maps that are based on field measurements. Carbon stock in all pools in the baseline case are estimated as part of the baseline procedures. See VMD0015 v2.2, equation 17 at section 4.2.
Comments	-

Data / Parameter	$A_{ROAD,i,t}$
Data unit	ha
Description	Area of roads in stratum i in year t.
Source of data	Post exploration reports and associated GIS files.

Description of measurement methods and procedures applied	Measured in GIS.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post:0
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	-

Data / Parameter	$\Delta C_{DECKS,i,t}$
Data unit	t CO ₂ -e
Description	Change in carbon stock resulting from logging deck creation in stratum i in year t.
Source of data	Calculated according to VMD0015 v2.2, equation 18.
Description of measurement methods and procedures applied	Calculated based on the area of logging decks in stratum i in year t ($A_{DECKS,i,t}$) and the carbon stock in all pools in the baseline case in stratum I ($C_{BSL,i}$) according to VMD0015 v2.2, equation 18.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-

QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	Area of logging decks is taken from post-harvest assessment reports and post-harvest maps that are based on field measurements. Carbon stock in all pools in the baseline case are estimated as part of the baseline procedures. See VMD0015 v2.2, equation 17 at section 4.2.
Comments	-

Data / Parameter	ADECKS,i,t
Data unit	ha
Description	Area of logging decks in stratum i in year t.
Source of data	Post exploration reports and post-harvest maps.
Description of measurement methods and procedures applied	Area of logging decks is taken from post exploration reports and post-harvest maps that are based on field measurements.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	-

Data / Parameter	$A_{DistPA,q,i,t}$
Data unit	ha
Description	Area impacted by natural disturbance in the project stratum i converted to natural disturbance stratum q in year t; ha
Source of data	Remote Sensing imagery combined with ground verification
Description of measurement methods and procedures applied	Measured in a GIS environment through the DETER database, NBR analysis in Google Earth Engine and verified in the field using direct observation on site.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 47. Ex-post: See the values applied in table 83.
Monitoring equipment	Remote sensing data, DETER database, field collection and GIS software's
QA/QC procedures applied	Orbital imaging steps will be supervised by a professional with more than ten years of experience remote sensing in tropical forests. In addition, field surveys will be adopted to effect and guarantee quality imaging at extremely high spatial resolution. All Digital Image Processing (PDI) steps will be internally rechecked. The orbital imaging results will be compared with data collected in the field for validation, where such quality assurance and control procedures will be led by forest inventory specialists from the BRC team (see Appendix 07).
Purpose of data	Calculation of project emissions.
Calculation method	Spatially explicit information on forest degradation is downloaded from the DETER database and clipped with the spatial boundaries of the project area. A field incursion is carried out mapping the forest canopy and the forest floor surface. Forest gaps are identified based on mapping results and georeferenced. Investigation through direct observation of the mapped sites is

	carried out to conclude whether the area in question has been affected by any natural source of degradation.
Comments	-

Data / Parameter	DDRF (Degradation Disturbance Reduction Factor)
Data unit	dimensionless
Description	Factor by which $A_{dist,q,i,t}$ is reduced to reflect the impact of the baseline degradation on available stocks for reduction due to disturbance
Source of data	Calculated according to VMD0015 v2.2, equation 19
Description of measurement methods and procedures applied	Calculated based on the average volume of fuelwood gathered in the project area in the baseline scenario in stratum i in year t ($FG_{BSL,i,t}$), the mean wood density of species harvested for fuelwood or charcoal production (D_{mn}), the carbon fraction of dry matter (CF), the area of stratum i (A_i) and the carbon stock in all pools in the baseline in stratum i ($C_{BSL,i}$), according to VMD0015 v2.2, equation 19.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	Average volume of fuelwood gathered in the project area is estimated based on a Participatory Rural Appraisal (PRA). Basic wood density of all species is taken from the tropical wood density

	database (annex 12). Carbon fraction of biomass for dry matter is default according to IPCC (2006). Carbon stock in all pools in the baseline is calculated according to baseline procedures. The area impacted by natural disturbance is proportionally reduced to reflect previous firewood/charcoal extraction, according to VMD0015 v2.2, equation 19. See VMD0015 v2.2, equations 19 and 20 at section 4.2.
Comments	-

Data / Parameter	$A_{burn,i,t}$
Data unit	ha
Description	Area burnt for stratum i in year t.
Source of data	Equal to $A_{DistPA,q,i,t} + A_{DefPA,i,u,t}$ in the project case.
Description of measurement methods and procedures applied	For the calculation of project emissions, the burned area is considered equivalent to burn scars monitored plus annual deforested area monitored, assuming that all deforestation is preceded by a fire to clear the land in the project case.
Frequency of monitoring/recording	Annual.
Value applied:	Ex-ante: See the values applied in table 50. Ex-post: See the values applied in table 63.
Monitoring equipment	NBR analysis in Google Earth Engine.
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$C_{P,Dist,q,i}$
Data unit	t CO ₂ -e ha ⁻¹
Description	Carbon stock in all pools in post-natural disturbance q in baseline stratum i.
Source of data	Calculated according to VMD0015 v2.2, equation 24.
Description of measurement methods and procedures applied	Calculated based on the carbon stock in aboveground tree biomass in stratum I ($C_{AB_tree,i}$), carbon stock in belowground tree biomass in stratum I ($C_{BB_tree,i}$), carbon stock in aboveground non-tree vegetation in stratum I ($C_{AB_non-tree,i}$), carbon stock in belowground non-tree vegetation in stratum I ($C_{BB_non-tree,i}$), carbon stock in dead wood in stratum I ($C_{DW,i}$), carbon stock in litter in stratum I ($C_{LI,i}$), mean stock in soil organic carbon in stratum I ($C_{SOC,i}$), according to VMD0015 v2.2, equation 24.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: Coefficient of biomass loss 0.1-0.5, according with Alencar et al. 2006 Ex-post: Coefficient of biomass loss 0.1-0.5, according with Alencar et al. 2006
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	Carbon stock in pools in post-natural disturbance strata is measured following a standard operational procedure for biomass inventory (appendix 07), which is based on VMD0001 v1.1, VMD0002 v1.0, VMD0003 v1.0 and VMD0004 v1.0 criteria. Carbon stock sequestered in wood products from harvests following natural disturbance in post-natural disturbance stratum is calculated according to VMD0005 v1.1 in the case of use of wood from the stratum where the disturbances of natural cause occurred. See VMD0015 v2.2, equation 24 at section 4.2.

Comments	
Data / Parameter	$\Delta C_{P,Dist,q,i,t}$
Data unit	t CO ₂ -e ha ⁻¹
Description	Net carbon stock changes in pools as a result of natural disturbance in the project case in post-natural disturbance stratum q in stratum i in year t.
Source of data	Calculated according to VMD0015 v2.2, equation 23.
Description of measurement methods and procedures applied	Calculated based on the carbon stock in all pools in the baseline case in stratum I (CBSL,i), carbon stock in pools in post-natural disturbance strata q in stratum I (CP,Dist,q,i) and carbon stock sequestered in wood products from harvests following natural disturbance in post-natural disturbance stratum q, in stratum I (CDist, WP,q,i), according to VMD0015 v2.2, equation 23.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: tables 48. Ex-post: table 84.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	Carbon stock in all pools in the baseline case is calculated as part of the procedures to estimate baseline GHG emissions. Carbon stock in pools in post-natural disturbance strata is measured following a standard operational procedure for biomass inventory (appendix 07), which is based on VMD0001 v1.1, VMD0002 v1.0, VMD0003 v1.0 and VMD0004 v1.0 criteria. Carbon stock sequestered in wood products from harvests following natural disturbance in post-natural disturbance stratum is calculated according to VMD0005 v1.1 in the case of use of wood from the

	stratum where the disturbances of natural cause occurred. See VMD0015 v2.2, equation 23 at section 4.2.
Comments	-

Data / Parameter	$\Delta C_{P,DistPA,i,t}$
Data unit	t CO ₂ -e
Description	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i in year t.
Source of data	Calculated according to VMD0015 v2.2, equation 20.
Description of measurement methods and procedures applied	Estimated based on the Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, in year t ($A_{DistPA,q,i,t}$), and the net carbon stock changes in pools as a result of natural disturbance in post-natural disturbance stratum q in stratum i in year t ($\Delta C_{P,Dist,q,i,t}$), according to VMD0015 v2.2, equation 20.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 49. Ex-post: See the values applied in table 84.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions
Calculation method	Calculated according to VMD0015 v2.2, equation 20.
Comments	-

Data / Parameter	$GHG_{P,E,i,t}$
Data unit	t CO _{2e} .yr ⁻¹
Description	Greenhouse gas emissions as a result of deforestation activities within the within the project area in the project case stratum i in year t.
Source of data	Calculated based on VMD0006 v1.4 equation 30.
Description of measurement methods and procedures applied	Calculated based on the non-CO ₂ emissions due to biomass burning in stratum i in year t ($E_{BiomassBurn,i,t}$), according to VMD0006 v1.4 equation 15.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	There is no deforestation recorded, so the values applied for ex-ante and ex-post are set as 0.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	Calculated based on VMD0006 v1.4 equation 30.
Comments	Net CO _{2e} emission from fossil fuel combustion in stratum i in year t ($E_{FC,i,t}$) and direct N ₂ O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t ($N_2O_{direct-N,i,t}$) are conservatively excluded from the project scope and the calculation of the baseline estimates following VM0007 v1.6 section 5.4 criteria.

Data / Parameter	$E_{BiomassBurn,i,t}$
Data unit	t CO _{2e}
Description	Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO ₂ , CH ₄ , N ₂ O)

Source of data	Calculated based on VMD0013 v1.3 equation 1.
Description of measurement methods and procedures applied	Calculated based on area burnt for stratum i in year t ($A_{burn,i,t}$), average aboveground biomass stock before burning stratum i, in year t ($B_{i,t}$), combustion factor for stratum i (unitless) ($COMF_i$), emission factor for stratum i for gas g (Gg_i) and the Global warming potential for gas g (GWP_g), according to VMD0013 v1.3 equation 1.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 50. Ex-post: See the values monitored in table 87.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	Calculated based on VMD0013 v1.3 equation 1.
Comments	-

Data / Parameter	$\Delta C_{WPS-REDD}$
Data unit	t CO ₂ -e
Description	Net GHG emissions in the REDD project scenario up to year t.
Source of data	Calculated according to VMD0015 v2.2, equation 01.
Description of measurement methods and procedures applied	Calculated based on net carbon stock change as a result of deforestation in the project area in the project case in stratum i in year t ($\Delta C_{P,DefPA,i,t}$), Net carbon stock change as a result of degradation in the project area in the project case in stratum i in year t ($\Delta C_{P,Deg,i,t}$), Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum i in year t ($\Delta C_{P,DistPA,i,t}$) and Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in

	the project case in stratum i in year t ($GHG_{P-E,i,t}$), according to VMD0015 v2.2, equation 01.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 51. Ex-post: See the values applied in table 74.
Monitoring equipment	N/A
QA/QC procedures applied	BRC GHG information system and controls associated with the project and its monitoring. This information system rules the process for obtaining, recording, compiling and analyzing data and information important for quantifying and reporting GHG emissions and removals relevant for the project (including leakage) and baseline scenario (see Appendix 15).
Purpose of data	Calculation of project emissions
Calculation method	See VMD0015 v2.2, equation 01.
Comments	-

Data / Parameter	$\Delta C_{LK-REDD}$
Data unit	t CO ₂ e
Description	Net GHG emissions due to leakage from the REDD project activity up to year t*
Source of data	Calculated according to VMD0007 v1.6 equation 4.
Description of measurement methods and procedures applied	Calculated based on net GHG emissions due to activity shifting leakage for projects preventing planned deforestation up to year t ($\Delta C_{LK-AS,planned}$), and the Net GHG emissions due to market-effects leakage up to year t* (ΔC_{LK-ME}), according to VMD0007 v1.6 equation 4.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.

Value applied:	Ex-ante: See the values applied in table 52. Ex-post: See the values applied in table 88.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage.
Calculation method	Calculated according to VMD0007 v1.6 equation 4.
Comments	-

Data / Parameter	$\Delta C_{LK-AS,planned}$
Data unit	t CO ₂ e
Description	Net GHG emissions due to activity shifting leakage for projects preventing planned deforestation up to year t*
Source of data	Calculated according to VMD0009 v1.3, equation 01.
Description of measurement methods and procedures applied	Calculated based on the area of activity shifting leakage in stratum i in year t ($LKA_{planned,i,t}$), the net carbon stock changes in all pre-deforestation pools in baseline stratum I, ($\Delta C_{BSL,i}$) and the Greenhouse gas emissions as a result of leakage of avoiding deforestation activities in stratum i in year t ($GHG_{LK,E,i,t}$), according to VMD0009 v1.3, equation 01.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 52. Ex-post: See the values applied in table 88.
Monitoring equipment	-

QA/QC procedures applied	-
Purpose of data	Calculation of leakage.
Calculation method	Calculated according to VMD0009 v1.3, equation 01.
Comments	-

Data / Parameter	$LK_{Aplanned,i,t}$
Data unit	ha
Description	The area of activity shifting leakage in stratum i in year t.
Source of data	Calculated according to VMD0009 v1.3, equation 06.
Description of measurement methods and procedures applied	Calculated according to the total area of monitored deforestation by the baseline agent of the planned deforestation in stratum i in year t ($A_{defLK,i,t}$), and the New calculated forest clearance by the baseline agent of the planned deforestation in stratum i in year t where no leakage is occurring ($NewR_{i,t}$).
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 52. Ex-post: See the values applied in table 88.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage.
Calculation method	Calculated according to VMD0009 v1.3, equation 06.
Comments	-

Data / Parameter	$A_{defLK,i,t}$
Data unit	ha
Description	The total area of monitored deforestation by the baseline agent of the planned deforestation in stratum i in year t .
Source of data	Remote sensing imagery (Sentinel 2, Landsat 8), PRODES database.
Description of measurement methods and procedures applied	Annual deforestation is measured in GIS using remote sensing techniques and reported with spatial explicit data by raster and shapefile. evidence.
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: See the values applied in table 52. Ex-post: See the values applied in table 89.
Monitoring equipment	Landsat 8 OLI, Sentinel MSI.
QA/QC procedures applied	Accuracy assessment of PRODES classification was performed by comparing each class of the land cover map from the reference period (2011 and 2020) with a set of XX points randomly distributed over the reference region for each year. The reference data used for this step comes from the visual interpretation of high spatial resolution images available in Google Earth. The global accuracy of the mapping for the different classes of land cover presented values above XX% for all three classes in each year analyzed. The overall accuracy of the forest cover reference map (2020) was XX%. See more details in the Appendix 13.
Purpose of data	Calculation of leakage.
Calculation method	Classified images with information about the area of annual deforestation in Brazil are downloaded from PRODES websites and clipped with the project area spatial limits. Images from Sentinel are downloaded from ESA.
Comments	-

Data / Parameter	NewR _{i,t}
Data unit	ha
Description	New calculated forest clearance by the baseline agent of the planned deforestation in stratum i in year t where no leakage is occurring.
Source of data	Calculated according to VMD0009 v1.3, equation 04 or 05.
Description of measurement methods and procedures applied	Calculated based on projected annual proportion of land that will be deforested outside the project boundary in stratum i in year t ($D_{planned,i,t,OP}$), and Total area of planned deforestation outside the project boundary over the baseline period for stratum I ($A_{planned,i,OP}$), according to equation 04 or based on Deforestation by the baseline agent of the planned deforestation in stratum i in year t in the absence of the project ($WoPR_{i,t}$), projected annual proportion of land that will be deforested in project stratum i in year t ($D_{planned,i,t}$), and Total area of planned deforestation over the baseline period for project stratum I ($A_{planned,i}$).
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage.
Calculation method	Calculated according to VMD0009 v1.3, equation 04 or 05.
Comments	Equation 04 is used when an identified deforestation agent has made public a business plan or similar documentation containing data suited for estimating a conversion rate over the baseline period. Equation 05 is used when the conversion rate must be estimated. In the case of equation 05 is used, the projected annual proportion of land that will be deforested is the same used to set the baseline, while the deforestation provoked by the

	identified deforestation agent is calculated by VMD0009 v1.3, equation 01 or 02.
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Data / Parameter	$D_{\text{planned},i,t,OP}$
Data unit	%
Description	Projected annual proportion of land that will be deforested outside the project boundary in stratum i in year t .
Source of data	Deforestation permits for areas outside the project boundary.
Description of measurement methods and procedures applied	Defined in deforestation permits.
Frequency of monitoring/recording	N/A
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of leakage.
Calculation method	N/A
Comments	This parameter is used when an identified deforestation agent has made public a business plan or similar documentation containing data suited for estimating a conversion rate over the baseline period in areas outside the project boundary.

Data / Parameter	$A_{\text{planned},i,OP}$
Data unit	ha

Description	Total area of planned deforestation outside the project boundary over the baseline period for stratum i
Source of data	Deforestation permits for areas outside the project boundary.
Description of measurement methods and procedures applied	Defined in deforestation permits.
Frequency of monitoring/recording	N/A
Value applied:	Ex-ante: 0 Ex-post: 0
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of leakage.
Calculation method	N/A
Comments	This parameter is used when an identified deforestation agent has made public a business plan or similar documentation containing data suited for estimating a conversion rate over the baseline period in areas outside the project boundary.

Data / Parameter	$WoPR_{i,t}$
Data unit	ha
Description	Deforestation by the baseline agent of the planned deforestation in the absence of the project in stratum i in year t.
Source of data	Calculated according to VMD0009 v1.3, equation 01 or 02.
Description of measurement methods and procedures applied	Projected based on linear regression according to VMD0009 v1.3 equation 01 or based on number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years

	prior to project implementation in stratum i by agent ag within the country ($HistHa_{i,ag}$), according to VMD0009 v1.3 equation 02.
Frequency of monitoring/recording	Annual
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of leakage.
Calculation method	Equation 01 is used when the results of the analysis must produce a statistically significant regression with a $p \leq 0.05$ and an adjusted r^2 of ≥ 0.75 . The regression is calculated based on the deforested by the deforestation agent each year over the previous five years within the country. Where no statistically significant regression can be found, equation 02 is used
Comments	-

Data / Parameter	$HistHa_{i,ag}$
Data unit	ha
Description	Number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years prior to project implementation in stratum i by agent ag within the country
Source of data	Remote sensing imagery (Sentinel 2, Landsat 8), PRODES database.
Description of measurement methods and procedures applied	Annual deforestation is measured in GIS using remote sensing techniques and reported with spatial explicit data by raster and shapefile. evidence.
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: 0

	Ex-post: 0
Monitoring equipment	Landsat 8 OLI, Sentinel MSI.
QA/QC procedures applied	Accuracy assessment of PRODES classification was performed by comparing each class of the land cover map from the reference period (2011 and 2020) with a set of 200 points randomly distributed over the reference region for each year. The reference data used for this step comes from the visual interpretation of high spatial resolution images available in Google Earth. The global accuracy of the mapping for the different classes of land cover presented values above XX% for all three classes in each year analyzed. The overall accuracy of the forest cover reference map (2020) was 95,5%. See more details in the Appendix 13.
Purpose of data	Calculation of leakage.
Calculation method	Classified images with information about the area of annual deforestation in Brazil are downloaded from PRODES websites and clipped with the project area spatial limits. Images from Sentinel are downloaded from ESA.
Comments	-

Data / Parameter	$GHG_{LK,E,i,t}$
Data unit	t CO _{2e}
Description	Greenhouse gas emissions as a result of leakage of avoiding deforestation activities in stratum i in year t.
Source of data	Calculated according to VMD0009 v1.3, equation 07.
Description of measurement methods and procedures applied	Calculated based on Non-CO ₂ emissions due to biomass burning in stratum i in year t ($E_{biomassburn,i,t}$), according to VMD0009 v1.3, equation 07.
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: 0 Ex-post: 0

Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage
Calculation method	Calculated according to VMD0009 v1.3, equation 07
Comments	-

Data / Parameter	ΔC_{LK-ME}
Data unit	t CO ₂ -e
Description	Net greenhouse gas emissions due to market- effects leakage
Source of data	Calculated according to VMD0011 v1.0 equation 1.
Description of measurement methods and procedures applied	Calculated based on Total GHG emissions due to market- effects leakage through decreased timber harvest ($LK_{MarketEffects,timber}$), and Total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets ($LK_{MarketEffects,FW/C}$), according to VMD0011 v1.0 equation 1.
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: See the values applied in table 53. Ex-post: See the values applied in table 91.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage
Calculation method	Calculated according to VMD0011 v1.0 equation 1.

Comments	-
Data / Parameter	LK _{MarketEffects,timber}
Data unit	t CO ₂ -e
Description	Total GHG emissions due to market- effects leakage through decreased timber harvest
Source of data	Calculated according to VMD0011 v1.0 equation 2
Description of measurement methods and procedures applied	Calculated according to leakage factor for market-effects calculations (LF _{ME}) and summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project (ALT _i), according to VMD0011 v1.0 equation 2.
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: See the values applied in table 53. Ex-post: See the values applied in table 91.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage
Calculation method	Calculated according to VMD0011 v1.0 equation 2
Comments	-

Data / Parameter	LF _{ME}
Data unit	Dimensionless
Description	Leakage factor for market-effects calculations.

Source of data	Default data from VMD0011 v1.0
Description of measurement methods and procedures applied	A comparison between the proportion of total biomass in commercial species that is merchantable (PMP_i) and the mean proportion of total biomass that is merchantable for each forest type (PML_{FT}) was performed based on the wood volume to be extracted in PAIs #01 and #02 and the wood volume found by the RADAMBRASIL project for all types of forest existing in the project area in all states of Amazonia Legal.
Frequency of monitoring/recording	Annual
Value applied:	0.2
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage
Calculation method	See Appendix 05.
Comments	-

Data / Parameter	PMP_i
Data unit	m^3
Description	Total volume in commercial species that is merchantable.
Source of data	Pre-exploratory inventories/Forest Exploration Plans.
Description of measurement methods and procedures applied	Commercial species volume was evaluated in both PAIs for all trees with DBH above 30cm.
Frequency of monitoring/recording	-
Value applied:	PAI#01: 17 (commercial timber) / 03 (fuelwood, charcoal) PAI#02: 28 (commercial timber) / 7.2 (fuelwood, charcoal)

Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	-
Calculation method	See Appendix 03 and 05.
Comments	-

Data / Parameter	LDF
Data unit	t C m-3
Description	Logging damage factor.
Source of data	Default value provided by VMD0011 v1.0.
Description of measurement methods and procedures applied	-
Frequency of monitoring/recording	-
Value applied:	0.53
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage.
Calculation method	-
Comments	See VMD0011 v1.0 equation 4.

Data / Parameter	LIF
Data unit	t C m-3
Description	Logging infrastructure factor.
Source of data	Default value provided by VMD0011 v1.0.
Description of measurement methods and procedures applied	-
Frequency of monitoring/recording	-
Value applied:	0.29
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage.
Calculation method	-
Comments	See VMD0011 v1.0 equation 4.

Data / Parameter	LK _{MarketEffects,FW/C}
Data unit	t CO ₂ -e
Description	Total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets
Source of data	Calculated according to VMD0011 v1.2 equation 6.
Description of measurement methods and procedures applied	Calculated based on Leakage factor for market effects calculations (LF _{ME}), the fuelwood/charcoal leakage management adjustment factor (dimensionless) (LKFC _{MAF}), and the summed emissions from fuelwood/charcoal harvests in stratum i in the

	baseline case potentially displaced through implementation of carbon ($AL_{FW/C,i}$), according to VMD0011 v1.2 equation 6.
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: See the values applied in table 53. Ex-post: See the values applied in table 91.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage
Calculation method	Calculated according to VMD0011 v1.2 equation 6.
Comments	-

Data / Parameter	NER_{REDD}
Data unit	t CO ₂ e
Description	Total net GHG emission reductions of the REDD project activity up to year t (t CO ₂ e).
Source of data	Calculated according to VM0007 v1.7 equation 2.
Description of measurement methods and procedures applied	Calculated based on the net GHG emissions in the REDD baseline scenario up to year t ($\Delta C_{BSL-REDD}$), the net GHG emissions in the REDD project scenario up to year t ($\Delta C_{WPS-REDD}$) and the net GHG emissions due to leakage from the REDD project activity up to year t ($\Delta C_{LK-REDD}$), according to VM0007 v1.7 equation 2.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 56. Ex-post: See the values applied in table 92.

Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs
Calculation method	According to VM0007 v1.7 equation 2.
Comments	-

Data / Parameter	Buffer _{Planned}
Data unit	t CO ₂ e
Description	Buffer withholding for avoiding planned deforestation project activities
Source of data	Calculated according to VM0007 v1.7 equation 14.
Description of measurement methods and procedures applied	Calculated based on the net greenhouse gas emissions in the baseline from planned deforestation up to year t ($\Delta C_{BSL,planned}$), the emission from fossil fuel combustion in stratum i in year t ($E_{FC,i,t}$), the Direct N ₂ O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t ($N_{2O_{direct-i,t}}$), and the buffer withholding percentage (Buffer%), according to VM0007 v1.7 equation 14.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex- ante: See the values applied in table 57. Ex-post: See the values applied in table 95.
Monitoring equipment	-
QA/QC procedures applied	-

Purpose of data	Calculation of VCUs
Calculation method	Calculated according to VM0007 v1.7 equation 14.
Comments	See details in Appendix IV.

Data / Parameter	Uncertainty _{REDD-BSL,SS}
Data unit	%
Description	Total uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline scenario
Source of data	Calculated according to VMD0017 v2.2 equation 5.
Description of measurement methods and procedures applied	Calculated based on the percentage uncertainty in the combined carbon stocks and greenhouse gas sources in stratum i in the REDD baseline scenario ($U_{REDD-BSL,SS,i}$), and the sum of combined carbon stocks and GHG sources in the REDD baseline scenario ($E_{REDD-BSL,SS,t,i}$), according to VMD0017 v2.2 equation 5.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 56. Ex-post: See the values applied in table 94.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs
Calculation method	Calculated according to VMD0017 v2.2 equation 5.
Comments	Uncertainty in baseline rate of deforestation is set as zero ($Uncertainty_{REDD-BSL,RATE} = 0$), as the deforestation rates are based on actual deforestation plans, following VMD0017 v2.2, section 5.1.1 criteria. In this sense $Uncertainty_{REDD-BSL,SS}$ equals to

	cumulative uncertainty in REDD baseline scenario up to year t ($Uncertainty_{REDD-BSL,t*}$).
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Data / Parameter	$Uncertainty_{REDD-WPS}$
Data unit	%
Description	Total uncertainty in the REDD project scenario
Source of data	Calculated according to VMD0017 v2.2 equation 13.
Description of measurement methods and procedures applied	Calculated according to the percentage uncertainty in the combined carbon stocks and greenhouse gas sources in stratum i in the REDD project scenario ($U_{REDD-WPS,SS,i}$) and the sum of combined carbon stocks and GHG sources multiplied by the area of stratum i (A_i) in the REDD project scenario ($E_{REDD-WPS,SS,t,i}$), according to VMD0017 v2.2 equation 13.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 56. Ex-post: See the values applied in table 94.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs.
Calculation method	Calculated according to VMD0017 v2.2 equation 13.
Comments	-

Data / Parameter	NER_{REDD+_ERROR}
Data unit	%

Description	Cumulative uncertainty for the REDD+ project activities up to year t
Source of data	Calculated according to VMD0017 v2.2 equation 21
Description of measurement methods and procedures applied	Calculated based on Cumulative uncertainty in REDD baseline scenario up to year t ($Uncertainty_{REDD_BSL,t}$), the total uncertainty in the REDD project scenario ($Uncertainty_{REDD_WPS}$), the Net GHG emissions in the REDD baseline scenario up to year t ($\Delta C_{BSL-REDD,t}$), and the Net GHG emissions in the REDD project scenario up to year t ($\Delta C_{WPS-REDD,t}$), according to VMD0017 v2.2 equation 21
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years
Value applied:	Ex-ante: See the values applied in table 56. Ex-post: See the values applied in table 94.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs
Calculation method	Calculated according to VMD0017 v2.2 equation 21
Comments	-

Data / Parameter	Adjusted_NER _{REDD+}
Data unit	%
Description	Total net GHG emission reductions of the REDD+ project activities up to year t* adjusted to account for uncertainty
Source of data	Calculated according to VMD0017 v2.2 equation 21
Description of measurement methods and procedures applied	Calculated based on the total net GHG emission reductions of the REDD project activity up to year t (NER _{REDD}), and the cumulative

	uncertainty for the REDD+ project activities up to year t (NER_{REDD+_ERROR}).
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 56. Ex-post: See the values applied in table 94.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs.
Calculation method	Calculated according to VMD0017 v2.2 equation 21.
Comments	-

Data / Parameter	VCUt
Data unit	VCU
Description	Number of Verified Carbon Units at year t^* or $t_2 - t_1$
Source of data	Calculated according to VMD0017 v2.2 equation 19.
Description of measurement methods and procedures applied	Calculated based on the total net GHG emission reductions of the REDD+ project activity up adjusted to account for uncertainty ($Adjusted_NER_{REDD+}$), and the total permanence risk buffer withholding ($Buffer_{Planned}$), according to VMD0017 v2.2 equation 19.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in table 57. Ex-post: See the values applied in table 95.

Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs
Calculation method	Calculated according to VMD0017 v2.2 equation19.
Comments	-

6.3. Monitoring Plan

Project implementation will be monitored considering project activities. This GPD presents a series of previously established potential project activities, some of them are under development yet, based on beneficiary's interests. Project activities may vary between instances according to mapped needs. BRC commits to improve the project activities by including the CCB standard in the near future, reinforcing the impacts caused on climate, communities and biodiversity on the project region.

6.3.1. Monitoring of Project Implementation

The below provides relevant information for this task. The BRC will be responsible for implementing the project activity and monitoring it. Implementation of specific project activities may be carried out by external consultants operating under the supervision of the BRC. The digital files will be stored in the BRC database.

Table 59 – Project Activities.

Project Axis	Standardized Benefits Category	Project Activity	Technical description of the monitoring task
Community	Health	Advocacy	Articulation with public authorities to support programs and activities organized by public institutions to improve the health assistance to the communities the BRC is working with. It will be recorded based on numbers of reunions between parts, and it will be presented in periodic monitoring reports.

Project Axis	Standardized Benefits Category	Project Activity	Technical description of the monitoring task
Community	Health	Infrastructure and campaigns	Support to improve infrastructure and covering of health campaigns. It will be recorded based on numbers infrastructure installed or renovated, and in numbers of attendances, and it will be presented in periodic monitoring reports.
Community	Education	Advocacy	Articulation with public authorities to support programs and activities organized by public institutions to improve the educational quality in the communities the BRC is working with. It will be recorded based on numbers of reunions between parts, and it will be presented in periodic monitoring reports.
Community	Education	Infrastructure and equipment	Support to improve infrastructure and school equipment. It will be recorded based on numbers of infrastructure installed or renovated and through numbers of equipment donated and installed, and it will be presented in periodic monitoring reports.
Community	Education	Lectures	Fostering the schools in its demands, as themes related to biodiversity, environmental issues, natural conservation, climate change, and what shows up. It will be recorded based on numbers of lectures promoted and of participants, and it will be presented in periodic monitoring reports.
Community	Water	Access to clean water	Potability analysis, artesian well and other strategies (to be mapped) will be implemented to guarantee access to quality water. It will be recorded based on numbers of families accessing the new good, and it will be presented in periodic monitoring reports.
Community	Employment	Jobs	BRC is going to hire community members to work in the field. It will be done, usually, on a daily paid basis to specific services (field guide, forestry worker, forestry inventory worker, bricklayer, carpenter, etc). It will be recorded based on numbers of workers hired during a year period, and it will be presented in periodic monitoring reports.
Community	Well-being	Under-development	Under-development
Community	Training	Under-development	Under-development
Community	Livelihoods	Under-development	Under-development

6.3.2. Monitoring of Actual Carbon Stock Changes, GHG emissions and Leakage

This monitoring task will follow VMD00015 v2.2 criteria, which provides methods for monitoring ex post emissions and removals of GHGs, due to deforestation, forest degradation, natural disturbances and carbon stock enhancement in the project area and leakage belt. The monitoring of actual carbon stock changes and GHG emissions is performed in three steps:

6.3.3. Selection and Analyses of Sources of Land-Use and Land-Cover (LU/LC) Change Data

This project uses different GIS sources to assess changes in land use and land cover in the project area and leakage belt. To compose the initial data for the monitoring process, a set of deforestation and degradation alerts is used. For the annual quantification of the change in land use from the Forest class to the non-Forest class, the Brazilian Amazon Forest Satellite Monitoring Program (PRODES) is used, under the responsibility of the National Institute for Space Research (INPE). To quantify the change in land use continuously on a weekly scale, as well as degradation activities, the Real-Time Deforestation Detection System (DETER) is used, also under the responsibility of INPE (INPE, 2019; Assis et al. 2019).

As a complementary alert system, the Global Forest Watch integrated monitoring system is used, consisting of three alert systems: GLAD (Hansen et al., 2016), GLAD-S2 (Pickens et al., 2020) and RADD (Reiche et al. 2021). Another system used is MapBiomass Alerta (MapBiomass Alerta Project, 2023), a compilation of data from several providers (e.g. INPE, IMAZON, University of Maryland, among others) validated with high-resolution images.

Fire degradation is also monitored using the Fire Information for Resource Management System (FIRMS), under the responsibility of NASA (National Aeronautics and Space Administration). This data distributes real-time active fire information from the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the S-NPP and NOAA20 satellites (Schroeder et al. 2014). These detections are stored weekly and intersected in the Project Areas and Leak Belt. It is very important to note that this data provides fire alerts that allow us to monitor but does not allow us to quantify the area degraded by fire, it only indicates burning activity within a radius of 375 meters. Therefore, using satellite images from DETER data, the area of forest fires within the monitored areas is quantified. In this context, the fire area to be reduced in the biomass stock is measured.

Cartographic information is made available openly and free of charge on the web and is downloaded, stored, and organized. Furthermore, to control and guarantee the quality of initial data alerts, we validate deforestation polygons with visual interpretation using satellite images. The satellite images used to validate the initial data are obtained via Google Earth Engine, distributed by the responsible agencies with correction and normalization processing to extract surface reflectance data. The set of images used is composed of images from the Sentinel 2 satellites (MSI sensor, Multispectral Instrument), Landsat 9 (OLI-2 sensor, Operational Land Imager 2) and monthly

mosaics from Planet NICFI (Norway's International Climate and Forests Initiative Satellite Data Program). The use of SAR (Synthetic Aperture Radar) images from Sentinel 1 is in the process of being implemented. Images from the CBERS 4A satellite (WFI sensor, Wide Field Camera), obtained from the INPE image catalogue, are also used.

6.3.4. Processing LU/LC Change Data

The monitoring system is structured to collect and process data from different sources, such as INPE, FIRMS, GFW and MAPBIOMAS, using the R language. After processing, the data is crossed with the monitored properties and stored. Alert validation occurs weekly, using satellite images manipulated via Google Earth Engine. The results are documented in partial, monthly and annual reports, which include georeferencing, quantification and visual validation of deforestation polygons (Figure 1).

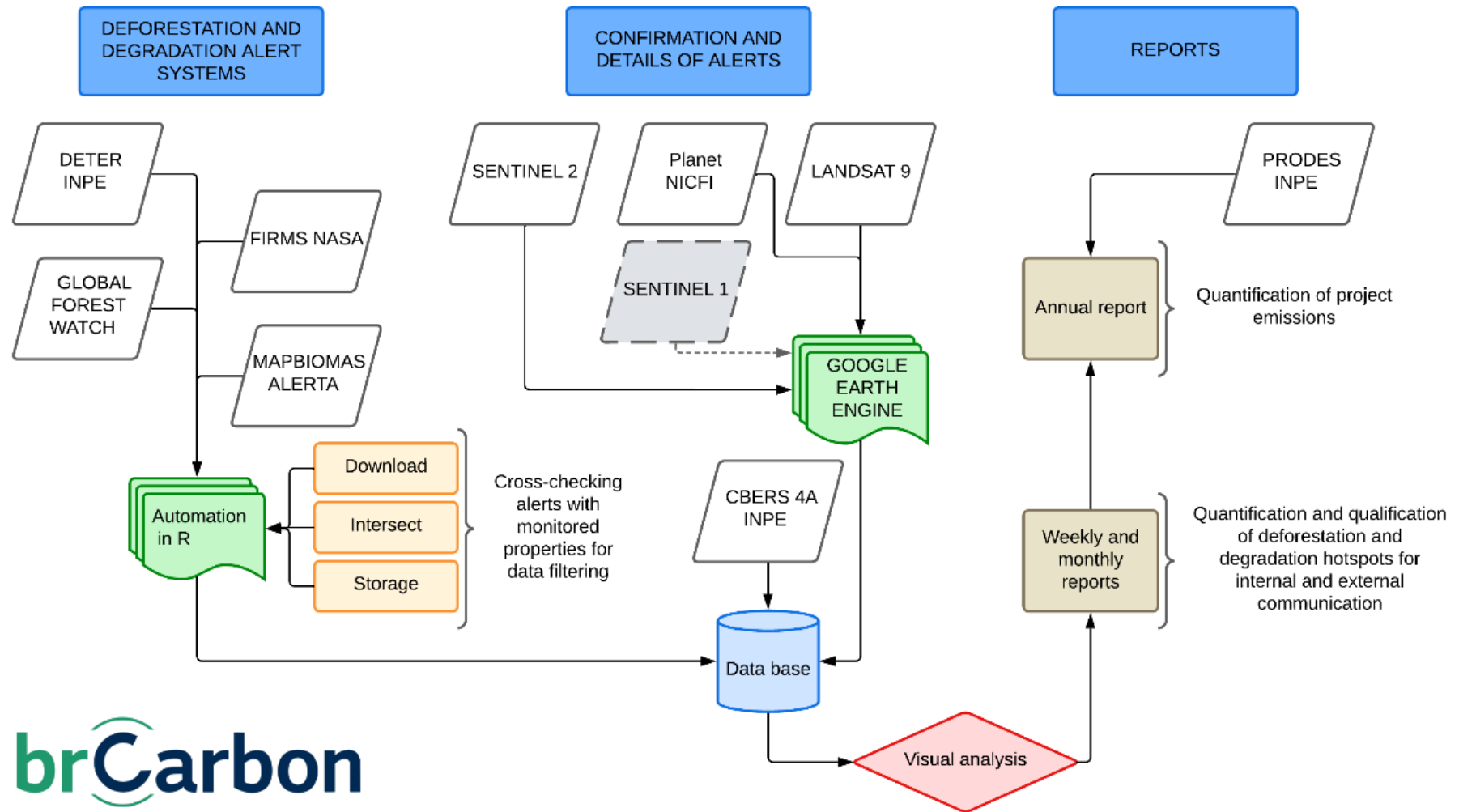


Figure 21. Flowchart of the monitoring system's technical procedures

6.3.4.1. Post-Processing and Accuracy Assessment

PRODES project data will be used annually to monitor land use changes on all lands managed by the identified deforestation agent (including the project area and lands outside the project boundaries). Forest cover reference maps will be generated and updated as soon as the data is released by INPE.

Data from DETER services will be used weekly to evaluate deforestation and forest degradation alerts (ADegW,I, ADistPA,i,t, Aburn,i,t). Alerts of deforestation and forest degradation will be verified with visual analysis using satellite images. If deforestation is confirmed in the visual assessment and by PRODES data, they will be used to estimate GHG emissions due to deforestation in the project area (ADefPA,i,u,t) or activity transfer leakage (ADefLK,i, u,t) in the project scenario. If DETER data is not confirmed by PRODES, but is verified with visual analysis using satellite images, it will be used to update forest cover reference maps and therefore also counted as deforestation in the project area or transfer leakage of activities in the project scenario. DETER data has high temporal resolution and lower spatial resolution than PRODES data, which makes it suitable for generating deforestation alerts, which can be used to guide rapid BRC responses. Likewise, Global Forest Watch alerts are used for this purpose and with a better spatial resolution (10 m). The degraded forests detected up to the project start date were disregarded by the BRC when preparing the first forest benchmark map.

A confusion matrix was generated comparing each land cover map class for the year 2022. A set of 200 random points distributed by the reference region was generated, with 100 points for each map class: forest and deforestation (non-Forest). The evaluation of each point was carried out by photointerpretation using images from Satellite, being classified as ground-truth points to generate the confusion matrix. The global accuracy found for the reference map was 97.0% for both classes in 2022, as shown in Table 60. See APPENDIX_XII-Forest_Benchmark_Classification for details.

Table 60 - Confusion matrix of benchmark map for year 2022.

Class	Forest	Deforestation	Total Geral	Users Accuracy
Forest	98	2	100	98.0
No-forest	3	97	100	97.0
Total Geral	101	99	200	
Producer accuracy	6.7	99.9		Global Accuracy
				97.0

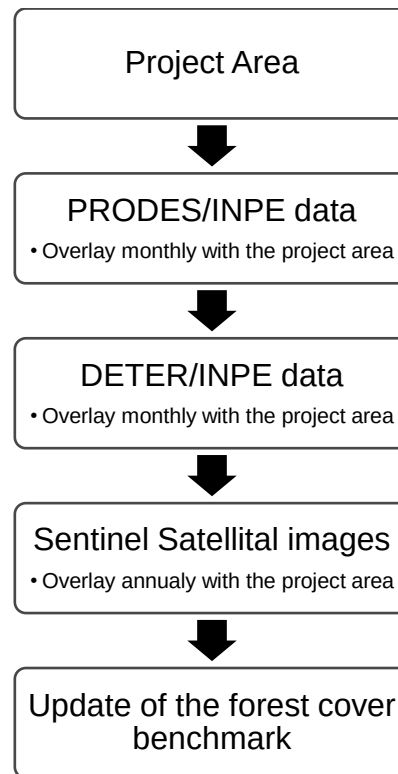


Figure 22 – Monitoring steps flowchart.

6.3.4.2. Interpretation and Analyses

PRODES project data will be used to monitor project area deforestation ($ADefPA,i,u,t$) and activity shifting leakage ($ADefLK,i,u,t$) in the project case. Net carbon stock change as a result of deforestation in the project case in the project area and leakage belt will be calculated taking in consideration the net carbon stock changes in all pools in the project case ($\Delta C_{pools,Def,u,i,t}$), according to VMD0015 v2.2 equations 03 to 06 (see section 5.2) and VMD0009 v1.3 equations 01 to 07 (see section 5.3).

DETER services data and direct observation will be used to monitor forest degradation ($ADegW,l$, $ADistPA,i,t$, $Aburn,i,t$) in the project case. Net carbon stock change as a result of degradation in the project area in the project case will be calculating taking in consideration the extraction of trees for illegal timber or fuelwood and charcoal ($\Delta CP,DegW,i,t$) and selective logging of FSC certified forest management areas ($\Delta CP,SelLog,i,t$), according to VMD0015 v2.2 equations 07 to 18 (see section 5.2).

An initial participatory rural appraisal (PRA) of the communities inside and surrounding the project area was performed to determine if there was the potential for illegal extraction of trees to occur. Considering GPD initial scope, it remained characterized that there are no families living inside the project area, or on project vicinity, exploring the forest for timber and fuel wood, what shall be considered as a not impact activity driven by subsistence purposes. No timber or fuel wood

economic activity was perceived by BRC. In this sense, BRC will assume that extraction of trees for timber or fuelwood is not present at the project area. Rather than making a PRA every two years, BRC will monitor the forest degraded area annually considering the protocols established in this monitoring plan. This constitutes a methodology deviation which leads to more accurate and conservative estimates since significance of timber and fuel wood extraction GHG related emissions will always be tested. This methodology deviation was reported in section 3.6. The degradation penetration is determined through field verifications. These techniques allow us to map forest gaps and draw the buffer area based on the access points. The biomass carbon of trees cut and removed through degradation process ($CDegW_{i,t}$) will be monitored through direct measure in sample plots installed for this purpose before each verification event and with a minimum frequency of 05 years.

In the case FSC certified forest management operation is happening at a specific PAI, the volume of timber extracted ($VEXT_{j,z,i,t}$), the length and width of skid trails in stratum ($LSKID_{i,t}$, $WSKID$), the area of roads and logging decks ($AROAD_{i,t}$, $ADECKS_{i,t}$) will be taken from annual operating plans, exploration authorizations and post exploration reports.

According to common practice in Amazonia, it is assumed that fire is used for land clearing after deforestation in the project area, in the baseline and project scenarios. Non-CO₂ emissions due to biomass burning are considered according to VMD00015 v2.2 equation 30 and VMD0013 v1.2, equation 01 and 02 (see section 5.2).

6.3.4.3. Documentation

The monitoring report will bring relevant information on the time series of data on land use-change, and GHG emissions in the monitoring report, considering data sources and processing protocols, data classification and accuracy assessment, following VMD0015 v2.2. Digital files will be stored in BRC database. Hard copies will be archived at BRC headquarters.

6.3.5. Estimation of Ex-post Net Carbon Stock Changes and GHG Emissions

Ex-post estimates are performed according to the methodological procedures described in section 4. The technical description of the monitoring task and an overview of data collection procedures are described in section 5. All data to be collected is described in section 5, 6.1 and 6.2. Sections 6.1 and 6.2 also bring information on the applicable quality control and quality assurance procedures.

6.3.6. Revising the Baseline for Future Project Crediting Periods

The baseline will be updated considering the methodological procedures described in section 3.4 after 10 years of the project start date.

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1. Data and Parameters Monitored

The first monitoring period spans the end of the dry season and the onset of the wet season period of 2023 in the Amazon biome, which encompasses the period that's occurs the most significant quantity of deforestation due the process of slash and burn (dry season). So, for the first vintage (2023) the monitoring period of the Amazonas APD Grouped Project is from 21st July 2023 to 31st December 2023, for more information's please section 1.10.

Data / Parameter	ADefPA,i,u,t
Data unit	ha
Description	Area of recorded deforestation in the project area in stratum I converted to land use u in year t.
Value applied:	Table 66.
Comments	-
Data / Parameter	ADegW,i
Data unit	Ha
Description	Area potentially impacted by degradation processes in stratum i
Value applied:	Table 69.
Comments	-

Data / Parameter	CDegW,i,t
Data unit	t CO ₂ -e.ha ⁻¹
Description	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i in year t.

Value applied:	Table 70.
Comments	-

Data / Parameter	AP _i						
Data unit	ha						
Description	Total area of degradation sample plots in stratum i.						
Value applied:	<table border="1"> <tr> <td>PAI</td><td>AP_i</td></tr> <tr> <td># 1</td><td>0,00000001</td></tr> <tr> <td># 2</td><td>0</td></tr> </table>	PAI	AP _i	# 1	0,00000001	# 2	0
PAI	AP _i						
# 1	0,00000001						
# 2	0						
Comments							
Data / Parameter	VEXT,z,i,t						
Data unit	m ³						
Description	Volume extracted from logging stratum z, in stratum i in year t.						
Value applied:	0						
Comments	-						

Data / Parameter	LSKID,i,t
Data unit	m
Description	Length of skid trails in stratum i in year t.
Value applied:	0

Comments	-
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Data / Parameter	Wskid
Data unit	m
Description	Mean width of skid trails in stratum i
Value applied:	0
Comments	-

Data / Parameter	AROAD,i,t
Data unit	ha
Description	Area of roads in stratum i in year t.
Value applied:	0
Comments	-

Data / Parameter	ADECKS,i,t
Data unit	ha
Description	Area of logging decks in stratum i in year t.
Value applied:	0
Comments	-

Data / Parameter	ADistPA,q,i,t
Data unit	ha

Description	Area impacted by natural disturbance in the project stratum i converted to natural disturbance stratum q in year t; ha
Value applied:	Table 83.
Comments	-

Data / Parameter	$A_{burn,i,t}$
Data unit	ha
Description	Area burnt for stratum i in year t.
Value applied:	Table 63.
Comments	Equal to $A_{DistPA,q,i,t} + A_{DefPA,i,u,t}$ in the project case.

Data / Parameter	$A_{defLK,i,t}$
Data unit	ha
Description	The total area of monitored deforestation by the baseline agent of the planned deforestation in stratum i in year t.
Value applied:	0
Comments	-

7.2. Baseline Emissions

Baseline emissions are estimated according to VMD0006 v1.4, as part of the procedures used to set the project baseline. A complete overview of the procedures used to set the baseline can be found in section 5.1.

The annual area of baseline planned deforestation ($AA_{planned,i,t}$) is calculated according to VMD0006 BL-PL v1.4 equation 5. The table below shows the annual area of planned deforestation over the baseline scenario in all PAIs for the first monitoring period:

Table 61 - Total and annual area of planned deforestation over the baseline scenario in all PAIs in the first monitoring period.

Year	$AA_{\text{planned},i,t}$			
	PAI#01		PAI#02	
	Ds	Db	Ds	Db
2023	500.00	0.00	0.00	500.00
$A_{\text{planned},i,t}$	5,000.00			5000.00

The baseline carbon stock change in aboveground tree biomass, belowground tree biomass, aboveground non-tree biomass, belowground non-tree biomass, deadwood, litter, soil organic carbon and wood products are fixed throughout the first baseline period and can be found on tables 35, 36, 37, 38, 39, 40, 41, 42 respectively.

The net carbon stock changes in all pools in the baseline ($\Delta C_{\text{BSL},i,t}$) is calculated according to equation 13 from VMD0006 v1.4. The table below shows the net carbon stock changes in all pools in the baseline in all PAIs for the first monitoring period:

Table 62 - Net carbon stock changes in all pools in the baseline period in all PAIs (t CO₂-e) in the first monitoring period.

Year	$\Delta C_{\text{BSL},i,t}$		$\Delta C_{\text{BSL},i,t}$
	PAI#01	PAI#02	Total
2023	276.442,79	265.543,73	541.986,52

The greenhouse gas emissions as a result of deforestation activities within the project boundary are estimated according to VMD0006 v1.4 equation 15 and VMD0013 v1.3, equations 1 and 2. The table below shows the greenhouse gas emissions as a result of deforestation activities within the project boundary in all PAIs for the first monitoring period. For all purposes, the annual area of planned deforestation ($AA_{\text{planned},i,t}$) is considered as burned ($A_{\text{burn},i,t}$) for GHG emission estimates in the baseline scenario.

Table 63 - Non-CO₂ emissions in the baseline case in all PAIs (t CO₂-e) in the first monitoring period.

Year	A _{burn,i,t}				GHG _{BSL,E}
	PAI#01		PAI#02		
	Ds	Db	Ds	Db	
2023	500	-	-	500	35,021

The baseline net GHG emissions for planned deforestation is determined according to VMD0006 BL-PL v1.4 equation 1. The table below shows the net carbon stock changes in all pools in the baseline in all PAIs for the first monitoring period:

Table 64 - Net GHG emissions in the baseline from planned deforestation in the baseline period in all PAIs in the first monitoring period (t CO₂-e).

Year	$\Delta C_{BSL,planned}$		$\Delta C_{BSL,planned}$
	PAI#01	PAI#02	Total
2023	303.024,03	291.829,60	594.853,63

7.3. Project Emissions

The net GHG emissions in the project case is equal to the sum of stock changes due to deforestation and forest degradation plus the total GHG emissions minus any eligible forest carbon stock enhancement, according to VMD0015 v2.3, equation 01 (see section 5.2.5). Data monitored during the first monitoring period is presented in the table below.

Table 65 - Net GHG emissions in the REDD project scenario up to year t* (t CO₂-e) (ex-post).

Year	PAI	Stratum (i)	$\Delta C_{P,DefPA,i,t}$	$\Delta C_{P,Deg,i,t}$	$\Delta C_{P,DistPA,i,t}$	GHG _{P-E,i,t}	$\Delta C_{P,Enh,i,t}$	$\Delta C_{WPS-REDD}$
2023	#01	Ds	58.887,51	-	-	-	-	58.887,51
		Db	-	-	-	-	-	-
	#02	Ds	-	-	-	-	-	-
		Db	-	-	-	-	-	-

Carbon stock enhancement is conservatively assumed to be zero in all strata, following VMD0015 v2.3 step 02 criteria.

7.3.1. Deforestation Monitored

The area of recorded deforestation was measured through DETER data and visual interpretation of high spatial resolution satellite imagery from Sentinel instead of classified images from PRODES project, during the first monitoring period, because PRODES data was still not available for the first monitoring period by the time this monitoring report was issued (see more details on APPENDIX_XIII-MR1_DEFORESTATION_REPORT). This was treated as a deviation from the monitoring plan and should take place only during the first monitoring event. Deforestation monitored during the first monitoring period is presented in the table below.

Table 66: Deforestation monitored in the project area in the first monitoring period (ex-post) (ha).

Year	$A_{DefPA,u,i,t}$			
	PAI#01		PAI#02	
	Ds	Db	Ds	Db
2023	81.96	0.00	0.00	0.00

The net carbon stock change as a result of deforestation in the project area in the project case is calculated according to VMD0015 v2.3, equation 03. The table below presents the net carbon stock change as a result of deforestation in the project area in the project case in the first monitoring period:

Table 67: Net carbon stock change as a result of deforestation in the project case in the first monitoring period (ex-post) (t CO₂-e).

Year	$\Delta C_{P,DefPA,i,t}$		$\Delta C_{P,DefPA,i,t}$	$\Delta C_{P,DefPA,i,t}$
	PAI#01	PAI#02	Total	Cumulative
2023	58.887,51	-	58.887,51	58.887,51

7.3.2. Forest Degradation Monitored

GHG emissions related to forest degradation were considered in function of timber, fuelwood and charcoal collection and selective logging activity in the project area in the project case, according to VMD0015 v2.3, equation 07 (see section 5.2.2). Data calculated for the first monitoring period is presented in the table below.

Table 68: Net carbon stock change as a result of degradation in the project area in the project case in stratum i in year t; (t CO₂-e) (ex-post).

Year	PAI	Stratum (i)	$\Delta C_{P,DegW,i,t}$	$\Delta C_{P,SelLog,i,t}$	$\Delta C_{P,Deg,i,t}$
2023	#01	Ds	0	0	0
		Db	0	0	0
	#02	Ds	0	0	0
		Db	0	0	0

7.3.2.1. Timber, Fuelwood and Charcoal Collection Monitored

There is no forecast for Timber, Fuelwood, and Charcoal Collection. The owner does not intend to carry out forest management in the area, and no community use of these products has been identified within the project areas during the social surveys. Net carbon stock changes as a

result of degradation ($\Delta C_{P,DegW,i,t}$) was calculated according to VMD0015 v2.3, equation 08 and determined insignificant based on T-SIG (APPENDIX_XII-FOREST_BENCHMARK_CLASSIFICATION).

Table 69: Area potentially impacted by degradation processes in stratum i in the first monitoring period (ex- post) (t CO₂-e).

Year	$A_{DegW,i}$			
	PAI#01		PAI#02	
	Ds	Db	Ds	Db
2023	0	0	0	0

Table 70: Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i in year t in the first monitoring period (ex-post) (t CO₂-e).

Year	$C_{DegW,i,t}$			
	PAI#01		PAI#02	
	Ds	Db	Ds	Db
2023	0	0	0	0

Table 71: Net carbon stock change as a result of degradation in the project case in the first monitoring period (ex-post) (t CO₂-e).

Year	$\Delta C_{P,DegW,i,t}$		$\Delta C_{P,DegW,i,t}$	$\Delta C_{P,DegW,i,t}$
	PAI#01	PAI#02	Total	Cumulative
2023	0	0	0	0

7.3.2.2. Selective Logging Monitored

GHG emissions due to selective logging in the project scenario were zero. No forest management operations were held in the project area in the first monitoring period. Ex-post estimates are made based on the GHG emissions arising in the logging gap, logging infrastructure and the carbon stock in wood products pool, according to VMD0015 v2.3, equation 09 (see section 5.2.2.2). During the initial monitoring period, selective logging was absent; however, as the grouped project expands, a reassessment of the imperative for such data will be undertaken.

7.3.3. Natural Disturbance Monitored

The area impacted by natural disturbance ($A_{DistPA,q,i,t}$) is measured according to DETER database associated with direct observations. The area impacted by natural disturbance is proportionally reduced to reflect previous firewood/charcoal extraction (DDRF), in ex-post estimates,

according to VMD0015 v2.3, equation 19 (see section 5.2.3). In the case the natural disturbance monitored is also related to wildfires, the area of natural disturbance is equal to the sum of the areas of all burn scars perceived in an annual basis, following VMD0015 v2.3, equations 22 and 21. Data monitored for the first monitoring period are presented in the table below.

Table 72: Area impacted by natural disturbances (ex post) (ha).

Year	DDRF	$A_{DistPA,q,i,t}$			
		PAI#01		PAI#02	
		Ds	Db	Ds	Db
2023	0	0	0	0	0

Carbon stock changes in all pools as a result of natural disturbance ($C_{P,Dist,q,i}$) is calculated according to VMD0015 v2.3, equation 24. Data monitored for the first monitoring period are presented in table 32.

Net carbon stock changes in pools as a result of natural disturbance is calculated according to VMD0015 v2.3, equation 23. Data calculated for the first monitoring period are presented in table 32.

GHG emissions resulting from areas undergoing natural disturbance are calculated according to VMD0015 v2.3, equation 20. Data calculated for the first monitoring period is presented in the table below.

Table 73 - Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i in year t (t CO₂-e ha⁻¹) (ex post).

Year	PAI	Stratum (i)	$A_{DistPA,q,i,t}$	$\Delta C_{P,Dist,q,i,t}$	$\Delta C_{P,DistPA,i,t}$
2023	#01	Ds	-	599,10	-
		Db	-	628,94	-
	#02	Ds	-	599,10	-
		Db	-	628,94	-

7.3.4. Non-CO₂ Emissions Monitored

Burn scars from wildfires ($A_{burn,q,i,t}$) are measured according to ΔNBR (Normalized Burn Index) spectral index and verified with high spatial resolution satellite imagery from Sentinel, along with ground verifications (see section 5.2.4). Data monitored for the first monitoring period are presented in the table below.

Data monitored for the first monitoring period are presented in the table below.

Table 74 - Area impacted by wildfires (ex post) (ha).

Year	DDRF	Aburn,q,i,t			
		PAI#01		PAI#02	
		Ds	Db	Ds	Db
2023		0	0	0	0

The average aboveground biomass stock before burning ($B_{i,t}$) is calculated according to VMD0013 v1.3, equation 2 (see section 5.2.4). Data monitored for the first monitoring period are presented in the table below.

Table 75 - Average aboveground biomass stock before burning for stratum i, year t (tons d.m.ha-1).

Year	PAI	Stratum (i)	$B_{i,t}$
2023	#01	Ds	324,11
		Db	300,36
	#02	Ds	251,45
		Db	268,88

Non-CO2 emissions due to biomass burning are calculated according to VMD0013 v1.3, equation 1 (see section 5.2.4). Data calculated for the first monitoring period is presented in the table below.

Table 76 - Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO2, CH4, N2O) (t CO2e).

Year	PAI	Stratum (i)	Aburn,i,t	$B_{i,t}$	COMFi	Ebiomassburn,i,t
2023	#01	Ds	0,00	324,11	0,45	0,00
		Db	0,00	300,36	0,45	0,00
	#02	Ds	0,00	251,45	0,45	0,00
		Db	0,00	268,88	0,45	0,00

GHG emissions from fossil fuels and nitrogen application were conservatively excluded following VM0007 v1.7, table 06, criteria. Non-CO2 emissions due to biomass burning in stratum i in year t ($E_{BiomassBurn,i,t}$) is equal to Greenhouse gas emissions as a result of deforestation activities within the project area in the project case in stratum i in year t ($GHG_{P,E,i,t}$).

7.4. Leakage Emissions

GHG emissions due to leakage are based on activity shifting and market-effects leakage throughout the project lifetime. Leakage emissions are determined according to VM0007 v1.7 section 8.4.2 equation 4⁹ (see report section 5.3). Data calculated for the first monitoring period is presented in the table below.

Table 77 – Leakage Emissions

Year	$\Delta C_{LK-AS,planned}$	ΔC_{LK-ME}	$\Delta C_{LK-REDD}$
2023	0	0	0

7.4.1. Activity Shifting Leakage

Net greenhouse gas emissions due to activity shifting leakage ($\Delta C_{LK-AS,planned}$) is zero in the first monitoring period as there are no forested areas subject to legal suppression across all the lands managed by the identified deforestation agent disregarding the project boundary (see section 3.4). Methodologically speaking, deforestation by the identified agent of the planned deforestation in the absence of the project ($WoPR_{i,t}$) is equal to the total area of planned deforestation over the baseline period for project ($A_{planned,i}$) times the projected annual proportion of land that will be deforested ($D\%_{planned,i,t}$), what makes the new calculated forest clearance by the baseline agent of the planned deforestation where no leakage is occurring ($NewR_{i,t}$) and the total area of monitored deforestation by the baseline agent of the planned deforestation ($A_{defLK,i,t}$) to be set as zero (see section 5.3.1).

New calculated forest clearance by the baseline agent of the planned deforestation was calculated according VMD0009 v1.3, equation 05. The area of activity shifting leakage is determined according to VMD0009 v1.3, equation 06.

7.4.2. Market Effects Leakage

Leakage factor for market-effects calculations (LFME) is calculated according to VMD0011 v1.2 criteria (see section 5.3.2).

Carbon emission due to displaced timber harvests in the baseline scenario ($CBSL_{XBT,i,t}$) is calculated according to VMD0011 v1.2 equation 5. Summed emissions from timber harvest potentially displaced through implementation of carbon project ($ALT_{i,t}$) are estimated according to VMD0011 v1.2 equation 4. Market-Effects Leakage Through Decreased Timber Harvest ($LK_{MarketEffects,timber}$) is estimated according to VMD0011 v1.2 equation 2.

⁹ Adjusted to reflect to project scope.

Carbon emission due to displaced fuelwood/charcoal harvests in the baseline scenario is calculated according to VMD0011 v1.2 equation 7. Summed emissions from fuelwood/charcoal harvests in the baseline case potentially displaced through project implementation (ALFW/C,i) is calculated according to VMD0011 v1.2 equation 8. Market Effects Leakage Through Decreased Harvest of Fuelwood and Charcoal Sold into Regional and/or National Markets (LKMarketEffects,FW/C) are calculated according to VMD0011 v1.2 equation 5.

GHG emissions from market effects ($\Delta CLK-ME$) are calculated according to VMD0011 v1.2 equation 1. Valeu Silvio, Data calculated for the first monitoring period is presented in the table below.

Table 78 - Net greenhouse gas emissions due to market- effects leakage (t CO₂-e) (ex post)

Year	VBSL,EX,i,t	FGBSL,t	LKMarketEffects,timber	LKMarketEffects,FW/C	$\Delta CLK-ME$
2023	22,300.00	5,000.00	0	0	0

7.5. GHG Emission Reductions and Carbon Dioxide Removals

7.5.1. Total Net GHG Emission Reduction

Net GHG emission reduction estimates are based in VM0007 v1.7 equation 2 (see section 5.4). Data calculated for the first monitoring period is presented in the table below.

Table 79 - Total net GHG emission reductions of the REDD project activity (t CO₂e) (ex-post).

Year	Baseline emissions or removals	Project emissions or removals	Leakage emissions	Net GHG emission reductions or removals
	$\Delta CBSL-REDD$	$\Delta CWPS-REDD$	$\Delta CLK-REDD$	NERREDD
2023	594.853,63	58.887,51	-	535.966,12
TOTAL	594.853,63	58.887,51	-	535.966,12

7.5.2. Calculation of AFOLU Pooled Buffer Account Contribution

Buffer is calculated through the new verra platform (Project Hub) and calculator, (see section 5.4.1). Buffer withholding percentage is calculated according to AFOLU Non-Permanence Risk Tool v4.2 available at Verra's Project Hub (ANNEX_IV-NON-PERMANENCE_RISK_TOOL_V4.2). The overall non-permanence risk rating is presented in the table below:

Table 80 - Overall Risk Rating for the first monitoring period.

Risk Category		Rating
a)	Internal Risk	0
b)	External Risk	6
c)	Natural Risk	3.5
Overall Risk Rating (a + b + c)		12

7.5.3. Uncertainty Analysis

The uncertainty in baseline rate of deforestation is set as zero ($\text{UncertaintyBSL_RATE} = 0$), as the deforestation rates are based on actual deforestation plans, following VMD0017 v2.2, section 5.1.1 criteria. Uncertainty in the combined carbon stocks and greenhouse gas sources in the REDD baseline scenario is estimated according to VMD0017 v2.2 equation 5. The percentage uncertainty in the combined carbon stocks and greenhouse gas sources were calculated as the 95% confidence interval half width as a percentage of the mean (APPENDIX_XII-FOREST_BENCHMARK_CLASSIFICATION). Total Uncertainty in REDD baseline scenario is estimated according to VMD0017 v2.2 equation 6. The uncertainty in REDD project scenario is estimated according to VMD0017 v2.2 equation 13. The total error in the REDD+ project activity is therefore calculated by VMD0017 v2.2 equation 21¹⁰. Deductions are made in the case total error in the REDD+ project activity exceeds 15% of NERREDD at the 95% confidence level according to VMD0017 v2.2 equation 21¹¹ (see section 5.4.3). Data calculated for the first monitoring period is presented in the table below.

Table 81 - Total net GHG emission reductions of the REDD+ project activities up to year t*adjusted to account for uncertainty (t CO2e) (ex-post).

Year	NERREDD	NERREDD+_ERROR	Adjusted_NERREDD+
2021	535.966,12	29.024,81	535.966,12
Total	535.966,12	29.024,81	535.966,12

¹⁰ Here suitable not to show values related to WRC project activities, which were not included in the scope of this project.

¹¹ Here suitable not to show factors related to ARR or WRC project activities, which were not included in the scope of this project.

7.5.4. Calculation of Verified Carbon Units

Total number of Verified Carbon Units (VCUs) generated by the project activity implementation is estimated (ex-ante) according to VM0007 v1.7 equation 19¹² (see section 5.4.4). Data calculated for the first monitoring period is presented in the table below.

Table 82 - Number of Verified Carbon Units (VCU) (ex-post).

Year	Adjusted_NERREDD+	BufferPlanned	VCUt
2021	535.966,12	64.315,93	471.650
Total	535.966,12	64.315,93	471.650

Table 83 – Non-permanence Risk Rating

State the non-permanence risk rating (%)	12%
Has the non-permanence risk report been attached as either an appendix or a separate document?	☒ Yes ☐ No
For ARR and IFM projects with harvesting, state, in tCO ₂ e the Long-term Average (LTA).	Not applicable
Has the LTA been updated based on monitored data, if applicable?	☐ Yes ☐ No If no, provide justification.
State, in tCO ₂ e, the expected total GHG benefit to date	5.765.427 tCO ₂ e
If a loss occurred (including a loss event or reversal), state the amount of tCO ₂ e lost:	

Table 84 – Emissions (ex-post) from the project.

Vintage period	Baseline emissions (tCO ₂ e)	Project emissions (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Buffer pool allocation (tCO ₂ e)	Reductions (tCO ₂ e)	Removals (tCO ₂ e)	Total VCU issuance (tCO ₂ e)
21-July-2023 to 31-Dec-2023	748,586.23	58,887.51	19,454.22	82,763.85	670,244.50	0	587,481

¹² Here suitable to reflect ex-ante estimates.

Vintage period	Baseline emissions (tCO ₂ e)	Project emissions (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Buffer pool allocation (tCO ₂ e)	Reductions (tCO ₂ e)	Removals (tCO ₂ e)	Total VCU issuance (tCO ₂ e)
Total	748,586.23	58,887.51	19,454.22	82,763.85	670,244.50	0	587,481

Table 85 – Differences in reduction/removals from ex-ante and ex-post.

Vintage period	Ex-ante estimated reductions/removals	Achieved reductions/removals	Percent difference	Explanation for the difference
21-July-2023 to 31-Dec-2023	553,988	535.966,12	-3.36%	
Total	553,988	535.966,12	-3.36%	

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