BRAZILIAN AMAZON APD GROUPED PROJECT

Document Prepared by BRCarbon

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Project Title	Brazilian Amazon APD Grouped Project
Version	1.8
Date of Issue	22 March 2022
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CONTENTS

FIGURES INDEX

TABLES INDEX

1 PROJECT DETAILS

1.1 Summary Description of the Project

The **Brazilian Amazon APD Grouped Project** (hereafter called GPD) aims the forest conservation on private properties located in the nine states of the "Legal Amazon" (Fig. 01). The Legal Amazon 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. Corresponding to 61% of the Brazilian territory (5,364,100km²), the Legal Amazon encompasses the whole Amazon Biome in Brazil, besides 14% of the Cerrado Biome (Brazilian Savannah) and 1% of the Mato Grosso's Pantanal. It encompasses the states of Acre, Amapá, Amazonas, Mato Grosso, Pará, Rondônia, Roraima, Tocantins, and part of the State of Maranhão.

The GPD main goal it is to create positive economic incentives to landowners for the rainforest and Cerrado 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 legally clear their forest areas 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 to forests, forest monitoring by satellite images, forest biomass 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 five initial project activity instances (PAI#1-5) implementation will result in the direct conservation of 18,652.91 hectares of forest, in 5 properties located in the states of Acre and Mato Grosso. In the first baseline period (10 years) the project will avoid the deforestation of 17,972 hectares and will reduce emissions of 10,403,955 tons CO2 which represents an annual average of GHG emissions reductions of 1,040,395 tons CO2.

Figure 1: Legal Amazon.

1.2 Sectoral Scope and Project Type

The GPD is part of the Agriculture, Forestry and Other Land Use (AFOLU) sectoral scope and consist in a Reduced Emissions from Deforestation and Degradation (REDD) project, under the category of Avoiding Planned Deforestation (APD).

This document refers to the grouped project description and the monitoring of its initial five project activity instances (PAIs#1-5).

1.3 Project Eligibility

According to VCS v4.1, 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. In addition, 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 VCS v4.1 also states that: "*Eligible REDD activities include Avoiding Planned Deforestation and/or Degradation (APDD): This category includes activities that reduce net GHG emissions by stopping or reducing deforestation or degradation on forest lands that are legally authorized and documented for conversion*".

This GPD meets all VCS v.4.1 eligibility criteria, since the project area was defined in accordance with the forest benchmark map, considering the accumulated deforestation over a 10-year historical series (2011 to 2020), 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 1.4 below for the eligibility criteria for the inclusion of new project activity instances.

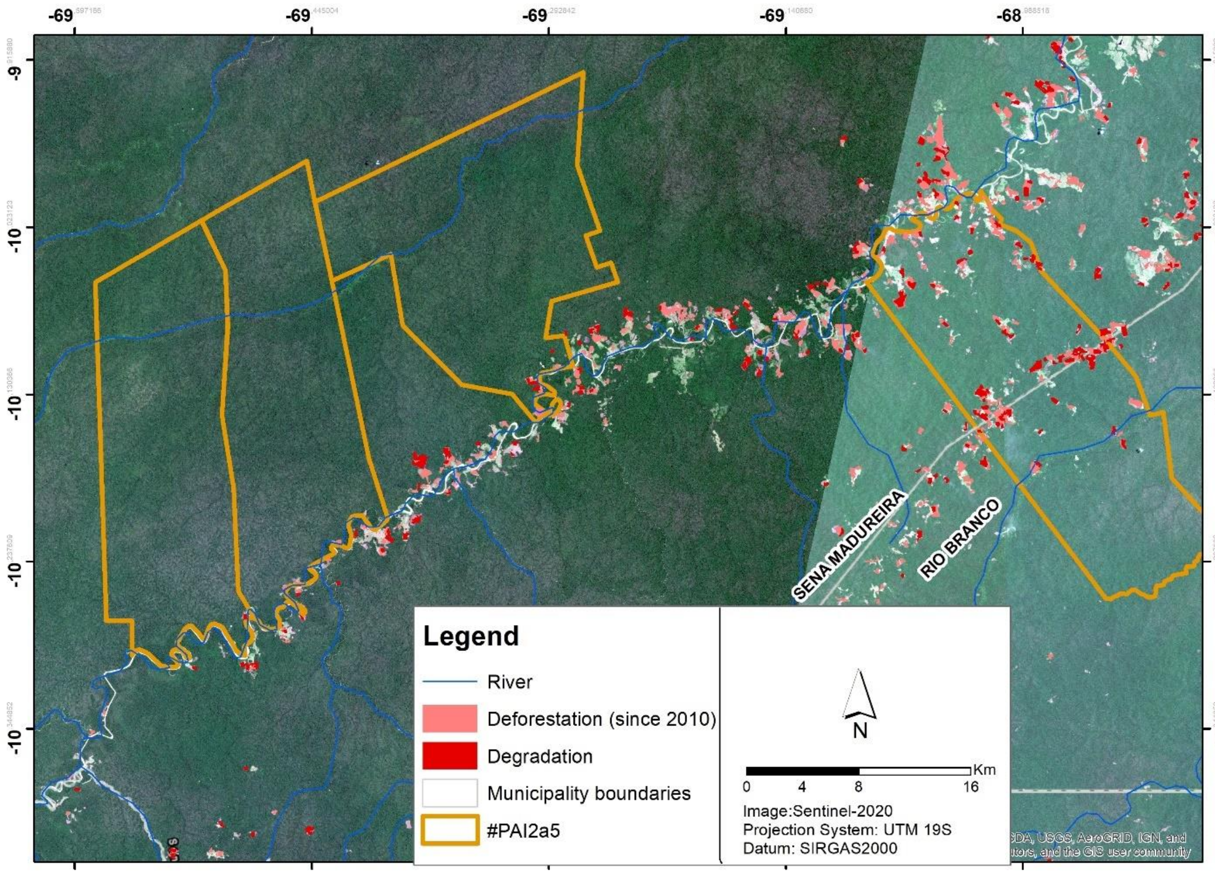

Figure 2: Eligible areas in PAIs #2-5.

1.4 Project Design

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

1.4.1 Eligibility Criteria

According to the VCS v4.1, grouped projects shall meet the following criteria:

"*3.5.8: Grouped projects shall have one or more clearly defined geographic areas within which project activity instances may be developed*".

The GPD assumes only one wide geographic area known as the Brazilian Legal Amazon (5,364,100Km²). 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, Savana Parque and Savana Arborizada*). This geographic area spreads through the states of Acre, Amapá, Amazonas, Pará, Roraima, Mato Grosso, Rondônia, Tocantins and part of the territory of Maranhão.

"*3.5.9: 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*".

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 #1-5. 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.

"*3.5.10: As with non-grouped projects, grouped projects may incorporate 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 1.11 and 5.3.

"3.5.11: The baseline scenario for a project activity shall be determined for each designated geographic area, in accordance with the methodology applied to the project".

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.

"3.5.12: 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."

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.

"3.5.13: 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.

"3.5.14: 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".

Not applicable. There is no capacity limit applicable to the project activity type (APD) considered in the grouped project.

1.4.2 Eligibility Criteria for New PAIs

"*3.5.15: 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. 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 v1.6. Regarding PAIs #1-5, the applicability conditions are met as demonstrated:

- The 5 initial PAIs have no areas registered under the CDM or under any other GHG program.
- All lands included in the PAIs #1-5 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 #1-5 do not include agricultural lands that are flooded to increase production, neither 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 1.11 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 leakage mitigation, social and biodiversity related activities and monitoring activities are also described in section 1.11 and 5.3.

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 area 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 Legal Amazon as a unique wide geographic area, taking into consideration that all private properties within this biome are subject to the same legal framework. New PAIs must follow the same baseline approach described in the 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:** 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 #1-5. 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.

1.4.3 Inclusion of New PAIs

"3.5.16: "Grouped projects provide for the inclusion of new project activity instances after 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 Amazon biome, with surplus of forest cover, as per the federal law 12.651, from May 2012.

2) **Comply 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 compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body:** this document was prepared based on the joint PD and monitoring report VCS template and covers PAIs #1-5. 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) **Be validated at the time of verification against the applicable set of eligibility criteria:** each new project activity instance included in the grouped project, must be validated

against the applicable set of eligibility criteria, stated in the item 2 above, by the time of the grouped project verification.

5) **Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance:** evidence of project ownership is defined as the second eligibility criteria, as mentioned in item 2 above.

6) **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 # 01-05. 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.

7) **Be eligible for crediting from the start date of the instance through to the end of the 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.

1.5 Project Proponent

Organization name	BRCARBON SERVIÇOS AMBIENTAIS LTDA
Contact person	Bruno Brazil
Title	Technical Director
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1.6 Other Entities Involved in the Project

Organization name	BATISTA E CIA LTDA

Role in the project	Implementation partner and landowner of the PAIs #1-5 areas
Contact person	Moacir Eloy Crocetta
Title	Founder
Address	Av. Bezerra Sabino de Queiroz, nº7471, Bairro Jardim Araucária, Vilhena - RO. CEP 76987-476
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1.7 Ownership

The GPD ownership is defined by item 6, section 3.6.1 of the VCS v4.1, as follows: "*An enforceable and irrevocable agreement with the holder of the statutory, property or contractual right in the land, vegetation or conservational or management process that generates GHG emission reductions or removals which vests project ownership in the project proponent.*". For additional information please refer to Appendix 01.

1.8 Project Start Date

The GPD started on August 02nd, 2021, with the signature of a long-term conservation agreement with PAIs #1-5 landowner. This milestone represents the beginning of the protection plan and the date on which activities that led to the generation of GHG emission reductions were implemented.

1.9 Project Crediting Period

The GPD will generate GHG emission reductions eligible for issuance as VCUs for 100 years. The crediting period starts on August 02nd, 2021 and ends on July 01st, 2121. 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 #1-5 will generate GHG emission reductions eligible for issuance as VCUs for 10 years, that is, the first baseline period. A legal agreement (Appendix 01) was signed with the landowner to continue the management practices that will lead to the project area conservation for at least 30 years, thus, the project activity instances longevity is 30 years. New PAIs will have different crediting period starting dates, based on the deforestation permits issued by the responsible environmental agencies in each state.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

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

Table 1: Project scale.

Project Scale	
Project	
Large project	X

Table 2: Estimated GHG emission reductions.

Year	Estimated GHG emission reductions (tCO_2e)
2021	871,515
2022	941,948
2023	994,352
2024	1,031,261
2025	1,044,230
2026	1,122,913
2027	1,208,145
2028	1,295,014
2029	1,116,774
2030	777,803
Total estimated ERs	10,403,955
Total number of crediting years (GPD)	100
Total number of crediting years (PAIs #1-5)	10
Average annual ERs	1,040,396

1.11 Description of the Project Activity

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

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, as cattle rising 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 Legal Amazon. Complementary activities will be related to leakage mitigation, the promotion of positive net benefits to communities, biodiversity conservation[1] 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.

1.11.1 Climate

Legal Protection: this project activity consists of signing long-term conservation agreements with private landowners in the Legal Amazon. The agreements are made for 30 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 though satellite images associated with ground truth verifications annually. Land use change

[1] This project was designed in conformity with the CCB standard requirements.

maps and orbital imagery will be collected from PRODES[2] & DETER[3]/INPE[4], Mapbiomas and ESA[5]. The area burnt is measured according to ΔNBR[6] spectral index and verified with high spatial resolution satellite imagery from Sentinel, along with ground truth verifications.

Forest Biomass Inventory: aboveground biomass in trees will be estimated through permanent plots systematically installed over the project area. 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 with 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 over forest biomass inventory methods check standard operational procedures (Appendix 07).

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 VMD0015 v2.2 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 others necessary to comply with the FSC standard. To this date, of all the areas initially considered in the GDP scope, only the Katianã Seringal (PAI#02) has an approved forest management plan (Appendix 03). This plan, however, is not yet operational.

[2] PRODES, or Project for Monitoring Deforestation in the Legal Amazon by Satellite, is a project of the National Institute for Space Research (INPE) that monitors clear-cut deforestation in the Legal Amazon and produces since 1988 the annual rates of deforestation in the region. PRODES generates the official data on deforestation used by the Brazilian government. http://www.dpi.inpe.br/prodesdigital/dadosn/.

[3] DETER is a deforestation and forest degradation warning service in the Legal Amazon based on high frequency satellite data from return visits.

[4] National Institute for Space Research is a Brazilian federal institute dedicated to space research and exploration, created in 1961.

[5] European Space Agency.

[6] Normalized Burn Index.

Forest management operations at PAI # 02 are not scheduled to take place before the grouped project first verification.

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 Nino. 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[7]. 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[8].

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.

1.11.2 Community

Digital inclusion: in many cases the existing communities within the project area live in isolated conditions, without access to means of communication and travel days to the nearest city. This puts them in a vulnerable condition, negatively affecting their economy, health, education, and well-being. This project activity is focused on installation of towers for the provision of internet and an internet access point in schools.

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

[7] The implementation of this activity will depend on the vocation, interest and cooperation with the traditional communities present in the project area. Environmental education actions will be aimed at raising awareness of the issue and may increase the communities' adherence to the initiative, but the formation of the brigades will take place on a voluntary basis.

[8] The implementation of these systems will depend on the fire brigade's effective creation and the potential for effective communication with the brigades in the project area.

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. Purchase of medicines or equipment for the posts.

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

Training: training will be offered to communities in different areas: 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, distribution of filters, chlorine, fencing of springs (to prevent the animals' access to water), acquisition of pumps, and hydraulic rams' implementation.

1.11.3 Biodiversity

Biodiversity Protection: biodiversity monitoring will have focus on species richness and the protection of threatened and game species identified in the initial survey. Environmental education activity will be performed to sensitize communities about the identified species threaten degree and the biodiversity importance.

1.12 Project Location

The GPD is located in the Amazon Biome's Deforestation Arc 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 9 Brazilian states: Acre, Amapá, Amazonas, Pará and Roraima, and part of the territory of Maranhão, Mato Grosso, Rondônia and Tocantins (Legal Amazon).

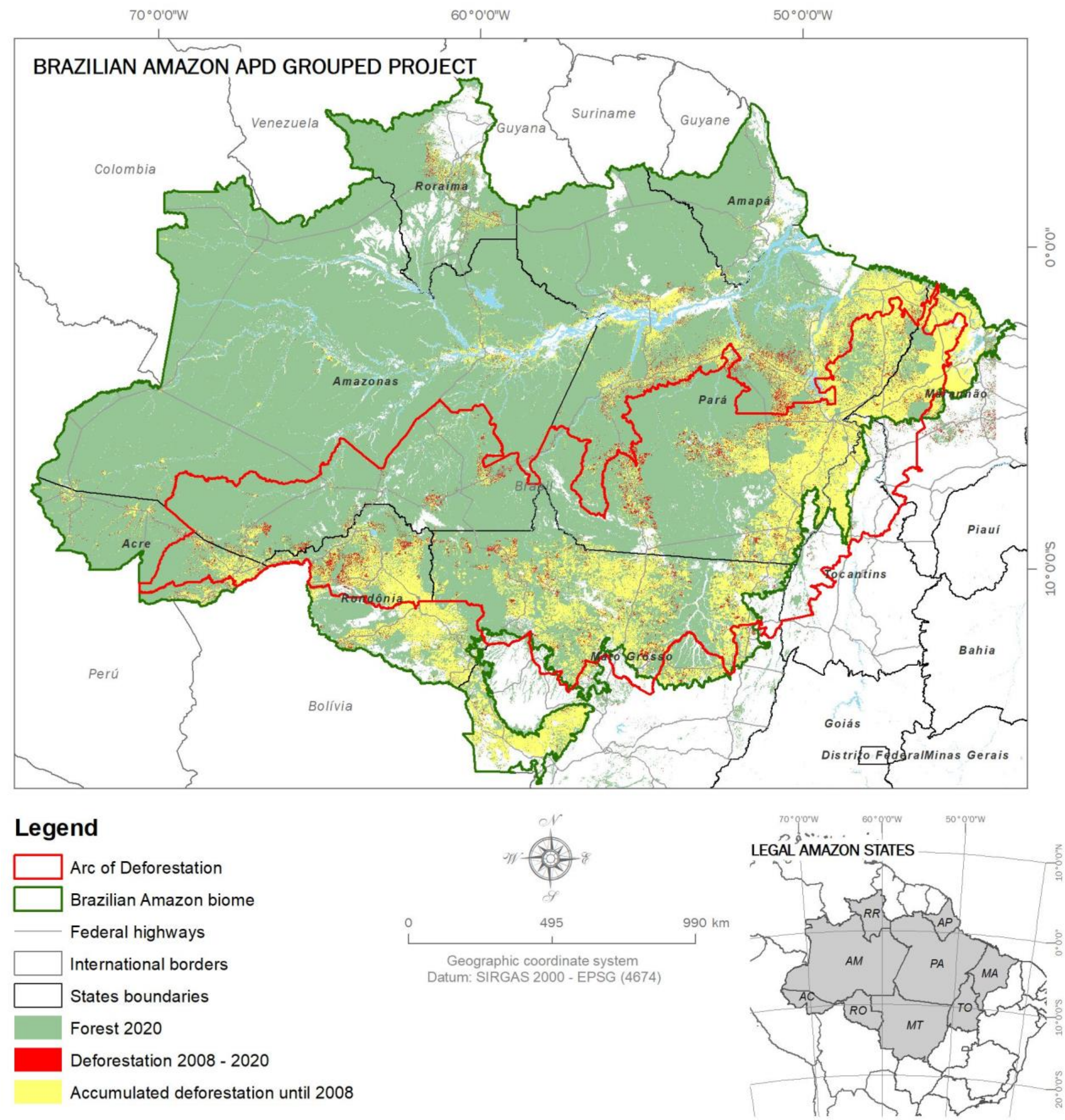


Figure 3: Project location.

PAIs #2-5 are in the municipalities of Sena Madureira and Rio Branco in Acre and PAI#01 is located in the municipality of Aripuanã, in Mato Grosso (Fig. 03). The table below shows the properties areas, the project area, and a centroid geographical coordinate by project activity instance (Tab. 01). Coordinates are also submitted separately as a KML file (GIS database).

Table 3: PAIs location.

PAI	Property name	Geodetic coordinate (Lat. Long.)	
#01	Castanhal	-9.914599	-59.407591
#02	Katiana	-10.265973	-69.532794
#03	Palmares	-10.098529	-69.3136
#04	Porongaba	-10.046559	-69.038648
#05	Potiguar	-10.227201	-69.452399

1.13 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 in each state (Appendix 02). The figure below shows the expansion of the cattle raising activity in the PAIs #2-5 region in the past 20 years.

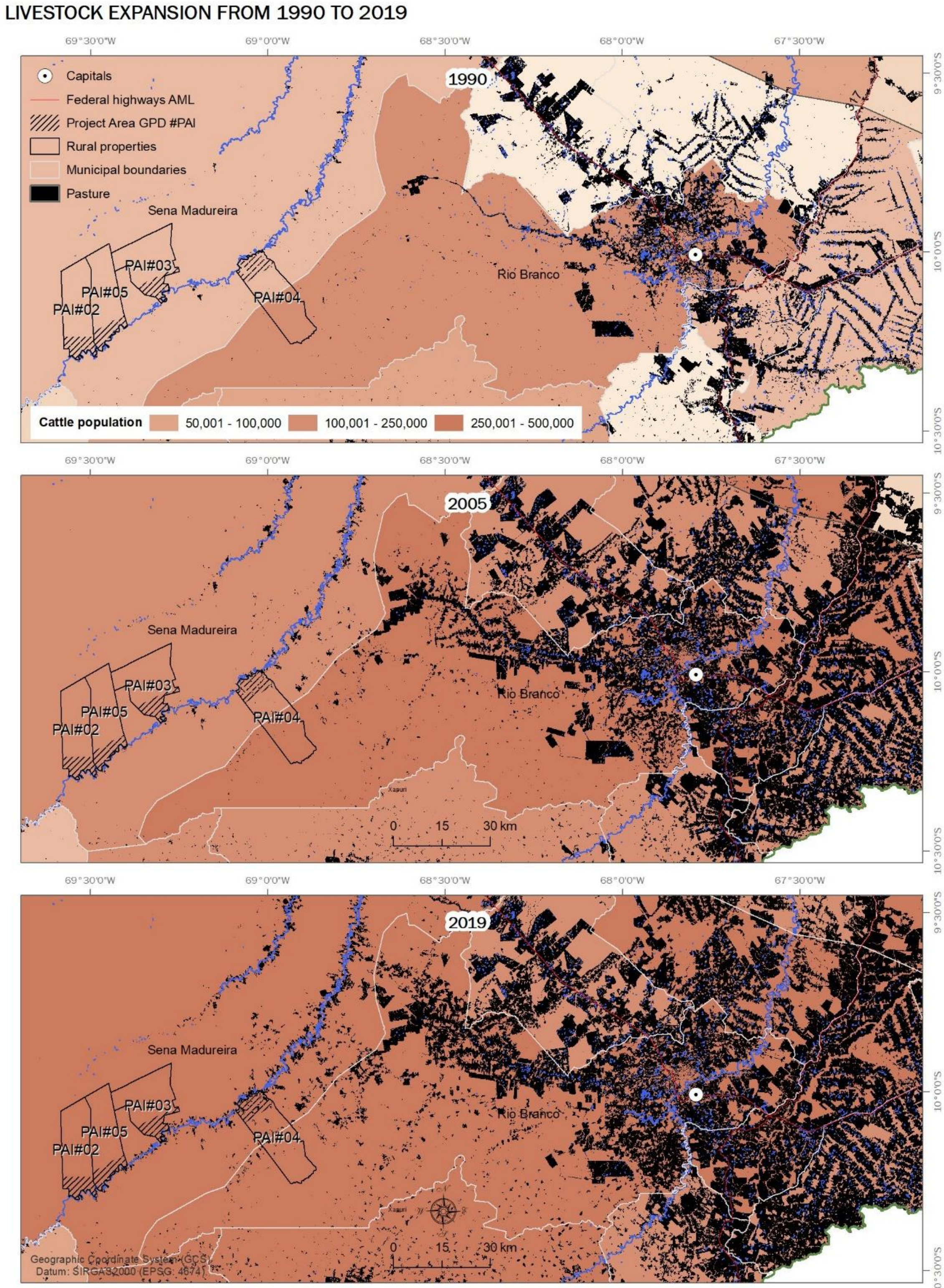


Figure 4: PAIs #2-5 region. BAU activity.

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

1.13.1 Climate

Based on spatial data from global climate mapping at a spatial resolution of 0.5 °, two climate types were identified in the project areas. In a more significant portion, the Am climate was identified and in a more punctual way the Af.

The humid tropical climate is a type of climate that corresponds to the "Am" category of the Köppen-Geiger climate classification. It has average monthly temperatures above 18 ° C in all months of the year and is considered a type of intermediate climate that is between the types Af (equatorial climate) and Aw (tropical savanna climate).

The tropical climate is usually found along equator. Regions with this climate typically characterize tropical forests and are denoted by the Af group in the Köppen-Geiger climate classification. The equatorial climate is typically hot and humid. Places with this climate are typically located at a latitude of 10º of the Equator.

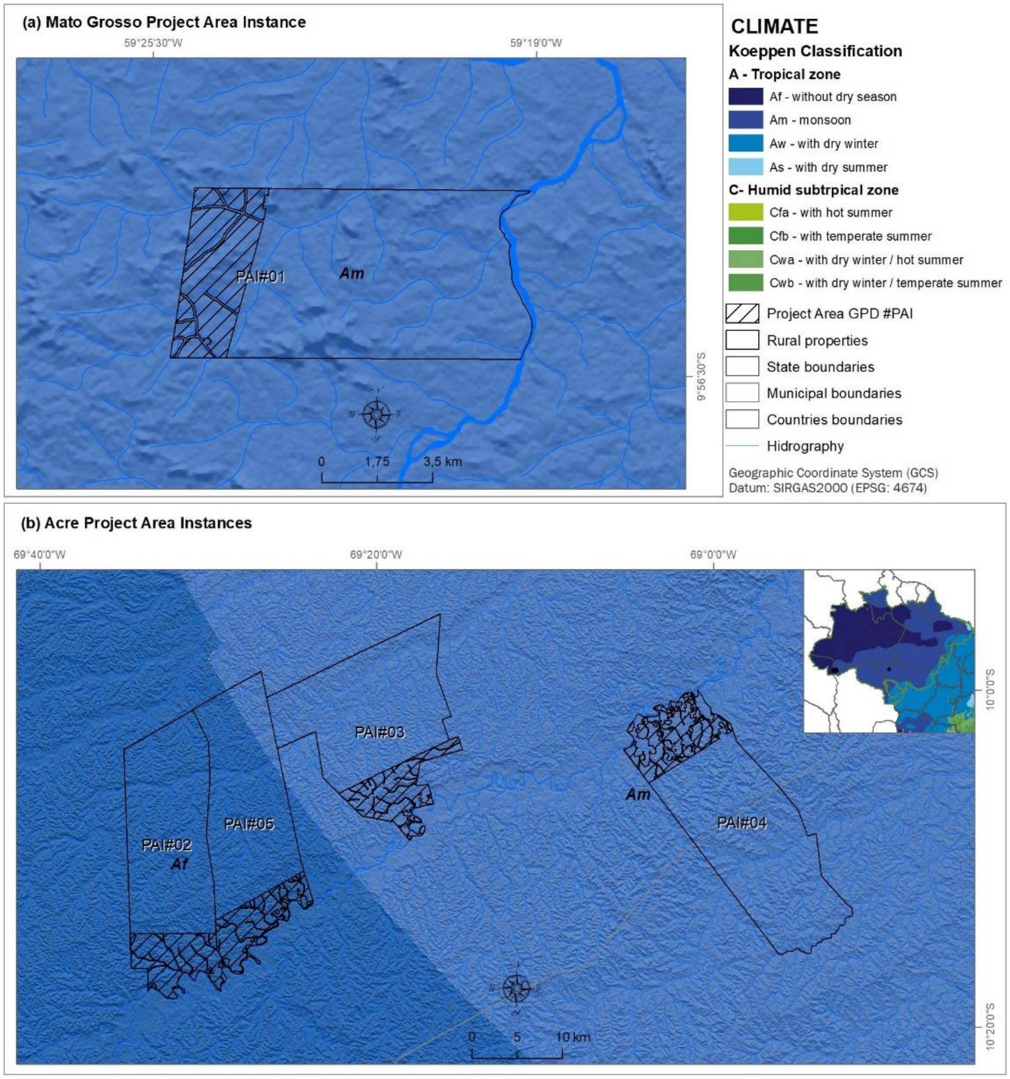


Figure 5: Climate types in PAIs.

1.13.2 Soils

Three types of soils were identified in the PAIs #2-4: Gleissolos, Red-Yellow Argisols and Luvissolos. In PAI#01 two types of soils were identified: Red-yellow Argisols and Litholic Neosols. The soils were identified from Thematic Vectorial Pedology base in the scale of 1:250,000 developed by IBGE (2018), generated from the refinement of the data of the RADAM Brazil Project (1979).

In the Project Areas the Gleissolos are found near the banks of rivers and subject to seasonal flooding of these areas following the regime of flood and drought of the Amazonian rivers, occurring only in the instances of Acre (PAI# 2-5). They are periodically saturated with water are formed by original materials and can be stratified or not, being able to present a historic horizon with insufficient thickness for its characterization as an organic soil. They commonly develop in recent sediments near watercourses and in coluvial-alluvial materials subject to hydromorphic conditions (water-influenced environments), and can also form in areas of flat relief of river terraces. Gleissolos are not consider as peatlands by FAO and are not subjected to draining in the project baseline scenario. Since the methodology used in the project limits the use of modules related to WRC to peatlands and tidal wetlands, it is understood that the methodological framework applicable to WRC is not applicable to the project, considering its initial scope.

The red yellow Argisols occur in all instances of the project. Argisols is the most common soil order in Brazil and is widely used by agriculture, both for the practice of livestock, as well as agriculture due to its clay content that favors the retention of water and organic matter in the soil among other desirable characteristics for plant development. They are mineral soils, non-hydromorphic, with horizon A or E (horizon of loss of clay, iron or organic matter, light color) followed by textural B horizon, with clear difference between horizons.

Luvissolos are found only in the instances of Acre and do not occur within the Project Areas. They are not little developed and have characteristics of the original material (rock) evidenced by the presence of primary minerals. They range from shallow to deep soils, typically low permeability.

Neosols are found only in the instance of Mato Grosso (PAI#01). It is a type of poorly evolved soil consisting of mineral material, or organic material less than 20 cm thick, not presenting any type of diagnostic Horizon B. Litholic Neosols are sandy, shallow soils that present lithic contact or fragmentary lytic contact within 50 cm of the soil surface. They admit the presence of horizon B at the beginning of training, if it does not meet the requirements for any type of diagnostic Horizon B. The limitations to use are related to low depth, rock presence and steep slopes associated with the areas of occurrence of these soils.

The two types of soils present in the Acre PAIs have in common an aspect related to the high concentration of clay in their composition and none of the classes identified has restrictions for pasture formation, are soils with agricultural aptitude and with support conditions in the project area for livestock activity. For example, in the vicinity of PAIs #2-5 areas, in the floodplains of the Iaco River, livestock farming is a common practice and occurs in the stains of the three different soils identified in the project area.

In the Mato Grosso Instance (PAI# 1), the presence of Lithic Neosoils is not a barrier to the practice of livestock, because the grasses used for pasture have short, superficial roots and adapted to well-drained soil. Therefore, it does not represent a restriction for the practice of livestock activity, as can be seen in the region as a common practice.

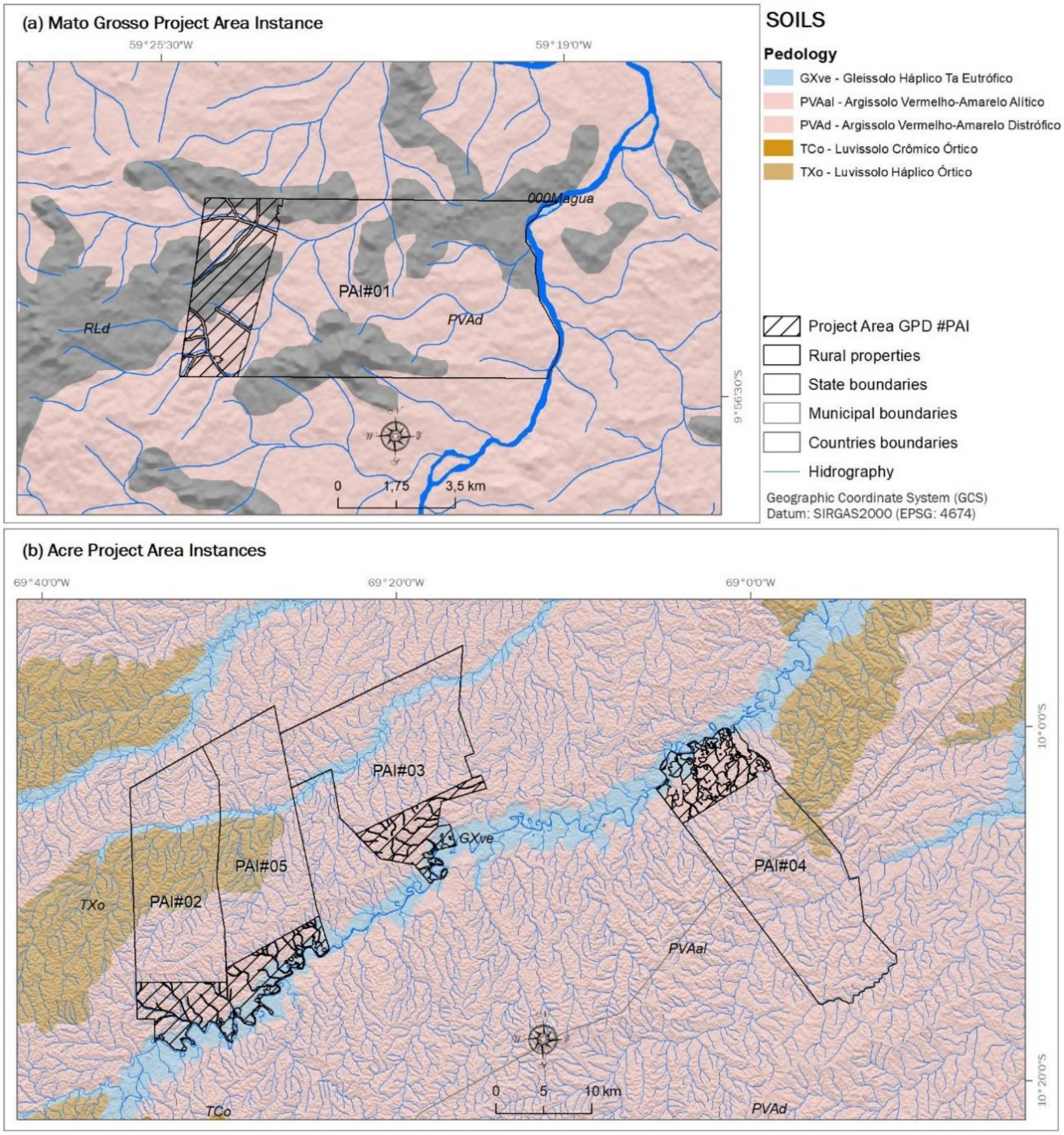


Figure 6: Soil types in PAIs.

1.13.3 Topography

Topography data came from INPE's TOPODATA Program. The INPE data were generated in a resolution of 30m for the whole of Brazil from SRTM mission - Shuttle Radar Telemathic Mapper data, with spatial resolution of 90m. Altitude data were used in relation to sea level, slope % and the land classification shape proposed by EMBRAPA for the entire national territory.

On the flood plans and proximity of the Rio Iaco (PAIs #2-5) the altimetric dimensions range from 150 to 300 meters from sea level. The average altitude in the project areas is 180 m above sea level, ranging from 164 to 190 m between the different instances. In the region of

Fazenda Castanhal (PAI#1) the altitude varies from 115 to 230 m altitude in relation to sea level. In the area of the Castanhal Farm project the average altitude is 165 m, ranging between 144 and 230m (Fig. 07).

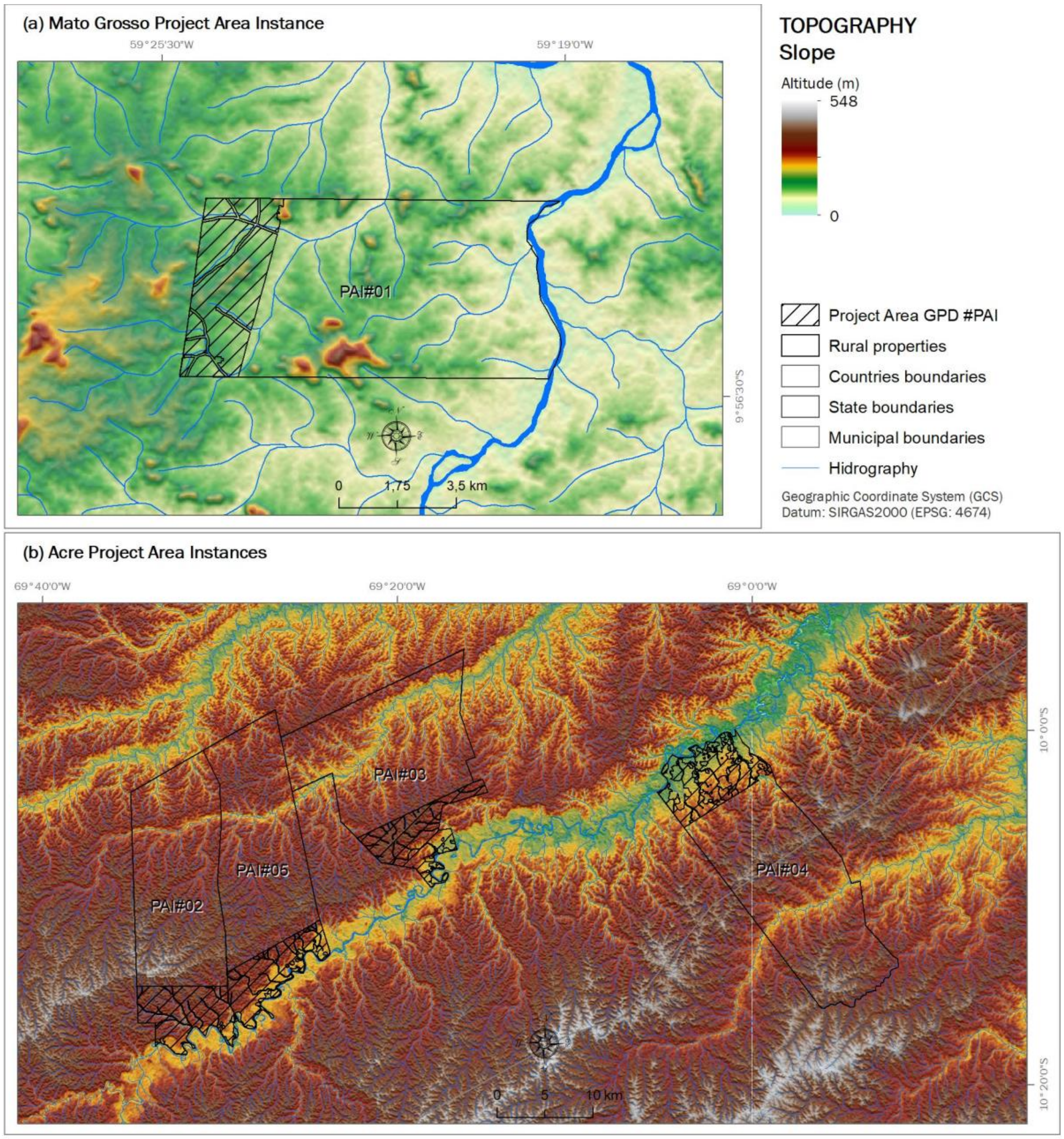


Figure 7: Topography in PAIs.

1.13.4 Slope

The relief on Acre PAIs varies from Wavy to Smooth Wavy with small patches of Strong Wavy releif according to EMBRAPA classification (1989). The average slope in project areas is 7.1%, ranging from 0.5% to 33.2%. In the Mato Grosso PAI soft wavy type is predominant, with areas with wavy relief and strong wavy. The mean slope in the project area is 7.7%, ranging from 0.4% to 45.8% (Fig. 08).

Areas with slope greater than 25°, which corresponds to approximately 46%, were excluded from the project area in respect to legal suppression restrictions imposed by the Brazilian Forest Code.

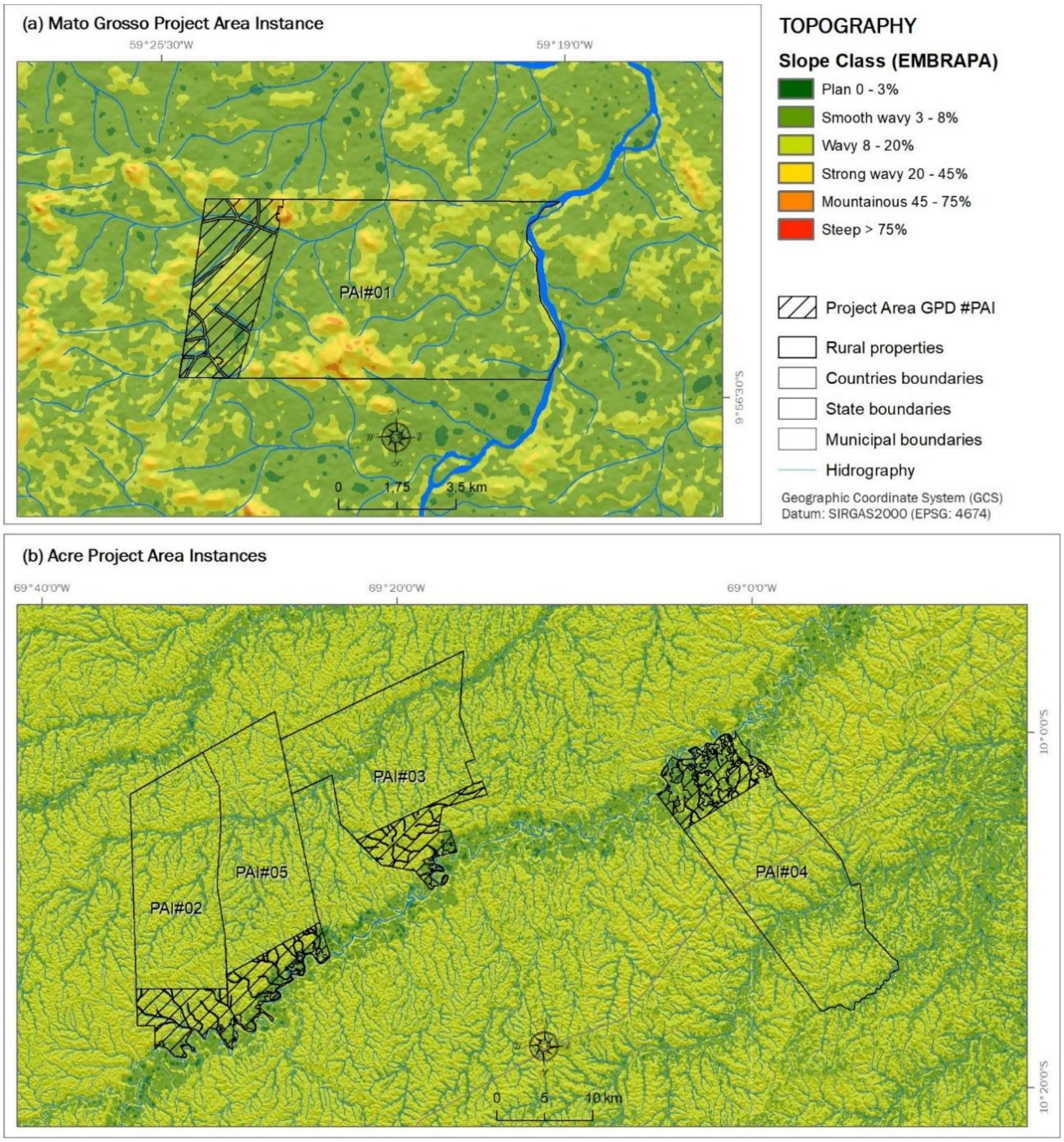


Figure 8: Slope in PAIs.

1.13.5 Vegetation

All PAIs are inserted in the Amazon, where it can be observed a diversity in the vegetation types associated with edaphoclimatic variations throughout the Biome. Open and dense

Ombrophilous Forests (humid forests) predominate, characterized by the dominance of perennial species, always green due to the high rainfall and solar radiation incidence of with little variation throughout the year near the Equator.

Among the Ombrophilous Forests, variations in forest types associated with local edapho-climatic specificities are identified, strongly influenced by the weather, soil types and distance from large rivers. Throughout the PAIs #1-5, two forest types and three sub-formations were identified (Fig. 09), as follows:

1. Dense Ombrophilous Forests: Submontane (Ds) and Lowland (Db).
2. Open Ombrophilous Forests: Submontane (As), Alluvial (Aa) and Lowlands (Ab).

The Dense Ombrophilous Forests are also known as tropical rain forest. 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.

The Open Ombrophilous Forests are a variation of the Dense Ombrophilous Forest, being a more open forest formation, where combinations of species are commonly observed in associations. It occurs in the transition regions between the Amazon biome and neighboring areas with more dry days than in the regions where dense anthropophilic forest occurs.

The Alluvial Sub formation does not vary topographically, always presenting repetitive environments on the alluvial terraces and margins of the watercourses. The Lowlands sub formation usually occurs in coastal plains in altitude ranging from 5 to 100m. The submontane sub formation is situated on the plateaus and/or mountains.

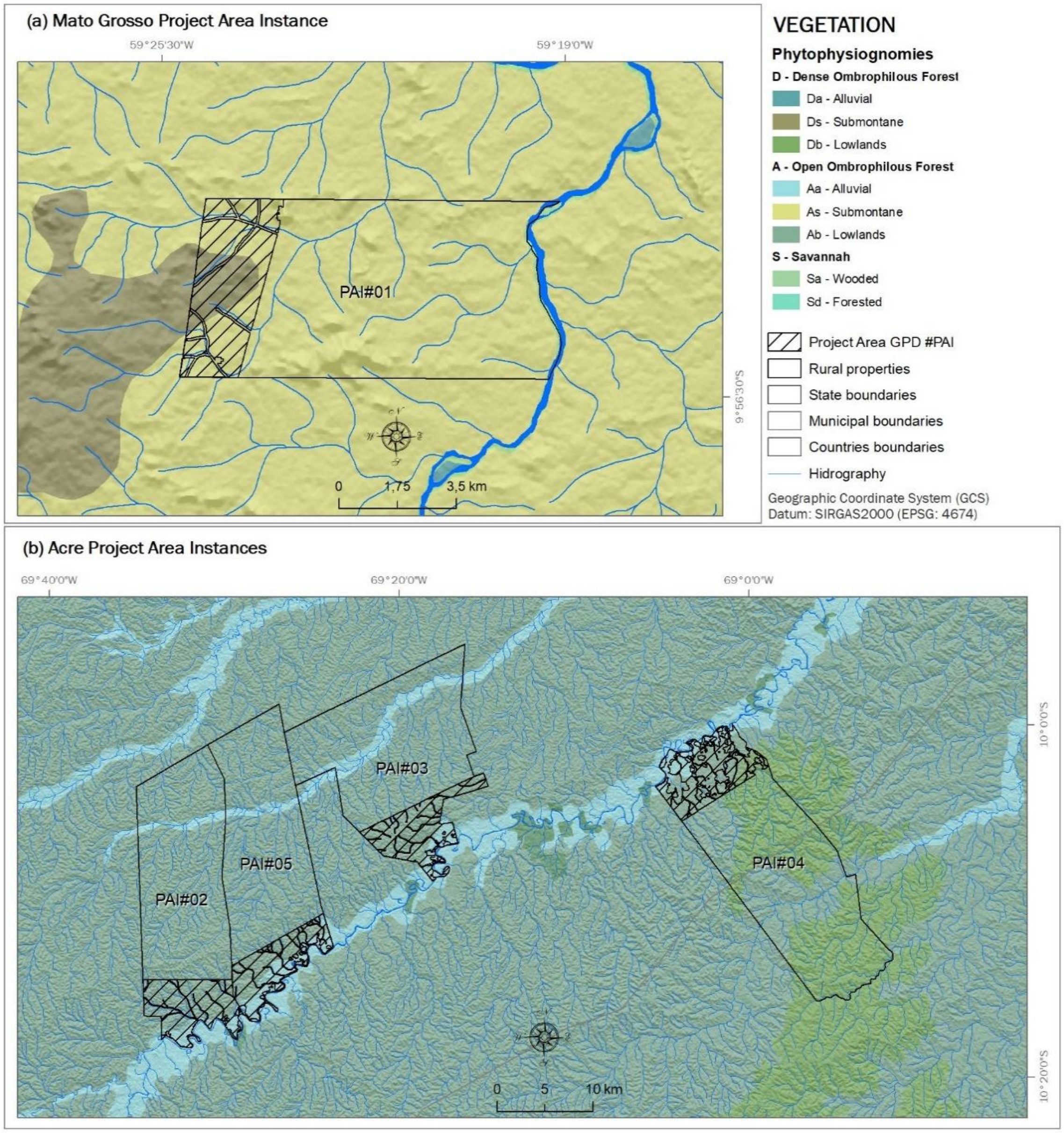


Figure 9: Vegetation in PAIs.

The vegetation in PAIs#01 is composed of Submontane Open Forests (As) covering 67.06% of the project area and Submontane Dense Forests (Ds) covering about 32.94% of the project area (Tab. 04). According to data from Forest Inventory in the project area (2021), the carbon stock present in living biomass above ground is 113.81 MgC.ha^{-1} in Submontane Open Forests (As) and 97.75 MgC.ha^{-1} in Submontane Dense Forests.

Table 4: PAI#01 vegetation.

Forest Type	Area (ha)	Coverage (%)

Open Submontane (As)	664.90	67.06%
Dense Submontane (Ds)	326.61	32.94%
Total	**991.,51**	**100.0%**

The vegetation in PAIs #2-5 is composed of Open Alluvial, Open Lowland and Dense Lowland. The carbon stock present in living biomass above ground in these formations is 102.1 MgC.ha^{-1} for Alluvial Open Forests (Aa) and 104.7 MgC.ha^{-1} for Lowland Open Forests (Ab). (Tab. 05).

Table 5: PAIs #2-5 vegetation.

Forest Type	PAI #02 Area (ha)	PAI #03 Area (ha)	PAI #04 Area (ha)	PAI #05 Area (ha)	General Area (ha)	Coverage (%)
Open Alluvial (Aa)	837.76	665.86	803.23	1,611.93	3,918.78	22,2%
Open Lowlands (Ab)	3,886.91	3,864.98	3,392.72	2,598.00	13,742.62	77,8%
Total	**4,724.66**	**4,530.85**	**4,195.96**	**4,209.93**	**17,661.40**	**100.0%**

1.13.6 Hydrology

All PAIs are in the Amazon Basin, formed by the Amazon River and its tributaries with common characteristics such as the extent and water volume and bigger variation in the dimensions and widths of their Igarapés. rainfall regimes, interspersing periods of floods and droughts.

The Instance of Mato Grosso (PAI#01) is located on the left bank of the Aripuanã River, belonging to the Madeira River basin. The Aripuanã river rises in Mato Grosso state, on the Parecis Plateau, around the elevation 500 m. Its main tributaries are the Guariba and Roosevelt rivers, both along the left bank. In the northern part of the basin the average relative humidity is always above 80% with highs in the months of January to May with 89% and minimums in August and September with 83%, resulting from the strong moisture emanating from the forest. On the other hand, in the extreme south the relative humidity portrays the humidity pattern more like that of the central plateau, with highs in the months of January to March, always below 85% and minimum in the months of more severe drought with values below 60%. The river regime follows the rainfall regime, with a period of flooding that begins in November, peaks between March and April and ends in May. The droughts start in June and end in October, with lows in September and October.

The Instances of Acre (PAI# 2-5) are in the Solimões River basin, the main ones being the Purus, Iaco and Acre rivers. These rivers have an extreme flood and ebb regime, directly reflecting the regional rainfall regime. For example, the Iaco River in the city of Sena Madureira presents a cross-section in the rainy season equivalent to 50 times its value in the ebb, which occurs in the dry season. All these rivers are navigable, allowing the traffic of vessels at the time of the floods (December-April). PAIs in Acre are drained by three watersheds: the Iaco River, the Quatipary Stream, and the Macauã River, all contributors to the Iaco River, one of the main tributaries of the Purus River- drains along the right bank. Many small and intermittent igarapés located in the project area dry completely during the dry season and are extremely muddy at the beginning of the rainy season, indicating the low permeability of these soils and the high rate of erosion within the area of this basin.

The drainage network with the main bodies of water that makes up the project areas in the Acre Instances (PAI# 2-5) can be observed in figure 10.

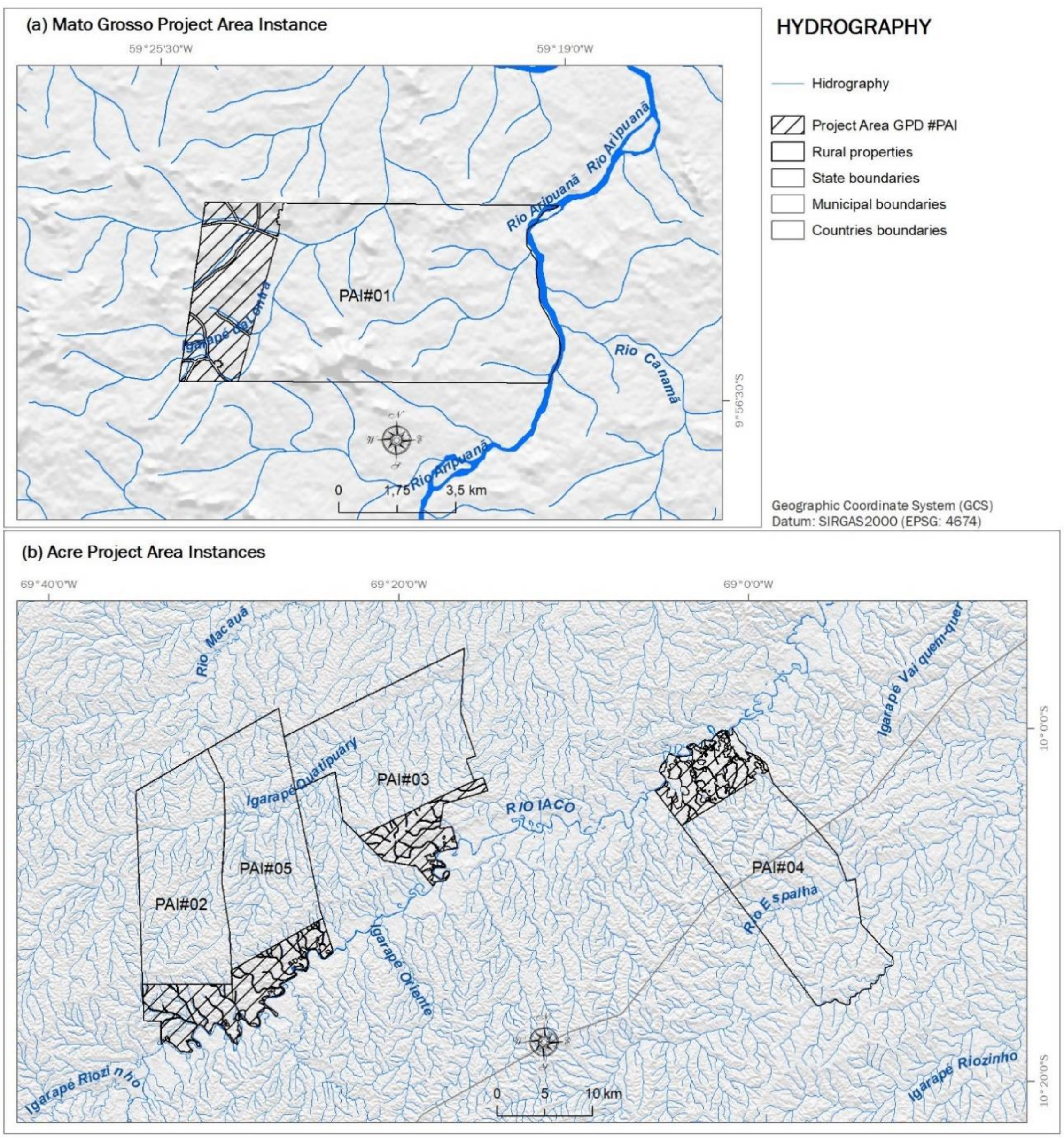


Figure 10: Hidrology in PAIs.

1.13.7 Deforestation

According to INPE, the accumulated deforestation in the Legal Amazon was 71,455 Km2 in the last 10 years, having reached 10,851 Km2 last year and showing a clear trend of increase. To date, about 17% of the forest cover in Amazonia has been lost. Walker et al. (2020) estimates that 62.2% of the aboveground carbon stocks present in the Brazilian Amazon were lost in 10 years due to deforestation and forest degradation. Lovejoy & Nobre (2018) estimates that negative synergies between deforestation, climate change, and widespread use of fire indicate a tipping point for the Amazon system to flip to non-forest ecosystems in eastern, southern and central Amazonia at 20-25% deforestation.

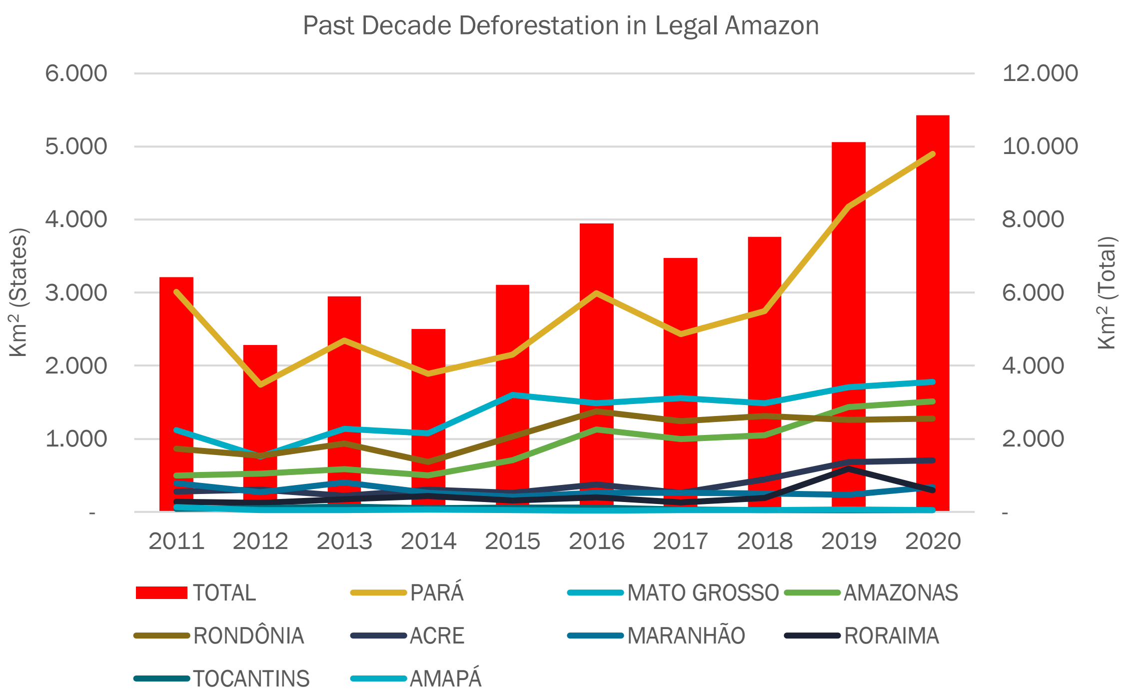


Figure 11: Legal Amazon Deforestation (2011 – 2020).

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

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. 6938 from August 31, 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, 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 Valorisation 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).

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. These population participated from the project assembling since its beginning, as presented in the community section of CCB GPD and complementary social reports (Appendix 10).

1.15 Participation under Other GHG Programs

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

Not applicable. The project is not registered nor seeking registration in any other GHG program, rather than VCS and CCB.

1.15.2 Projects Rejected by Other GHG Programs

Not applicable. The project is not registered nor seeking registration in any other GHG program, rather than VCS and CCB.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Not applicable. The project is not registered nor seeking registration in any emissions trading program or any other mechanism that includes GHG allowance trading.

1.16.2 Other Forms of Environmental Credit

Not applicable. The project proponent is not interested in issuing another GHG related environmental credit. To date, the project has not sought or received another form of GHG-related environmental credit. The project may be registered in the ISA Carbono program if the program becomes validated against the Verra JNR requirements and if methodological incompatibilities[9] between the program and the project are resolved.

1.17 Additional Information Relevant to the Project

1.17.1 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 (Appendix IX). Below, we find maps (figure 12) and geographical coordinates for the areas that will be monitored as part of the leakage management plan. The applicable mitigation measures will be related to the deduction of the carbon credits generated by the GPD in the volume equivalent to GHG emissions caused by planned deforestation monitored in the leakage management areas in each monitoring period, and advocacy with landowners. More details can be checked in sections 1.11 and 4.3.

[9] ISA Carbono baseline considers avoided unplanned deforestation and it's not spatially explicit, while this project baseline is set considering avoided planned deforestation and its spatially explicit. Moreover, the project considers a more comprehensive amount of carbon pools. With that said is understood that the GPD is not compatible with the jurisdictional program and shall be kept as a standalone project.

Figure 12. Properties subject to leakage monitoring

Table 6: Properties subject to Leakage Monitoring.

Property ID	Rural Property Name	Area (ha)	City	State	Geodetic Coordinates (Lat. Long.)	
1	FAZENDA CHAPADÃO	1,576.1	Vilhena	Rondônia	-12.828	-60.1752
2	FAZENDA AGROPECUÁRIA SANTA RTA	11,034.0	Humaitá	Amazonas	-7.65733	-63.1468
3	CHÁCARA 05-A	0.4	Vilhena	Rondônia	-12.717	-60.1083
4	CHÁCARA 02-R	7.0	Vilhena	Rondônia	-12.7161	-60.1154
5	CHÁCARA 02-B	3.4	Vilhena	Rondônia	-12.7157	-60.1089
6	CHÁCARA 01-R2	40.1	Vilhena	Rondônia	-12.7383	-60.1732

1.17.2 Commercially Sensitive Information

Is to be considered as commercially sensitive information in the GPD scope, trade secrets, financial, commercial, scientific, technical or other information whose disclosure could reasonably be expected to result in a material financial loss or gain, prejudice the outcome of contractual or other negotiations or otherwise damage or enrich the project proponents, land owners or entity to which the information relates or internal policy decisions, classified, financial, commercial, scientific, technical or other information whose public disclosure could reasonably be expected to undermine or negatively affect the development and/or implementation of the project. Information related to the determination of the baseline scenario, demonstration of additionality, and estimation and monitoring of GHG emission reductions (including operational and capital expenditures) are not considered to be commercially sensitive and are provided in the public versions of the project documents.

1.17.3 Sustainable Development

This GPD directly contributes to decrease the proportion of the population living below the international poverty line (UN SDG 1), in combating climate change and its impacts (UN SDG 13) and to protect and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss (UN SDG 15). The GPD is in the validation stage against the CCB standard and will present monitoring parameters related to SDGs 01 and 15 in the PDD CCB. The forest cover will be monitored year by year and will serve as an impact indicator to SDG 13. The monitoring results will be reported through the monitoring reports in both standards, VCS and CCB.

1.17.4 Further Information

This project is in line with the Government Program "Floresta +"[10] and in line with Law 14.119/21[11], which regulates the payment for environmental services in Brazil. The Floresta + Program provides for the remuneration of private entities for forest conservation, while the law considers GHG verified emission reduction from forest carbon projects as eligible for payments.

2 SAFEGUARDS

2.1 No Net Harm

This GPD is under validation against the CCB standard. According to the CCB standard requirements, the project proponent will carry out a social engagement process, socioeconomic and cultural surveys, socioeconomic and cultural diagnoses, and a process aimed at obtaining

[10] https://www.gov.br/pt-br/noticias/meio-ambiente-e-clima/2020/10/floresta-carbono-incentiva-conservacao-de-vegetacao-nativa

[11] https://www2.camara.leg.br/legin/fed/lei/2021/lei-14119-13-janeiro-2021-790989-publicacaooriginal-162148-pl.html

free, prior, and informed consent on the project's activities. In these processes, the mapped communities will be given the chance to discuss the project benefits, costs, and risks, according to their own perspective. The GPD will be oriented towards the promotion of positive net benefits to the traditional communities reliant on project area. Potentially negative impacts are not expected due to the implementation of the project activities.

2.2 Local Stakeholder Consultation

A stakeholder consultation process will be conducted in 4 stages, during the project implementation. The first stage will be focused on socioeconomic and cultural surveys and diagnostics. In this first stage, a project draft will also be shared with the communities and other stakeholders, providing for specific types of activities, to support discussions with and between community representatives, and as a preparation for the second round of interaction. Still in the first stage, the project benefits, costs, and potential risks will be discussed in assembly.

The second stage will be conducted in the form of workshops oriented to the participatory design of project activities, and with a focus on obtaining free, prior, and informed consent from communities within the project area or affected by the project activities. In these workshops, the project social activities, the monitoring parameters and the mechanisms for participation and benefit sharing will be defined. In addition, potential negative impacts and possible mitigation measures will be considered and mechanisms for ongoing communication and grievance redress procedure will be defined. The third stage will be carried out in the form of social monitoring, based on the monitoring plan previously defined. The fourth stage will be carried out for the dissemination of the monitoring results, the procedure for participating in the CCB public comment period, the validation process, and the auditor’s role.

2.3 Environmental Impact

Environmental impact assessments will be conducted within the scope of the GPD, in line with the monitoring plan validated in this document, the CCB theory of change matrix and the monitoring plan validated in the CCB PDD. In short, environmental impact assessments will take place using satellite images, surveillance cameras capable of detecting smoke (potentially), trap cameras for recording fauna, bio-acoustic sensors (potentially), various fauna survey techniques carried out by contracted consultancies (capture networks, footprints analysis, sighting, hearing, etc.), and through the reports of environmental agents trained to cooperate for these purposes.

Impact assessments will therefore operate at two different levels. Firstly, the integrity of the forest cover in the project area and its connectivity with the surrounding forest areas will be assessed, as a proxy for the area of habitats available. Second, the diversity of species in the project area will be assessed, focusing on specific groups such as mammals, birds, reptiles, and amphibians. The monitoring parameters will be specifically listed in the CCB PDD and will be related to the outputs, outcomes and impacts described in the theory of change matrix. The frequency of assessments will follow the frequency of monitoring and will occur every 5 years. The results of monitoring and environmental impact assessments will be available on the BRC website, on VERRAs website and will be disseminated among communities and other stakeholders relevant to the project in specific workshops.

2.4 Public Comments

This project was open for public comment from 18/08/2021 to 17/09/2021. Any comments received have been uploaded in the "Other Documents" section in the VERRA registry system.

2.5 AFOLU-Specific Safeguards

The local stakeholder identification process was carried out through site visits during the first stage of the local stakeholder consultation. For 15 days, the BRC team and hired consultants toured the project area (PAIs #2-5) in the company of community representatives to map the homes, carry out a socioeconomic and cultural diagnosis and present the BRC. At this time, aspects inherent to the implementation of the carbon project were also discussed, using a perspective of benefits, costs, and risks. The BRC team also visited PAI 01 for another 15 additional days. On this occasion, no communities were identified living in the project area or making use of the area for their livelihoods. The figure 12 shows the families identified in PAIs 02 to 05.

There are 43 families living in PAIs #2-5 (tab. 07). Most of these people are descended from rubber tappers who settled in the region during the rubber cycle in Brazil and can be understood as riverside populations or family farmers and squatters. The main economic activity is cattle breeding, and the commercialization of chestnuts can occur as a complementary activity. The production of rice, beans, corn, and cassava exists only for subsistence. Family income is not known to family leaders. Communities live in isolation, without access to public policies, goods, or services. The education offered is of low quality, the schools have a deficient infrastructure, the teaching is multi-serial and offered by a few teachers, as a result, there is a high degree of illiteracy and functional illiteracy. The nearest hospital stays in Rio Branco for a 2-day trip along the Iaco River, which accentuates their vulnerability. There is no basic sanitation. People use aseptic pits or make their needs in the bush. Water is collected from springs and is used for drinking, preparing food, washing dishes, clothes, and bathing. There is no water potability analysis and in many situations, animals have free access to the same source. The garbage is either burned or simply thrown away in an open gully. The energy is provided in most cases by photovoltaic systems, with truck batteries. The cook stoves are wood burning.

BRC does not expect the project to bring risks to the identified stakeholders, to its resources or to its ownership rights. On the contrary, the project was designed to promote positive net impacts to communities, in compliance with the CCB requirements. Risks, however, were discussed with the stakeholders identified during the first stakeholder consultation stage, due to the doubts and fears expressed by the communities during the interviews. In this sense, BRC addressed issues such as expropriation, involuntary relocation, logging, and threats to the community livelihoods, associated with the project's conservation objectives. At this point it was characterized that the project would not imply in expropriation or involuntary relocation, that forest management operations, although possible within the project scope, were not planned for the PAIs #01, #03, #04 and #05 in the short term, and that the project activity would not impose zero deforestation commitments to communities. BRC understands that both, the landowner, and the squatters have specific rights that must be respected and that can be exercised in harmony, which was attested to the communities during the first stakeholder consultation stage as a measure to mitigate the risks perceived by the communities. In addition, BRC understands that the communities' livelihoods depend on the deforestation of small patches for agriculture or pasture and that the project should not interfere in this local dynamic, which was also attested to communities as a mitigation measure. Another specific mitigation measure ends in the second stage of the stakeholder consultation process, which relates to obtaining free, prior, and informed consent. At this stage, after a second round of clarification and the elaboration of participatory project design workshops, the relevant communities must consent to the execution of the project before the project activities commencing. In this way, through the stakeholder consultation process and BRC social engagement protocols, the existing risks in the perception of communities are mitigated. Other aspects, such as costs and benefits of the project, will also be discussed in the clarification round and during the participatory project design workshops.

Processes to ensure ongoing communication and consultation with local stakeholders, including a grievance redress procedure to resolve any conflicts which may arise between the project proponent and local stakeholders will be defined during participatory project design workshops, during the consultation process second stage. BRC intends to install towers in the project area to provide internet to communities, alleviating the condition of isolation and facilitating communication.

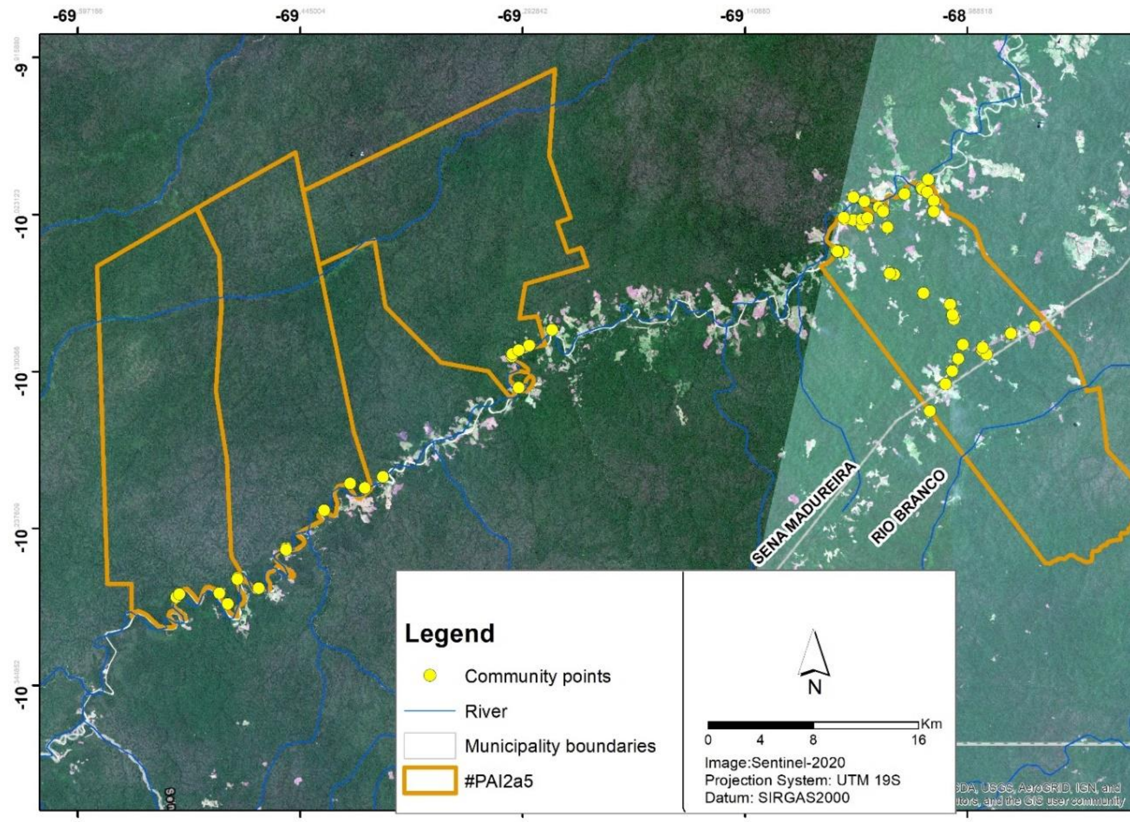


Figure 13: Communities living inside the project area (PAIs #2-5).

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The list below references the methodology, modules and tools used in the project scope:

- VM0007 REDD+ Methodology Framework (REDD+ MF) Version 1.6, 08 September 2020.
- VMD0001 Estimation of carbon stocks in the above- and below ground biomass in live tree and non-tree pools (CP-AB), Version 1.1, 11 October 2013.
- VMD0002 Estimation of carbon stocks in the dead wood pool (CP-D), Version 1.0, 03 December 2010.
- VMD0003 Estimation of carbon stocks in the litter pool (CP-L), Version 1.0, 03 December 2010.
- VMD0004 Estimation of stocks in the soil organic carbon pool (CP-S), Version 1.0, 03 December 2010.

- VMD0005 (CP-W) Estimation of carbon stocks in the long-term wood products pool, Version 1.1, 20 November 2012.
- VMD0006 Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation/forest degradation and planned wetland degradation (BL-PL) Version 1.3, 08 September 2020.
- VMD0009 Estimation of emissions from activity shifting for avoiding planned deforestation/forest degradation and avoiding planned wetland degradation (LK-ASP), Version 1.3, 08 September 2020.
- VMD0013 Estimation of greenhouse gas emissions from biomass and peat burning (E–BPB), Version 1.2, 08 September 2020.
- VMD0015 Methods for monitoring of GHG Emissions and removals (M-MON), Version 2.1, 20 November 2012.
- VMD0016 Methods for Stratification of the Project Area (X-STR), Version 1.2, 08 September 2020.
- VT0001 Tool for the demonstration and assessment of additionality in VCS agriculture, forestry, and other land use (AFOLU) project activities (T-ADD), Version 3.0 1 February 2012.
- AFOLU Non-Permanence Risk Tool, v4.0, 19 September 2019.
- CDM Tool for testing significance of GHG emissions in A/R CDM project activities (T-SIG) v1.0.

3.2 Applicability of Methodology

The project activity is responsible to reduce emissions from planned deforestation (APD) and is defined as a REDD activity type, according to the section 1.3. The project activity meets the applicability conditions of the VM0007 v1.6 and the specific tools and modules, as it is described below:

VM0007 v1.6:

- All lands included in the GPD are not registered under other GHG program (voluntary or compliance) (section 1.15).
- All the lands located within the project areas are covered and qualified as forest for at least the 10 years prior to the project start date (section 1.13 and 3.4 presented the eligibility analysis with forest benchmark maps).
- Baseline deforestation in the project area is categorized as planned deforestation, VCS category APD (section 3.4).
- All the conversion of forest lands to deforested conditions in the GPD in the baseline scenario is legally permitted (see section 3.4 with all information

regarding this aspect) and are in accordance with the Brazilian Forest Law that allows the landowner to legally suppress the forest areas.

- The Leakage of a APD project where the baseline deforestation agent is identified, is defined by the VMD0009 v1.3, estimating the total area of deforestation across all the lands managed by the baseline deforestation agent. Actions related to increasing agricultural productivity or intensifying agricultural activity, aimed at reducing leakage, are not part of the project scope.

VMD0001 v1.1:

- The GPD meets the applicability condition of this tool because the project area is covered by forest (see forest cover benchmark in section 1.3 and 3.4).
- Inclusion of the aboveground tree biomass pool as part of the project boundary is mandatory as per the framework module REDD-MF. Non-tree aboveground biomass and belowground (tree and non-tree) biomass will also be considered in carbon stocks estimates, which is optional per the methodology requirements (for justification check section 3.3).

VMD0002 v1.0:

- The GPD meets the applicability condition of this tool because the project area is covered by forest (see forest cover benchmark in section 1.13 and 3.4).
- The dead wood pool is included as part of the project boundary, which is optional per the methodology requirements (for justification check section 3.3).

VMD0003 v1.0:

- The GPD meets the applicability condition of this tool because the project area is covered by forest (see forest cover benchmark in section 1.13 and 3.4).
- The litter pool is included as part of the project boundary, which is optional per the methodology requirements (for justification check section 3.3).

VMD0004 v1.0:

- The GPD meets the applicability condition of this tool because the project area is covered by forest (see forest cover benchmark in section 1.13 and 3.4).
- Soil Organic carbon pool is included as part of project boundary, which is optional per the methodology requirements (for justification check section 3.3).

VMD0005 v1.1:

- The GPD meets the applicability condition of this tool because logging operations are expected to happen in the baseline scenario prior to the conversion of forest to non-forest. 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 the requirements of the framework module REDD-MF (VM0007).

- In the GPD level each instance that has logging operations as part of the deforestation process in the baseline scenario and involves the timber for commercial markets will perform the significance analysis using the T-SIG tool.

VMD0006 v1.3:

- The GPD project area is defined by forestland that would be legally converted to non-forest land in each PAI, characterizing the project activity as Avoid Planned Deforestation (APD). This tool was used to estimate the GHG baseline emissions in all PAIs.

VMD0009 v1.3:

- The GPD met the applicability condition of this tool because the baseline scenario is the conversion of forest lands that are legally authorized and documented to non-forest land. This module is used to estimate the leakage emissions due to activity shifting of the deforestation agent. Also, as it was used the BL-PL module, the use of the VMD0009 module is mandatory.

VMD0013 v1.2:

- This module will be used under in the GPD two main conditions, the first one to estimate the GHG emissions generated in the deforestation process, known as slash and burn (more details in the annex III, the forest exploration plan), in the baseline scenario. The other condition is to monitor GHG emissions from biomass burning during the project scenario caused by forest fires. So, 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 v2.2:

- The use of this module is mandatory for REDD project activities.
- 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.
- 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.
- Logging operations may only conduct selective logging that maintains a land cover that meets the definition of forest within the project boundary.

- All trees cut for timber extraction during logging operations must have a DBH greater than 30 cm.
- 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.
- The logging practices cannot include the piling and/or burning of logging slash.
- Volume of timber harvested must be measured and monitored.

VMD0016 v1.2:

- 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.

VMD0017 v2.2:

- This module is mandatory for REDD+ project activities.

T-SIG[12]:

- This tool must be used to justify the omission of carbon pools and emission sources, according to the REDD+ MF, section 2.
- The GPD significance analysis of carbon pools and emission sources will use the T-SIG to determine whether a carbon pool and/or emission source is significant.

VT0001 v3.0[13]

- According to the VM0007, section 7.1, this tool was used to identify credible alternative land use scenarios and evaluate both the alternatives, also to demonstrate the additionality of the project. For additional information, please refer to section 3.5, below.
- Also, the GPD meets the applicability conditions of this tool because the conservation and protection activities of the project do not lead to violation of any applicable law even if the law is not enforced. For additional information, please refer to section. For additional information, please refer to section 1.14, above.

[12] CDM Tool for testing significance of GHG emissions in A/R CDM project activities.

[13] Replaces CDM Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (T-ADD) at Verra's webpage.

AFOLU Non-Permanence Risk Tool v4.0

- This tool does not provide any applicability conditions. For additional information regarding the risk assessment and buffer determination assumptions, please refer to appendix IV.

3.3 Project Boundary

3.3.1 Geographical Boundaries

PAIs #2-5 are in the municipalities of Sena Madureira and Rio Branco in Acre and PAI#01 is in the municipality of Aripuanã, in Mato Grosso (Fig. 03). The five properties total area is 113,594.56 ha, of which 18,652.91ha (16,42%) has been delimited as the project area. The project activity contains more than one discrete area of land. Spatial limits for the project area, properties within the project scope and the leakage belt are defined in the maps below, considering all PAIs:

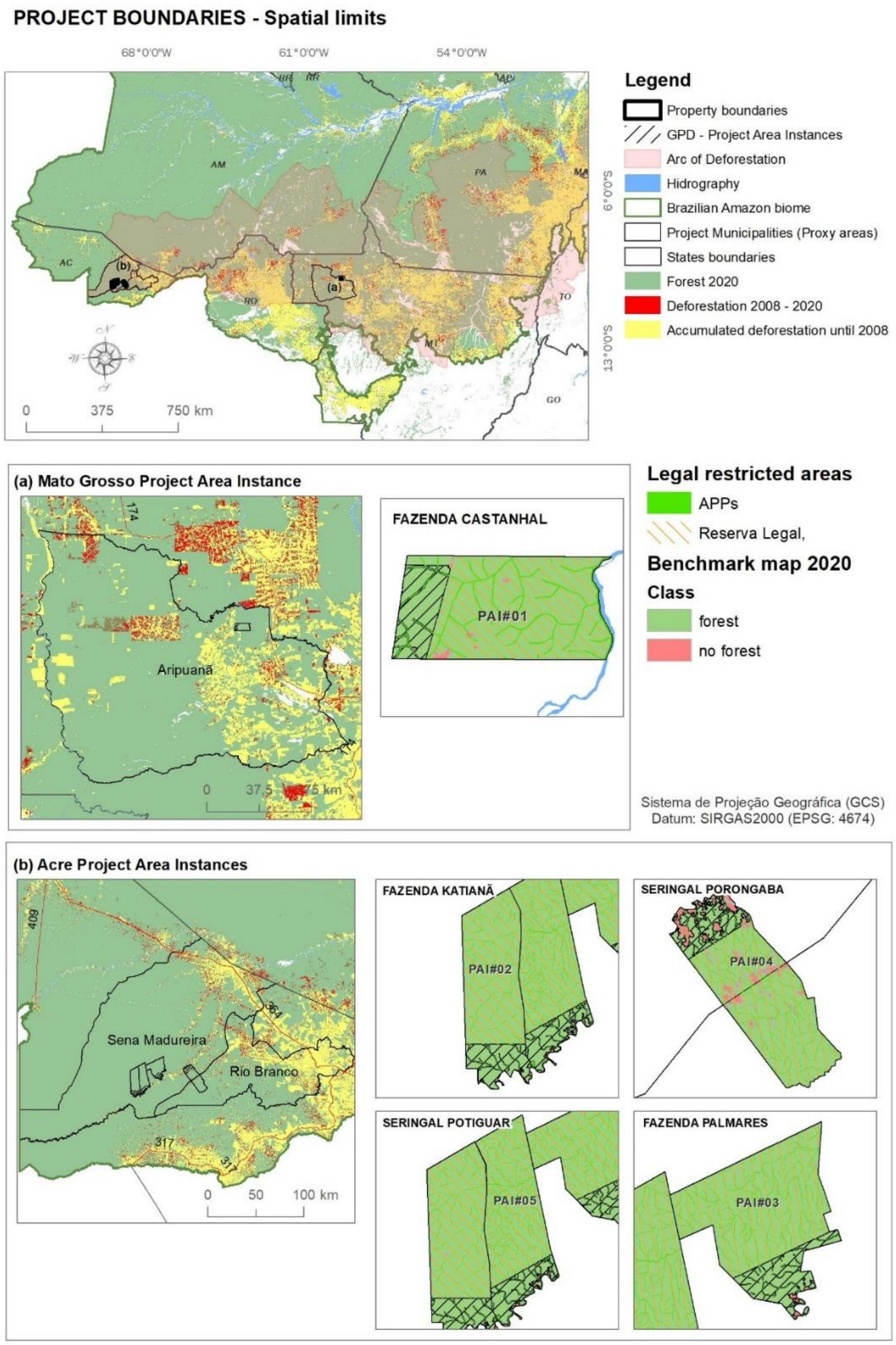


Figure 14: Project boundaries. PAIs #1-5, spatial limits.

The table below lists the names of the project activity instances, their IDs, total land area and landholder/user rights details. The geographic coordinates of each polygon vertex are available at Appendix 06 and in the project GIS database.

Table 7: PAIs #1-5 spatial features.

ID		Property Name	Property area	Project area	Landholder details and user rights (SICAR number, number of squatter families)
PAI#01		Castanhal	5,524.86	991.51	MT-5101407-4CACB40D0AE24939A317398F5FC45192 No families inside of the project area
PAI#02		Katiana	25,467.50	4,724.66	AC-1200500-448F.55FB.03DB.45E1.B562.5DEC.2812.CB2D 05 squatter families
PAI#03		Palmares	26,897.90	4,530.85	AC-1200500-9B87.9BF4.D62A.42C5.90B9.438C.2EED.3BB7 04 squatter families
PAI#04		Porongaba	31,240.63	4,195.96	AC-1200500-0240.2E7C.2004.4705.AFF5.AC02.5939.EEE1 27 squatter families
PAI#05		Potiguar	24,463,68	4,209.93	- AC-1200500-7CFD.C408.46DF.4C87.A738.D86D.0D15.2519 - AC-1200500-6077.1940.1B92.4127.A88A.019C.EEBE.C8ED 07 squatter families
Total			**113,594.56**	**18,652.91**	

3.3.2 Temporal Boundaries

A historical reference period from 2011 to 2020 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 v1.6, 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 for the first 10-year period after the project starting date in sections 4.1 and 4.4.

3.3.3 Carbon Pools

The table below shows the relevant carbon reservoirs considered in the scope of the project, according to VM0007 v1.6, table 4 and the applicability conditions of VMD0001 v1.1, VMD0002 v1.0, VMD0003 v1.0 VMD0004 v1.0 and VMD0005 v1.1. A significance analysis for each reservoir is presented on the carbon calculation spreadsheets (Appendix 08).

Table 8: Carbon pools.

Carbon Pools	Included?	Justification/Explanation
Above-ground tree biomass	Included	Inclusion is mandatory as per VM0007 v1.6, table 04.
Aboveground nontree woody biomass	Included	Inclusion is optional in the case stocks are not greater in the baseline than in the project scenario, per VMD0001 v1.1, 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	Inclusion is optional per VMD0001 v1.1, section 04. Carbon stocks are significant in this pool in tropical forests, representing 20% of the aboveground tree woody biomass.
Belowground carbon stocks in nontree vegetation	Included	Inclusion is optional per VMD0001 v1.1, section 04. Part of the forest types in the project area are characterized by the occurrence of bamboo, vines, and shrubs.
Deadwood	Included	Inclusion is optional in the case stocks are not greater in the baseline than in the project scenario, per VMD0002 v1.0, 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 v1.6, table 04.
Litter	Included	Inclusion is optional per VMD0003 v1.0, section I.
Soil organic carbon	Included	Inclusion is optional in the case stocks are not greater in the baseline than in the project scenario, per VM0004 v1.0.

A standard operational procedure for above ground biomass, SOC, Litter and Dead Wood inventory and field data collect was elaborated (Appendix 07). The document is based on VMD0001 v1.1, VMD0002 v1.0, VMD0003 v1.0, VMD0004 v1.0 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

The table below shows the relevant GHG sources:

Table 9: GHG Emission sources.

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 uses 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-CO2 gases are expected to be emitted due to woody biomass burning in the baseline scenario.
		N_2O	Included	
	Combustion of fossil fuels	CO_2	Excluded	Carbon and Non-CO2 emissions from harvesting equipment, log transport, and primary forest product manufacturing in the baseline scenario can be conservatively excluded according to VM0007 v1.6, table 7.
		CH_4	Excluded	
		N_2O	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-CO2 emissions from use of fertilizers in the baseline scenario can be conservatively excluded according to VM0007 v1.6, table 7.
		CH_4	Excluded	
		N_2O	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-CO2 gases emitted from woody biomass burning will be included if unplanned, unavoidable deforestation occurs in each monitoring period.
		N_2O	Included	
	Combustion of fossil fuels	CO_2	Excluded	Carbon and Non-CO2 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 v1.6, table 7.
		CH_4	Excluded	
		N_2O	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 v1.6, table 7
		CH_4	Excluded	
		N_2O	Excluded	

3.4 Baseline Scenario

Baseline scenario was set according to VMD0006 v1.3 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 BATISTA E CIA LTDA is identified as the single agent of planned deforestation in the baseline considering the current GPD scope (PAIs #01 to #05), which is considered as the "simplest scenario" per VMD0006 v1.3, section 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 (Fig. 15). Primary data about the properties is obtained on the Rural Environmental Registry System (SICAR)[14]. 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

[14] https://www.car.gov.br/#/

start date are disregarded to comply with the methodology applicability conditions. Degraded forests were disregarded to avoid inexpressive strata and in respect of the areas of use of traditional communities living in the project area in the case of PAIs #1-5. This can be reconsidered in future situations where there are significant areas of degraded forests in new PAIs. 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 (2018), from RADAM Brazil Project data refinement (1979) (Annex 06). Climatic data were obtained from the nearest meteorological stations in INMET database (GIS database). Considering a 10-year historical series the mean annual total precipitation are 1914mm and 2278mm and the mean temperature are 25°C and 23.3°C in Cotriguaçu (PAI#01) and Rio Branco regions (PAIs #2-5), respectively. 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 #2-5) can be drained by the Iaco river in winter and by the AC-090 highway in summer. Calves are transported to fattening farms located close to urban centers and within the radius of supply of large slaughterhouses. PAI#01 is in Mato Grosso and is inserted in an economic matrix dominated by the livestock activity, being the main economic activity in the region. The common practice adopted by landowners is the use of wood, followed by deforestation to form pastures. Part of the herd in the municipality of Aripuanã is slaughtered in the municipality for local supply in small slaughterhouses, and most is produced and fattened in the municipality itself and then sold alive and transported to larger slaughterhouses belonging to large companies in the sector through the MT-420 highway to the municipality of Juína/MT or by the MT-208 highway to the municipality of Juruena. Thus, it is understood that the project areas are inserted in the national meat supply chain. The viability of the potential business is corroborated by the livestock activity in the region, observed directly in the field by the BRC team and analyzed in the light of interviews with local ranchers. A calf in the PAIs #2-5 is currently sold for around USD 400 and is the region's main economic activity. The price charged in PAI#01 varies from USD 600 to USD 1,000 a head of the ox.

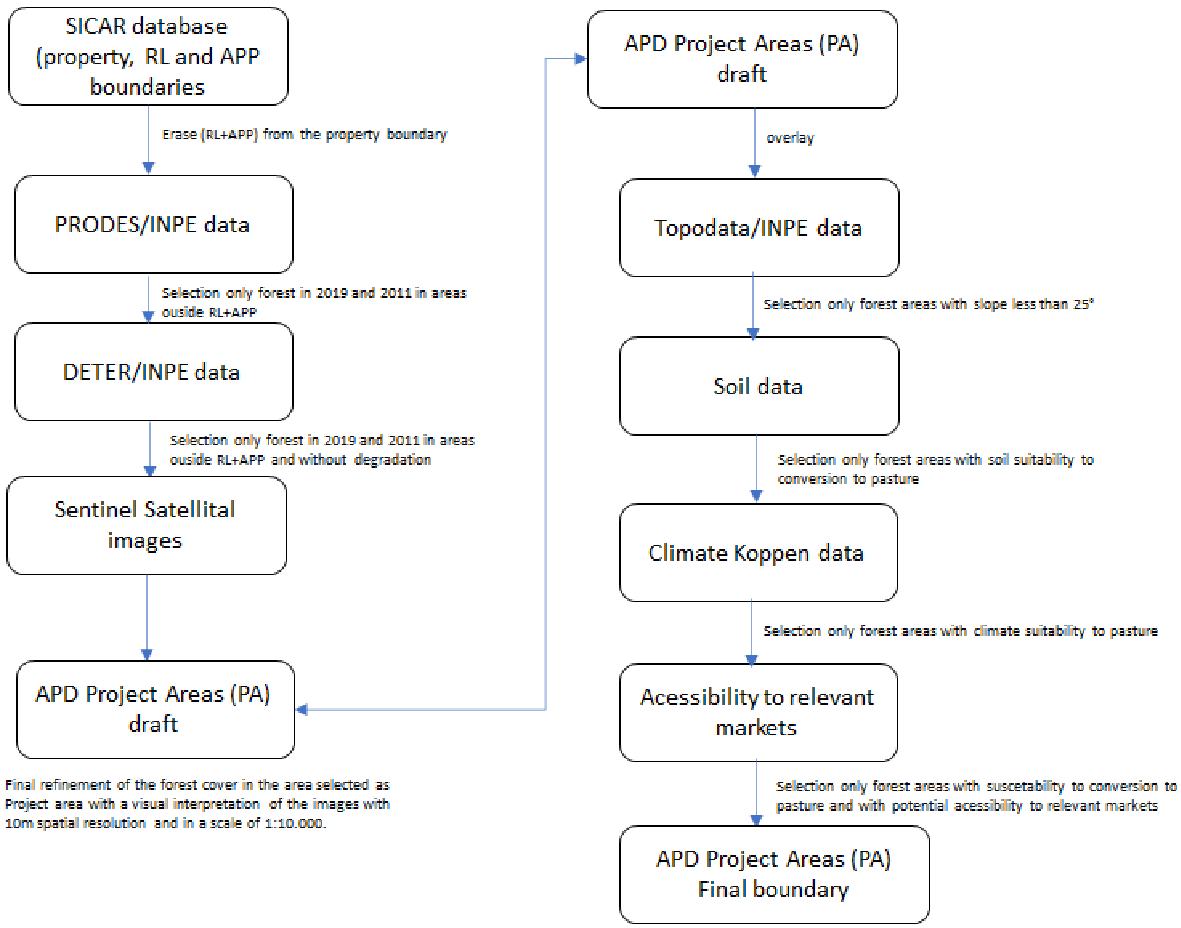


Figure 15: Suitability of project area for baseline activity.

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 v1.3, section 1.2 requirements. Each property under the GPD scope represents a PAI. Each PAI has its specific related documents (Appendix 02). 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 supress 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 02). 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 #1-5 (Fig. 11).

3.4.3 Rate of Deforestation

The deforestation rates ($D\%_{planned,i}$) are defined according to valid verifiable plans (Annex 08). 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 10: Deforestation rates in each PAI.

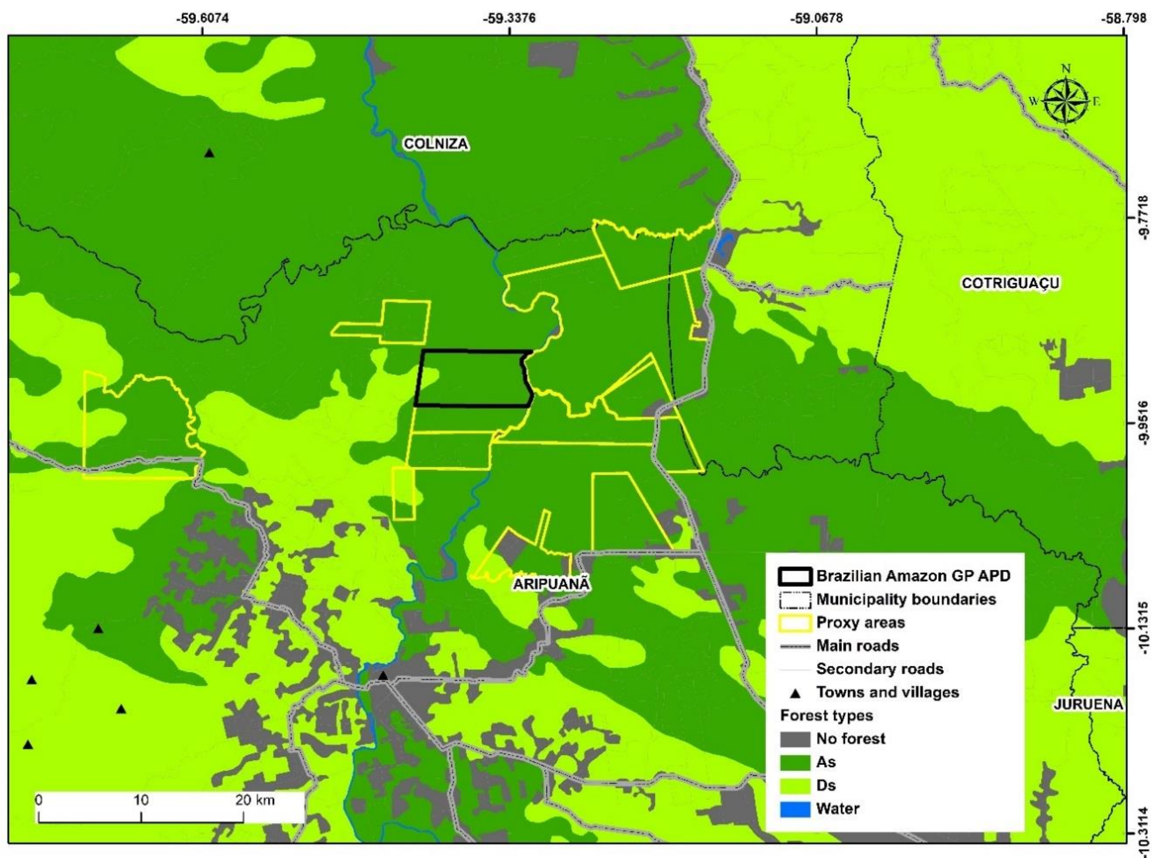
PAI#	Name	Annual deforestation rate (ha/yr)
1	Castanhal	277.74
2	Katianã	404.34
3	Palmares	493.73
4	Porongaba	497.17
5	Potiguar	497.17

3.4.4 Likelihood of Deforestation

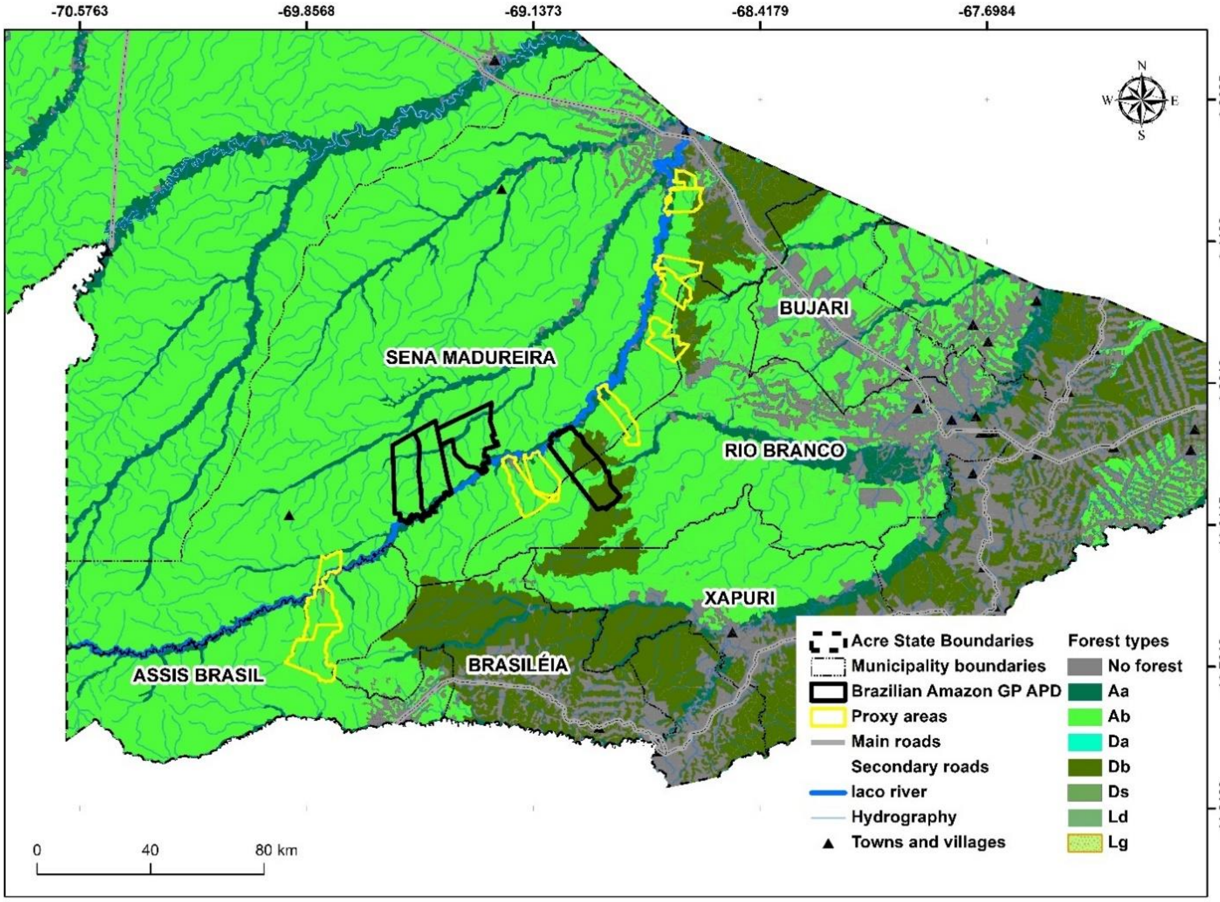
The likelihood of deforestation (L-D_i) is set to be 100%, according to the VMD0006, section 1.4 criteria. The private properties (Appendix 06) under GDP scope are not under government control and are not zoned for deforestation.

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 area in yellow polygons around PAI#1 in Mato Grosso and other PAI#s in Acre with spatial similarity. The geographical proximity of this private properties demonstrates similar forest types (a and b), Koppen's climate classes (c and d) and terrestrial and fluvial transportation networks. All proxy was selected in the geographic political boundaries at municipality level, Aripuana - MT and Sena Madureira - AC.



(a)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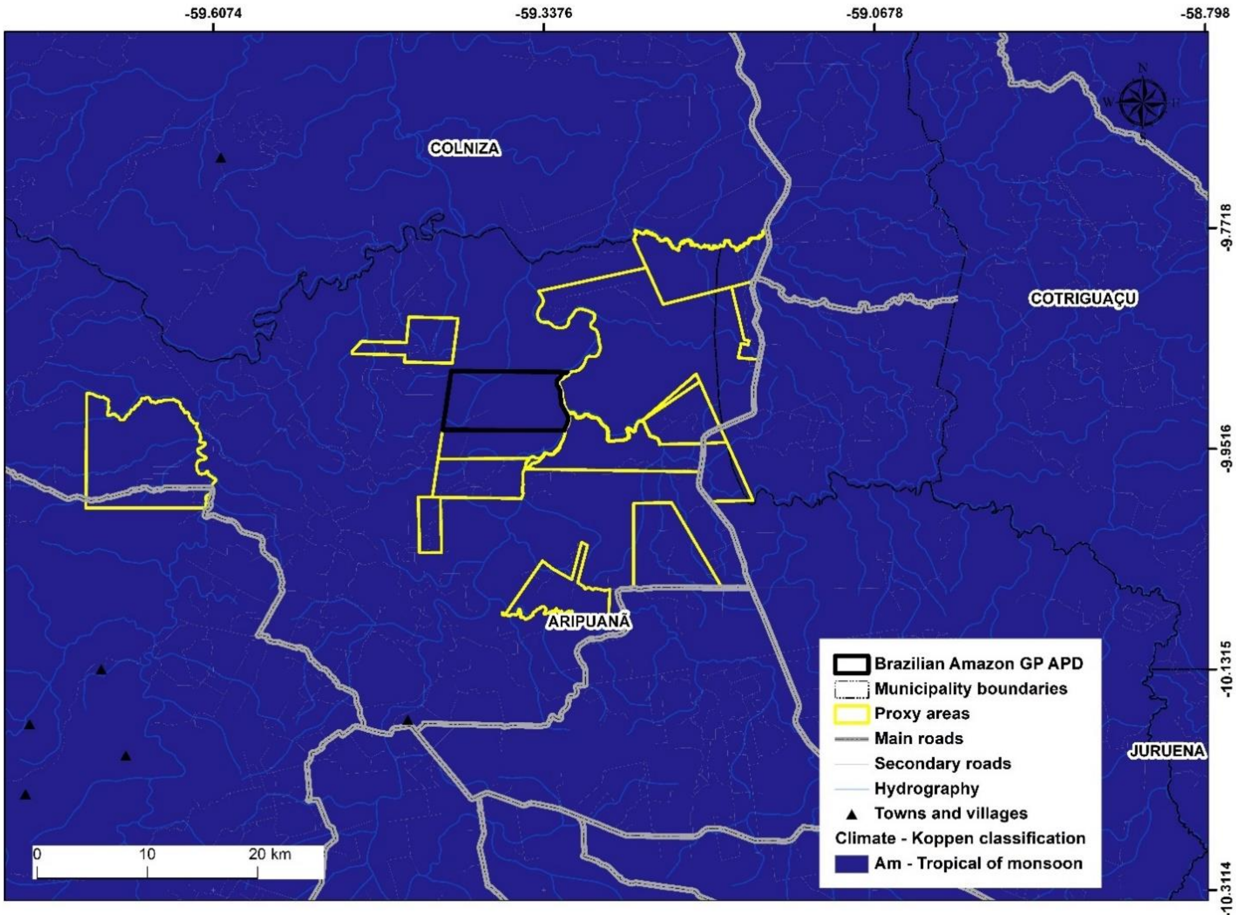
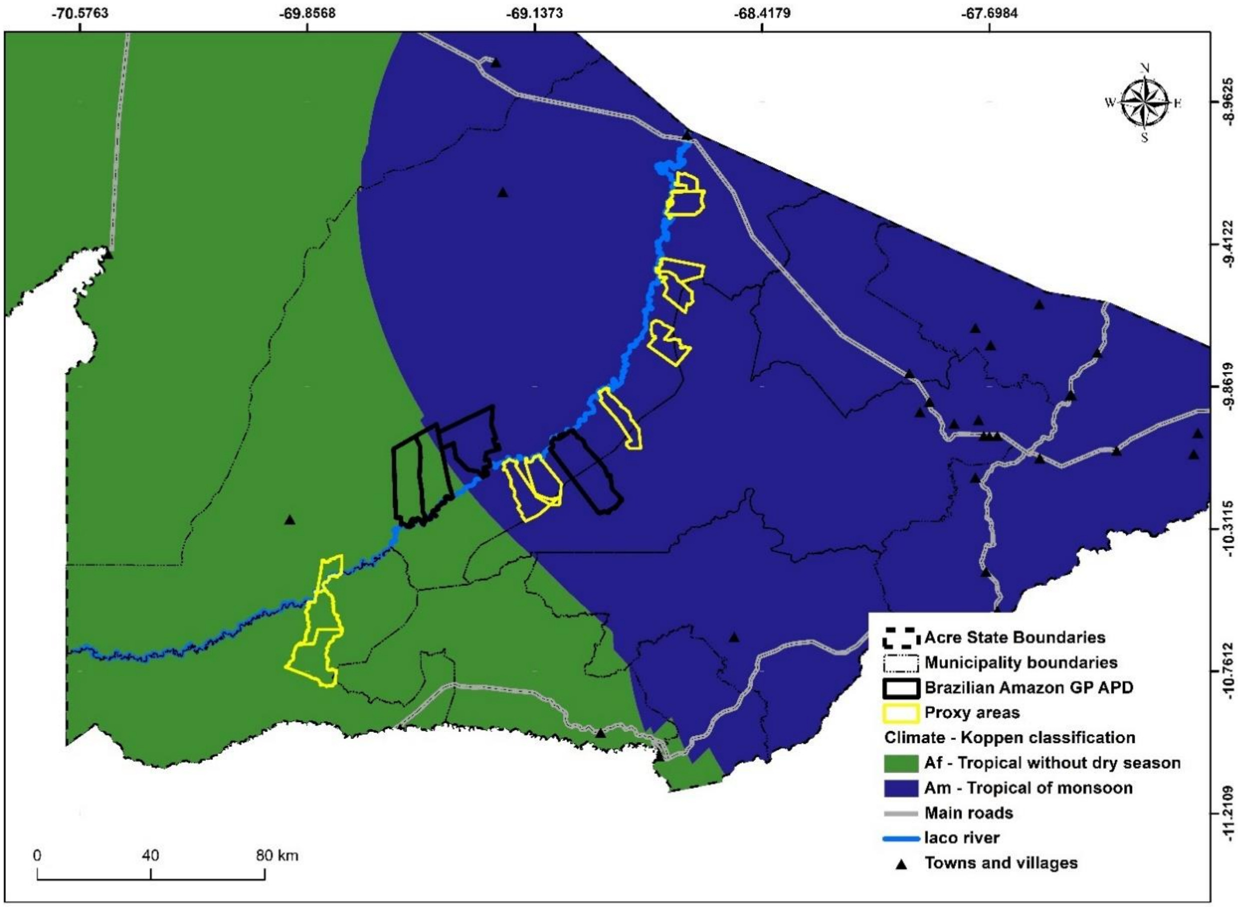
-69.8568
-69.1373
-68.4179
-67.6984
-8.9625
-9.4122
-9.8619
-10.3115
-10.7612
-11.2109
N
S
W
E
BUJARI
SENA MADUREIRA
RIO BRANCO
XAPURI
ASSIS BRASIL
BRASILÉIA
Acre State Boundaries
Municipality boundaries
Brazilian Amazon GP APD
Proxy areas
Main roads
Secondary roads
Iaco river
Hydrography
Towns and villages
Forest types
No forest
Aa
Ab
Da
Db
Ds
Ld
Lg
0
40
80 km

(b)


-59.6074
-59.3376
-59.0678
-58.798
-9.7718
-9.9516
-10.1315
-10.3114
COLNIZA
COTRIGUAÇU
ARIPUANÃ
JURUENA
Brazilian Amazon GP APD
Municipality boundaries
Proxy areas
Main roads
Secondary roads
Hydrography
Towns and villages
Climate - Koppen classification
Am - Tropical of monsoon
0
10
20 km

(c)



(d)

Figure 16: 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 11: Forest types and slope classes similarity between proprieties where the PAIs are located and proxy areas.

Forest types		Aa	Ab	Ap	Db
Proprieties (PAI#s 2,3,4 e 5)	Area (ha)	9,409	81,646	62	16,937
	Area (%)	9%	76%	0%	16%
Proxy areas AC	Area (ha)	9,878	105,120	4,363	7,060
	Area (%)	8%	83%	3%	6%

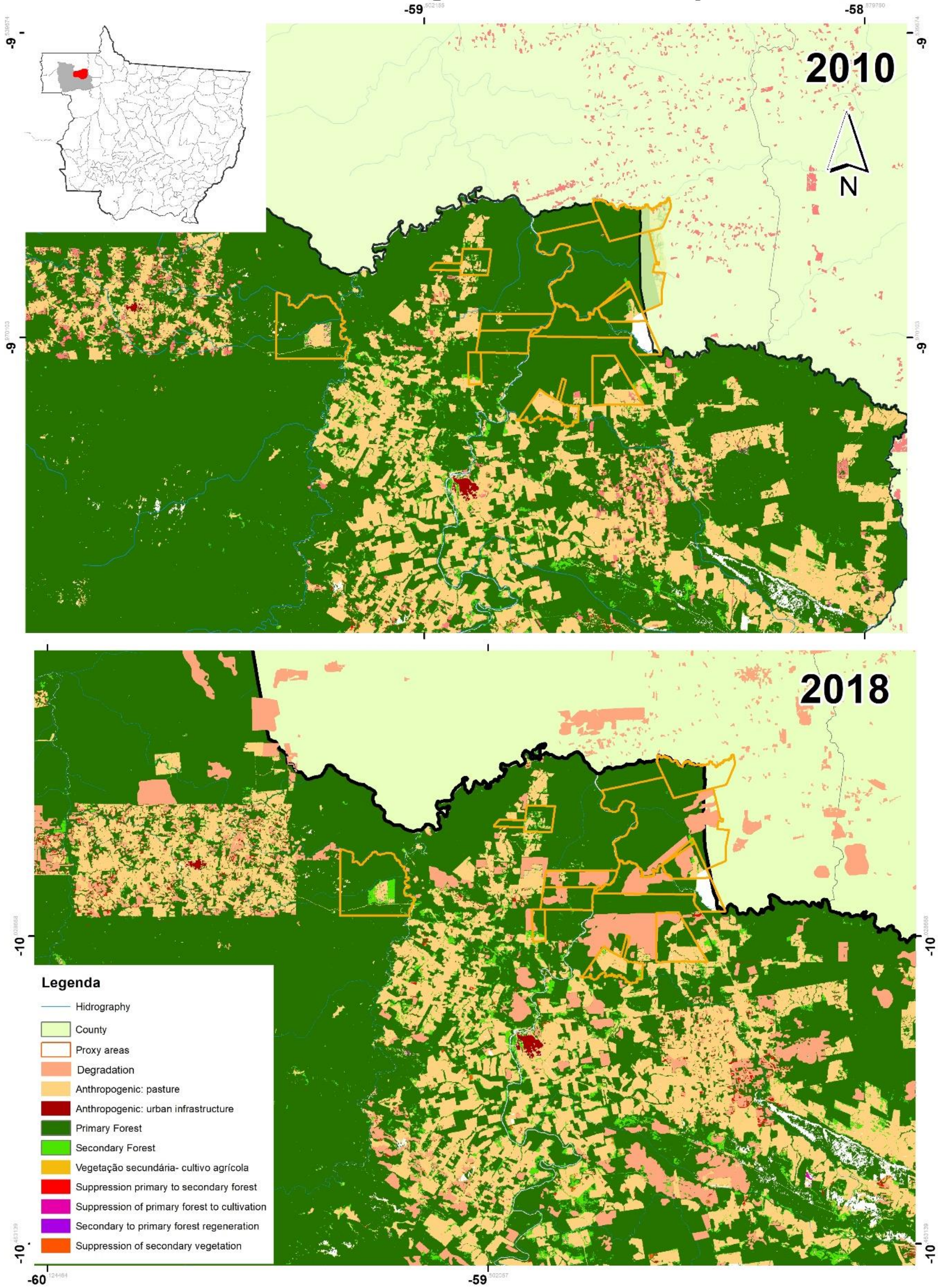
Forest types		Ac	Ap	As	Da	Ds
Propriety (PAI#01)	Area (ha)			5,247		326
	Area (%)			94%		6%
Proxy areas MT	Area (ha)	643	1,110	53,324	4	2,667

	Area (%)	1%	2%	92%	0.0%	5%

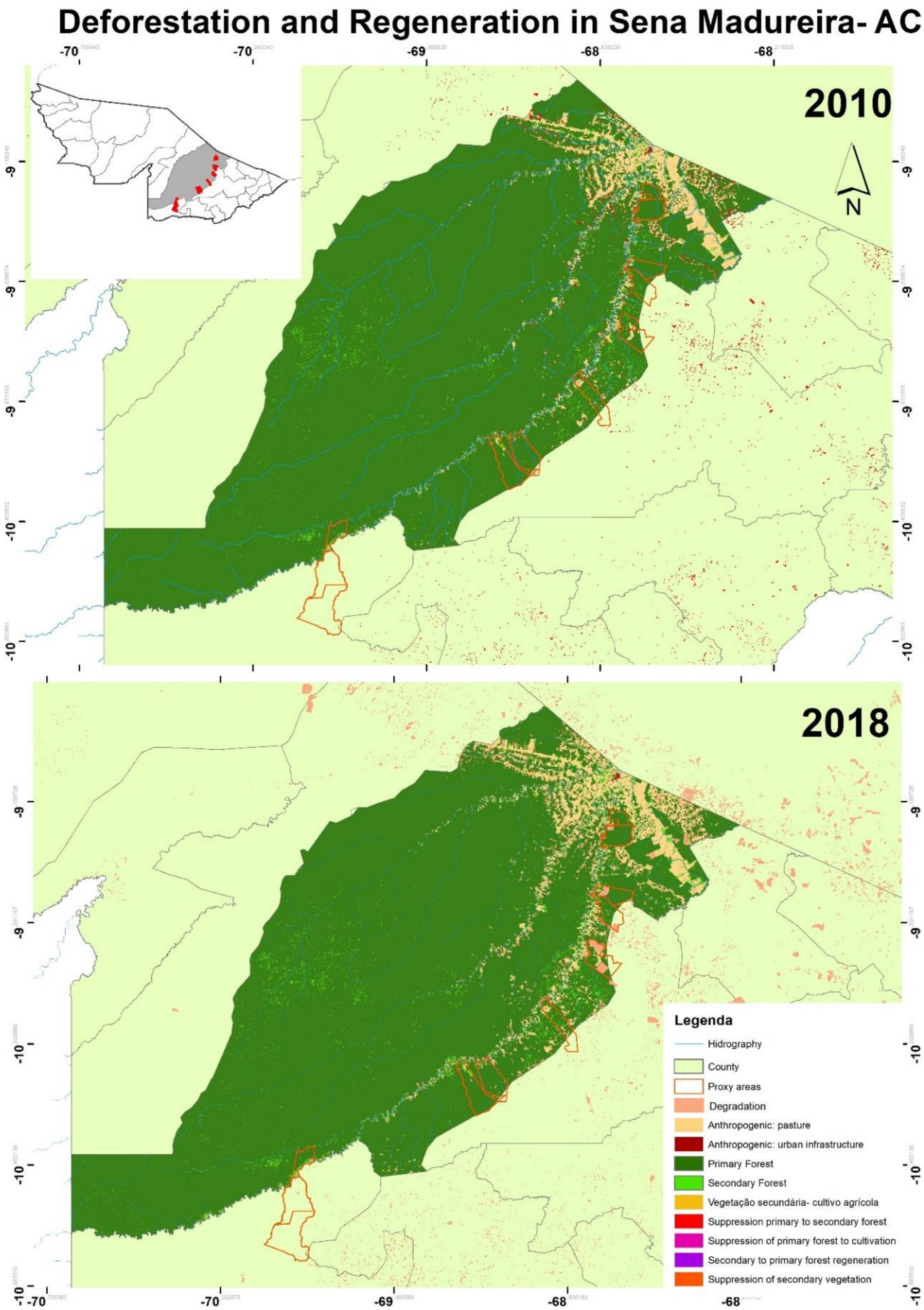
Slope classes		Plan (< 3%)	Smooth wavy (3 - 8 %)	Wavy (8 - 20 %)	Heavy wavy (20 - 45 %)
Proprieties (PAI#s 2,3,4 e 5)	Area (ha)	23,201	56,160	28,565	32
	Area (%)	21%	52%	26%	0.0%
Proxy areas AC	Area (ha)	25,338	61,638	39,162	76
	Area (%)	20%	49%	31%	0.1%
Slope classes		**Plan (< 3%)**	**Smooth wavy (3 - 8 %)**	**Wavy (8 - 20 %)**	**Heavy wavy (20 - 45 %)**
Propriety (PAI#01)	Area (ha)	25,338	61,638	39,162	76
	Area (%)	20%	49%	31%	0.1%
Proxy areas MT	Area (ha)	25,338	61,638	39,162	76
	Area (%)	20%	49%	31%	0.1%

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 timeseries show the increase of pasture at landscape scale. PAI#1 in Mato Grosso (a) and PAI#s in Acre (b). All maps compare the land use and transitions in the years 2010 and 2018 showing increase of pasture are and spatially evidence in low intensity of recovery of secondary forests.

Deforestation and Regeneration in Aripuanã- MT



(a)



(b)

Figure 17: 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 o VMD0006 v1.3 equation 5. See section 4.1.1 for details on the topic.

3.5 Additionality

GPD additionality was assessed according to VT0001 v3.0. This tool was adapted from the CDM "*Tool for the Demonstration and Assessment of Additionality in A/R CDM Project Activities*" (Version 02) and provides a stepwise approach to demonstrate additionality in VCS AFOLU projects. The following sections present the results of each step.

3.5.1 Identification of Alternative Land Use Scenarios to the AFOLU Project Activity

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[15],** 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[16], 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[17].

The identified deforestation agent has a history of deforestation in other lands of his property for economic purposes (Fig. 11), and valid and verifiable plans for deforesting the project area (Appendix 11), which makes scenario "b" realistic and credible.

[15] According to Law 12,651, of May 25, 2012 the land owner is allowed to convert up to 20% of forest within its rural property in Amazon biome, for economic purposes.

[16] Law No. 9,393 of December 19, 1996.

[17] Law No. 8,629 of February 25, 1993.

Illegal deforestation is a common practice throughout the GPD geographic area (Legal Amazon), 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, refers 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 cattle herd progression over the historic reference period of 2011 – 2020 in the municipalities of Sena Madureira (AC) and Aripuanã (MT) where PAIs #1-5 are located (Figs. 19, 20).

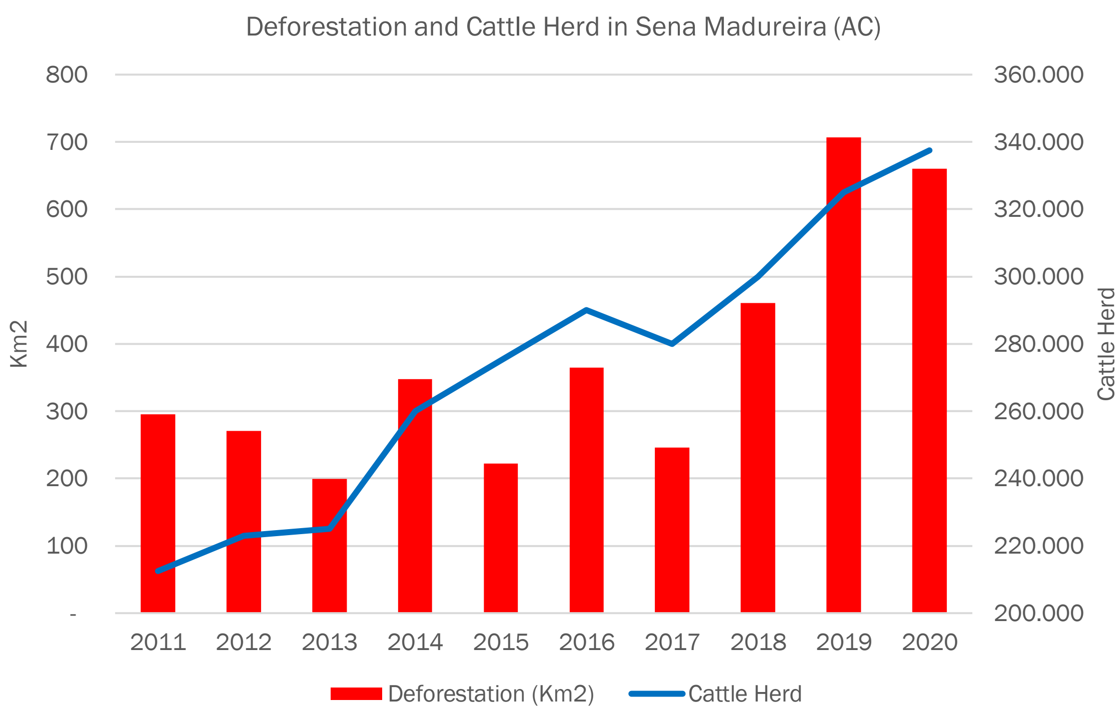


Figure 18: Deforestation and cattle herd in Sena Madureira (AC) (2011 – 2020).

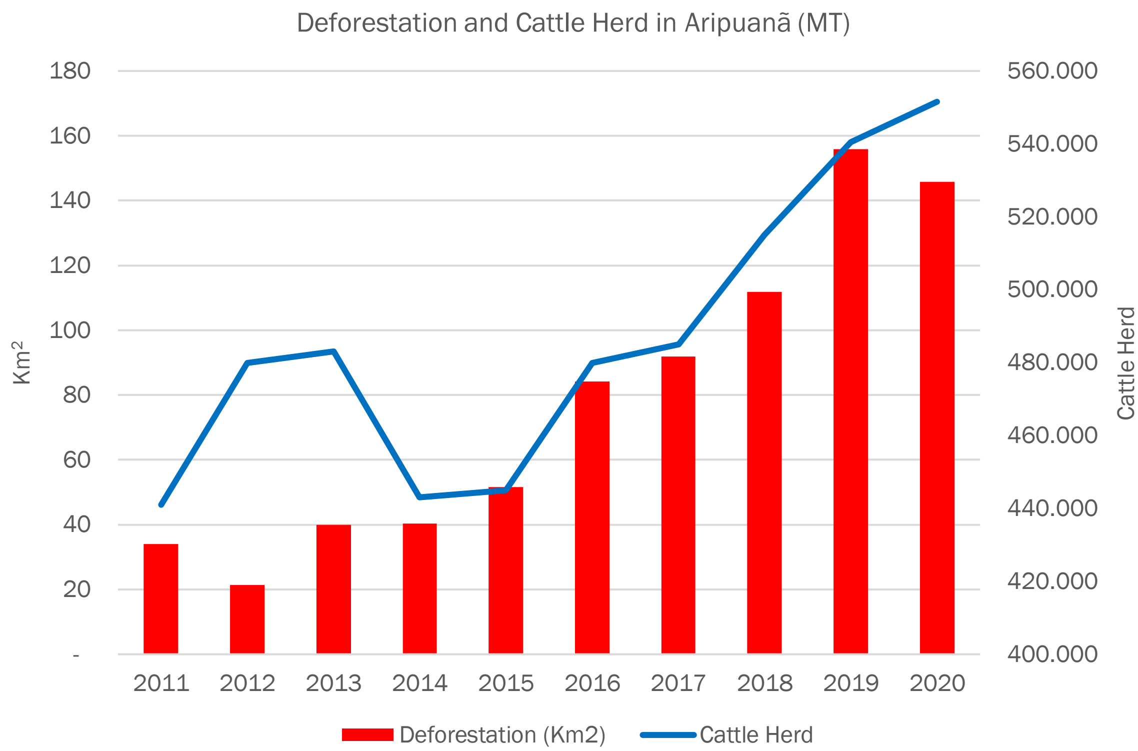


Figure 19: Deforestation and cattle herd in Aripuanã (MT) (2011 – 2020).

3.5.2 Investment Analysis

The proposed project activity is economically less attractive than any agriculture project because no financial benefits other than VCS related income are expected for the project proponent due to the project implementation (see section 1.11). Even though, a comparative financial analysis between the project scenario and the baseline scenario can be found in Appendix 11. The tables below show summarized estimated costs associated with the VCS AFOLU project for the first year (Tab. 12) and the baseline period (Tab. 13) (Outcome of VT0001 v3.0 sub-steps 2a, 2b). The project financial spreadsheet can be found in Appendix 11.

Table 12: Summarized GPD costs (1st. year)

Costs (1st year)	USD[18]
Administrative[19]	$154,300.00
Project activity implementation	$202,400.00

[18] Considering exchange rate at 5 BRL/USD.

[19] Payroll and office expenses.

Monitoring[20]	$26,400,00
Certification[21]	$256,549.06
Logistics	$37,000.00
Sub total	$676,649.06
Fees and taxes	$118,616.58
Total	**$795,265.63**

Table 13: Summarized GPD costs (1st. baseline period)

Costs (1st Baseline period)[22]	USD
Year 01	$795,265.63
Year 02	$82,035.94
Year 03	$82,035.94
Year 04	$82,035.94
Year 05	$995,437.27
Year 06	$82,035.94
Year 07	$82,035.94
Year 08	$82,035.94
Year 09	$82,035.94
Year 10	$1,130,426.13
Total	**$3,495,380.62**

3.5.3 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 VCUs (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.

[20] Considering external consultant's costs.

[21] Validation and verification against VCS + CCB standards, related fees, and taxes.

[22] Considering fees and taxes.

- **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 illegal deforestation in Brazil (Outcome of VT0001 v3.0 sub-step 3b).

3.5.4 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[23], the ecological ICMS[24] and the REM program in the states of Acre and Mato Grosso.

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 tittle represents 1 ha with preserved forest cover. As these tittles 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[25], only 111 properties were found for the entire Amazon biome, offering their surplus of native vegetation remnants for "Legal Reserve compensation" in other properties. Only 5 of the 111 properties are in the state of Acre and 9 are located in the state of Mato Grosso. Of these properties, only one in the state of Acre and three in the state of Mato Grosso could be considered on the same scale[26]. Notwithstanding, the fact that they are offered in the market, does not mean

[23] The Environmental Reserve Quotas (CRAs) are titles representing vegetation cover that can be used to compensate for the lack of a Legal Reserve on another property.

[24] The Ecological ICMS is a tax mechanism that allows municipalities access financial resources collected by the States through the Tax on Circulation of Goods and Services.

[25] https://www.bvrio.org/

[26] Areas up to 30% larger or 30% smaller than the project area in each PAI were considered to be of similar scale.

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 take into account 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.

The ecological ICMS was created in 2019 in the state of Acre and came into force in 2021. The mechanism increases tax income for municipalities with a larger area of conservation units, but it does not serve the purpose of remunerating landowners for the conservation of native vegetation on their properties. In this sense it can be understood that ecological ICMS has a different regulatory framework and are not like REDD projects.

The state of Acre counts with the System of Incentives for Environmental Services (SISA), created by State Law nº 2,308/2010. The SISA foresees the implementation of different programs, of which "ISA – Carbono" has the most advanced stage of implementation. ISA Carbono activity is carried out with financial resources from German Cooperation, through the REDD Early Movers Program (REM). Through these actions, the state government invests in sustainable cattle raising, family agriculture production and NTFP extractives, subsidizing production chains. Mato Grosso also counts on a State REDD+ System, established by Law No. 9,878 of 2013, which start benefiting from REM program in 2017. As in Acre, REM program activity in Mato Grosso is focused on sustainable cattle raising, NTFP extractives, structuring of sustainable production chains, family agriculture and traditional communities. These state program actions are carried out with focus on socioeconomic development and on reducing deforestation pressure on forests and, in this sense, could be consider as similar activities to a REDD+ project. In the other hand, essential distinctions between these mechanisms can be noted. In the first place, it can be noted that jurisdictional REDD+ programs are implemented as public policies, thus having a sectoral coverage in contrast to carbon projects, which work at the property level. Second, it is understood that the REDD+ program activities aim at reducing deforestation as a whole and not just legal deforestation, as foreseen in this GDP. Third, these REDD+ programs build baselines as a function of deforestation rates observed in a reference period in a non-spatially explicit way, unlike REDD+ projects, which project deforestation in a spatially explicit way over time. Finally, it is understood that the REDD+ programs existing today in the states of Acre and Mato Grosso receive payments for results without the verified GHG emission reduction serving the purpose of offsetting GHG emissions from the paying source. In this sense, BRC understands that the public policies implemented by theses state governments are complementary to GPD activity. BRC will seek articulation with the government authorities to facilitate the access of communities living in the project area to the benefits from REM program implementation and benefit sharing mechanisms in each state.

In conclusion, no similar activities are diffused in the same geographical area, or activities considered to be similar have essential distinctions to the GPD. Hence, the GPD activity is additional.

3.6 Methodology Deviations

According to the VCS v.4, section 3.17, projects may deviate from the procedures related to measurements or monitoring set out in methodologies where the proposed deviation leads to the same level of accuracy or is more conservative than what is set out in the methodology. This GPD has three methodology deviations:

1) $CAB_{\_non\text{-}tree,i,t}$ - carbon stock in aboveground biomass in non-trees is considered as part of the average aboveground biomass stock subjected to burning ($B_{i,t}$) in VMD0013 v1.2, equation 2 in the baseline and project scenarios. The proposed methodology deviation relates to measurement and monitoring procedures and lead to more accurate estimates once this carbon pool is expected to be burned in the baseline case and project scenario. For additional information see Appendix 08.

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 all families living inside the project area explore the forest for timber and fuel wood, what shall be considered as a low 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 a constant in PAIs where community presence is perceived. Rather than making a PRA in 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.

3) Monitoring period: The first monitoring period extends from August 2 (project start date) to October 19, 2021 (first monitoring report closing date). BRC proposes a methodology deviation related to the minimum duration of a monitoring period, to be applicable only in the first monitoring event.

   Considering that this is a REDD+ APD project, GHG emissions in the baseline scenario would occur would occur in the same period (from august to october) as the monitored period, that refers to the dry period in Amazonia, where logging and forest suppression is feasible, which is evidenced by the project start date (dry period in Amazonia), by operational and financial capacity of the landowner, through contracts signed with service providers for vegetation suppression and also through spatial analysis in other areas of the landowner property (Appendix 12). The project GHG emissions, in turn, cannot be considered as underestimated as the project excludes all deforested area within the properties, in the last 10 years, from the project area. In this way, the reduction of forest area affects the estimates negatively anyway. GHG emissions due to activity shifting leakage were considered as zero in the first year, because of the current project scope, which characterizes the absence of legally suppressible forest areas on other farms within the landowners' properties. Finally, market effects leakage varies in function of the volume of timber projected to be extracted from within the project boundary during the baseline and would be the same for the first vintage, regardless of the length of the monitoring period (if 3 or 12 months).

Thus, with the proposed deviation, the project will achieve the same level of accuracy in GHG estimates. The deviation will not negatively impact the conservativeness of the quantification of GHG emission reductions.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions are estimated according to VMD0006 v1.3. 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 section 3.5.

4.1.1 Deforestation in the Baseline Scenario

The annual area of baseline planned deforestation ($AA_{planned,i,t}$) is calculated according to VMD0006 BL-PL v1.3 equation 5:

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

Where:

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

The total area of planned deforestation over the first baseline period ($A_{planned,i,t}$), in each PAI (Tab. 15), 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 02). 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-Di is set to be 100%, according to the VMD0006 v1.3 requirements.

Table 14: Total and annual area of planned deforestation over the baseline scenario in all PAIs.

Year	$AA_{planed,i,t}$															Total (ha)
	PAI#01			PAI#02			PAI#03			PAI#04			PAI#05			
	As	Ds	Total	Aa	Ab	Total	Aa	Ab	Total	Aa	Ab	Total	Aa	Ab	Total	
2021	186	92	278	-	404	404	247	247	494	249	249	497	249	249	497	2,170
2022	186	92	278	-	404	404	247	247	494	249	249	497	249	249	497	2,170
2023	186	92	278	-	404	404	172	322	494	249	249	497	249	249	497	2,170
2024	107	52	158	-	404	404	-	494	494	57	440	497	249	249	497	2,051
2025	-	-	-	-	404	404	-	494	494	-	497	497	249	249	497	1,892
2026	-	-	-	-	404	404	-	494	494	-	497	497	249	249	497	1,892
2027	-	-	-	-	404	404	-	494	494	-	497	497	120	377	497	1,892
2028	-	-	-	55	349	404	-	494	494	-	497	497	-	497	497	1,892
2029	-	-	-	404	-	404	-	494	494	-	219	219	-	233	233	1,349
2030	-	-	-	404	-	404	-	87	87	-	-	-	-	-	-	492
$A_{planed,i,t}$	665	327	992	864	3,180	4,043	666	3,865	4,531	803	3,393	4,196	1,612	2,598	4,210	17,972

4.1.2 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 forest inventories, while stocks in the post-deforestation categories are taken from peer reviewed literature.

4.1.2.1 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 v1.3, 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 15: Baseline carbon stock change in aboveground tree biomass (t CO_2-e ha^{-1}).

Stratum (i)	$C_{AB\_tree,bsl,i}$	$C_{AB\_tree,post,i}$	$\Delta C_{AB\_tree,i}$
As	417.30	0.1	417.19
Ds	358.41	0.1	358.30
Aa	374.30	0.1	374.19
Ab	383.90	0.1	383.79

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 v1.1 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 07.

4.1.2.2 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 v1.3, 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 16: Baseline carbon stock change in belowground tree biomass (t CO_2-e ha^{-1}).

Stratum (i)	$C_{BB\_tree,bsl,i}$	$C_{BB\_tree,post,i}$	$\Delta C_{BB\_tree,i}$
As	41.73	0.02	41.71
Ds	111.11	0.02	111.09
Aa	37.43	0.02	37.41
Ab	38.39	0.02	38.37

Forest carbon stock in belowground tree biomass ($C_{BB\_tree,bsl,i}$) is calculated through root-to-shoot ratios taken from peer reviewed literature (Silva 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).

4.1.2.3 Aboveground Non-Tree Biomass

The baseline carbon stock change in aboveground non-tree biomass ($\Delta C_{AB\_non\text{-}tree,i}$) is calculated according to the difference between the forest carbon stock in aboveground non-tree biomass in stratum I ($C_{AB\_non\text{-}tree,bsl,i}$) and the post-deforestation carbon stock in aboveground non-tree biomass in stratum I ($C_{AB\_non\text{-}tree,post,i}$), according to VMD0006 v1.3, equation7:

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

Where:

$\Delta C_{AB\_non\text{-}tree,i}$	Baseline carbon stock change in aboveground non-tree biomass in stratum i; tCO_2-e ha^{-1}
$C_{AB\_non\text{-}tree,bsl,i}$	Forest carbon stock in aboveground non-tree vegetation in stratum i; tCO_2-e ha^{-1}.
$C_{AB\_non\text{-}tree,post,i}$	Post-deforestation carbon stock in aboveground non-tree vegetation in stratum i; tCO_2-e ha^{-1}.
i 1, 2, 3, …	M strata.

Table 17: Baseline carbon stock change in aboveground non-tree biomass (t CO_2-e ha^{-1}).

Stratum (i)	$C_{AB\_non\text{-}tree,bsl,i}$	$C_{AB\_non\text{-}tree,post,i}$	$\Delta C_{AB\_non\text{-}tree,i}$
As	44.65	15.00	29.65

Ds	19.00	15.00	4.00
Aa	40.05	15.00	25.05
Ab	41.08	15.00	26.08

Forest carbon stock in aboveground non-tree biomass ($C_{AB\_non\text{-}tree,bsl,i}$) 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 ($C_{AB\_non\text{-}tree,post,i}$) is taken from peer reviewed literature (Silva Neto et al., 2012).

4.1.2.4 Belowground Non-Tree Biomass

The baseline carbon stock change in belowground non-tree biomass ($\Delta C_{BB\_non\text{-}tree,i}$) is calculated according to the difference between the forest carbon stock in belowground non-tree ($C_{BB\_non\text{-}tree,bsl,i}$) and the post-deforestation carbon stock in belowground non-tree biomass ($C_{BB\_non\text{-}tree,post,i}$), according to VMD0006 v1.3, equation 9:

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

Where:

$\Delta C_{BB\_non\text{-}tree,i}$	Baseline carbon stock change in belowground non-tree biomass in stratum i; t CO_2-e ha^{-1}.
$C_{BB\_non\text{-}tree,bsl,i}$	Forest carbon stock in belowground non-tree biomass in stratum i t CO_2-e ha^{-1}.
$C_{BB\_non\text{-}tree,post,i}$	Post-deforestation carbon stock in belowground tree biomass in stratum i; t CO_2-e ha^{-1}.
i 1, 2, 3, …	M strata.

Table 18: Baseline carbon stock change in belowground non-tree biomass (t CO_2-e ha^{-1}).

Stratum (i)	$C_{BB\_non\text{-}tree,bsl,i}$	$C_{BB\_non\text{-}tree,post,i}$	$\Delta C_{BB\_non\text{-}tree,i}$
As	8.93	3.00	5.93
Ds	3.80	3.00	0.80
Aa	8.01	3.00	5.01
Ab	8.22	3.00	5.22

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 ($C_{BB\_non\text{-}tree,post,i}$) is taken from peer reviewed literature (Silva Neto et al., 2012).

4.1.2.5 Deadwood

The baseline carbon stock change in deadwood ($\Delta C_{DW,i}$) is calculated according to the difference between the forest carbon stock in deadwood ($C_{DW,i}$) and the post-deforestation carbon stock in deadwood ($C_{DW,post,i}$), according to VMD0006 v1.3 equation 10:

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

Where:

$\Delta_{CDW,i}$	Baseline carbon stock change in dead wood in stratum i; t CO_2-e ha^{-1}.
$C_{DW,bsl,i}$	Forest carbon stock in dead wood in stratum i; t CO_2-e ha^{-1}.
$C_{DW,post,i}$	Post-deforestation carbon stock in dead wood in stratum i; t CO_2-e ha^{-1}.
i 1, 2, 3, …	M strata.

Table 19: Baseline carbon stock change in deadwood (t CO_2-e ha^{-1}).

Stratum (i)	$C_{DW,bsl,i}$	$C_{DW,post,i}$	$\Delta_{CDW,i}$
As	34.29	-	34.29
Ds	22.40	-	22.40
Aa	14.20	-	14.20
Ab	8.60	-	8.60

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 v1.0 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 07.

4.1.2.6 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 v1.3 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 CO_2-e ha^{-1}.
$C_{LI,bsl,i}$	Forest carbon stock in litter in stratum i; t CO_2-e ha^{-1}.
$C_{LI,post,i}$	Post-deforestation carbon stock in litter in stratum i; t CO_2-e ha^{-1}.

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

Table 20: Baseline carbon stock change in litter (t CO_2-e ha^{-1}).

Stratum (i)	$C_{LI,bsl,i}$	$C_{LI,post,i}$	$\Delta C_{LI,i}$
As	19.06	-	19.06
Ds	24.16	-	24.16
Aa	9.49	-	9.49
Ab	9.64	-	9.64

Forest carbon stock in litter ($C_{LI,bsl,i}$) is estimated based on field measurements of fixed area plots, according to VMD0003 v1.0 criteria. Post-deforestation carbon stock in litter ($C_{LI,post,}$) 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 07.

4.1.2.7 Soil Organic Carbon

The baseline carbon stock change in soil organic carbon ($\Delta_{SOC,i}$) 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 v1.3 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 CO_2-e ha^{-1}.

$C_{SOC,bsl,i}$ 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 21: Baseline carbon stock change in soil organic carbon (t CO_2-e ha^{-1}).

Stratum (i)	$C_{SOC,bsl,i}$	$C_{SOC,PD-BSL,i}$	$\Delta C_{SOC,i}$
As	75.58	104.25	(28.68)

Ds	77.20	121.21	(44.01)
Aa	120.11	104.25	15.86
Ab	120.00	121.21	(1.21)

Forest carbon stock in soil organic carbon ($C_{SOC,bsl,i}$) is estimated based on field measurements of fixed area plots, according to VMD0004 v1.0 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 v1.0 criteria. For more information about the sampling design, allometric equations adopted and associated SOPs, refer to Appendix 07.

4.1.2.8 Wood Products

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

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

$C_{WP,i}$ 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 v1.1 equation 1:

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

Where:

$C_{XB,ty,i}$ Mean stock of extracted biomass carbon by class of wood product ty from stratum i; tCO_2-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; m^3.
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).
44/12	Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C-1.

Total area (Ai) equal to the project area ($A_{planned,i,}$). The volume of timber extracted ($V_{ex,ty,j}$) is taken from pre-exploratory inventories or forest exploration plans (Annex 08). 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 v1.1 equation 3:

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

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 CO2-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.

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

Table 22: Carbon stocks in the long-term wood products pool.

PAI	Stratum (i)	$C_{WP,i}$	$C_{WP100,i}$
PAI#01	As	8.20	6.89
	Ds		
PAIs #2-5	Aa	8.60	7.23
	Ab		6.88

4.1.3 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 v1.3:

$$\Delta C_{BSL,i,t} = AA_{planned,i,t} \times (\Delta C_{AB_{tree},i} - \Delta C_{WP,i} + \Delta C_{AB_{non-tree},i} + \Delta C_{LI,i})$$

$$+(\sum_{t-10}^{t} AA_{planned,i,t}) \times (\Delta C_{BB_{tree},i} + \Delta C_{BB_{non-tree},i} + \Delta C_{DW,i}) * \left(\frac{1}{10}\right)$$

$$+(\sum_{t-20}^{t} AA_{planned,i,t}) \times \left(C_{WP100,i} + \Delta C_{SOC,i}\right) * \left(\frac{1}{20}\right)$$

Where:

$\Delta C_{BSL,i,t}$	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 23: Net carbon stock changes in all pools in the baseline period in all PAIs (t CO_2-e).

Year	$\Delta C_{BSL,i,t}$					$\Delta C_{BSL,i,t}$	$\Delta C_{BSL,i,t}$
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	134,052	190,840	218,925	220,451	220,451	984,719	984,719
2022	147,512	212,055	233,386	235,012	235,012	1,062,978	2,047,697
2023	136,696	233,270	252,065	249,574	249,574	1,121,179	3,168,877
2024	92,470	254,485	279,656	274,923	264,136	1,165,668	4,334,545
2025	23,700	275,699	305,390	301,457	278,697	1,184,944	5,519,490
2026	23,700	296,914	331,125	327,371	293,259	1,272,370	6,791,859
2027	23,700	318,129	356,860	353,285	315,055	1,367,030	8,158,890
2028	23,700	335,767	382,595	379,199	342,267	1,463,529	9,622,419
2029	23,700	331,753	408,330	273,729	243,388	1,280,901	10,903,319
2030	23,700	334,509	242,368	182,025	145,822	928,424	11,831,744

4.1.4 Non-CO_2 Emissions in the Baseline Scenario

The greenhouse gas emissions as a result of deforestation activities within the project boundary is estimated according to VMD0006 v1.3 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_2e 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.
$N2O_{direct\text{-}N,i,t}$	Direct N_2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t; 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 CO_2e emission from fossil fuel combustion ($E_{FC,i,t}$) and nitrogen application (N2Odirect-N,i,t) in the baseline scenario are conservative excluded (see section 3.3.4).

Non-CO_2 emissions due to biomass burning ($E_{BiomassBurn,i,t}$) are calculated according to VMD0013 v1.2, equation 1:

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

Where:

$E_{biomassburn,i,t}$	Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO_2, CH_4, N_2O) (t CO_2e)
$A_{burn,i,t}$	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 dioxide1, methane and nitrous oxide (unitless)
i 1, 2, 3 …	M strata (unitless)
t 1, 2, 3, …	t* time elapsed since the start of the project activity (years)

The 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 form the latest IPCC assessment report.

The average aboveground biomass stock before burning is calculated according to VMD0013 v1.2, equation 2[27]:

$$B_{i,t} = (C_{AB\_tree,i,t} + C_{AB_{non-tree_{bsl}},i} + C_{DW i,t} + C_{LI,i,t}) \times 12/44 \times (1/CF)$$

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_2e ha-1).
$C_{AB\_non\text{-}tree,i,t}$	Carbon stock in aboveground biomass in non-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).

Table 24: Non-CO_2 emissions in the baseline case.

Year	$A_{burn,i,t}$										$GHG_{BSL,E}$
	PAI#01		PAI#02		PAI#03		PAI#04		PAI#05		
	As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab	
2021	186	92	-	404	247	247	249	249	249	249	61,546
2022	186	92	-	404	247	247	249	249	249	249	61,546
2023	186	92	-	404	172	322	249	249	249	249	61,571
2024	107	52	-	404	-	494	57	440	249	249	58,092
2025	-	-	-	404	-	494	-	497	249	249	53,227
2026	-	-	-	404	-	494	-	497	249	249	53,227
2027	-	-	-	404	-	494	-	497	120	377	53,269
2028	-	-	55	349	-	494	-	497	-	497	53,290
2029	-	-	404	-	-	494	-	219	-	233	37,874
2030	-	-	404	-	-	87	-	-	-	-	13,716

[27] Adjusted to reflect methodological deviation.

4.1.5 Net GHG emissions in the Baseline Scenario

The baseline net GHG emissions for planned deforestation is determined according to VMD0006 BL-PL v1.3 equation 1:

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

Where:

$\Delta C_{BSL,planned}$ Net greenhouse gas emissions in the baseline from planned deforestation up to year t*; t CO_2-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 25: Net GHG emissions in the baseline from planned deforestation in the baseline period in all PAIs (t CO_2-e).

Year	$\Delta C_{BSL,planned}$					$\Delta C_{BSL,planned}$	$\Delta C_{BSL,planned}$
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	142,617	202,230	232,752	234,374	234,292	1,046,265	1,046,265
2022	156,076	223,445	247,213	248,936	248,854	1,124,524	2,170,789
2023	145,260	244,660	265,917	263,497	263,416	1,182,750	3,353,540
2024	97,354	265,875	293,564	288,909	278,059	1,223,760	4,577,300
2025	23,700	287,089	319,299	315,462	292,621	1,238,171	5,815,471
2026	23,700	308,304	345,034	341,376	307,182	1,325,597	7,141,067
2027	23,700	329,519	370,769	367,290	329,021	1,420,299	8,561,366
2028	23,700	347,139	396,503	393,204	356,272	1,516,820	10,078,186
2029	23,700	343,010	422,238	279,887	249,940	1,318,775	11,396,961
2030	23,700	345,766	244,827	182,025	145,822	942,140	12,339,101

4.2 Project Emissions (ex-ante)

Project GHG emissions will be considered according to VMD0015 v2.2. 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.

4.2.1 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 2011 and 2020, for ex-ante estimates. Deforestation in the project area will be monitored ex-post according to PRODES data.

Table 26: Projected deforestation in the project area (ex-ante) (ha).

Year	ADefPA,u,i,t									
	PAI#01		PAI#02		PAI#03		PAI#04		PAI#05	
	As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab
2021	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2022	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2023	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2024	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2025	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2026	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2027	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2028	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2029	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1
2030	0	0	0.6	0.6	3.2	3.2	24.3	24.3	1.1	1.1

Net carbon stock changes in all pools in the project case is calculated according to VMD0015 v2.2, 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 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}.
$C_{P,post,u,i}$	Carbon stock in all pools in post-deforestation land use u in stratum i; t CO_2-e ha^{-1}.
$C_{WP,i}$	Carbon stock sequestered in wood products[28] from harvests in stratum i; t CO_2-e ha^{-1}.
u 1,2,3,...	U post-deforestation land uses.

[28] Calculated according to the Module CP-W.

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 27: Net carbon stock changes in all pools in the project case (ex-ante) (t CO2-e ha-1).

Stratum (i)	$C_{BSL,i}$	$C_{P,post,u,i}$	$C_{WP,i}$	$\Delta C_{pools,Def,u,i,t}$
As	641.5	122.4	8.2	511.0
Ds	616.1	139.3	8.2	468.5
Aa	603.6	122.4	8.6	472.6
Ab	609.8	139.3	8.6	461.9

Net carbon stock change as a result of deforestation in the project area in the project case is calculated according to VMD0015 v2.2, equation 03:

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

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 28: Net carbon stock change as a result of deforestation in the project case (ex-ante) (t CO_2-e).

Year	$\Delta C_{P,DefPA,i,t}$					$\Delta C_{P,DefPA,i,t}$	$\Delta C_{P,DefPA,i,t}$
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	-	575	2,985	22,670	1,063	27,292	27,292
2022	-	575	2,985	22,670	1,063	27,292	54,584
2023	-	575	2,985	22,670	1,063	27,292	81,876
2024	-	575	2,985	22,670	1,063	27,292	109,168
2025	-	575	2,985	22,670	1,063	27,292	136,461
2026	-	575	2,985	22,670	1,063	27,292	163,753
2027	-	575	2,985	22,670	1,063	27,292	191,045
2028	-	575	2,985	22,670	1,063	27,292	218,337
2029	-	575	2,985	22,670	1,063	27,292	245,629
2030	-	575	2,985	22,670	1,063	27,292	272,921

4.2.2 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 v2.2, 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 CO_2-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 CO_2-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.

4.2.2.1 Timber, Fuelwood and Charcoal Collection in the Project Scenario

Forest degradation projections were made as a function of the initial participatory rural appraisal results, for ex-ante estimates. According to initial PRA, all families living inside the project area explore the forest for timber and fuel wood, what shall be considered as a low 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 a constant in PAIs where community presence is perceived. The average consumption of wood per family is 15.6 m^3yr^{-1}. The number of families living inside the PAIs can be found in table 7.

For ex-post estimates, 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. The degradation penetration is determined through field observations and remote sensing data, associated with field verifications. These techniques allow to map forest gaps and draw the buffer area based on the access points. Total area of degradation sample plots is equal to at least 1% of the area subject to degradation in each PAI.

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 is calculated according to VMD0015 v2.2, equation 08:

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

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 CO_2-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 CO_2-e.

A_{Pi} 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 29: Net carbon stock change as a result of degradation in the project case (ex-ante) (t CO_2-e).

Year	$\Delta C_{P,DegW,i,t}$					$\Delta C_{P,DegW,i,t}$	$\Delta C_{P,DegW,i,t}$
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	12	41	28	873	55	1,009	1,009
2022	12	41	28	873	55	1,009	2,017
2023	12	41	28	873	55	1,009	3,026
2024	12	41	28	873	55	1,009	4,035
2025	12	41	28	873	55	1,009	5,044
2026	12	41	28	873	55	1,009	6,052
2027	12	41	28	873	55	1,009	7,061
2028	12	41	28	873	55	1,009	8,070
2029	12	41	28	873	55	1,009	9,078
2030	12	41	28	873	55	1,009	10,087

4.2.2.2 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 v2.2, equation 09:

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

Where:

$\Delta C_{P,SelLog,i,t}$	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 CO_2-e.
$C_{LG,i,t}$	Actual net project emissions arising in the logging gap in stratum i in year t; t CO_2-e.
$C_{LR,i,t}$	Actual net project emissions arising from logging infrastructure in stratum i in year t; t CO_2-e.
$C_{WP\ i,t}$	Carbon stock in wood products pool from stratum i, in year t; t CO_2-e.
t 1, 2, 3, …	t years elapsed since the start of the project activity.

4.2.2.2.1 GHG emissions arising from the logging gap

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

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

Where:

$C_{LG,i,t}$	Actual net project emissions arising in the logging gap, in stratum i in year t; t CO_2-e.
$C_{EXT,\ z,i,t}$	Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t; t CO_2-e.
$L_{DFz,i}$	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 v2.2, 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 v2.2, 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 (Annex 12). Carbon fraction of biomass for tree species is default according to IPCC (2006).

4.2.2.2.2 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.

4.2.2.2.2.1 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 v2.2, 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.
SK_i	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:

SK_i	Skid trail emission factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum i; t t 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 tree[29] that can be within the path of a skid trail, following VMD0015 v2.2, step 02 criteria, and equation 15:

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

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 CO2-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 v2.2, equation 09:

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

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}.
$C_{SOC,i,t=0}$	Mean carbon stock in soil organic carbon for stratum i, in year t=0; t CO_2e ha^{-1}.
F_{LU}	Land use factor after conversion; dimensionless.

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

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 v1.0 criteria (Appendix 07). Land use, management and input factors are default value given by IPCC (2006).

4.2.2.2.2.2 GHG emissions resulting from roads creation

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

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

Where

$\Delta C_{ROAD,i,t}$	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.

4.2.2.2.2.3 GHG emissions resulting from logging decks creation

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

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

Where:

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

$A_{DECKS,i,t}$	Area of logging decks in stratum i in year t; ha.
$C_{BSL,i}$	Carbon stock in all pools in the baseline case in stratum i; t CO2-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 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.

4.2.3 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 2016 and 2020, for ex-ante estimates. The area of recorded wildfires is obtained from DETER service (GIS database).

Table 30: Area potentially impacted by natural disturbances (wildfire) (ex-ante) (ha).

Year	$A_{DistPA,q,i,t}$									
	PAI#01		PAI#02		PAI#03		PAI#04		PAI#05	
	As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab
2021	0	0	0	0	0	0	3,9	3,9	0	0
2022	0	0	0	0	0	0	3,9	3,9	0	0
2023	0	0	0	0	0	0	3,9	3,9	0	0
2024	0	0	0	0	0	0	3,9	3,9	0	0
2025	0	0	0	0	0	0	3,9	3,9	0	0
2026	0	0	0	0	0	0	3,9	3,9	0	0
2027	0	0	0	0	0	0	3,9	3,9	0	0
2028	0	0	0	0	0	0	3,9	3,9	0	0
2029	0	0	0	0	0	0	3,9	3,9	0	0
2030	0	0	0	0	0	0	3,9	3,9	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 v2.2, equation 19:

$$DegradationDisturbanceReductionFactor = \left(\left(\frac{FG_{BSL,i,t} * D_{mn}}{0.9}\right) * CF * \frac{44}{12}\right) / (A_i * C_{BSL,i})$$

Where:

DDRF	Factor by which Adist,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.

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 (Appendix 08, PAI#01 and PAI#02 spreadsheets). 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 v2.2, equations 22 and 21, respectively presented:

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

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

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[30] 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 v1.2.

Net carbon stock changes in pools as a result of natural disturbance is calculated according to VMD0015 v2.2, 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}.
$C_{P,Dist,q,i}$	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 31: Net carbon stock changes in all pools as a result of natural disturbance in the project case (ex-ante) (t CO2-e ha-1).

Stratum (i)	$C_{BSL,i}$	$C_{P,Dist,q,i,t}$	$C_{WP,q,i}$	$\Delta C_{p,dist,q,i,t}$
As	641.54	192.46	0	449.08
Ds	616.07	184.82	0	431.25
Aa	603.59	181.08	0	422.51
Ab	609.82	182.95	0	426.87

[30] Normalized Burn Index.

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. Carbon stock changes in all pools as a result of natural disturbance is calculated according to VMD0015 v2.2, equation 24:

$$C_{P,Dist,q,i} = C_{AB\_tree,i} + C_{BB\_tree,i} + C_{AB\_non-tree,i} + C_{BB\_non-tree,i} + C_{DW,i} + C_{LI,i} + C_{SOC,i}$$

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}.
$C_{AB\_non\text{-}tree,i}$	Carbon stock in aboveground non-tree vegetation in stratum i; t CO_2-e ha^{-1}.
$C_{BB\_non\text{-}tree,i}$	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 to be *de minimis* in all instances, following VMD0015 v2.2 step 02 criteria.

GHG emissions resulted from areas undergoing natural disturbance are calculated according to VMD0015 v2.2, equation 20:

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

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.
$\Delta C_{P,Dist,q,i,t}$	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 32: Net carbon stock change in all pools as a result of natural disturbances in the project case (ex-ante) (t CO2-e ha-1).

Year	$\Delta C_{P,DistPA,i,t}$					$\Delta C_{P,DistPA,i,t}$	$\Delta C_{P,DistPA,i,t}$
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	0.0	0.0	0.0	3,313	-	3,313	3,313
2022	0.0	0.0	0.0	3,313	-	3,313	6,625
2023	0.0	0.0	0.0	3,313	-	3,313	9,938
2024	0.0	0.0	0.0	3,313	-	3,313	13,250
2025	0.0	0.0	0.0	3,313	-	3,313	16,563
2026	0.0	0.0	0.0	3,313	-	3,313	19,876
2027	0.0	0.0	0.0	3,313	-	3,313	23,188
2028	0.0	0.0	0.0	3,313	-	3,313	26,501
2029	0.0	0.0	0.0	3,313	-	3,313	29,814
2030	0.0	0.0	0.0	3,313	-	3,313	33,126

4.2.4 Non-CO_2 Emissions in the Project Scenario

Non-CO2 emissions occurring within the project boundary will be calculated according to VMD0015 v2.2 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 CO_2-e.
$E_{FC,i,t}$	Emission from fossil fuel combustion in stratum i within the project area in year t; t CO_2-e.
$E_{BiomassBurn,i,t}$	Non-CO2 emissions due to biomass burning in stratum i in year t; t CO_2-e.

$N_2O_{direct\text{-}N,i,t}$	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 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.

GHG emissions from fossil fuels and nitrogen application were conservatively excluded following VM0007 v1.6, table 06, criteria. Non-CO_2 emissions due to biomass burning are calculated according to VMD0013 v1.2, equation 1:

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

Where:

$E_{biomassburn,i,t}$	Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO_2, CH_4, N_2O) (t CO_2e).
$A_{burn,i,t}$	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 dioxide1, methane and nitrous oxide (unitless).
i 1, 2, 3 …	M strata (unitless).
t 1, 2, 3, …	t* time elapsed since the start of the project activity (years).

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 form 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 form the latest IPCC assessment report.

[31] Normalized Burn Index.

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

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

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_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 33: Non-CO_2 emissions in the project case (ex-ante) (t CO_2-e).

Year	$A_{burn,i,t}$										$GHG_{BSL,E}$
	PAI#01		PAI#02		PAI#03		PAI#04		PAI#05		
	As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab	
2021	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2022	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2023	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2024	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2025	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2026	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2027	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2028	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2029	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4
2030	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	0.0	0.0	218.4

4.2.5 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 v2.2, equation 01:

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

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 v2.2 step 02 criteria.

Table 34: Net GHG emissions in the REDD project scenario (ex-ante) (t CO_2-e).

Year	$\Delta C_{WPS-REDD}$					$\Delta C_{WPS-REDD}$	$\Delta C_{WPS-REDD}$
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	11	616	3,012	27,074	1,118	31,831	31,831
2022	11	616	3,012	27,074	1,118	31,831	63,662
2023	11	616	3,012	27,074	1,118	31,831	95,493
2024	11	616	3,012	27,074	1,118	31,831	127,324
2025	11	616	3,012	27,074	1,118	31,831	159,155
2026	11	616	3,012	27,074	1,118	31,831	190,986
2027	11	616	3,012	27,074	1,118	31,831	222,816
2028	11	616	3,012	27,074	1,118	31,831	254,647
2029	11	616	3,012	27,074	1,118	31,831	286,478

2030	11	616	3,012	27,074	1,118	31,831	318,309

4.3 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 VMD0007 v1.6 equation 4[32]:

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

Where:

$\Delta C_{LK-REDD}$ Net GHG emissions due to leakage from the REDD project activity up to year t* (t CO_2e).

$\Delta C_{LK-AS,planned}$ Net GHG emissions due to activity shifting leakage for projects preventing planned deforestation up to year t* – from Module LK-ASP (t CO_2e).

ΔC_{LK-ME} Net GHG emissions due to market-effects leakage up to year t* – from Module LK-ME (t CO_2e).

Table 35: Net GHG emissions due to leakage from the REDD project activity (t CO2-e).

Year	$\Delta C_{LK-AS,planned}$	ΔC_{LK-ME}	$\Delta C_{LK-REDD}$
2021	0	41,475	41,475
2022	0	41,475	41,475
2023	0	41,475	41,475
2024	0	41,475	41,475
2025	0	41,475	41,475
2026	0	41,475	41,475
2027	0	41,475	41,475
2028	0	41,475	41,475
2029	0	41,475	41,475
2030	0	41,475	41,475

4.3.1 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.

[32] Adjusted to reflect project scope.

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:

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

Where:

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

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

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).

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

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).
$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in project stratum i in year t (percent).
$A_{planned,i}$	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:

$$WoPR_{i,t} = a + b \times t$$

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 r2 of ≥0.75. The regression is calculated based on the deforested by the deforestation agent each year over the previous five years within the country. Where no statistically significant regression can be found, equation 02 is used.

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

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

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 CO2e).
$E_{biomassburn,i,t}$	Non-CO2 emissions due to biomass burning in stratum i in year t (t CO2e).
$N_2O_{direct-N,i,t}$	Direct N2O emission as a result of nitrogen application on the alternative land use in stratum i in year t (t CO2e).
i 1, 2, 3, …	M strata (unitless).
t 1, 2, 3 …	t* time elapsed since the start of the project activity (years).

Non-CO_2 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, $Adef_{LK,i,t}$ 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 1.17.1). In this sense, GHG emissions due to activity shifting for avoiding planned deforestation are set to zero in ex-ante and ex-post estimates.

4.3.2 Market Effects Leakage

GHG emissions from market effects are calculated according to VMD0011 v1.0 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 v1.0 equation 2:

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

Where:

$LK_{MarketEffects,timber}$	Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO_2-e.
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 CO_2-e.
i 1,2,3,...	M strata.

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.

Table 36: Leakage factor.

Forest Type	PMP_i		PML_{FT}								
	PAI#01	PAI#2-5	PA	MT	AM	RO	AC	MA	RR	TO	AP
As	16.6	-	93.8	80.4	114.8	89.4	56.1	ND	73.0	70.0	ND
Ds	-	-	149.5	ND	112.7	116.0	82.7	93,90	97.7	ND	236.8
Aa	-	-	156.0	83.4	92.2	92.7	96.0	ND	69.00	ND	ND
Ab	-	27.5	104.3	81.8	92.7	76.5	103.4	ND	ND	ND	ND

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

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

Where:

$AL_{T,i}$	Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO_2-e
$C_{BSL,XBT,i,t}$	Carbon emission due to displaced timber harvests in the baseline scenario in stratum i in time t; t CO_2-e
i 1, 2, 3, …	M strata

Carbon emission due to displaced timber harvests in the baseline scenario is calculated according to VMD0011 v1.0 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 v1.0 equation 5:

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

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 CO2-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 CO2-e

Summed emissions from fuelwood/charcoal harvests in the baseline case potentially displaced through project implementation is calculated according to VMD0011 v1.0 equation 6:

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

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 v1.0 equation 7:

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

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 37: Net greenhouse gas emissions due to market- effects leakage (t CO_2-e).

Year	$V_{BSL,EX,i,t}$	$FG_{BSL,t}$	$LK_{MarketEffects,timber}$	$LK_{MarketEffects,FW/C}$	ΔC_{LK-ME}
2021	57.000	6.516	40.514	961	41.475
2022	57.000	6.516	40.514	961	41.475
2023	57.000	6.516	40.514	961	41.475
2024	54.933	6.153	40.514	961	41.475
2025	52.247	5.679	40.514	961	41.475
2026	52.247	5.679	40.514	961	41.475
2027	52.219	5.676	40.514	961	41.475
2028	52.219	5.676	40.514	961	41.475
2029	37.260	4.050	40.514	961	41.475
2030	14.518	1.578	40.514	961	41.475

4.4 Estimated Net GHG Emission Reductions and Removals (ex-ante)

4.4.1 Total Net GHG Emission Reduction

Net GHG emission reduction estimates are based in VM0007 v1.6 equation 2:

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

Where:

NER_{REDD}	Total net GHG emission reductions of the REDD project activity up to year t (t CO_2e).
$\Delta C_{BSL\text{-}REDD}$	Net GHG emissions in the REDD baseline scenario up to year t* (t CO_2e).
$\Delta C_{WPS\text{-}REDD}$	Net GHG emissions in the REDD project scenario up to year t* (t CO_2e).
$\Delta C_{LK\text{-}REDD}$	Net GHG emissions due to leakage from the REDD project activity up to year t*(t CO_2e).

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 4.1, 4.2 and 4.3, respectively.

Table 38: Total net GHG emission reductions of the REDD project activity (t CO_2e) (ex-ante).

Year	Estimated baseline emissions or removals (tCO_2e) $\Delta C_{BSL-REDD}$	Estimated project emissions or removals (tCO_2e) $\Delta C_{WPS-REDD}$	Estimated leakage emissions (tCO_2e) $\Delta C_{LK-REDD}$	Estimated net GHG emission reductions or removals (tCO_2e) NER_{REDD}
2021	1,046,265	31,832	41,475	972,958.66
2022	1,124,524	31,832	41,475	1,051,217
2023	1,182,750	31,832	41,475	1,109,443
2024	1,223,760	31,832	41,475	1,150,454
2025	1,238,171	31,832	41,475	1,164,864
2026	1,325,597	31,832	41,475	1,252,290
2027	1,420,299	31,832	41,475	1,346,992
2028	1,516,820	31,832	41,475	1,443,513
2029	1,318,775	31,832	41,475	1,245,468
2020	942,140	31,832	41,475	868,833
Total	12,339,101	318,319	414,749	11,606,033

4.4.2 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. Non_CO2 emissions from fossil fuels and fertilizer usage were conservatively excluded from the project scope. Buffer is calculated through VM0007 v1.6 equation 8:

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

Where:

$Buffer_{Planned}$	Buffer withholding for avoiding planned deforestation project activities; t CO_2e.
$\Delta CBSL_{,planned}$	Net greenhouse gas emissions in the baseline from planned deforestation up to year t*; t CO_2-e.
$E_{FC,i,t}$	Net CO2e emission from fossil fuel combustion in stratum i in year t; t CO_2-e.
N2Odirect i,t	Direct N2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t; t CO_2-e.
Buffer%	Buffer withholding percentage (percent).

Buffer withholding percentage is calculated according to AFOLU Non-Permanence Risk Tool v4.0 (Appendix 04). The overall non-permanence risk rating is presented in the table below:

Table 39: Overall Risk Ratting.

Risk Category		Rating
a)	Internal Risk	0
b)	External Risk	0
c)	Natural Risk	7.5
Overall Risk Ratting (a + b + c)		10

4.4.3 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 produce 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.

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:

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

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 CO2-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 (see appendix 08).

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:

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

Where:

$Uncertainty_{REDD-WPS}$	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 (Ai) in the REDD project scenario (t CO2e).
i 1, 2, 3, …	M strata (unitless).

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

The total error in the REDD+ project activity is therefore calculated by VMD0017 v2.2 equation 21[33]:

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

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 CO2e)
$\Delta C_{WPS-REDD,t*}$	Net GHG emissions in the REDD project scenario up to year t* (t CO2e)

[33] Here suitable not to show values related to WRC project activities, which were not included in the scope of this project.

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 NERREDD at the 95% confidence level according to VMD0017 v2.2 equation 21[34]

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

Where:

$Adjusted\_NER_{REDD+}$	Total net GHG emission reductions of the REDD+ project activities up to year t*adjusted to account for uncertainty (t CO2e).
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 40: Total net GHG emission reductions of the REDD+ project activities up to year t*adjusted to account for uncertainty (t CO2e) (ex-ante).

Year	NER_{REDD}	NER_{REDD+_ERROR}	$Adjusted\_NER_{REDD+}$
2021	972,959	74,075	972,959
2022	1,051,217	82,497	1,051,217
2023	1,109,443	87,026	1,109,443
2024	1,150,454	96,493	1,150,454
2025	1,164,864	97,304	1,164,864
2026	1,252,290	105,932	1,252,290
2027	1,346,992	116,398	1,346,992
2028	1,443,513	126,931	1,443,513
2029	1,245,468	114,628	1,245,468
2020	868,833	83,725	868,833
Total	11,606,033	985,009	11,606,033

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

4.4.4 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 v1.6 equation19[35]:

$$VCU_t = Adjusted\_NER_{REDD+} - Buffer_{Planned}$$

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)
$Buffer_{Planned}$	Total permanence risk buffer withholding (t CO2e)

Table 41: Number of Verified Carbon Units (VCU) (ex-ante).

Year	$Adjusted\_NER_{REDD+}$	$Buffer_{Planned}$	VCU_t
2021	972,959	101,443	871,515
2022	1,051,217	109,269	941,948
2023	1,109,443	115,092	994,352
2024	1,150,454	119,193	1,031,261
2025	1,164,864	120,634	1,044,230
2026	1,252,290	129,376	1,122,913
2027	1,346,992	138,847	1,208,145
2028	1,443,513	148,499	1,295,014
2029	1,245,468	128,694	1,116,774
2020	868,833	91,031	777,803
Total	11,606,033	1,202,078	10,403,955

To estimate the number of Verified Carbon Units (VCUs) for the monitoring period T = t2-t1, was used the following equation:

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

Where:

VCU_t	Number of Verified Carbon Units at year t = t2 - t1 (VCU)
$Adjusted\_NER_{REDD+,t2}$	Total net GHG emission reductions of the REDD+ project activity up toyear t2 and adjusted to account for uncertainty (t CO2e)

[35] Here suitable to reflect ex-ante estimates.

$Adjusted\_NER_{REDD+,t1}$	Total net GHG emission reductions of the REDD+ project activity up toyear t1 and adjusted to account for uncertainty (t CO2e)
$Buffer_{Planned}$	Total permanence risk buffer withholding (t CO2e)

5 MONITORING

5.1 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 v1.3 equation 4.
Value applied:	See the values applied in the table 15.
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-Di) according to VMD0006 v1.3 equation 4.
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 14.
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	$D\%_{planned,i,t}$
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 the table 10.
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 v1.3, section 1.3 criteria.
Purpose of Data	Determination of baseline scenario.
Comments	-

Data / Parameter	$L\text{-}D_i$
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 v1.3, section 1.4.
Purpose of Data	Determination of baseline scenario.
Comments	-

Data / Parameter	$\Delta C_{AB\_tree,i}$
Data unit	t CO_2e.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 v1.3 equation 6.
Value applied:	See the values applied in the table 15.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the forest carbon stock in aboveground tree biomass in stratum I ($C_{AB\_tree,bsl,i}$) and the post-deforestation carbon stock in aboveground tree biomass in stratum I ($C_{AB\_tree,post,i}$), according to VMD0006 v1.3 equation 6.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{BB\_tree,i}$
Data unit	t CO_2e.ha^{-1}
Description	Baseline carbon stock change in belowground tree biomass in stratum i.
Source of data	Calculated based on VMD0006 v1.3 equation 8.

Value applied:	See the values applied in the table 16.
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the forest carbon stock in aboveground tree biomass in stratum I ($C_{AB\_tree,bsl,i}$) and the post-deforestation carbon stock in aboveground tree biomass in stratum I ($C_{AB\_tree,post,i}$); according to VMD0006 v1.3 equation 8.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{AB\_non\text{-}tree,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Baseline carbon stock change in aboveground non-tree biomass in stratum i.
Source of data	Calculated based on VMD0006 v1.3 equation 7.
Value applied:	See the values applied in the table 17.
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 ($C_{AB\_non\text{-}tree,bsl,i}$) and Post-deforestation carbon stock in aboveground non-tree vegetation in stratum i ($C_{AB\_non\text{-}tree,post,i}$); according to VMD0006 v1.3 equation 7.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{BB\_non\text{-}tree,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Baseline carbon stock change in belowground non-tree biomass in stratum i.
Source of data	Calculated based on VMD0006 v1.3 equation 9
Value applied:	See the values applied in the table 18.

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 v1.3 equation 9.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{DW,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Baseline carbon stock change in dead wood in stratum i.
Source of data	Calculated based on VMD0006 v1.3 equation 10.
Value applied:	See the values applied in the table 19.
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 v1.3 equation 10.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{LI,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Baseline carbon stock change in litter in stratum i.
Source of data	Calculated based on VMD0006 v1.3 equation 11.
Value applied:	See the values applied in the table 20.
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 v1.3 equation 11.

Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{SOC,i}$
Data unit	t CO_2e.ha^{-1}
Description	Baseline carbon stock change in soil organic carbon in stratum i.
Source of data	Calculated based on VMD0006 v1.3 equation 12.
Value applied:	See the values applied in the table 21.
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 v1.3 equation 12.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{AB\_tree,i}$
Data unit	t CO_2e.ha^{-1}
Description	Carbon stock in aboveground biomass in trees in the baseline in stratum i
Source of data	Forest inventory 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 the table 15.
Justification of choice of data or description of measurement methods and procedures applied	Forestry Inventory is performed according to VMD0001 v1.1 and VMD0016 v1.6 criteria.

Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{BB\_tree,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Carbon stock in belowground biomass in trees in the baseline in stratum i
Source of data	Calculated based on VMD0001 v1.1, equation 5.
Value applied:	See the values applied in the table 16.
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 v1.1, 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_2e.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 v1.1, section 5, part 3 criteria.
Value applied:	See the values applied in the table 17.
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_2e.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 v1.1, equation 13.
Value applied:	See the values applied in the table 18.
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 v1.1, equation 13.

Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{DW,i,}$
Data unit	t $CO_2e.ha^{-1}$
Description	Carbon stock in dead wood in the baseline in stratum i.
Source of data	Calculated based on VMD0002 v1.0, equation 9.
Value applied:	See the values applied in the table 19.
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 (CFdw), according to VMD0002 v1.0, equation 9.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{LI,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Carbon stock in litter in the baseline in stratum i
Source of data	Calculated based on VMD0003 v1.0, equation 1.
Value applied:	See the values applied in the table 20.
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 v1.0, equation 1.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{SOC,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Mean carbon stock in soil organic carbon in the baseline in stratum i.
Source of data	Calculated based on VMD0004 v1.0, equation 1.
Value applied:	See the values applied in the table 21.
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 v1.0, equation 1.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{wp,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Baseline carbon stock change in in wood products in stratum i
Source of data	Calculated based on VMD0005 v1.1 equation 2
Value applied:	See the values applied in the table 22.
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 v1.1 equation 2.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{XB,ty,i}$
Data unit	t $CO_2e.ha^{-1}$
Description	Mean stock of extracted biomass carbon by class of wood product ty from stratum i.
Source of data	Calculated based on VMD0005 v1.1 equation 1.
Value applied:	PAI#1: 15,47; 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 v1.1 equation 1.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$V_{ex,ty,j}$
Data unit	m^3
Description	Volume of timber extracted from within stratum i (does not include slash left onsite) by species j and wood product class ty.
Source of data	Forest Exploration Plan (Annex 08)
Value applied:	PAI#1: 14,96; PAI#2: 15,7
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 v1.1 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:	Appendix 08, PAI#01 and PAI#02 spreadsheets).
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	Nogueira et al. 2008
Value applied:	0.485
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}
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 v1.1.
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	$C_{WP100,i}$
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 v1.1 equation 3.
Value applied:	See the values applied in the table 22.
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 ty (SLF_{ty}), 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 ty (OF_{ty}).
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$C_{AB\_tree,post,i}$
Data unit	t $CO_2e.ha^{-1}$
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 the table 16.
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 $CO_2e.ha^{-1}$
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 the table 17.
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions.
Comments	

Data / Parameter	$C_{BB\_non\text{-}tree,post,i}$
Data unit	t CO_2e.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 the table 18.
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_2e.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 $CO_2e.ha^{-1}$
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	$C_{SOC,PD-BSL,i}$
Data unit	t CO2-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 the table 21.
Value applied:	Calculated based on VMD0004 v1.0, 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 v1.0, equation 3.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$GHG_{BSL-E,i,t}$
Data unit	t CO2e.yr-1
Description	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i in year t.
Source of data	Calculated based on VMD0006 v1.3 equation 15.
Value applied:	See the values applied in the table 24.
Justification of choice of data or description of measurement methods and procedures applied	Calculated based on the non-CO2 emissions due to biomass burning in stratum i in year t (EBiomassBurn,i,t), according to VMD0006 v1.3 equation 15.
Purpose of Data	Calculation of baseline emissions.
Comments	Net CO2e emission from fossil fuel combustion in stratum i in year t (EFC,i,t) and direct N2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t (N2Odirect-N,i,t) are conservatvelly 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 (CO2, CH4, N2O).
Source of data	Calculated based on VMD0013 v1.3 equation 1.
Value applied:	See the values applied in the table 24.

Justification of choice of data or description of measurement methods and procedures applied	Calculated based on area burnt for stratum i in year t ($A_{burn,i,t}$), 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 ($G_{g,i}$) 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	$A_{burn,i,t}$
Data unit	ha
Description	Area burnt for stratum i in year t.
Source of data	Equal to $AA_{planned,i,t}$ in the baseline case.
Value applied:	See the values applied in the table 24.
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	-

Data / Parameter	Bi,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:	<table><tr><td>As</td><td>Ds</td><td>Aa</td><td>Ab</td></tr><tr><td>299.01</td><td>246.01</td><td>254.18</td><td>257.19</td></tr></table>

Justification of choice of data or description of measurement methods and procedures applied	Calculated based on carbon stock in aboveground biomass in trees in stratum i in year t ($C_{AB\_tree,i,t}$), Carbon stock in dead wood for stratum i in year t ($C_{DWi,t}$), Carbon stock in litter for stratum i in year t ($C_{LI,i,t}$) and Carbon fraction of biomass (CF), according to VMD0013 v1.3 equation 2.
Purpose of Data	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:	CH4=6.8; N20=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_2O).

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:	CH4=28; N20=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_2e
Description	Net carbon stock changes in all pools in the baseline stratum i in year t.

Source of data	Calculated based on VMD0006 v1.3 equation 4.
Value applied:	See the values applied in the table 23.
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 ($\Delta C_{AB\_non\text{-}tree,i}$), the baseline carbon stock change in belowground non-tree biomass in stratum I ($\Delta C_{BB\_non\text{-}tree,i}$), the baseline carbon stock change in wood products in stratum I ($\Delta C_{WP,i}$), the baseline carbon stock change in dead wood in stratum I ($\Delta C_{DW,i}$), the baseline carbon stock change in litter in stratum I ($\Delta C_{LI,i}$) and the baseline carbon stock change in soil organic carbon in stratum I, according to VMD0006 v1.3 equation 4.
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$\Delta C_{BSL,planned}$
Data unit	t CO_2e
Description	Net greenhouse gas emissions in the baseline from planned deforestation.
Source of data	Calculated based on VMD0006 v1.3 equation 1.
Value applied:	See the values applied in the table 25.
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 ($GHG_{BSL\text{-}E,i,t}$), according to equation 1 from VMD0006 v1.3.
Purpose of Data	Calculation of baseline emissions.
Comments	-

5.2 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 the table 26. Ex-post: See the values applied in the table 49.
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 95% 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 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.
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 ($C_{AB\_non-tree,i}$), 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 ($c_{SOC,PD-BSL,i}$), 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 the table 28. Ex-post: For this monitoring period the same value applied in the ex-ante, see table 28.
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	$C_{WP,i}$
Data unit	t CO_2-e ha^{-1}
Description	Carbon stock sequestered in wood products from harvests in stratum i
Source of data	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 the table 28. Ex-post: equal to ex ante, see the values applied in the table 28.

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 the table 28. Ex-post: See the values applied in the table 50.
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: See the values applied in the table 52.
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 the table 29Ex-post: See the values applied in the table 53
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 the table 29. Ex-post: See the values applied in the table 51
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 CO2-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 ($\Delta C_{ROAD,i,t}$) 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 ($C_{AB\_non\text{-}tree,i}$) and the Carbon stock in belowground non-tree biomass in stratum I ($C_{BB\_non\text{-}tree,i}$), 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 (CSOC,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 (CSOC,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 the table 6.2 of the Volume 4, Chp 6, IPCC (2006); Croplands: See the applicable values in the 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 the table 6.2 of the Volume 4, Chp 6, IPCC (2006); Croplands: See the applicable values in the 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_I
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 the table 6.2 of the Volume 4, Chp 6, IPCC (2006); Croplands: See the applicable values in the 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	$A_{DECKS,i,t}$
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 the table 30. Ex-post: See the values applied in the table 66.
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 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	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 the table 33. Ex-post: See the values applied in the table 70.
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 31 Ex-post: table 67
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 the table 32. Ex-post: See the values applied in the table 67.
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 v1.3 equation 30.
Description of measurement methods and procedures applied	Calculated based on the non-CO2 emissions due to biomass burning in stratum i in year t ($E_{BiomassBurn,i,t}$), according to VMD0006 v1.3 equation 15.
Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex-ante: See the values applied in the table 33. Ex-post: See the values applied in the table 70.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of project emissions.
Calculation method	Calculated based on VMD0006 v1.3 equation 30.

Comments	Net CO_2e emission from fossil fuel combustion in stratum i in year t ($E_{FC,i,t}$) and direct N_2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t ($N_2O_{direct\text{-}N,i,t}$) are conservatively excluded from the project scope and the calculation of the baseline estimates following VM0007 v1.6 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_2O)
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 ($G_{g,i}$) 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 the table 33. Ex-post: See the values monitored in the table 70.
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	$\Delta C_{WPS\text{-}REDD}$
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 the table 34. Ex-post: See the values applied in the table 75
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_2e
Description	Net GHG emissions due to leakage from the REDD project activity up to year t*
Source of data	Calculated according to VMD0007 v1.6 equation 4.

Description of measurement methods and procedures 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 the table 35. Ex-post: See the values applied in the table 74.
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 CO2e
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 (LKAplanned,i,t), the net carbon stock changes in all pre-deforestation pools in baseline stratum I, (ΔCBSL,i) and the Greenhouse gas emissions as a result of leakage of avoiding deforestation activities in stratum i in year t ($GHG_{LK,E,i,t}$), 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 the table 35

	Ex-post: See the values applied in the table 71.
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 the table 35Ex-post: See the values applied in the table 71.
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 the table 35 Ex-post: See the values applied in the table 71
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.

Data / Parameter	$D\%_{planned,i,t,OP}$
Data unit	%

Description	Projected annual proportion of land that will be deforested outside the project boundary in stratum i in year t.
Source of data	Deforestation permits for areas outside the project boundary.
Description of measurement methods and procedures 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	$A_{planned,i,OP}$
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≤0.05 and an adjusted r2 of ≥0.75. The regression is calculated based on the deforested by the deforestation agent each year over the previous five years within the country. Where no statistically significant regression can be found, equation 02 is used
Comments	-

Data / Parameter	HistHai,ag
Data unit	ha
Description	Number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years prior to project implementation in stratum i by agent ag within the country
Source of data	Remote sensing 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-CO2 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 the table 37. Ex-post: See the values applied in the table 71.
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 the table 37. Ex-post: See the values applied in the table 74
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 v1.0 equation 5.
Description of measurement methods and procedures applied	Calculated based on Leakage factor for market effects calculations (LF_{ME}), 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 v1.0 equation 5.
Frequency of monitoring/recording	Annual
Value applied:	Ex-ante: See the values applied in the table 37 Ex-post: See the values applied in the table 74
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of leakage
Calculation method	Calculated according to VMD0011 v1.0 equation 5.
Comments	-

Data / Parameter	NER_{REDD}
Data unit	t CO_2e

Description	Total net GHG emission reductions of the REDD project activity up to year t (t CO2e).
Source of data	Calculated according to VM0007 v1.6 equation 2.
Description of measurement methods and procedures 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 v1.6 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 the table 38. Ex-post: See the values applied in the table 75.
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs
Calculation method	According to VM0007 v1.6 equation 2.
Comments	-

Data / Parameter	$Buffer_{Planned}$
Data unit	t CO2e
Description	Buffer withholding for avoiding planned deforestation project activities
Source of data	Calculated according to VM0007 v1.6 equation 8.
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 ($\Delta C_{BSL,planned}$) and the buffer withholding percentage (Buffer%), according to VM0007 v1.6 equation 8.

Frequency of monitoring/recording	Before every verification event with a minimum frequency of 05 years.
Value applied:	Ex- ante: See the values applied in the table 41 Ex-post: See the values applied in the table 78
Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs
Calculation method	Calculated according to VM0007 v1.6 equation 8.
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 the table 40 Ex-post: See the values applied in the table 77.
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 ($Uncertainty_{REDD-BSL,t*}$).

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 the table 40 Ex-post: See the values applied in the table 77.
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 the table 40 Ex-post: See the values applied in the table 77.
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 the table 40 Ex-post: See the values applied in the table 77.
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 t2 - t1
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 the table 41. Ex-post: See the values applied in the table 78.

Monitoring equipment	-
QA/QC procedures applied	-
Purpose of data	Calculation of VCUs
Calculation method	Calculated according to VMD0017 v2.2 equation 19.
Comments	-

5.3 Monitoring Plan

A monitoring plan was structured based on VM0007 v1.6 and VMD0015 v2.2 criteria.

5.3.1 Monitoring of Project Implementation

Project implementation will be monitored considering the project activities as defined in section 1.11. This GPD presents a range of potential project activities. The project activities may vary among PAIs. Table 45 below brings relevant information to this task, following VM0007 v1.6 section 9.3.1 criteria. BRC will be responsible for the project activity implementation and its monitoring. Implementation of specific project activities can be carried out by external consultants operating under supervision of BRC. Digital files will be stored in BRC database[36]. Hard copies will be archived at BRC headquarters[37].

Table 42: Project activity monitoring.

Project Axis[38]	Standardized Benefits Category[39]	Project activity	Technical description of the monitoring task[40]

[36] Backed up at OneDrive associated with a corporative Microsoft account.

[37] Av. Cezira Giovanoni Moretti 655, sala 7 AgTech Garage Reserva dos Jequitibás, Piracicaba, São Paulo.

[38] Project Axis are related to the expected impacts on Climate, Communities and Biodiversity and can be understood as general project objectives.

[39] Standardized benefits categories corelates to CCB standard (see PDD CCB).

[40] Brings information on data to be collected, overview of data collection procedures, quality control and quality assurance procedure when relevant.

Climate	Forest Cover/GHG emission reduction	Legal Protection	Legal protection for the forests will be granted through signature of long-term conservation agreements with landowners of each PAI. This activity will be monitored through verifications on the ongoing administrative processes to close new deals with landowners in each quarter.
Climate	Forest Cover/GHG emission reduction	Surveillance	Deforestation, forest degradation and burn scars will be monitored though satellite images and with ground truth verifications annually. Land use change maps and orbital imagery will be collected from PRODES & DETER/INPE[41], Mapbiomas[42] and ESA[43]..
Climate	GHG emission reduction	Biomass Inventory	Biomass will be re-measured after the first baseline period, that is, with a 10-year interval. Carbon stock change in every pool will be estimated by stock difference method. Aboveground biomass in trees will be estimated through permanent plots systematically installed over the project area. Non-tree biomass component will 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. 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 over forest biomass inventory methods check standard operational procedures (Appendix 07).
Climate	Sustainable Forest Management	FSC Certification	Forest management operations can only take place in the project area if FSC certified. Forest management operations will be adequate to FSC standard[44] in each PAI. Adequation of forest management operations to FSC certification will be performed through training and direct investments in infrastructure, machinery, and equipment in a case-by-case basis. Necessary investments are a landowner responsibility. FSC certification is a pre-condition for a specific PAI monitoring under the GPD. Internal audits against FSC Standard will be carried out to verify this project activity implementation before each verification event, with a maximum frequency of 05 years. Independent third-party audits will be performed annually to maintain FSC

[41] http://terrabrasilis.dpi.inpe.br/

[42] https://mapbiomas.org/

[43] https://sentinels.copernicus.eu/web/sentinel/home

[44] FSC-STD-BRA-01-2001 v1.1

			certification status of each PAI where forest management operations take place as valid.
Climate	GHG emission reduction	Leakage mitigation	Potential activity shifting leakage will be mitigated through advocacy with landowners within the project scope. The area of monitored activity shifting leakage and associated GHG emissions in each PAI, will be summarized in a special report and shared with landowners before each verification event, with a maximum frequency of 05 years. The number of special reports generated and the number of meetings with landowners to discuss leakage will be reported in each VCS monitoring report.
Climate	GHG emission reduction	Wildfire Prevention and Fire Fighting	Training on good management practices and firefighting will be offered to communities living inside the project area in a way to prevent wildfires to spread. Good management practices training will have focus on risk control and mitigation measures. Firefighting training will take place for the formation of volunteer brigades. (see PD CCB). Training's execution will be registered through activity reports. Number of trainings will be reported in each monitoring report. Wildfire can also be prevented by firebreaks implementation. The number and the length of firebreaks implemented will be monitored and reported in each monitoring report. Finally, wildfires spread can be prevented through fast brigade responses. In this sense, this project activity may encompass the implementation of monitoring towers with cameras capable to detect smoke patterns automatically. This surveillance systems can detect fire in a 15Km ratio and warn the brigades leaders within 05 minutes from the fire start. The implementation of this systems will depend on the volunteer brigade formation and on the implementation of an effective communication system in each PAI. Monitoring towers implementation will be reported in activity reports.
Community	Health	Advocacy	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. Monitoring will be based on activity reports. The number of meetings held with public authorities, MOUs signed and invested resources will be reported in activity reports and monitoring reports.
Community	Health	Infrastructure & equipment	Installation or renovation of health posts. Purchase of medicines or equipment for the posts. The number of health posts constructed or renovated and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports.
Community	Education	Advocacy	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. Monitoring will be based on activity reports. The number of meetings held with public authorities, MOUs signed and invested resources will be reported in activity reports and monitoring reports.
Community	Education	Infrastructure & equipment	Installation or renovation of schools. Purchase of scholar equipment. The number of schools constructed or renovated and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports.
Community	Education	Lectures	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. The number of lectures and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports.
Community	Well-being	Digital inclusion	In many cases the existing communities within the project area live in isolated conditions, without access to means of communication and travel days to the nearest city. This puts them in a vulnerable condition, negatively affecting their economy, health, education, and well-being. This project activity is focused on installation of towers for the provision of internet and an internet access point in schools. The number of towers and internet access points provided and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports.
Social	Well-being	Sanitation	Promotion of environmental sanitation through the implantation of ecological toilets / pits (eg: embrapa pit, pit with banana and tire, biodigester pit, dry toilet, etc.). The number of trainings, number of people who attended the trainings and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports.
Community	Training	Training	Training will be offered to communities in different areas: forest inventory, sustainable forest management (timber and non-timber forest products), forest fire fighting, solid waste management, associations. The number of trainings, number of people who attended the trainings and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports.
Community	Employment	Jobs	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. The number of paid days, and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports. The number of paid days will be normalized by full time jobs, following CCB criteria on the matter.
Community	Water	Access to clean water	Potability analysis, distribution of filters, chlorine, fencing of springs (to prevent the animals' access to water), acquisition of pumps, and hydraulic rams' implementation. The number of potability analysis performed, filters distributed, chlorine distributed, springs fenced, pumps and hydraulic rams implemented and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports.
Biodiversity	Biodiversity	Biodiversity protection	Biodiversity monitoring will have focus on species richness and the protection of threatened and game species identified in the initial survey. Environmental education activity will be performed to sensitize them about the identified species threaten degree and the biodiversity importance. The number threatened species and game species, and the total amount of invested resources during a specific monitoring period will be reported in activity reports and monitoring reports.

5.3.2 Monitoring of Actual Carbon Stock Changes, GHG emissions and Leakage

This monitoring task will follow VMD00015 v2.1 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 tree steps:

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

This project uses different sources of GIS for assessing land-use and land-cover change in the project area and leakage belt. Classified orbital images from PRODES project from INPE (in port. *Instituto de Pesquisas Espaciais*) is used for assessing deforestation. PRODES project uses images compatible with those generated by the Landsat series satellites of NASA/USGS (USA) called "of the Landsat class". These images are characterized by having spatial resolution in the range of 30 meters and at least 3 spectral bands. Currently, images from the satellite Landsat-8, SENTINEL-2 (European Union) or CBERS-4 from INPE/CRESDA (Brazil/China) can also be used. Accuracy assessments are made using SENTINEL satellite series from the European Space Agency (ESA), with 10x10m spatial resolution. Classified orbital images from DETER service from INPE are used for assessing deforestation alerts and forest degradation. DETER service uses images from WFI sensors, from the Sino-Brazilian Earth Resources Satellite (CBERS-4) and AWiFS, from the Indian Remote Sensing Satellite (IRS), with 64 and 56 meters of spatial resolution, respectively.

5.3.2.2 Processing LU/LC Change Data

Landsat-8, SENTINEL-2 and CBERS-4 images are available from their providers already orthorectified, with refined system geometric correction using control points and digital terrain elevation models. This corresponds to the highest level of geometric correction and means that the images are ready to be used together with existing maps and field measurements without the need for further processing, in accordance with current cartographic standards. The PRODES project performs image composition for multiple satellites (and dates) to reduce cloud cover and haze in a scene and assess the increase in the deforested area. DETER system has a high temporal resolution. A visual analysis of each scene is conducted by INPE technicians to assess the quality of the image, selecting images that are not overly contaminated with cloud cover and haze.

5.3.2.3 Post-Processing and Accuracy Assessment

The PRODES[45] project data will be used annually to monitor land use change in all the lands managed by the identified deforestation agent (including the project area and lands outside the project boundary). Forest cover benchmark maps will be generated and updated as soon as the data is released by INPE.

Data from DETER services will be used in a monthly basis to assess deforestation alerts and forest degradation ($A_{DegW,I}$, $A_{DistPA,i,t}$, $A_{burn,i,t}$). Deforestation alerts and forest degradation will be verified on field by direct observation. In the case deforestation is confirmed by PRODES data it will be used to estimate GHG emissions due to project area deforestation ($A_{DefPA,i,u,t}$) or activity shifting leakage ($A_{DefLK,i,u,t}$) in the project scenario. In the case DETER data is not confirmed by PRODES but is verified in the field through direct observation, it will be used to update the forest cover benchmark maps and so, also accounted as project area deforestation or activity shifting leakage in the project scenario. DETER data has a high temporal resolution and a lower spatial resolution than PRODES data, which makes it suitable for the generation of deforestation alerts, that can be used to guide fast responses from BRC. Forests degraded detected by DETER until the project start date were conservatively disregarded by BRC in the elaboration of the first forest benchmark map. This measure was taken to simplify stratification and in respect of the areas of use from the communities living inside the project area.

Finally, a visual analysis of the project area, with Sentinel images from 2021, on a scale of 1: 10,000, is conducted by GIS analysts to determine an overall classification accuracy of the outcome of the previous steps aiming a 90% target or more. A confusion matrix was generated comparing each land cover map class for the year 2020, the project's start date. A set of 200

[45] http://www.dpi.inpe.br/prodesdigital/dadosn/

random points distributed by the reference region was generated, with 100 points for each map class: forest and non-forest, and 20 points in each of the PAIs. The evaluation of each point was carried out by photointerpretation using images from Sentinel Satellite 2A and 2B, with 10m of spatial resolution, being classified as ground-truth points to generate the confusion matrix. The global accuracy found for the reference map was 95.5% for both classes in 2020, as shown in table 46. See Appendix 13 for details.

Table 43: Confusion matrix of benchmark map for year 2020.

Class	Forest	No-forest	Total Geral	Users Accuracy	Omission error
Forest	95	5	100	95,0	5,0
No-forest	4	96	100	96,0	4,0
Total Geral	**99**	**101**	**200**		
Productors accuracy	96,0	95,0			Global Accuracy
Inclusion error	4,0	5,0			95,5

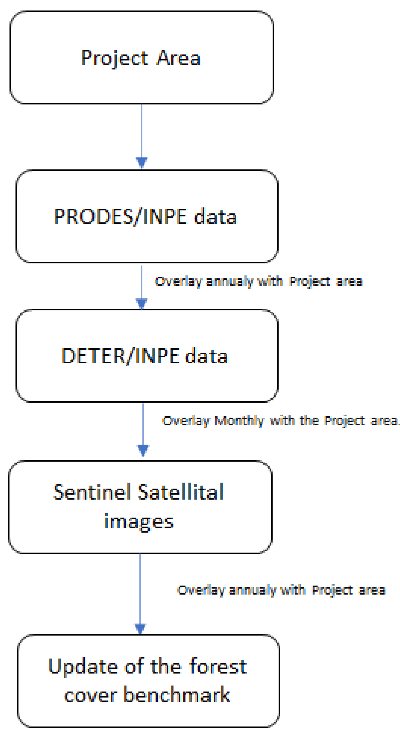


Figure 20: Monitoring steps flowchart.

5.3.2.4 Interpretation and Analyses

PRODES project data will be used to monitor project area deforestation ($A_{DefPA,i,u,t}$) and activity shifting leakage ($A_{DefLK,i,u,t}$) 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 ($\Delta_{Cpools,Def,u,i,t}$), according to VMD0015 v2.2 equations 03 to 06 (see section 4.2) and VMD0009 v1.3 equations 01 to 07 (see section 4.3).

DETER services data and direct observation will be used to monitor forest degradation ($A_{DegW,I}$, $A_{DistPA,i,t}$, $A_{burn,i,t}$) 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 ($\Delta C_{P,DegW,i,t}$) and selective logging of FSC certified forest management areas ($\Delta C_{P,SelLog,i,t}$), according to VMD0015 v2.2 equations 07 to 18 (see section 4.2).

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 all families living inside the project area explore the forest for timber and fuel wood, what shall be considered as a low 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 a constant in PAIs where community presence is perceived. Rather than making a PRA in 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 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 ($C_{DegW,i,t}$) 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 ($V_{EXT,j,z,i,t}$), the length and width of skid trails in stratum ($L_{SKID,i,t,}$ WSKID), the area of roads and logging decks ($A_{ROAD,i,t}$, $A_{DECKS,i,t}$) 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 4.2).

5.3.2.5 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.

5.3.3 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 4. All data to be collected are described in section 4, 5.1 and 5.2. Sections 5.1 and 5.2 also brings information on the applicable quality control and quality assurance procedures.

5.3.4 Revising the Baseline for Future Project Crediting Periods

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

6 ACHIEVED GHG EMISSION REDUCTION AND REMOVALS

The first monitoring period encompass the dry period of 2021 in the Amazon biome which is the period that's occurs the most significative quantity of deforestation due the process of slash and burn. So, for the first vintage (2021) the monitoring period of the Brazilian Amazon APD Grouped Project is from 02nd August 2021 to 19th October 2021, for more information's please section 3.6 and MR CCB. The data used to monitor the first project vintage can be found in the Appendix 14.

6.1 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.
Value applied:	Table 49
Comments	-

Data / Parameter	$A_{DegW,i}$
Data unit	ha
Description	Area potentially impacted by degradation processes in stratum i
Value applied:	Table 52
Comments	-

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.
Value applied:	Table 53
Comments	-

Data / Parameter	AP_i
Data unit	ha
Description	Total area of degradation sample plots in stratum i.
Value applied:	see table below
Comments	-

PAI#	APi (ha)
2	14,23
3	11,74
4	15,75
5	16,43

Data / Parameter	$V_{EXT,z,i,t}$
Data unit	m^3
Description	Volume extracted from logging stratum z, in stratum i in year t.
Value applied:	0
Comments	-

Data / Parameter	$L_{SKID,i,t}$
Data unit	m
Description	Length of skid trails in stratum i in year t.
Value applied:	0
Comments	-

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

Data / Parameter	$A_{ROAD,i,t}$
Data unit	ha
Description	Area of roads in stratum i in year t.
Value applied:	0

Comments	-

Data / Parameter	$A_{DECKS,i,t}$
Data unit	ha
Description	Area of logging decks in stratum i in year t.
Value applied:	0
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
Value applied:	Table 66
Comments	-

Data / Parameter	$A_{burn,i,t}$
Data unit	ha
Description	Area burnt for stratum i in year t.
Value applied:	Table 70
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	-

6.2 Baseline Emissions

Baseline emissions are estimated according to VMD0006 v1.3, as part of the procedures used to set the project baseline. A complete overview on the procedures used to set the baseline can be found on section 4.1.

The annual area of baseline planned deforestation ($AA_{planned,i,t}$) is calculated according to VMD0006 BL-PL v1.3 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 44: Total and annual area of planned deforestation over the baseline scenario in all PAIs in the first monitoring period.

Year	$AA_{planed,i,t}$									
	PAI#01		PAI#02		PAI#03		PAI#04		PAI#05	
	As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab
2021	186.09	91.65	0.00	404.34	246.87	246.87	248.59	248.59	248.59	248.59
$A_{planed,i,t}$	991.50		4043.40		4565.63		4195.89		4209.93	

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 17, 18, 19, 20, 21, 22, 23 and 24, respectively.

The net carbon stock changes in all pools in the baseline ($\Delta C_{BSL,i,t}$) is calculated according to equation 13 from VMD0006 v1.3. The table below shows the net carbon stock changes in all pools in the baseline in all PAIs for the first monitoring period:

Table 45 : Net carbon stock changes in all pools in the baseline period in all PAIs (t CO_2-e) in the first monitoring period.

Year	$\Delta CBSL,i,t$					$\Delta CBSL,i,t$	$\Delta CBSL,i,t$
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	134,052.43	190,840.11	218,925.40	220,450.73	220,450.73	984,719.40	984,719.40

The greenhouse gas emissions as a result of deforestation activities within the project boundary is estimated according to VMD0006 v1.3 equation 15 and VMD0013 v1.2, 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 ($AA_{planed,i,t}$) is considered as burned ($A_{burn,i,t}$) for GHG emission estimates in the baseline scenario.

Table 46: Non-CO_2 emissions in the baseline case in all PAIs (t CO_2-e) in the first monitoring period.

Year	Aburn,i,t										GHGBSL,E
	PAI#01		PAI#02		PAI#03		PAI#04		PAI#05		
	As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab	
2021	186.08542	91.65401	0	404.3409	246.865	246.865	248.585	248.585	248.585	248.585	61,546.02

The baseline net GHG emissions for planned deforestation is determined according to VMD0006 BL-PL v1.3 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 47: Net GHG emissions in the baseline from planned deforestation in the baseline period in all PAIs in the first monitoring period (t CO_2-e).

Year	ΔCBSL,planned					ΔCBSL,planned	ΔCBSL,planned
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	142,616.63	202,230.23	232,752.34	234,374.01	234,292.21	1,046,265.42	1,046,265.42

6.3 Project Emissions (ex-post)

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 v2.2, equation 01 (see section 4.2.5). Data monitored during the first monitoring period is presented in the table below.

Table 48: Net GHG emissions in the REDD project scenario up to year t* (t CO_2-e) (ex-post).

Year	PAI	Stratum (i)	$\Delta C_{P,DefPA,i,t}$	$\Delta C_{P,Deg,i,t}$	$\Delta C_{P,DistPA,i,t}$	$GHG_{P-E,i,t}$	$\Delta C_{P,Enh,i,t}$	$\Delta C_{WPS-REDD}$
2021	#01	As	-	-	-	-	-	-
		Ds	-	-	-	-	-	-
	#02	Aa	774.06	2,616.33	2,191.58	-	-	5,581.97
		Ab	-	-	49.94	-	-	49.94
	#03	Aa	5,827.45	132.60	10,859.04	-	-	16,819.10
		Ab	-	-	33.30	-	-	33.30

	#04	Aa	11,463.59	1,384.42	1,664.28	-	-	14,512.29
		Ab	47,140.80	-	15,366.16	1,150.16	-	63,657.13
	#05	Aa	2,124.98	-	4,119.52	108.58	-	6,353.07
		Ab	-	-	-	-	-	-

Carbon stock enhancement is conservatively assumed to be zero in all strata, following VMD0015 v2.2 step 02 criteria.

6.3.1 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. This was treated as a deviation from the monitoring plan and shall take place only during the first monitoring event. Deforestation monitored during the first monitoring period is presented in the table below.

Table 49: Deforestation monitored in the project area in the first monitoring period (ex-post) (ha).

Year	ADefPA,u,i,t										
	PAI#01			PAI#02		PAI#03		PAI#04		PAI#05	
	As		Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab
2021	0.00	0.00	1.64	0.00	12.33	0.00	24.97		99.61	4.63	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 v2.2, 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 50: Net carbon stock change as a result of deforestation in the project case in the first monitoring period (ex-post) (t CO_2-e).

Year	ΔCP,DefPA,i,t					ΔCP,DefPA,i,t	ΔCP,DefPA,i,t
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	0	774.06	5,827.45	58,604.39	2,124.98	67,330.89	67,330.89

6.3.2 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 v2.2, equation 07 (see section 4.2.2). Data calculated for the first monitoring period are presented in the table below.

Table 51: 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) (ex-post).

Year	PAI	Stratum (i)	$\Delta C_{P,DegW,i,t}$	$\Delta C_{P,SelLog,i,t}$	$\Delta C_{P,Deg,i,t}$
2021	#01	As	-	-	-
		Ds	-	-	-
	#02	Aa	2,616.33	-	2,616.33
		Ab	-	-	-
	#03	Aa	132.60	-	132.60
		Ab	-	-	-
	#04	Aa	1,384.42	-	1,384.42
		Ab	-	-	-
	#05	Aa	-	-	-
		Ab	-	-	-

6.3.2.1 Timber, Fuelwood and Charcoal Collection Monitored

The area of forests subjected to degradation due to timber, fuel wood and charcoal collection was defined through a 1 Km buffer ratio from each family house location in every community in PAIs#2-5 (Fig. 20, Tab. 53) in the first monitoring period. Forest degradation through timber, fuel wood and charcoal collection was disregarded in PAI#01, because no communities live in this area. Stumps were counted and measured in 8 sample plots (A_{Pi}) (transects of 1000mx40m) representing 2.07% of $A_{degW,i}$. Biomass carbon of trees cut and removed through degradation process from plots measured was estimated through the same allometric equations used to determine the above ground biomass in the tree component. Net carbon stock changes as a result of degradation ($\Delta C_{P,DegW,i,t}$) was calculated according to VMD0015 v2.2, equation 08 and determined insignificant based on T-SIG (Appendix 08 – Ex post estimates, first monitoring period).

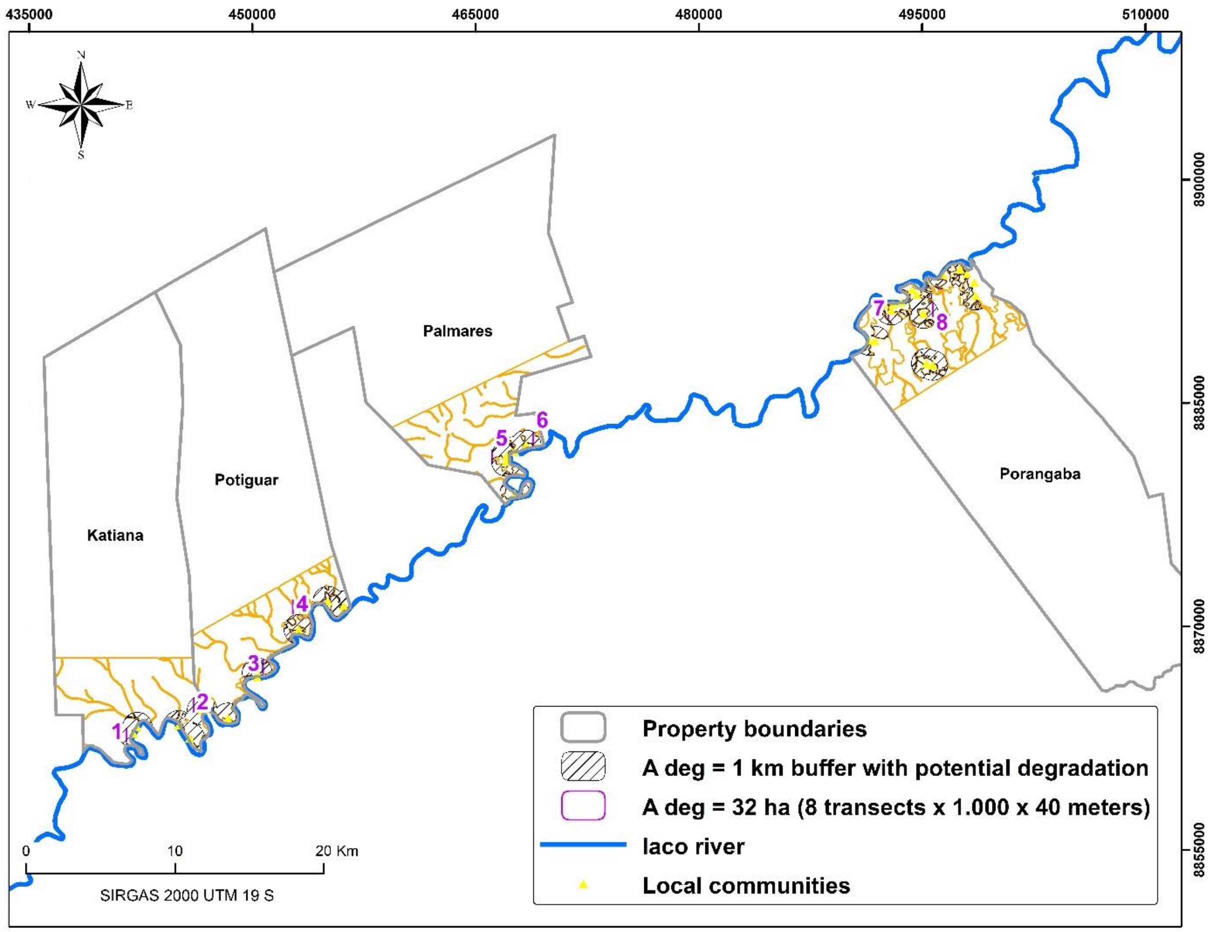


Figure 21: Area subjected to forest degradation due to timber, fuel wood and charcoal collection in the project area in the first monitoring period and sample transects location.

Table 52: Area potentially impacted by degradation processes in stratum i in the first monitoring period (ex-post) (t CO_2-e).

Year	$A_{DegW,i}$									
	PAI#01		PAI#02		PAI#03		PAI#04		PAI#05	
	As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab
2021	0	0	410,69	167,51	387,27	36,51	449,22	676,84	649,74	30,21

Table 53: 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 CO_2-e).

Year	$C_{DegW,i,t}$									
	PAI#01		PAI#02		PAI#03		PAI#04		PAI#05	
	As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab

2021	0	0	90,7	0	4,02	0	48,55	0	0	0

Table 54: Net carbon stock change as a result of degradation in the project case in the first monitoring period (ex-post) (t CO_2-e).

Year	$\Delta C_{P,DegW,i,t}$					$\Delta C_{P,DegW,i,t}$	$\Delta C_{P,DegW,i,t}$
	PAI#01	PAI#02	PAI#03	PAI#04	PAI#05	Total	Cumulative
2021	0	2,616.33	132.60	1,384.42	0	4,133.35	4,133.35

6.3.2.2 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 v2.2, equation 09 (see section 4.2.2.2). Data calculated for the first monitoring period are presented in the table below.

Table 55: 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 CO_2-e) (ex-post) (m^3).

Year	PAI	UPA	Stratum (i)	$C_{LG,i,t}$	$C_{LR,i,t}$	$C_{WP\ i,t}$	$\Delta C_{P,SelLog,i,t}$
2021	#01	N/A	As	0	0	0	0
		N/A	Ds	0	0	0	0
	#02	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#03	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#04	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#05	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0

6.3.2.2.1 GHG Emissions Arising from the Logging Gap

The volume extracted from logging stratum z, in stratum i in year t ($V_{EXT,z,i,t}$) in the first monitoring period is taken from post exploratory reports and is presented on the table below. The logging strata are the annual production units (UPA, unidade de produção anual, in Portuguese).

Table 56: Volume extracted from logging stratum z, in stratum i in year t in the first monitoring period (ex-post) (m^3).

Year	UPA	$V_{EXT,z,i,t}$									
		PAI#01		PAI#02		PAI#03		PAI#04		PAI#05	
		As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab
2021	N/A	0	0	0	0	0	0	0	0	0	0

The biomass carbon stock of the total volume extracted within each logging stratum ($C_{EXT,z,i,t}$) in the first monitoring period is calculated according to VMD0015 v2.2, equation 11. Data calculated for the first monitoring period are presented in the table below.

Table 57: Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t; (t CO2-e).

Year	PAI	UPA	Stratum (i)	$V_{EXT,z,i,t}$	D_j	CF_j	$C_{EXT,z,i,t}$
2021	#01	N/A	As	0	0	0	0
		N/A	Ds	0	0	0	0
	#02	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#03	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#04	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#05	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0

Emissions arising in the logging gap ($C_{LG,i,t}$) are calculated according to VMD0015 v2.2, equation 10. Data calculated for the first monitoring period are presented in the table below. See section 4.2.2.2.1 for further details.

Table 58: Actual net project emissions arising in the logging gap, in stratum i in year t in the first monitoring period (ex-post) (t CO_2-e).

Year	PAI	UPA	Stratum (i)	$V_{EXT,z,i,t}$	$LDF_{z,i}$	$C_{EXT,z,i,t}$	$C_{LG,i,t}$
2021	#01	N/A	As	0	0	0	0
		N/A	Ds	0	0	0	0
	#02	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#03	N/A	Aa	0	0	0	0

		N/A	Ab	0	0	0	0
	#04	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#05	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0

6.3.2.2.2 GHG Emissions Arising Through the Logging Infrastructure

GHG emissions arising through the logging infrastructure ($C_{LR,i,t}$) is estimated based on change in carbon stock resulting from skid trail, logging roads and logging deck creation according to VMD0015 v2.2, equation 12 (see section 4.2.2.2.2). Data calculated for the first monitoring period are presented in the table below.

Table 59: Actual net project emissions arising from logging infrastructure in stratum i in year t; t CO2-e ha-1.

Year	PAI	UPA	Stratum (i)	$\Delta C_{SKID,i,t}$	$\Delta C_{ROAD,i,t}$	$\Delta C_{DECKS,i,t}$	$C_{LR,i,t}$
2021	#01	N/A	As	0	0	0	0
		N/A	Ds	0	0	0	0
	#02	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#03	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#04	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#05	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0

6.3.2.2.2.1 GHG Emissions Arising from Skid Trail Creation

GHG emissions from the creation of skid trails is estimated in function of the carbon stock change in soil organic carbon resulting from skid trail creation, the mean live carbon stock of trees and non-tree biomass assumed to be killed per unit area in creation of skid trail, a skid trail emission factor, and the length of skid trails (see section 4.2.2.2.2.1).

Carbon stock change in organic carbon resulting from skid trail creation ($\Delta C_{SOC\_sk,i}$) is calculated according to VMD0015 v2.2, equation 09. Data calculated for the first monitoring period are presented in the table below.

Table 60: Carbon stock change in soil organic carbon resulting from skid trail creation in stratum i; t CO2-e ha-1.

Year	PAI	UPA	Stratum (i)	F_{LU}	F_{MG}	F_{I}	$C_{SOC,i,t=0}$	$\Delta C_{SOC\_sk,i}$
2021	#01	N/A	As	0	0	0	0	0
		N/A	Ds	0	0	0	0	0
	#02	N/A	Aa	0	0	0	0	0
		N/A	Ab	0	0	0	0	0
	#03	N/A	Aa	0	0	0	0	0
		N/A	Ab	0	0	0	0	0
	#04	N/A	Aa	0	0	0	0	0
		N/A	Ab	0	0	0	0	0
	#05	N/A	Aa	0	0	0	0	0
		N/A	Ab	0	0	0	0	0

Mean live carbon stock of trees and non-tree biomass assumed to be killed ($C_{dest,\ i}$) is calculated taking in consideration the average carbon stock of trees below the maximum diameter tree[46] that can be within the path of a skid trail, following VMD0015 v2.2, step 02 criteria, and equation 15. Data calculated for the first monitoring period are presented in the table below.

Table 61: 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}) (ex-post).

Year	PAI	UPA	Stratum (i)	$C_{AB\_tree\_dest,i}$	$C_{BB\_tree\_dest,i}$	$C_{AB\_non-tree,i}$	$C_{BB\_non-tree,i}$	$C_{dest,\ i}$
2021	#01	N/A	As	0	0	0	0	0
		N/A	Ds	0	0	0	0	0
	#02	N/A	Aa	0	0	0	0	0
		N/A	Ab	0	0	0	0	0
	#03	N/A	Aa	0	0	0	0	0
		N/A	Ab	0	0	0	0	0
	#04	N/A	Aa	0	0	0	0	0
		N/A	Ab	0	0	0	0	0
	#05	N/A	Aa	0	0	0	0	0
		N/A	Ab	0	0	0	0	0

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

Skid trail emissions factor (SK_i) is calculated according to VMD0015 v2.2, equation 14. Data calculated for the first monitoring period are presented in the table below.

Table 62: 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 CO_2-e m^{-1}) (ex-post).

Year	PAI	UPA	Stratum (i)	W_{SKID}	$\Delta C_{SOC\_sk,i}$	$C_{dest,i}$	SK_i
2021	#01	N/A	As	0	0	0	0
		N/A	Ds	0	0	0	0
	#02	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#03	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#04	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0
	#05	N/A	Aa	0	0	0	0
		N/A	Ab	0	0	0	0

GHG emissions from the creation of skid trails ($\Delta C_{SKID,i,t}$) are estimated by multiplying the total length of skid trails created and a skid trail emission factor, according to VMD0015 v2.2, equation 13. Data calculated for the first monitoring period are presented in the table below.

Table 63: Change in carbon stock resulting from skid trail creation in stratum i in year t; (t CO_2-e) (ex-post).

Year	PAI	UPA	Stratum (i)	SK_i	$L_{SKID,i,t}$	$\Delta C_{SKID,i,t}$
2021	#01	N/A	As	0	0	0
		N/A	Ds	0	0	0
	#02	N/A	Aa	0	0	0
		N/A	Ab	0	0	0
	#03	N/A	Aa	0	0	0
		N/A	Ab	0	0	0
	#04	N/A	Aa	0	0	0
		N/A	Ab	0	0	0
	#05	N/A	Aa	0	0	0
		N/A	Ab	0	0	0

6.3.2.2.2.2 GHG Emissions Resulting from Roads Creation

GHG emissions resulting from the creation of roads ($\Delta C_{ROAD,i,t}$) are calculated according to VMD0015 v2.2, equation 17 (see section 4.2.2.2.2.2). Data calculated for the first monitoring period are presented in the table below.

Table 64: Change in carbon stock resulting from logging road creation in stratum i in year t; (t CO_2-e). (ex-post).

Year	PAI	UPA	Stratum (i)	$C_{BSL,i}$	$A_{ROAD,i,t}$	$\Delta C_{ROAD,i,t}$
2021	#01	N/A	As	0	0	0
		N/A	Ds	0	0	0
	#02	N/A	Aa	0	0	0
		N/A	Ab	0	0	0
	#03	N/A	Aa	0	0	0
		N/A	Ab	0	0	0
	#04	N/A	Aa	0	0	0
		N/A	Ab	0	0	0
	#05	N/A	Aa	0	0	0
		N/A	Ab	0	0	0

6.3.2.2.2.3 GHG Emissions Resulting from Logging Decks Creation

GHG emissions resulting from the creation of logging decks ($\Delta C_{DECKS,i,t}$) are calculated according to VMD0015 v2.2, equation 18 (see section 4.2.2.2.2.3). Data calculated for the first monitoring period are presented in the table below.

Table 65: Change in carbon stock resulting from logging deck creation in stratum i in year t; (t CO_2-e). (ex-post).

Year	PAI	UPA	Stratum (i)	$C_{BSL,i}$	$A_{DECKS,i,t}$	$\Delta C_{DECKS,i,t}$
2021	#01	N/A	As	0	0	0
		N/A	Ds	0	0	0
	#02	N/A	Aa	0	0	0
		N/A	Ab	0	0	0
	#03	N/A	Aa	0	0	0
		N/A	Ab	0	0	0
	#04	N/A	Aa	0	0	0

		N/A	Ab	0	0	0
	#05	N/A	Aa	0	0	0
		N/A	Ab	0	0	0

6.3.3 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 v2.2, equation 19 (see section 4.2.3). 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 v2.2, equations 22 and 21. Data monitored for the first monitoring period are presented in the table below.

Table 66: Area impacted by natural disturbances (ex post) (ha).

Year	DDRF	$A_{DistPA,q,i,t}$									
		PAI#01		PAI#02		PAI#03		PAI#04		PAI#05	
		As	Ds	Aa	Ab	Aa	Ab	Aa	Ab	Aa	Ab
2021	0	0	0	5,19	0,12	25,7	0,08	3,94	36	9,7	0

Carbon stock changes in all pools as a result of natural disturbance ($C_{P,Dist,q,i}$) is calculated according to VMD0015 v2.2, equation 24. Data monitored for the first monitoring period are presented in the table 32.

Net carbon stock changes in pools as a result of natural disturbance is calculated according to VMD0015 v2.2, equation 23. Data calculated for the first monitoring period are presented in the table 32.

GHG emissions resulted from areas undergoing natural disturbance are calculated according to VMD0015 v2.2, equation 20. Data calculated for the first monitoring period are presented in the table below.

Table 67: 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)	$A_{DistPA,q,i,t}$	$\Delta C_{P,Dist,q,i,t}$	$\Delta C_{P,DistPA,i,t}$
2021	#01	As	-	449.08	-
		Ds	-	431.25	-
	#02	Aa	5.19	422.51	2,191.58
		Ab	0.12	426.87	49.94
	#03	Aa	25.70	422.51	10,859.04
		Ab	0.08	426.87	33.30

	#04	Aa	3.94	422.51	1,664.28
		Ab	36.00	426.87	15,366.16
	#05	Aa	9.75	422.51	4,119.52
		Ab	-	426.87	-

6.3.4 Non-CO_2 Emissions Monitored

Burn scars from wildfires ($A_{burn,q,i,t}$) are measured according to ΔNBR[47] spectral index and verified with high spatial resolution satellite imagery from Sentinel, along with ground verifications (see section 4.2.3). 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 68: Area impacted by wildfires (ex post) (ha).

Year	DDRF	$A_{burn,q,i,t}$									
		PAI#01		PAI#02		PAI#03		PAI#04		PAI#05	
		Aa	Ds	As	Ab	Aa	Ab	Aa	Ab	Aa	Ab
2021		0	0	0	0	0	0	0	40.83	3.9	0

The average aboveground biomass stock before burning ($B_{i,t}$) is calculated according to VMD0013 v1.2, equation 2 (see section 4.2.4). Data monitored for the first monitoring period are presented in the table below.

Table 69: Average aboveground biomass stock before burning for stratum i, year t (tonnes d.m. ha^{-1}).

Year	PAI	Stratum (i)	$B_{i,t}$
2021	#01	As	299.01
		Ds	246.01
	#02	Aa	254.18
		Ab	257.19
	#03	Aa	254.18
		Ab	257.19
	#04	Aa	254.18
		Ab	257.19
	#05	Aa	254.18
		Ab	257.19

[47] Normalized Burn Index.

Non-CO_2 emissions due to biomass burning are calculated according to VMD0013 v1.2, equation 1 (see section 4.2.4). Data calculated for the first monitoring period are presented in the table below.

Table 70: Greenhouse gas emissions due to biomass burning in stratum i in year t of each GHG (CO_2, CH_4, N_2O) (t CO_2e).

Year	PAI	Stratum (i)	$A_{burn,i,t}$	$B_{i,t}$	$COMF_i$	$E_{biomassburn,i,t}$
2021	#01	As	0.00	299.01	0.45	0
		Ds	0.00	246.01	0.45	0
	#02	Aa	0.00	254.18	0.45	0
		Ab	0.00	257.19	0.45	0
	#03	Aa	0.00	254.18	0.45	0
		Ab	0.00	257.19	0.45	0
	#04	Aa	0.00	254.18	0.45	0
		Ab	40.83	257.19	0.45	1,150.2
	#05	Aa	3.90	254.18	0.45	108.6
		Ab	0.00	257.19	0.45	0

GHG emissions from fossil fuels and nitrogen application were conservatively excluded following VM0007 v1.6, 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 ($GHG_{P,E,i,t}$).

6.4 Leakage (ex-post)

GHG emissions due to leakage are based on activity shifting and market-effects leakage throughout the project lifetime. Leakage emissions are determined according to VMD0007 v1.6 equation 4[48] (see section 4.3). Data calculated for the first monitoring period are presented in the table below.

Table 71: Net GHG emissions due to leakage from the REDD project activity (t CO2-e) (ex-post).

Year	$\Delta C_{LK-AS,planned}$	ΔC_{LK-ME}	$\Delta C_{LK-REDD}$
2021	0	41,474.88	41,474.88

[48] Adjusted to reflect project scope.

6.4.1 Activity Shifting Leakage

Net greenhouse gas emissions due to activity shifting leakage ($\Delta C_{LK\text{-}AS,planned}$) 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 1.17.1). 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 4.3.1).

New calculated forest clearance by the baseline agent of the planned deforestation was calculated according VMD0009 v1.3, equation 05. Data calculated for the first monitoring period are presented in the table below.

The area of activity shifting leakage is determined according to VMD0009 v1.3, equation 06. Data calculated for the first monitoring period are presented in the table below.

Table 72: The area of activity shifting leakage in stratum i in year t (ha) (ex-post).

Year	PAI	Stratum (i)	$A_{defLK,i,t}$	$NewR_{i,t}$	$LKA_{planned,i,t}$
2021	#01	As	0	0	0
		Ds	0	0	0
	#02	Aa	0	0	0
		Ab	0	0	0
	#03	Aa	0	0	0
		Ab	0	0	0
	#04	Aa	0	0	0
		Ab	0	0	0
	#05	Aa	0	0	0
		Ab	0	0	0

GHG emissions due to leakage are defined according to VMD0009 v1.3, equation 01. Data calculated for the first monitoring period are presented in the table below.

Table 73: The area of activity shifting leakage in stratum i in year t (ha) (ex-post).

Year	PAI	Stratum (i)	$LKA_{planned,i,t}$	$\Delta C_{BSL,i}$	$LKA_{planned,i,t}$	$\Delta C_{LK\text{-}AS,planned}$

2021	#01	As	0	0	0	0
		Ds	0	0	0	0
	#02	Aa	0	0	0	0
		Ab	0	0	0	0
	#03	Aa	0	0	0	0
		Ab	0	0	0	0
	#04	Aa	0	0	0	0
		Ab	0	0	0	0
	#05	Aa	0	0	0	0
		Ab	0	0	0	0

6.4.2 Market Effects Leakage

Leakage factor for market-effects calculations (LF_{ME}) is calculated according to VMD0011 v1.0 criteria (see section 4.3.2).

Carbon emission due to displaced timber harvests in the baseline scenario ($C_{BSL,XBT,i,t}$) is calculated according to VMD0011 v1.0 equation 4. Summed emissions from timber harvest potentially displaced through implementation of carbon project ($AL_{T,i}$) is estimated according to VMD0011 v1.0 equation 3. Market-Effects Leakage Through Decreased Timber Harvest ($LK_{MarketEffects,timber}$) is estimated according to VMD0011 v1.0 equation 2.

Carbon emission due to displaced fuelwood/charcoal harvests in the baseline scenario is calculated according to VMD0011 v1.0 equation 7. Summed emissions from fuelwood/charcoal harvests in the baseline case potentially displaced through project implementation ($AL_{FW/C,i}$) is calculated according to VMD0011 v1.0 equation 6. Market Effects Leakage Through Decreased Harvest of Fuelwood and Charcoal Sold into Regional and/or National Markets ($LK_{MarketEffects,FW/C}$) are calculated according to VMD0011 v1.0 equation 5.

GHG emissions from market effects ($\Delta C_{LK\text{-}ME}$) are calculated according to VMD0011 v1.0 equation 1. Data calculated for the first monitoring period are presented in the table below.

Table 74: Net greenhouse gas emissions due to market- effects leakage (t CO_2-e) (ex post)

Year	$V_{BSL,EX,i,t}$	$FG_{BSL,t}$	$LK_{MarketEffects,timber}$	$LK_{MarketEffects,FW/C}$	$\Delta C_{LK\text{-}ME}$
2021	57,000.40	6,516.00	40,513.89	960.99	41,474.88

6.5 Net GHG Emission Reductions and Removals (ex-post)

6.5.1 Total Net GHG Emission Reduction

Net GHG emission reduction estimates are based in VM0007 v1.6 equation 2 (see section 4.4.1). Data calculated for the first monitoring period are presented in the table below.

Table 75: Total net GHG emission reductions of the REDD project activity (t CO_2e) (ex-post).

Year	Baseline emissions or removals	Project emissions or removals	Leakage emissions	Net GHG emission reductions or removals
	$\Delta C_{BSL-REDD}$	$\Delta C_{WPS-REDD}$	$\Delta C_{LK-REDD}$	NER_{REDD}
2021	1,046,265.42	107,006.80	41,474.88	897,783.73
TOTAL	**1,046,265.42**	**107,006.80**	**41,474.88**	**897,783.73**

6.5.2 Calculation of AFOLU Pooled Buffer Account Contribution

Buffer is calculated through VM0007 v1.6 equation 8 (see section 4.4.2). Buffer withholding percentage is calculated according to AFOLU Non-Permanence Risk Tool v4.0 (Appendix 04). The overall non-permanence risk rating is presented in the table below:

Table 76: Overall Risk Ratting for the first monitoring period.

Risk Category		Rating
a)	Internal Risk	0
b)	External Risk	0
c)	Natural Risk	7.5
Overall Risk Ratting (a + b + c)		10

6.5.3 Uncertainty Analysis

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. 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 (see appendix 08). 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 21[49]. 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 21[50] (see section 4.4.3). Data calculated for the first monitoring period are presented in the table below.

Table 77: Total net GHG emission reductions of the REDD+ project activities up to year t*adjusted to account for uncertainty (t CO2e) (ex-post).

Year	NER_{REDD}	NER_{REDD+_ERROR}	$Adjusted\_NER_{REDD+}$
2021	897,783.73	106,326.11	897,783.73
Total	**897,783.73**	**106,326.11**	**897,783.73**

6.5.4 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 v1.6 equation19[51] (see section 4.4.4). Data calculated for the first monitoring period are presented in the table below.

Table 78: Number of Verified Carbon Units (VCU) (ex-post).

Year	$Adjusted\_NER_{REDD+}$	$Buffer_{Planned}$	VCU_t
2021	897,783.73	93,925.86	803,858
Total	**897,783.73**	**93,925.86**	**803,858**

[49] Here suitable not to show values related to WRC project activities, which were not included in the scope of this project.

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

[51] Here suitable to reflect ex-ante estimates.

APPENDICES

i. Conservation Agreements PAIs #1-5
ii. Baseline Deforestation permits .
iii. Forest Management Plans_PAI1_2.
iv. Risk Analysis and report .
v. CWP .
vi. Land Tenure.
vii. Field collects carbon pools.
viii. Calculus tables.
ix. Leakage Management Areas
x. CCB_Bio & communities surveys .
xi. Additionality.
xii. Methodology deviation
xiii. Benchmark_Forest_Cover_Map_2021
xiv. First monitoring period data.
xv. QA/QC

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