



**Verified Carbon
Standard**

TRIUNFO DO XINGU GROUPED REDD+ PROJECT



systemica

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Brazil is one of the countries with the highest rates of forest loss (Tyukavina et al., 2017). According to 2022 data from the *Instituto Nacional de Pesquisas Espaciais* (INPE, 2022a), 72,978 million ha of the Amazon Biome area were deforested until 2020. The Triunfo do Xingu Grouped REDD+ Project (TdX project) is located within the Brazilian Amazon, in the municipality of Altamira. Among the municipalities in Brazil with the biggest deforested accumulated area, Altamira is in the third position with 1,113 million of deforested ha, and an average deforestation rate of over 70,000 ha year⁻¹ (TerraBrasilis, 2022). This rate has seen an increasing trend in recent years. The main cause of deforestation in the region is the illegal suppression of forests for the implementation of pastureland, which also happens in areas protected by law, such as Legal Reserve (*reserva legal* - RL) and Permanent Preservation Area (*área de preservação permanente* - APP), and is driven by the economical attractiveness of this activity and encouraged by a lack of law enforcement and overall sense of impunity (see Section 1.14 and 3.4). The deforestation in the project area region, which is within the Triunfo do Xingu Environmental Protection Area (*área de proteção ambiental* - APA), is a common practice, and as a result, the region is characterized by low human development, including communities living below the poverty line, such as Caboclo Village, the local community of the project.

The project falls under the category of Reducing Emissions from Deforestation and Forest Degradation (REDD), using the VM0048 methodology for reducing emissions from deforestation and forest degradation (VERRA, 2023a). The overarching objective of the TdX project is to preserve 10,704.58 ha of tropical forest based on scientific methodologies, remote and terrestrial monitoring and, above all, through territory socio-environmental dynamics transformation over time. The expected reduction in net GHG emissions is 513,023.82 t CO₂e considering the deforestation rate from the PADA report¹ from the start date (August 31, 2022) until the end of the Baseline Validity Period (BVP; from January 1, 2019, to December 31, 2024) and 49,789 t CO₂e on an annual average during the first ten years.

The TdX project aims to achieve its environmental benefits and generate GHG emission reductions through several activities planned to avoid unplanned deforestation. The project activities encompass a monitoring system by assessing satellite images and using them for remote geospatial analysis. In addition, other activities that involve project entities, communities and stakeholders: patrolling and surveillance of the project area, maintenance of firebreaks, leakage control, potential roll-out to other areas and contact with neighboring communities (see Section 1.12). In this way, generating economic benefits through investments in local communities, teaching them sustainable ways to maintain their economic activities and improve socio-environmental quality, without the need to appeal to deforestation.

¹ PADA Report - VCS 3738.pdf

1.2 Audit History

Table 1.1 highlights the project's audit history. For the project validation, the validation date was entered in the Period column. This table includes all monitoring periods, including the period of this report.

Table 1.1. The audit history of the project.

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	31-Aug-2022 to 30-Aug-2052	Verified Carbon Standard (VCS) VM0015	Earthood Services Private Limited	30
Validation	31-Aug-2022 to 30-Aug-2052	Verified Carbon Standard (VCS) VM0048	Verifit S.methoA.S	30

1.3 Sectoral Scope and Project Type

The table below describes information relevant to AFOLU projects (Table 1.2).

Table 1.2. Information relevant to AFOLU projects.

Sectoral scope	The Triunfo do Xingu Grouped REDD+ Project is within the sectorial scope number 14 – Agriculture, Forestry and Other Land Use (AFOLU).
AFOLU project category ²	The project category is Reduced Emissions from Deforestation and Degradation (REDD) – Avoiding Unplanned Deforestation and/or Degradation (AUDD).
Project activity type	This category includes activities that reduce net GHG emissions by stopping deforestation and/or degradation of degraded to mature forests that would have occurred in any forest configuration.

1.4 Project Eligibility

1.4.1 General eligibility

According to the VCS Standard v4.7 (VERRA, 2024b) and considering the TdX project characteristics, four main sections must be followed by this project so it can be eligible. All the bullet points of the next paragraphs have, in their beginning, the VCS Standard section that sets a specific requirement, and then a brief description of how this project attends it.

Section 3.1 General Requirements

² See Appendix 1 of the VCS Standard

The project attends to all the applicable requisites of section 3.1 as listed below.

- Section 3.1.1: The project meets all applicable rules and requirements set out under the VCS program. More details about the methodology are given in Section 3.2, Applicability of Methodology.
- Section 3.1.2: A methodology eligible under the VCS Program is applied in full, namely, the Reducing Emissions from Deforestation and Forest Degradation, v1.0 (VM0048, (VERRA, 2023a)).
- Section 3.1.3 The project has applied the latest version of the applicable (VM0048, (VERRA, 2023a)), and will update to the latest version of the methodology when reassessing the baseline and renewing a crediting period.
- Section 3.1.4: Implementation is legal under Brazilian legislation. All laws considered during the compliance process are presented in Section 1.15 of this document. Therefore, the project does not lead to the violation of any applicable law, regardless of whether the law is enforced.
- Section 3.1.7: Rules and requirements of the VCS program take precedence over other approved GHG Program when there is a conflict between them.
- Section 3.1.8: All capacity limits and relevant requirements are considered when a methodology from an approved GHG program is used.
- Section 3.2.10: A non-permanence risk report was developed and is available together with this project description validation document.
- Section 3.2.11 to 3.2.22: All the forementioned topics 3.2.11 to 3.2.22 of the VCS Standard v4.7 regarding the non-permanence risk report are followed by this project and can be seen in it.

1.4.2 AFOLU project eligibility

Section 3.2 AFOLU-Specific Matters

All applicable minor sections of the 3.2. section have requirements followed by the TdX project:

- Section 3.2.2: The project is not located within a region covered by a jurisdictional REDD+ program, then it is not necessary to follow the requirements related to nested projects set out in the VCS Program document called Jurisdictional and Nested REDD+ Requirements.
- Section 3.2.3: All implementation partners are identified in Section 1.7, Other Entities Involved in the Project, of this document.
- Section 3.2.4: Project activities do not convert native ecosystems to generate GHG credits. As stated in Section 1.14 and confirmed by geospatial data, the land has not been cleared of native ecosystems within 10 years of the project start date. The geospatial analysis also concludes that fauna and flora of the project area are part of the Amazon Biome.
- Section 3.2.5: Project activities do not drain or degrade hydrological functions to generate GHG credits. Their resources are not used, and their riparian forest remains intact.

- Section 3.2.7 and 3.2.8: The project is going to reassess the defined baseline every six years to consider possible methodologies updates and changes in the drivers and/or behavior of agents that cause changes in the reference area.
- Section 3.2.9: Project activities do not occur on wetlands, then specific requirements for WRC projects are not necessary to be followed.

Section 3.6. Project Design

Since this is a grouped project, specific design requirement needs to be followed. The most important of them and the applicable ones are listed below. To complete description of those requirements and their attendance by each project instance is detailed in the next Section 1.5.

- Sections 3.6.2, 3.6.3 and 3.6.19: The REDD AUD project activity is specified in the PD with its relevant methodology. All criteria and procedures set out on those were applied to demonstrate the baseline scenario and additionality. Also, a non-permanence risk report was made and presented together with this PD.
- Section 3.6.10: The project has one clearly defined geographic area.
- Sections 3.6.11, 3.6.13, and 3.6.14: There is one instance in this validation document. Its additionality and baseline scenario set out the reference for the next ones. They are presented for the only designated geographic area of the project.
- Section 3.6.12: This project does have only one project activity (AUDD).
- Section 3.6.9: The capacity limits of the project activity are not exceeded by any project instance.
- Sections 3.6.16 and 3.6.17: A set of eligibility criteria is set in the next Section 1.5 for every TdX project instance. Also, the eventual inclusion of new project instances follows all the requirements of the VCS Standard for project instances.
- Section 3.6.22: This single project description has all the TdX project instances. It contains the delineation of geographic areas in which project activities occur, the baseline and additionality demonstrations, sets of eligibility criteria and a description of the central GHG information system.

Appendix 1 Eligible AFOLU Project Categories

Appendix 1 from the VCS Standard v4.7 details the eligibility criteria for every type of activity. Since the Triunfo do Xingu is a Grouped REDD+ project, paragraphs A1.5 to A1.8 are the important ones for this project. The requirements attended by TdX are listed below.

- Reduce emissions from unplanned deforestation by avoiding illegal squatters to invade the property to transform forest land into non-forest land in a direct human-induced conversion.
- The eligible area is composed of qualified forests once they have more than 10 years of existence prior to the project start date.

- The activities covered under the REDD project category have specifically the goal to avoid unplanned (unsanctioned) deforestation (the project does not include degradation), configuring as an AUD kind of project.

1.4.3 Transfer project eligibility

Not applicable.

1.5 Project Design

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

1.5.1 Grouped project design

Table 1.3 outlines the general requirements for grouped projects and specifies the eligibility criteria for new project activity instances within the TdX project. It also addresses the inclusion of the TdX-I1 (the first project activity instance). These elements align with the provisions detailed in the VCS Standard v4.7 (Verra, 2024a).

Table 1.3. Set of eligibility criteria and the attendance of the 1st Project Activity Instance (TdX-I1).

VCS Standard Eligibility for Grouped Project	TdX Project Activity Instances
3.6.10. Grouped projects shall specify one or more clearly defined geographic areas within which project activity instances may be developed.	The project has a clearly defined geographic area for the development of new instances of activity, corresponding to the jurisdictional allocation map of Verra (State of Pará). The baseline scenario determination and additionality demonstration were based on the initial project activity instance (Section 1.12), which is presented in this PD for validation.
3.6.11. Determination of baseline scenario and demonstration of additionality are based upon the initial project activity instances.	The determinations of the baseline scenario and the additionality were based upon the initial project activity instance: avoiding unplanned deforestation, also described in Sections 3.4 and 3.5, respectively. The set of eligibility criteria described here should ensure that the same baseline scenario

VCS Standard Eligibility for Grouped Project	TdX Project Activity Instances
	applies to future instances. All characteristics that impact the applicability of the baseline scenario should be described for the specific eligibility criteria. Particularly, it was established as an eligibility criterion for future instances that Sustainable Forest Management (SFM) must not occur in the project area of new instances in both the project scenario and the baseline scenario. Overall, the project's baseline scenario is characterized by the illegal conversion of forest lands to non-forest uses, a practice aligned with the regional land use common practice. This scenario is linked to the unplanned deforestation of eligible forest areas — which may include APP, LR, and LR surplus — that are cleared for cattle pasture by land grabbers. As discussed in Section 3.4, while the distinctions among APP, LR, and LR surplus are relevant from the perspective of landowners, they lose significance for the agents of deforestation. Remember that deforestation agents — essentially land grabbers — disregard formal boundaries, thereby unlawfully encroaching upon the area. In this context, the baseline scenario for all instances applied under this grouped project must mirror the baseline scenario, being characterized by invasion of property by land grabbers, unplanned deforestation, total burning of biomass and subsequent implementation of livestock farming and cattle

VCS Standard Eligibility for Grouped Project	TdX Project Activity Instances
	grazing. New instances must adhere to the same baseline scenario, including confirmation that there is no SFM implementation in the project area, both the project scenario and the baseline scenario. The additionality of the initial project activity instance was demonstrated for the designated geographic area, in accordance with the methodology applied to the project.
3.6.12. As with non-grouped projects, grouped projects may incorporate multiple project activities.	In validation, the only project activity is avoided unplanned deforestation, and the geographic area corresponds to the jurisdictional allocation map of Verra (State of Pará).
3.6.13. The baseline scenario for a project activity shall be determined for each designated geographic area, in accordance with the methodology applied to the project.	At validation, the project has a single designated geographic area, the first instance project area, with a single baseline scenario for the project activity. If new designated geographic areas are added, i.e. new project area instances, the baseline scenario will be determined for each one of them according to the adopted methodology.
3.6.14. The additionality of the initial project activity instances shall be demonstrated for each designated geographic area, in accordance with the methodology applied to the project.	At validation, the project has a single designated geographic area, the first instance project area, with a single additionality demonstration. If new designated geographic areas are added, i.e. new project area instances, additionality will be demonstrated for each one of them.
3.6.15. Where factors relevant to the determination of the baseline scenario or demonstration of additionality require assessment across a given area, the area shall be, at a minimum, the grouped project geographic area.	All factors relevant to the determination of the baseline scenario or demonstration of additionality were assessed across the grouped project geographic area corresponding to the

VCS Standard Eligibility for Grouped Project	TdX Project Activity Instances
3.6.16. Grouped projects shall include one or more sets of eligibility criteria for the inclusion of new project activity instances. A set of eligibility criteria shall ensure that new project activity instances: 1) Meet the applicability conditions set out in the methodology applied to the project. 2) Use the technologies or measures specified in the project description. 3) Apply the technologies or measures in the same manner as specified in the project description. 4) Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area. 5) Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area. For example, the new project activity instances have financial, technical and/or other parameters.	jurisdictional allocation map of Verra (State of Pará). This table has a set of eligible criteria for the inclusion of new project activity instances in the TdX project. It is also ensured that new project activity instances and the TdX-I1: • Meet the applicability conditions set out in the methodology applied to the project. • Uses technologies or measures specified in the project description and in the same manner as their description. • It is subject to the baseline scenario determined in the project description for the project activity specified in the geographic area. • Sets out the characteristics for financial, technical and/or other parameters used by additionality of this project. Eventually new instances need to be consistent with this first instance.
3.6.17. New project activity instances shall: 1) Occur within one of the designated geographic areas specified in the project description. 2) Conform with at least one complete set of eligibility criteria for the inclusion of new project activity instances. 3) Be included in the monitoring report with sufficient technical, financial, geographic, and other relevant information to demonstrate conformance. 4) Be included in an updated project description, with updated project location information, which shall be validated at the time of verification against the applicable set of eligibility criteria. 5) Have evidence of project ownership, in respect of each project activity instance,	New TdX project activity instances: 1. It will take place in the designated geographic area specified in the project description. 2. It will be in conformance with this defined set of eligible criteria. 3. It will be included in the monitoring report. 4. An updated project description will be included, with updated information on the project location, which will be validated by the VVB contract. 5. It will have evidence of project ownership. 6. It will have the same start date as or later than the TdX grouped project and

VCS Standard Eligibility for Grouped Project	TdX Project Activity Instances
6) Have a start date that is the same as or later than the grouped project start date. 7) Be eligible for crediting from the start date of the project activity instance through to the end of the project crediting period (only). 8) Only eligible for crediting from the start of the verification period in which they were added to the grouped project. 9) Not be-or have enrolled in another VCS project. 10) Adhere to the clustering and capacity limit requirements for multiple project activity instances set out in 3.6.8 - 3.6.9.	7. It will be eligible through all the project activity, instance crediting period. 8. It will be eligible for crediting from the start of the verification period in which they were added to the TdX grouped project. 9. It will not be or have been enrolled in another VCS project. 10. It will adhere to the clustering and capacity limit requirements. TdX-I1: - Occurs in the designated geographic area specified in the project description. - Comply with this set of eligible criteria presented by this table. - As this is the first instance, it is already included in this PD. - It will be validated by the contracted VVB. - Have evidence of project ownership, presented in Section 0 of the PD. - Have the same start date as the grouped project and is eligible through all the project crediting period. - It will not leave the VCS project and then enroll in another one.
3.5.17. AFOLU non-permanence risk analyses, where required, shall be assessed for each geographic area specified in the project description.	The AFOLU non-permanence risk analyses will be assessed for each new project activity instance. The TdX-I1 required non-permanence risk analysis is available together with this PD.

1.6 Project Proponent

The project proponent detailed information is shown in Table 1.4.

Table 1.4. Project proponent detailed information.

Organization name	Systemica Inteligência em Sustentabilidade S.A.
Contact person	Munir Younes Soares
Title	Director
Address	Rua Frei Caneca, nº 1246, cj 41, Consolação, São Paulo, Brazil, postal code: 01307-002
Telephone	+55 11 5039-1080
Email	munir@systemica.digital

1.7 Other Entities Involved in the Project

The entities involved detailed information is shown below (Table 1.5 to Table 1.9).

Table 1.5. Byblos Agronegócio Holding LTDA entity detailed information.

Organization name	Byblos Agronegócio Holding LTDA
Role in the project	Landowner and partner in the project activity implementation
Contact person	Rafael Bemerguy Sefer
Title	Owner of the Patacho and Campo Lindo farms
Address	Tv SOL D'Oeste, S/N, Sala C, Bom Planalto, Marabá (PA), Brasil, postal code: 68.501-730
Telephone	+55 91 9353-1020
Email	rafaelsefer@hotmail.com

Table 1.6. Santa Maria Pecuaria e Agronegocio LTDA entity detailed information.

Organization name	Santa Maria Pecuaria e Agronegocio LTDA
Role in the project	Landowner and partner in the project activity implementation
Contact person	Rafael Bemerguy Sefer
Title	Owner of the Belcon, Santa Marta, Retiro Encantado and Vó Lina farms
Address	Av. SOL D'Oeste, S/N, Sala B, Liberdade, Marabá (PA), Brasil, postal code: 68.501-730

Telephone	+55 91 9353-1020
Email	rafaelsefer@hotmail.com

Table 1.7. Didácio Milhomens Barros entity detailed information.

Organization name	Didácio Milhomens Barros
Role in the project	Landowner and partner in the project activity implementation
Contact person	Didácio Milhomens Barros
Title	Owner of the Nossa Senhora Aparecida farm
Address	QSC 19, Chácara 25, Conjunto F, Lote 11, Taguatinga, Distrito Federal, Brazil, postal code: 72.017-221
Telephone	+55 61 8406-5165
Email	didmilhomens@yahoo.com.br

Table 1.8. Marlei M. Nogueira entity detailed information.

Organization name	Marlei M. Nogueira
Role in the project	Service provider responsible for carrying out the forest biomass inventory in the project areas.
Contact person	Marlei Monteiro Nogueira
Title	Owner of the company Marlei M. Nogueira
Address	PSG Vila Nova Street, N° 562, Sacramento, Municipality of Belém – PA, postal code: 66123-120
Telephone	+55 (91) 99216 8684
Email	tcfservices@yahoo.com

Table 1.9. Caroline César de Oliveira MEI entity detailed information.

Organization name	Caroline César de Oliveira MEI
Role in the project	Service provider responsible for carrying out the social diagnosis within the scope of the Triunfo do Xingu Grouped REDD+ Project.
Contact person	Caroline César de Oliveira

Title	Owner of the company Caroline César de Oliveira MEI
Address	Formosa Street, N° 152, Santa Teresa, Belo Horizonte – MG, postal code 31.015-050
Telephone	+55 (31) 98259 8671
Email	carolinecesari@yahoo.com.br

1.8 Ownership

The grouped project covers a region in the municipality of Altamira, in the state of Pará, Brazil. The first instance is made up of seven private properties, Fazenda Nossa Senhora Aparecida, owned by Didácio Milhomens Barros, and six others owned by Rafael Sefer under two different companies: Fazenda Belcon, Fazenda Santa Marta, Fazenda Retiro Encantado and Fazenda Vó Lina are owned by Santa Maria Pecuária e Agronegócio Ltda; Fazenda Patacho and Fazenda Campo Lindo are owned by Byblos Agronegócio Holding Ltda. All properties within the project have 100% legal rights to control and operate project activities from the project start date, in full compliance with section 3.7 of the VCS Standard version 4.5^{3,4,5}.

In accordance with the VCS Standard requirements (3.7.1) it's possible to demonstrate that Systemica (PP) holds executory and irrevocable rights to control and operate the project, as evidenced by the legal contract between Systemica and landowners attached (“Instrumento Particular de Desenvolvimento de Projetos de Geração de Ativos Certificados de Carbono – Crédito de Carbono”) and signed by both owners⁶.

1.9 Project Start Date

The Triunfo do Xingu grouped REDD+ project started on the 31st of August 2022 (Table 1.10). This date represents the effective date on which the project began generating GHG emissions reduction in the project area when additional activities have started to avoid unplanned deforestation.

Table 1.10. Project start date.

Project start date	31-Aug-2022
Justification	Despite prior discussions with landowners and a thorough analysis of project viability ⁷ , 31st of August 2022 marks the beginning of the local activities initiated by Systemica, with the first REDD+ training for capacity building. This training addressed topics such as: how REDD+ projects work, the importance of emission reduction, the Sustainable

³ InspectionReport_INTERPA.rar

⁴ IndependentLegalOpinion.pdf

⁵ Land_documents.zip

⁶ 240528_Contract_PP_landowner.zip

⁷ 240516_FPIC_Landowners.zip

Development Goals (SDGs), how to increase forest carbon stocks, actions for controlling climate change and global warming, and the importance of community participation to achieve the goals of the Triunfo do Xingu Grouped REDD+ Project⁸.

Some the participants in the REDD+ training, as well as being from Caboclo village, are also workers from Nossa Senhora Aparecida Farm, owned by Didácio. The other participants are workers, relatives, or landowners of farms located within the project's Leakage Belt and live in the Caboclo village. This first action showed the commitment of the participants, especially from the workers, who at the time and still today work at Didácio's farm and participated in the REDD+ training, as they were involved in the initiation and continuity of project activities, particularly in "Patrolling and Surveillance," of which the training is a part.

The REDD+ training for capacity building was not an isolated action, but part of the activities planned by the proponent based on the social diagnosis conducted in Caboclo village and with workers from the project area, which took place parallel to the Start Date. The REDD+ training for capacity building is part of the "Patrolling and Surveillance" activity since it involves project workers, and "Contact with neighboring communities" activity since it involves Caboclo village. Also, the project is in the process of validation by the Climate, Community, and Biodiversity Standard (CCB), involving Caboclo village as the project community, the status of the CCB validation can be checked on the website of VERRA.

Consequently, it is due to the importance of these actors that the first activity was directed towards the local community and workers. This increased awareness can create consciousness about forest conservation and the importance of sustainable practices, and even influence the behavior of deforestation agents, ultimately contributing to the prevention of unplanned deforestation. Hence, this date represents the effective date on which the project began generating GHG emissions reduction in the project area.

⁸ 230515_REDD+CapacityBuilding.zip

1.10 Project Crediting Period

Table 1.11. Project Crediting Period.

Crediting period	☐ Seven years, twice renewable ☐ Ten years, fixed ☒ Other (state the selected credit period and justify how it conforms with the VCS Program requirements) The project has a crediting period of 30 years, starting on 31 th of August 2022 and going on 30 th of August 2052.
Start and end date of first or fixed crediting period	31- August-2022 to 30- August-2052.

1.11 Project Scale and Estimated GHG Emission Reductions or Removals

The TdX project is "project" scale denominated by the generation of less than or equal to 300,000 tonnes of CO₂e per year according to the VCS Standard v4.7 in section 3.10. The estimated annual net GHG emission reductions for the project crediting period are estimated in this verification process by 30 years period-based considering the current deforestation pattern. The expected reduction in net GHG emissions considering the deforestation rate from the PADA report⁹ from the start date (August 31, 2022) until the end of the Baseline Validity Period (BVP; from January 1, 2019, to December 31, 2024) can be verified in Table 1.12. It is important to highlight that for future baseline periods and baseline renewals, the project is expected to reflect greater reductions over time, mainly due to the conditions and advance of unplanned deforestation near the TdX project area. The table is being filled with the current PADA information, and the zero values do not represent a null quantity of VCUs, but are only placeholders to complete the template.

☒ < 300,000 t CO₂e/year (project)

☐ ≥ 300,000 t CO₂e/year (large project)

Table 1.12. Estimated annual GHG emission reductions for the project crediting period.

Calendar year of crediting period	Estimated net GHG emission reductions (t CO ₂ e)
31-August-2022 to 31-December-2022	33,611.02
01-January-2023 to 31-December-2023	100,434.59

⁹ PADA Report - VCS 3738.pdf

Calendar year of crediting period	Estimated net GHG emission reductions (t CO ₂ e)
01-January-2024 to 31-December-2024	102,495.75
01-January-2025 to 31-December-2025	104,556.90
01-January-2026 to 31-December-2026	106,618.05
01-January-2027 to 31-December-2027	8,939.20
01-January-2028 to 31-December-2028	8,939.20
01-January-2029 to 31-December-2029	8,939.20
01-January-2030 to 31-December-2030	8,939.20
01-January-2031 to 31-December-2031	8,939.20
01-January-2032 to 31-December-2032	8,244.62
01-January-2033 to 31-December-2033	6,183.46
01-January-2034 to 31-December-2034	4,122.31
01-January-2035 to 31-December-2035	2,061.15
01-January-2036 to 31-December-2036	0.00
01-January-2037 to 31-December-2037	0.00
01-January-2038 to 31-December-2038	0.00

Calendar year of crediting period	Estimated net GHG emission reductions (t CO ₂ e)
01-January-2039 to 31-December-2039	0.00
01-January-2040 to 31-December-2040	0.00
01-January-2041 to 31-December-2041	0.00
01-January-2042 to 31-December-2042	0.00
01-January-2043 to 31-December-2043	0.00
01-January-2044 to 31-December-2044	0.00
01-January-2045 to 31-December-2045	0.00
01-January-2046 to 31-December-2046	0.00
01-January-2047 to 31-December-2047	0.00
01-January-2048 to 31-December-2048	0.00
01-January-2049 to 31-December-2049	0.00
01-January-2050 to 31-December-2050	0.00
01-January-2051 to 31-December-2051	0.00
01-January-2052 to 30-August-2052	0.00
Total estimated ERRs considering the deforestation rate from the	513,023.82

Calendar year of crediting period	Estimated net GHG emission reductions (t CO ₂ e)
PADA report ¹⁰ from the start date (August 31, 2022) until the end of the Baseline Validity Period (BVP; from January 1, 2019, to December 31, 2024)	
Total number of years	30
Average annual ERRs	17,492.59

1.12 Description of the Project Activity

The Triunfo do Xingu Grouped REDD+ Project aims to conserve native ecosystems of the Amazon rainforest located within the municipality of Altamira, in Pará state, Brazil. To reach this goal, actions will be taken to avoid unplanned deforestation. It is important to state that none of those areas are located within a jurisdiction covered by a jurisdictional REDD+ program.

This project description, as a validation document, has one instance composed by six properties owned by Rafael Sefer, and a seventh one, owned by Didácio Milhomens, called Nossa Senhora Aparecida Farm. They have, respectively, 9,278.07 ha and 1,426.51 ha of eligible forest area. With the TdX project, it is expected to avoid 641,279.78 t CO₂e considering the deforestation rate from the PADA report¹¹ from the start date (August 31, 2022) until the end of the Baseline Validity Period (BVP; from January 1, 2019, to December 31, 2024). In the future, new instances may be added to the project, expanding the conservation of the forest.

The territory encompassed by the APA Triunfo do Xingu is a region characterized by the predominance of the logic of land occupation through the felling of forests with the use of fire to enable pastures for livestock. In this context, the conversion of forest areas into pastures has become the main productive justification for land occupation and possession. These pastures primarily serve to acquire land occupation and ownership, often resulting in abandonment and discontinuation of livestock activities.

In order to mitigate the risk of unplanned deforestation agents, the main measures that are going to be adopted are (i) satellite remote monitoring of the project area, leakage belt and leakage management area (ii) perimeter patrolling and surveillance of the project area, (iii) maintenance of firebreaks, and (iv) the insertion of the surrounding communities in the project activities, aiming to minimize invasions and unplanned deforestation, offering alternative income, environmental education and professional training. More details of the project activities are given below, including the description of goals, monitoring output and impact indicators, implementation schedule, and expected deforestation reduction impact of each project activity, as presented in Table 1.13. It is important to highlight that the project proponent also intends to certify the project with the CCB label. Therefore, in addition to the activities described here,

¹⁰ PADA Report - VCS 3738.pdf

¹¹ PADA Report - VCS 3738.pdf

the project aims to address biodiversity conservation activities and community well-being improvement in the future as well.

Patrolling and surveillance

The patrolling and surveillance initiative aims to engage the local community in protecting the area by providing training and offering temporary or permanent job opportunities. The monitoring process begins with an initial phase of local awareness through REDD+ training sessions, fostering a conservation mindset and introducing the community to the importance of sustainable land use. Following this, participants interested in doing monitoring rounds undergo further training in security protocols and the use of digital tools such as Timestamp and Avenza, which enhance monitoring efficiency and data collection. Additionally, the training includes detailed instruction on completing occurrence reports, ensuring that patrol teams can systematically document threats, land invasions, or illegal activities. Through regular and strategic surveillance, the project strengthens land security, reduces threats such as illegal occupation, and prevents unplanned deforestation. By integrating community engagement, technology, and structured reporting, this initiative ensures the long-term protection of ecologically important forest areas while promoting environmental awareness and sustainable livelihoods.

The protection of the forest area is the project's main activity and objective, to avoid unplanned deforestation, given that the project area is in a region with high deforestation rates. The mitigation of possible conflicts, resulting from illegal occupation of the project area by land grabbers or from the invasion of the project properties, will be carried out through the identification of strategic points to establish surveillance checkpoints prioritizing zones bordering areas with high probability of invasion, i.e., areas that have historically presented this type of event. Also, physical markers will be installed along the perimeter of the project area, each evidenced by georeferenced records indicating its precise location within the property, and frequent surveillance rounds around the project area perimeter will be established. The success of this activity involves the participation of other project entities (landowners) as well as their farm administrators, as they are primarily responsible for ensuring the frequency and monitoring of patrols.

Thus, based on previous experience, it is expected to have a positive impact perceived by the people from the adjacent community related to tenure security because of the project operations. But not limited to that, as the local community will also be involved in the activity through temporary or permanent hiring by the project, generating income opportunities and alternatives to common practices in the region that lead to deforestation.

It should be emphasized that patrolling and surveillance activities have already begun to be implemented and do not involve, under any circumstances, the use of firearms. All guidance provided to those involved, through training sessions and reference documents, stresses that in the event of any interaction with deforestation agents, potential unknown intruders, or local community members displaying irrational, hostile, or aggressive behavior, the mandatory conduct is to immediately withdraw and leave the area, thereby avoiding any confrontation or risk to life. In such cases, the incident must be reported to the landowners and the project team so that appropriate measures can be taken.

To ensure clarity and standardization, the project team developed the Field Monitoring Operational Procedure (POMC, abbreviation in Portuguese), which was presented to all individuals involved in patrolling and surveillance activities and formally signed by the landowners and the field forest supervisors¹². This document defines objectives, responsibilities, monitoring methods, safety conduct, and the list of materials and equipment permitted for the activity.

The POMC explicitly states that the authorized equipment includes mobile phone, radio, satellite tracking device, compass, first aid kit, snakebite kit, insect repellent, machete, knife, shin guards, helmet, backpack, clipboard, surveillance forms, pen, raincoat, water bottle, sunscreen, and flashlight with batteries. In this sense, the document makes it clear and unequivocal that no armed patrolling takes place.

Finally, it is noted that, as this is a recurring activity, the POMC is periodically reintroduced to those involved, ensuring continuous alignment with the established safety guidelines and responsibilities.

Satellite monitoring

The approach adopted by the project involves a system combining satellite images with field visits. The monitoring plan will use the Mapbiomas Alert data, which is a system that validates and refines deforestation alerts with high-resolution images by integrating and analyzing multiple alert systems, such as DETER, PRODES, SAD, Sirad-X, and others. This platform data is widely used because it integrates and validates the alerts of several products, increasing the reliability of the data and can be acquired on a daily frequency. Satellite monitoring evaluates alerts in a 10-20km buffer of the project area, which can evaluate deforestation alerts or hot spots, for example. This information is technically analyzed by correlating it with data on the site's slope, rainfall, wind direction and speed, among others, thus enabling better predictability of events. In addition, remote monitoring can be combined with field activities, allowing for the local identification of areas vulnerable to deforestation. In this way, quicker and more efficient response aids in prevention, contributing to the reduction of deforestation.

Leakage control

The project proponent, together with the landowners, comprehends the conceptual complexity and difficulties of implementing a policy for reducing the risk of potential leakage. Therefore, the project proponent will adopt a proactive initiative for fighting leakage sources. The Leakage Management Plan presented in Section 1.19.1 is a robust instrument that outlines the actions to be implemented to reduce the risk of leakage, including its objectives, targets, deadlines, and responsible parties.

Among the proposed actions, the project proponent plans cooperative efforts with the local stakeholders residing in the Leakage Management Area (which is defined as the non-forest region where the housing and infrastructure of Caboclo Village is located, as shown in Section 3.3.7), to promote a new approach to forest use and land use in the region, raising awareness among them about environmental education and develop REDD+ capacity building activities.

¹² [PatrollingSurveillanceActivities.zip](#)

Although there is a risk of leakage, the project proponent believes that the project activities will have positive impacts on surrounding areas in terms of deforestation reduction. This project might be a well-succeeded example of: (i) financial return due to REDD incentives, which can compensate for avoiding deforestation for other activities; (ii) maintenance of real estate (land acquisition and grabbing dynamics).

Maintenance of firebreaks

To prevent outside wildfires from entering the project forest area, the maintenance of firebreaks will be an important protective measure. The landowners are committed to maintaining firebreaks on the project properties, therefore, in addition to the landowners and their farm administrators, there may also be potential hirings of individuals from the community to maintain this activity. Firebreaks are very effective technique commonly employed in the region to contain and prevent fires, and are largely recommended by the fire department and IBAMA (2009). Regarding the implementation and maintenance of firebreaks, the fire department has developed technical material that is easy to access on techniques, dimensions and practical notions for the construction of firebreaks (PMESP, 2006). Therefore, the activity is expected to reduce the occurrence and intensity of forest fires, impacting the reduction of unplanned deforestation.

Potential roll-out to other areas

The project might probably stimulate other landowners to adhere to its concept. Communication with landowners might be performed using associative actions and environmental education. Other areas with the potential to be included in REDD projects have already been identified around the project site, which will favor and encourage forest conservation by means of financial incentives obtained from reduced emission sales and provide social and environmental benefits to neighboring communities.

Employing project monitoring activities, the project proponents believe that the well-succeeded example of this business plan will generate an increased number of sustainably managed areas, which will create ancillary benefits around the project boundary.

Furthermore, the project maintains frequent contact with institutional stakeholders, which can be important partners to enhance the reach of REDD projects in the region or even amplify the benefits of the project, which, ultimately, can contribute to the reduction of deforestation.

Contact with neighboring communities

The project activity will consist of the engagement of local communities through environmental education activities, with an emphasis on the importance of forests, environmental conservation, sustainable development, and climate change and mitigation, and through training and temporary or permanent employment, promoting income generation and opportunities. By reaching out to local communities and developing activities with the purpose of raising awareness about the importance of preserving forests, along with greater opportunities and income diversification, the project can lead these agents to avoid this common practice and adopt alternative, more sustainable practices. Moreover, training focused on forest protection in the riparian zone of the Caboclo stream not only highlights the importance of these areas for water resources conservation, on which the community depends, but also how this relates to

more sustainable agriculture practices and the community's adaptation to climate change. To develop these engagement activities with local communities, the project will also rely on the potential support of institutional stakeholders, especially public institutions involved in education, research, or technical and professional development, seeking to establish agreements and partnerships to enhance the benefits of the planned activities.

Table 1.13. Project activities, indicators, and schedule.

Project Activities	Goals	Output	Monitoring output indicator	Implementation schedule	Expected deforestation reduction impact	Monitoring impact indicator
Patrolling and surveillance	Avoid unplanned deforestation in the project area through constant and strategic patrolling	At least 30 monitoring of the project area during the 30 years of the project	Number of protected ha of native forest areas of high ecological importance and critical habitats	Annual	A reduction in deforestation rates is expected as patrolling and surveillance activities can inhibit the actions of invaders and illegal occupations that lead to deforestation. Additionally, this activity increases the perception of land security in the region, reducing potential conflicts with the community. Finally, hiring and training for patrolling and surveillance also involves raising environmental awareness and acquiring REDD+ capacities among workers and members of the local community, providing alternative sources of income and education, which will contribute to reducing the community's involvement in activities that contribute to deforestation in the region.	By 2052, 100% of the project area will be protected in areas of high ecological importance and critical habitats; SDG 13.0 Tonnes of greenhouse gas emissions avoided or removed
	Strengthening land security for the local community by reducing the rate of identified threat occurrences (such as invasion or illegal occupation) during patrol campaigns in the project area		Number of identified threat occurrences during monitoring	Half-yearly		
	Engage the local community in protecting the area through training and the temporary or permanent hiring of workers	At least 10 people hired for project activities, including women during the 30 years of the project	Number of community members training and participating in monitoring the project area or zone	Annual		
Satellite monitoring	Detect and support enforcement and the implementation of protection measures to prevent unplanned deforestation in the project area	Monthly updates during the 30 years of the project	Number of fire hotspots in the project area	Monthly	A reduction in deforestation rates is expected as satellite monitoring increases the scale of identifying areas vulnerable to deforestation, allowing for faster action.	
Maintenance of firebreaks	Prevent the entry of external fires into the project's forest area through the maintenance of firebreaks	At least 10 fire-fighting measures during the 30 years of the project	Number of fire-fighting measures	Biennial	A reduction in deforestation rates is expected as firebreak maintenance activities decrease the occurrence of wildfires that could lead to unplanned deforestation. The landowners are committed to maintaining firebreaks on the project	
			Number of fire-fighting equipment/PPE provided			

Project Activities	Goals	Output	Monitoring output indicator	Implementation schedule	Expected deforestation reduction impact	Monitoring impact indicator
	Train the local community to assist in firebreak maintenance, promoting income generation and efficiency in wildfire control, following the technical guidelines established by the Fire Department and IBAMA	At least 10 people hired for project activities, including women during the 30 years of the project	Number of community members participating in monitoring the project area or zone		properties, and in addition to the landowners and their farm administrators, there may also be potential hirings of individuals from the community to maintain this activity.	
Potential roll-out to other areas	Strengthening collaboration with institutional stakeholders and other landowners, expanding the impact of REDD initiatives in the region	At least once per year during the 30 years of the project	Frequency of meetings and communication with institutional stakeholders	Annual	There is a potential reduction in deforestation rates as the project's activities may encourage other landowners in the region to adopt more sustainable practices or even join REDD+ initiatives. Communication and collaboration with institutional stakeholders will expand the project's reach and, consequently, may encourage other landowners to participate.	
Contact with neighboring communities*	Engage local communities through educational initiatives, promoting awareness of environmental conservation, sustainable development, and environmental and climate risks	At least 10 awareness campaigns on environmental and citizenship education carried out during the 30 years of the project	Number of lectures and/or awareness events on environmental and civic education Percentage of people who have gained a better understanding of climate change adaptation and mitigation Participation obtained in the lectures and/or events on environmental and civic education	Biennial	A reduction in deforestation rates is expected with the engagement and participation of the local community in project activities, especially through educational initiatives or training for environmental awareness and REDD+ capacity building, but also through income generation and employment opportunities. This is because communities neighboring the project area are among the agents' groups driving deforestation and therefore need to be exposed to the	

Project Activities	Goals	Output	Monitoring output indicator	Implementation schedule	Expected deforestation reduction impact	Monitoring impact indicator
	Engage local communities through training and temporary or permanent employment, promoting income generation and alternatives to practices that lead to deforestation	At least 10 people hired for project activities, including women during the 30 years of the project	Number of participants in the job-oriented training courses		themes of environmental and climate risks of deforestation in order to prevent it. Engagement in protection actions in the Caboclo stream is even more relevant as it will highlight the importance of this activity for the conservation of water resources, the community's adaptation to climate change, and may encourage them to adopt more sustainable agricultural practices for water conservation. Finally, training and employment opportunities within the project ensure alternatives and sources of income, helping to avoid actions that lead to unplanned deforestation.	
			Number of people hired			
	Engage local communities to contribute to the maintenance of the Caboclo stream riparian zone	At least 02 workshops held on maintaining Permanent Preservation Areas, protecting springs, sustainable water use and building septic tanks during the 30 years of the project	Number of people involved in the protection strategy contributing to the protection of the Caboclo Stream riparian zone and/or other water bodies in the area			
* Activities also outlined in the Leakage Management Plan (LMP) presented in section "1.19.1 Leakage Management".						

1.13 Project Location

The Triunfo do Xingu Grouped REDD+ Project's area is situated in Altamira municipality, Pará state, Brazil. This municipality is 832 km from Belém, the capital of the state of Pará. Its estimated population, based on the IBGE estimates of 2021, is around 117 thousand inhabitants, and its territorial area averages 160 thousand square kilometers, equivalent to $1,6 \times 10^9$ ha.

Following the VCS Methodology VM0048 (VERRA, 2023a), the project area may only include areas composed of forest for a minimum of ten years prior to the project start date, a definition that also includes secondary forests. Therefore, satellite images between 2012 and 2022 were analyzed and classified and the areas within the property that were defined as forests were separated and utilized to compose the project area. In addition, some non-forest areas were also excluded, such as rivers, rocks, and non-forest vegetation.

The definition used for forest areas is the one given by the Food and Agriculture Organization of the United Nations (Ramírez & Morales, 2021): “land spanning more than 0.5 ha with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use”.

Table 1.14 contains the location of each property part of the TdX project first instance (TdX-I1), it also describes the size of total property area and eligible forest area.

Table 1.14. TdX-I1: Properties centroid's locations coordinates and areas.

Ownership	Properties	Area (ha)	Project Area/Eligible Forest (ha)	Centroid location coordinates	
				Longitude	Latitude
Rafael Bemerguy Sefer	Belcon Farm	2,197.53	1,858.69	-53° 39' 32,400"	-5° 37' 58,800"
	Campo Lindo Farm	2,443.14	1,771.06	-53° 31' 26,400"	-5° 42' 36,000"
	Patacho Farm	2,135.16	1,920.25	-53° 39' 28,800"	-5° 39' 18,000"
	Retiro Encantado Farm	2,342.88	1,255.89	-53° 32' 45,600"	-5° 43' 19,200"
	Santa Marta Farm	2,450.34	1,357.00	-53° 35' 16,800"	-5° 43' 19,200"
	Vó Lina Farm	2,364.57	1,115.17	-53° 39' 3,600"	-5° 44' 2,400"
Didácio Milhomens Barros	Nossa Senhora Aparecida Farm	1,880.19	1,426.51	-53° 24' 39,600"	-6° 7' 58,800"
Total		15,813.81	10,704.58	-	-

Geodetic coordinates of all the project locations have been submitted in the annex¹³ as a KML file. The properties boundaries are also available in Figure 1.1. The six properties up north are owned by Rafael Sefer, the seventh southernmost is from Didácio Barros. The reddish areas are the eligible forests that compose the project area of its first instance.

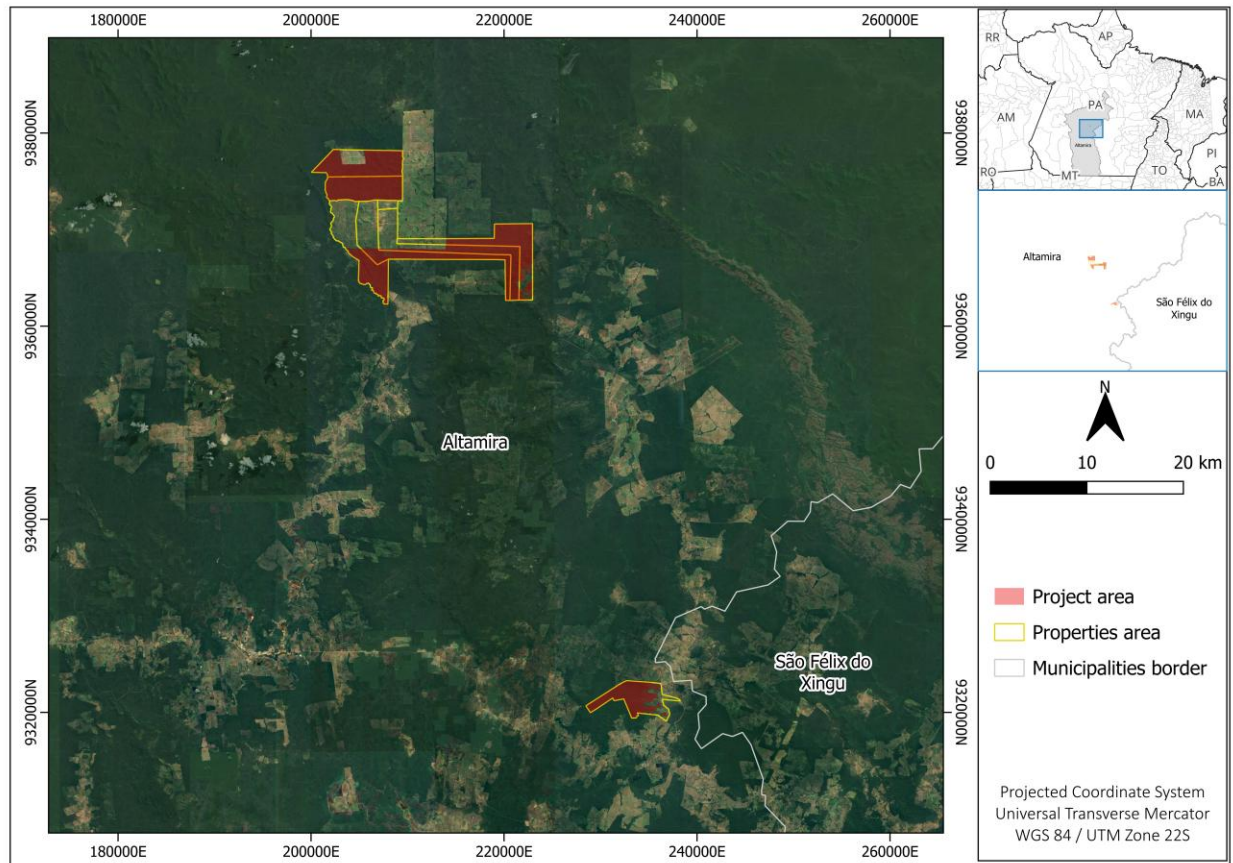


Figure 1.1. Map with both properties area perimeter in yellow and project area in red.

1.14 Conditions Prior to Project Initiation

Ecosystem type

The project area is composed of 100% native Amazon Rainforest vegetation and is divided of main forest strata, the ombrophilous forest of open canopy, forest transition zones, and ombrophilous forest of dense canopy.

¹³ TdX_Project_Area_V2.kml

Current and historical land-use:

There is no activity being conducted in the project area, which remains as native standing forest preserved for more than 10 years prior to the project start date. Also, there was no activity conducted in the project area in its historical land-use.

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

☐ Yes ☒ No

1.14.1 Current and historical land-use

This REDD project is going to be implemented in a region with a previous history of deforestation pressure. The landowner requested carbon incentives to monitor the project area and avoid unplanned deforestation. As seen in Figure 1.2, the land was cleared of native ecosystems within 10 years of the project start date. In the project area, the presence of secondary vegetation was not identified. There hasn't been deforestation of native ecosystems in the last 10 years from the start date of the project. Although vegetation was removed on the property in a period of longer than 10 years, at the Belcon, Campo Limpo, Patacho, Retiro Encantado, Santa Marta and Vó Lina Farms in 2004, and the Nossa Senhora Aparecida Farm in 2009, this intervention was outside the project area and in a controlled way.

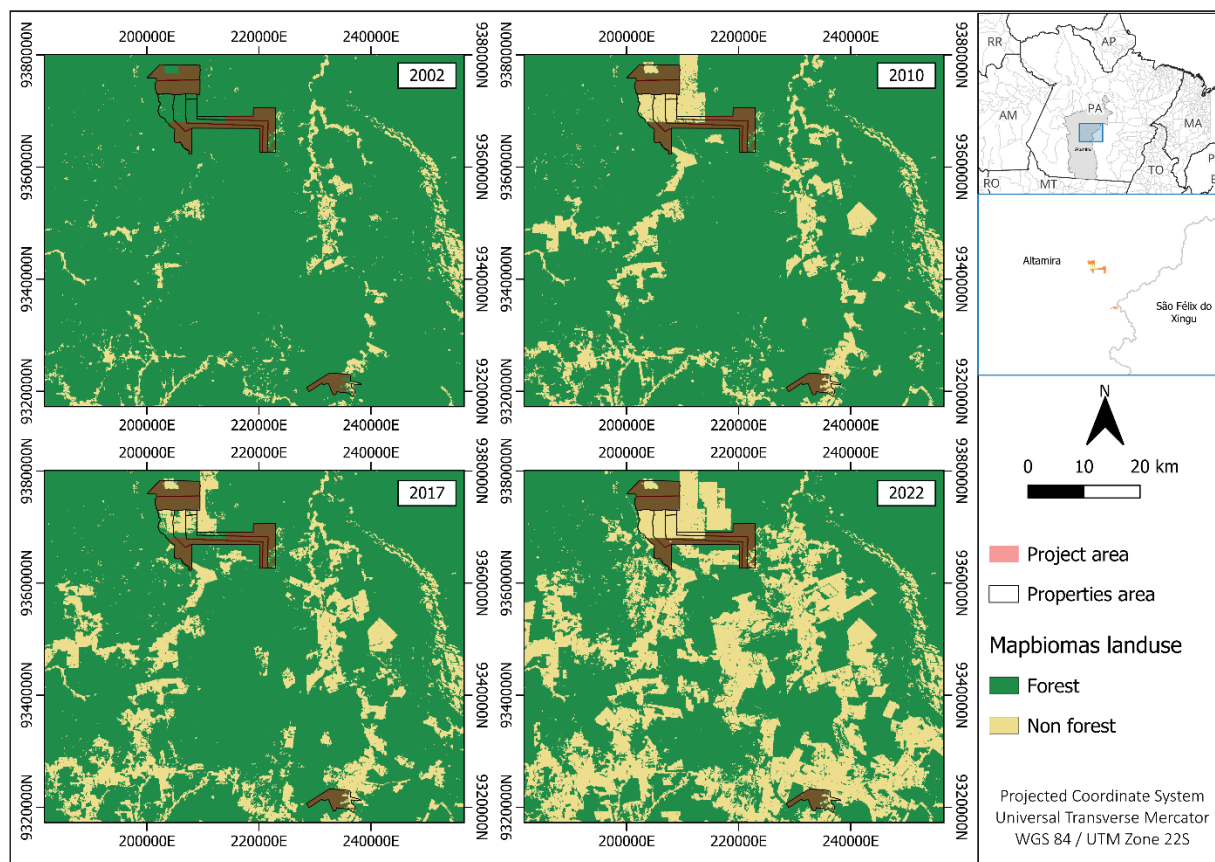


Figure 1.2. Forest coverage in 2002 (twenty years before the project started), 2010 (ten years before the project start), 2017 and 2022.

As seen in Figure 1.2, the main dynamics in land use is the conversion of areas of native vegetation to livestock, and the magnitude of the decrease of native vegetation while increased pasture lands show a huge pressure in the around region of the Project Area. In this context, the project was characterized and still fits into the AFOLU REDD+ category to Avoid Unplanned Deforestation and Degradation (AUDD).

In the big picture, the Brazilian Legal Amazon region is under deforestation big deforestation pressure in its borders. An estimated 20% of its original forest has already been lost (CNN, 2021). From 2015 to 2019, over 61,000.0 km² of forests have been destroyed in the region (Assis et al., 2019), equivalent to 0.77% of its total territory. This configures as an increase in deforestation when compared to the previous five years period (data shown in Figure 1.3). Even though the decade of 2010-2019 has the lowest historic deforestation taxes, the recent increase shows that the situation still is far to be under control.

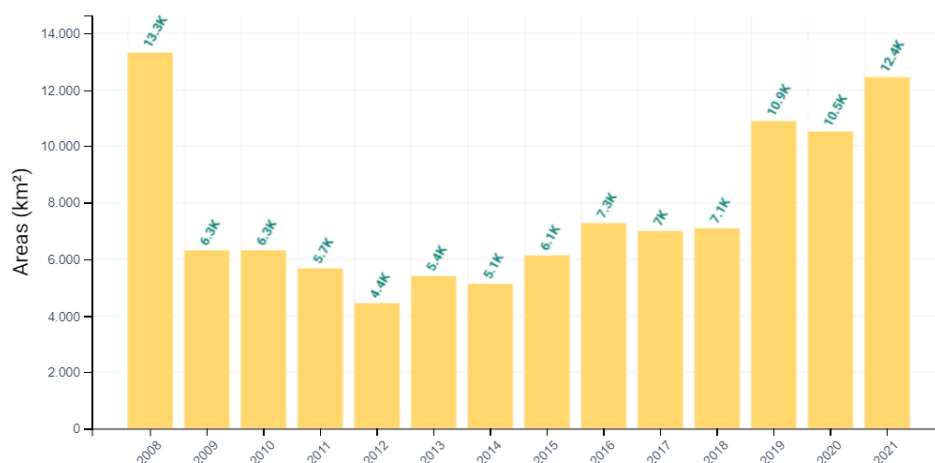


Figure 1.3: Deforestation areas in Brazilian Legal Amazon. From: Assis et al. (2019).

According to data from the Deforestation Alert System (SAD), from the Institute of Man and the Environment of the Amazon (Imazon), Pará is the state that most deforests in the Legal Amazon. In the last 12 months, from August 2021 to July 2022, 3,858 km² of forests in Pará were cut down, representing alone 36% of the deforestation in the Legal Amazon (IMAZON, 2022a).

In Pará, livestock is one of the main causes of deforestation, and its cattle herd is second only to Mato Grosso in size. The number of herds is seen as the main cause of deforestation in the Amazon, and the variation in the number of animals is accompanied, in part, by the expansion of pasture areas and the clearing of areas of dense forest (Castelo & Almeida, 2015).

According to data from the IBGE, the growth of the cattle herd in São Félix do Xingu, in the south of Pará, in 2020, still stands out nationally as the municipality with the highest number of cattle, with 2.4 million head of cattle and an increase of 5.4% in the year (IBGE, 2021c). In July, two of the four municipalities in Pará that were among the ten most deforested in the Legal Amazon are the municipalities of Altamira, with 81 km² and São Félix do Xingu, with a deforested area of 76 km². Together they represent a

destruction of 157 km² of deforestation. São Félix do Xingu is the municipality with the largest herd in the state: 1.03 million head in 2001 and 2.02 million in 2010. Another prominent municipality is Altamira. Together they lead the ranking of municipalities that hold more than a third of the state's cattle herd (IMAZON, 2022a).

According to MapBiomass (2022), the municipality of Altamira, where the project is located, has 1.126.019 ha occupied with pasture, which represents about 7.19% of the total municipality area, and 14,566,022 ha occupied with forest, which represents about 91.30% of the total municipality area.

Research shows that deforestation in the municipalities of the state of Pará follows a worrying trend. The lower the deforestation, the lower the growth of the cattle herd (Castelo & Almeida, 2015). This deforestation has generated total emissions of approximately 6,47 billion tons of equivalent CO₂, an average of 308 million tons per year (Assis et al., 2019).

In this deforestation process, the first step is the forest clear-cutting and logging. In sequence, the dry material is burned to install pasture activities. Most of carbon emissions from baseline activities occur during this operation. After burning the remnant forest biomass, the land is virtually clear and ready for other activities. This corroborates the main dynamics in land use found in the region, where the conversion of areas of native vegetation into livestock stands out, and the magnitude of the decrease of native vegetation while the increase of pastures shows enormous pressure in the region of the TdX Project.

1.14.2 APA Triunfo do Xingu: Historic and Unplanned deforestation

The APA Triunfo do Xingu was established by State Decree 2.612 in 2006 (Figure 1.4), and is located in the municipalities of São Félix do Xingu (where 66% of the total area is located) and Altamira (34%), with approximately 1.68 million ha and is part of the Amazon Protected Areas Program (ARPA), along with neighboring areas such as the Terra do Meio Ecological Station and the Serra do Pardo National Park (ISA, 2023).

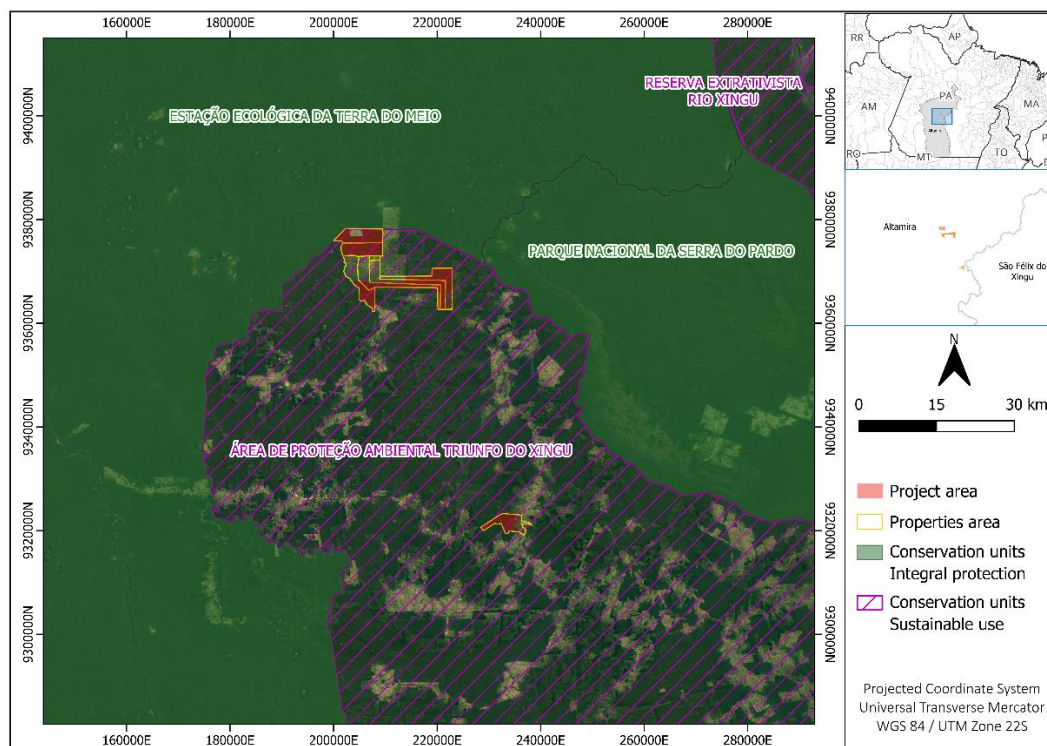


Figure 1.4: Location of the Triunfo do Xingu APA and the Project Area.

According to the survey of the study “Threat and Pressure of Deforestation in Protected Areas”, published quarterly by the Institute of Man and the Environment of the Amazon (Imazon) indicates that the Environmental Protection Area (APA) Triunfo do Xingu (PA) was the protected territory most pressured by deforestation in the first quarter of this year (Hashizume, 2021).

About 40% of the Triunfo do Xingu Environmental Protection Area (APA), formed by the Savanna-Ombrophilous Forest Contact, with ombrophilous forest of dense canopy and ombrophilous forest of open canopy, have already been converted to other uses, mainly for livestock (COSTA, 2013; Hashizume, 2021).

The areas with ombrophilous forest of dense canopy rainforest are characterized by dense vegetation in all strata

One of the main factors linked to the exaggerated deforestation in this APA is the non-existent consolidation of a management and zoning plan. 15 years have passed since its creation and the scenario only worsened with the annual meetings of the Management Council: the last one with registered documents was in May 2019, and the penultimate one took place a year earlier, in May 2018, according to the page of the Institute for Forestry Development and Biodiversity of the State of Pará (Ideflor-Bio) (Hashizume, 2021; ISA, 2023).

In addition, APA Triunfo do Xingu has an issue involving very strong land grabbing in its territory. Big companies and large ranchers are pushing for more land, aggravating the conflict over resources, including access to water. And since this is an area that never had a management plan, consequently the

conflicts were never resolved and any kind of intervention, especially the destruction of forests, is illegal (ISA, 2012). This situation is consequence of the east occupation front evolution in the region between the rivers Xingu and Iriri (COSTA, 2013). The deforestation pressure can be separated into:

- 1st phase. The minning company called Canopus explored a deposit of cassiterite, building its headquarters in the place that became the current Canopus Village.
- 2nd phase. Illegal logging activities throughout the years of 1986 to 1992. Big wood companies constructed north-south transport roadways in the central part of the Canopus roadway, that interligates the Xingu River with the Iriri River.
- 3rd phase. Occupation by family farming, from 1993 to 1999. It evidenced the regional connectivity between the city of São Feliz do Xingu and the Transamazônica roadway. Family farms bought land properties from ITERPA or directly from the previous owners, around the Canopus roadway, but not in the Canopus Village.
- 4th phase. Between 2000 and 2005, when the property of the Canopus company was invaded by farms and ranchers. A previous agreement between ITERPA and the family farmers was not legitimated. Considering this situation, it was easier for bigger farmers to acquire more land through invasion, purchase or aggregation of small settler lots. In many, occasions, this was a violent process.
- 5th phase. The creation of the APA Triunfo do Xingu in 2006. It creates an immediate expectation for land use planning and contestation of land grabbing and deforestation activities.

Human settlement and resource utilization in the project region began with the construction of the Canopus highway, or Trans Iriri, evolving through various economic cycles that altered activity focus and resource exploitation methods. Recent decades have seen deforestation closely tied to livestock farming, with the expansion of the Canopus highway facilitating large-scale cattle ranches. Presently, the project area faces a significant threat of deforestation due to cattle ranching, serving as the main driver of deforestation in the Triunfo do Xingu Environmental Protection Area (APA). This activity not only fuels real estate speculation but also remains the primary income source for historically established large ranchers and settlers in the territory¹⁴.

These conflicts and invasions have received attention and intervention from the government of Pará. The “Sustainable Territories” program was launched, based on a public notice for the registration of producers who will have special government assistance, presented as a pillar of the Amazônia Agora strategy with the participation of Ideflor -Bio and the Secretary of State for the Environment and Sustainability (Semas), among other bodies within the APA. The municipality of São Félix do Xingu also highlighted the creation of the initiative, aimed at registering and supporting “good practices” (Hashizume, 2021).

That said, it is evident that the invaded areas, especially the local communities, are recognized by the municipality and are on the way to registration and formalization.

¹⁴ 240508_TdXDeforestationPattern.pdf

1.14.3 Communities

The Canopus Village and Caboclo Village communities belong to the territory of Altamira, 1,400 kilometers away from the municipal seat. Cabloco Village, in particular, is located close to the properties that are part of the Triunfo do Xingu Grouped Redd+ Project, Belcon Farms, Campo Limpo, Patacho, Retiro Encantado, Santa Marta and Vó Lina at a distance of 60 kilometers, and 8 km from Nossa Senhora da Aparecida Farm (Figure 1.5).

The Caboclo Village community is a rural village, where most residents live from subsistence farming and the provision of rural services, with most of the local labor allocated during harvest periods, or in work related to rural properties of region. The village has about 90 to 100 inhabitants (AMARAL et al., 2006). Due to its proximity to one of the projects in the project (N. Sra. Aparecida Farm), Caboclo Village will be the priority target for implementing the planned actions.

Caboclo Village has a public health structure, a fuel station, and an arrivals station (Amaral et al., 2006). Its importance for the local population has been recognized, and it has received investments from the local City Council, which announced several works and services in these locations. Meetings with the community have also been held by the city hall, to survey the demands of health, education, agriculture, work and services that will be met to improve the quality of life and infrastructure for the local community. It is worth mentioning that the region has received investments in part from royalties, where part of the profits obtained from the use of water resources from the Belo Monte Hydroelectric Power Plant for programs and actions of the Municipal Executive (PMA ASCOM, 2021).

Canopus Village has greater importance and influence and is located, especially due to its strategic location. It also plays an important role in the process of transforming the territory, expressed, for example, in the deforestation activity in its surroundings (Amaral et al., 2006), Canopus Village is located around the project area, at a distance of about 60 km away from the headquarters of the Santa Maria farm. It is an area of land invasion and land grabbing that occurred mainly during the 1980s, and whose population currently lives mainly from cattle ranching and illegal mining (COSTA, 2013).

Because it is a very sensitive area, and there are eminent conflicts, the approach strategies need to be very well planned, to guarantee that the project team makes a participatory diagnosis possible, without getting into friction with the leaders of the project. illegal mining, which seems to operate with great capillarity and influence throughout the region.

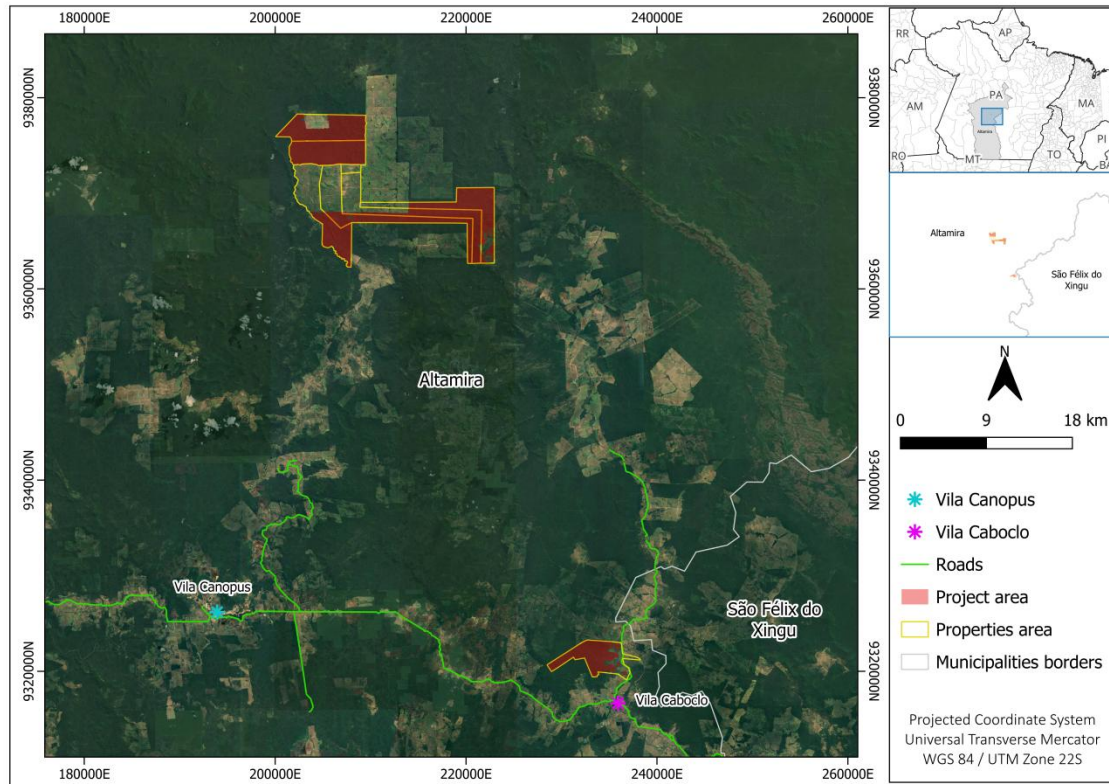


Figure 1.5. Location of the Caboclo Village and Canopus Village communities in relation to the Project Areas.

1.14.4 Ecosystem type

The Project region is in the ecosystem of the Brazilian Amazon. According to the IBGE environmental database (Bdia) (IBGE, 2022), the area covered by this project is predominantly forested, comprising three main phytophysognomies mapped in the region: (i) ombrophilous forest of open canopy, (ii) forest transition zones, and (iii) ombrophilous forest of dense canopy. This classification highlights the diversity of vegetation types present in the project area, as shown on the map (Figure 1.6).

The areas with ombrophilous forest of dense canopy rainforest are characterized by dense vegetation in all strata (tree, shrub, herbaceous, and lianas) (SFB, 2019). In the most preserved areas of ombrophilous forest of dense canopy rainforest, where physical conditions allow, the height of vegetation increases, and there is presence of epiphytes. In these areas, natural disturbances can be observed, which occur due to the natural death of trees or events such as lightning, strong winds, and other reasons (IBGE, 2012). On the other hand, the ombrophilous forest of open canopy rainforest is a variation of the ombrophilous forest of dense canopy, being a more open forest formation, where combinations of particular species in associations are commonly observed (SFB, 2019).

Beyond the project region, the broader context of the municipality also reflects the predominance of Amazonian forest formations, which integrate with other types of land cover and use. The municipality is part of the Amazon Biome, presenting an extensive territorial area covered by dense equatorial forest

with large trees and emerging vegetation. Its fauna follows the biological variety of the flora, presenting itself as rich and diversified (SEMAT, 2012). In addition to the Amazon rainforest, the municipality has other features such as secondary vegetation and crops such as sugarcane, cocoa, as well as subsistence crops (SEMAT, 2012).

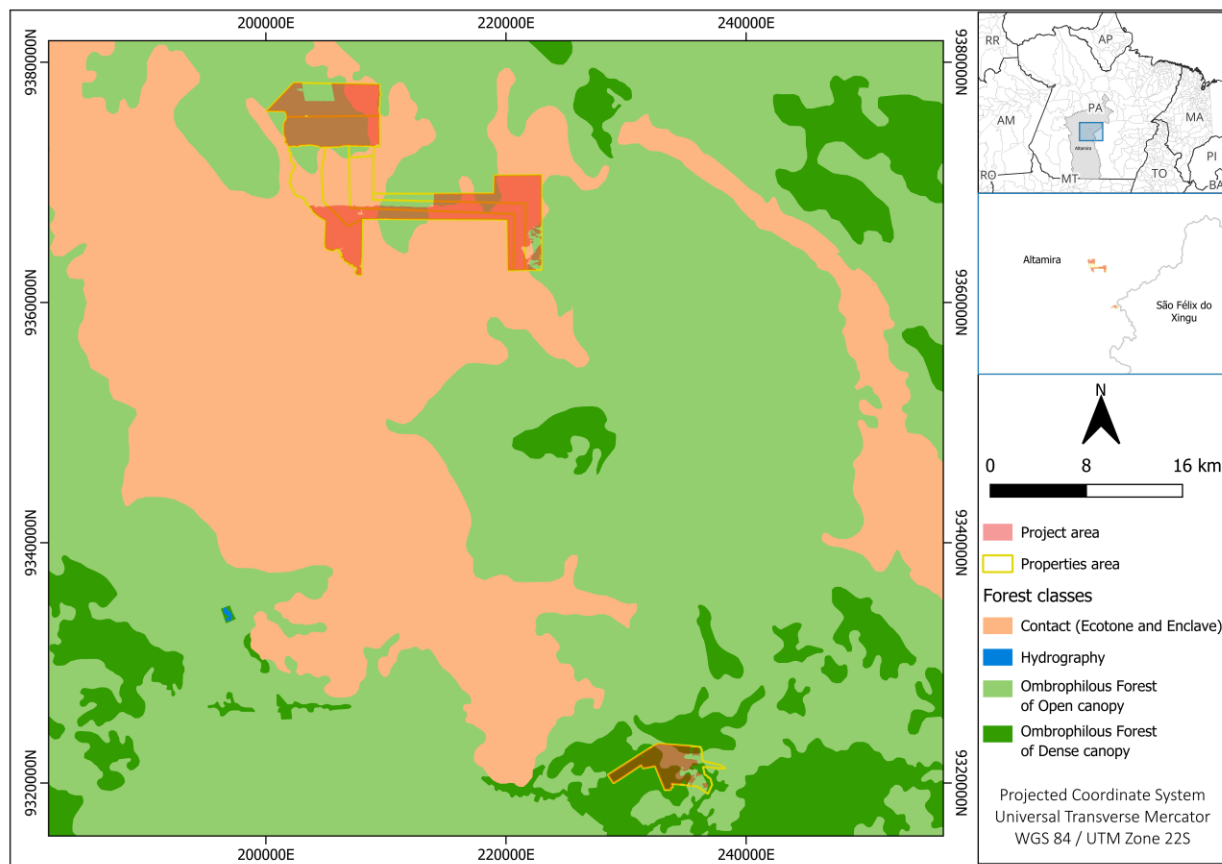


Figure 1.6. Vegetation type in Triunfo do Xingu Grouped Redd+ Project region.

1.14.4.1 Climate

The project region is classified as Tropical Climate – Am and Af categories – in the Köppen climate classification (Kottek et al., 2006). The region is undergoing a climate transition, which is why it has two climate categories. Most of the territory is classified as category Am (Figure 1.7). The database used to define the region's climates, according to the Köppen classification system, was a vector database published by Alvares et al. (2013). The average precipitation for the Af climate is about 2,233 mm, lower than the average precipitation for the Am climate, which is about 2,401 mm. The rainy season runs from December to May, while the dry season runs from June to November. Temperatures vary between 27 and 23 °C, with October being the hottest month and February the coldest (Carvalho et al., 2022).

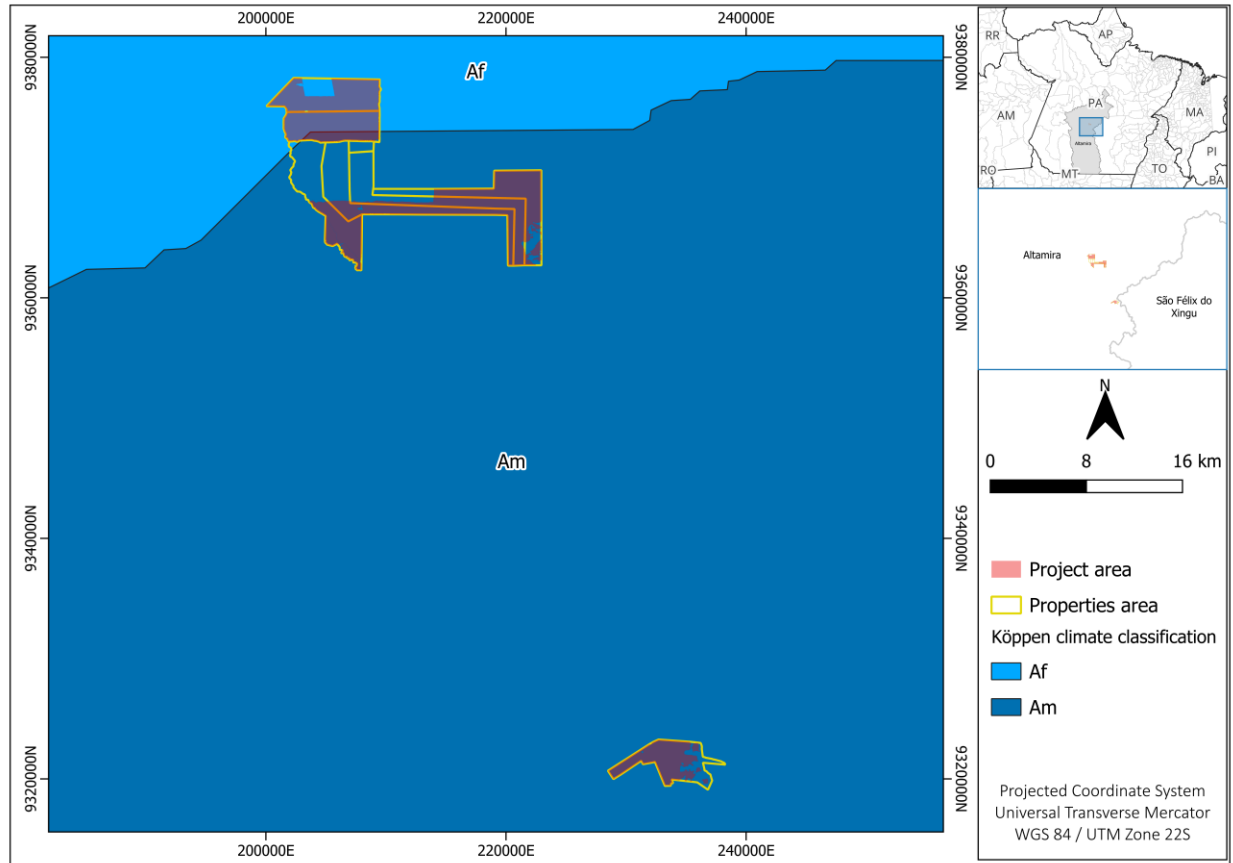


Figure 1.7 Predominant climate, according Köppen climate classification, in Triunfo do Xingu Grouped Redd+ Project region.

1.14.4.2 Hydrology

The project area is located in the Xingú River Basin (IBGE, 2021b), and within the area it has three sub-basins called the Iriri River Basin, the Pardo River Basin, and the "*Igarapé do Pontal*" Basin. The properties are located in the Iririri Basin and have a small overlap with the "*Igarapé do Pontal*" Basin. Also represented in the Figure 1.8 are the main hydrographs (ANA, 2012) such as the Igarapé da Bala River, as well as its headwaters and smaller rivers (FBDS, 2022).

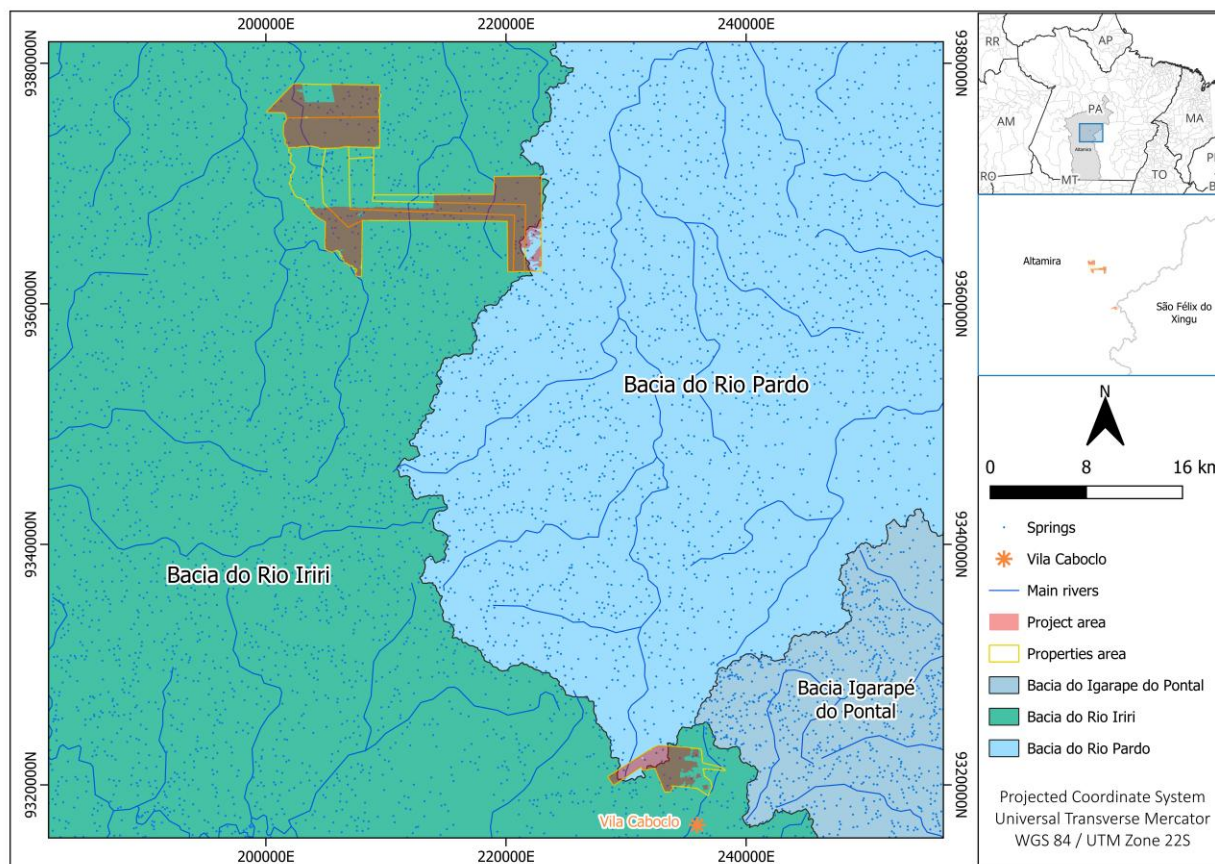


Figure 1.8. Hydrology of the Project Area.

1.14.4.3 Geology, Topography and Soils

Regarding geology, the municipality of Altamira is located on the tertiary and quaternary Amazonian plateau. In the valleys of the Xingu and Tapajós rivers, the outcrops found are from the Devonian period, while the Eo-Devonian are found on display in the Xingu riverbed, and in the Igarapé das Panelas. Downstream of the waterfalls between Tubarão and Igarapé Canoé belong to the Mesodevonian period, and to the northeast of Altamira there is a large flat and slightly undulating area whose formation is due to the evolution process of sediments from the Tertiary, Pliocene period (Falesi et al., 1967).

The Project region is formed by Argisols and Neosols. In particular, the relief is one of the factors in the formation of soils in Altamira. In flat reliefs, the Argisol predominates, represented by the Yellow Latosol with medium and clayey textures and, in the wavy areas, there is an occurrence of the Red-Yellow Latosol – medium and clayey textures – and Red-Yellow Podzolic – medium and clayey textures (Figure 1.9) (Falesi et al., 1967).

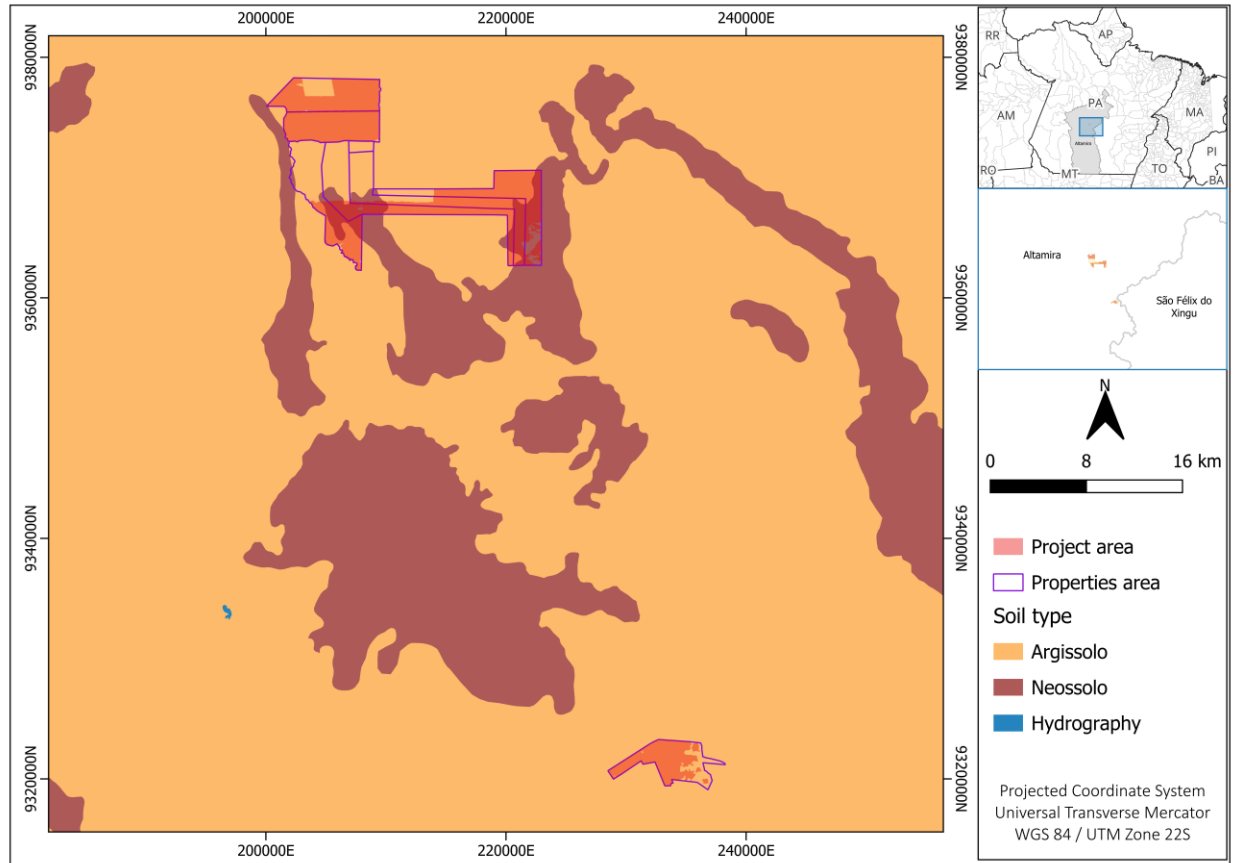


Figure 1.9: Soil type in Triunfo do Xingu Grouped Redd+ Project region.

With regard to slope, part of the project region is sloped and other areas are not, as there is a wide variation in slope, and the altitude in the project region ranges from 162 to 587 meters (Figure 1.10). To obtain elevation and slope information, a mosaic of digital elevation models, provided by NASA, with a spatial resolution of 30 meters (Farr et al., 2007). Topography is often related to physical and chemical soil variations that are often reflected by vegetation.

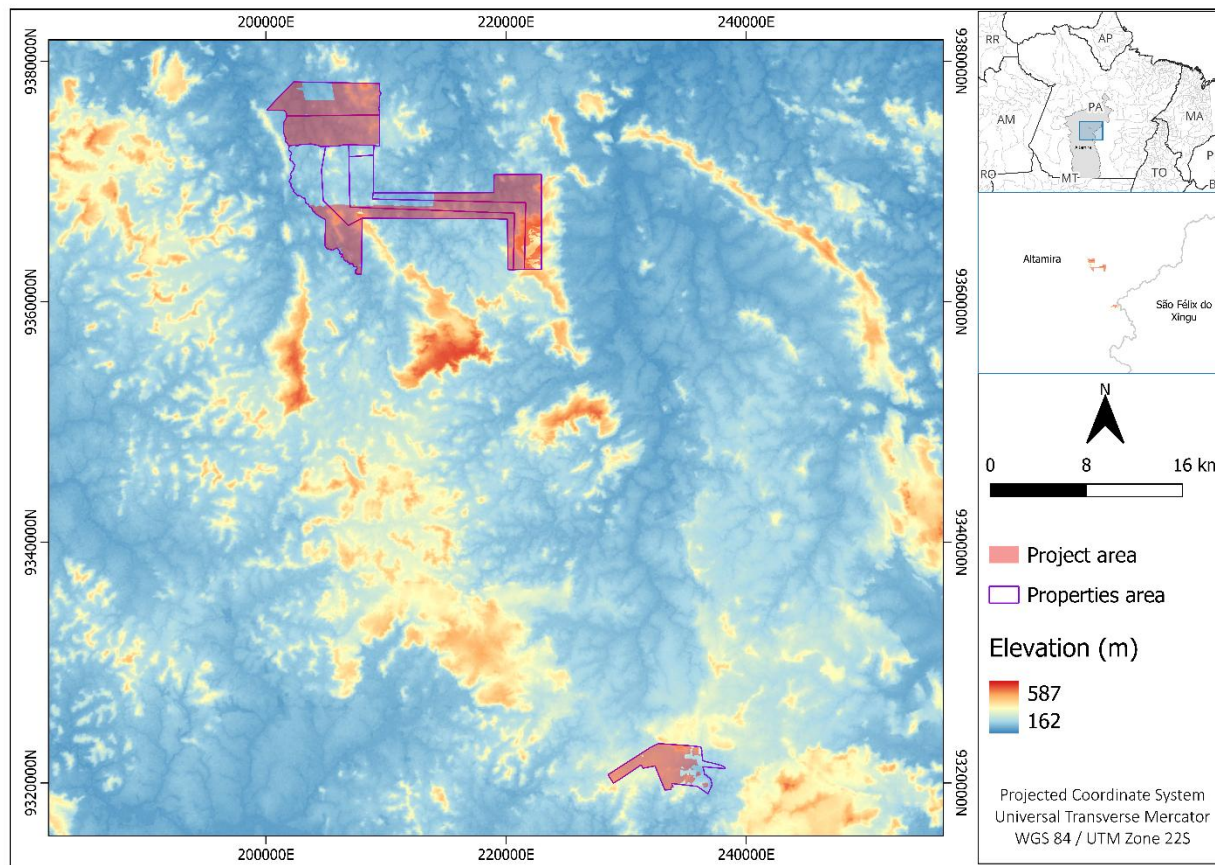


Figure 1.10: Map of elevation, in meters, in Triunfo do Xingu Grouped Redd+ Project region.

1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

Federal Laws and Regulatory Frameworks

At a federal level, one most important legislation is Law N° 12.651 of 25/05/2012 that created the newest Brazilian Forest Code. There are some important articles and chapters to be considered that are replicated below.

“Article 3. For the effects of this law, the following definitions apply:

I – Legal Amazon: the States of Acre, Pará, Amazonas, Roraima, Rondônia, Amapá and Mato Grosso, and the regions located to the North of parallel 13° S, in States of Tocantins and Goiás, and to the West of meridian 44° W, of the State of Maranhão (Figure 1.11).

II - Permanent preservation area (APP): protected areas covered or not by native vegetation, with the environmental function of preserving water resources, landscape, geological stability, biodiversity, gene flow of plants and animals, protect the soil and ensure the well-being of human populations.

III - Legal Reserve area located within a rural property or ownership, demarcated according to article 12, with the function of ensuring a sustainable economic use of natural resources of rural property, assisting the conservation and rehabilitation of ecological processes and promoting the conservation of biodiversity, as well as shelter and protection of wildlife and native flora.

(...)

Article 12. All property must maintain rural areas with native vegetation cover, as a legal reserve, without prejudice to the application of the rules on the Permanent Preservation Areas, subject to the following minimum percentages in relation to the area of the property, except as specified in art. 68 of this Act.:

I – Located in the Legal Amazon:

80% (eighty percent), in the property situated in forest area.

35% (thirty-five percent), in the property situated in cerrado.

20% (twenty percent), in the property situated in general fields.

II – Located in other regions of the country: 20% (twenty percent).

(...)

Article 29. Creates the Rural Environmental Registry (Cadastro Ambiental Rural – CAR) within the scope of the National System Information on the Environment – SINIMA as a public electronic record on a national level, mandatory for all rural properties, to integrate environmental information of rural properties and possessions, composing a database for control, monitoring, environmental and economic planning and combating deforestation.”

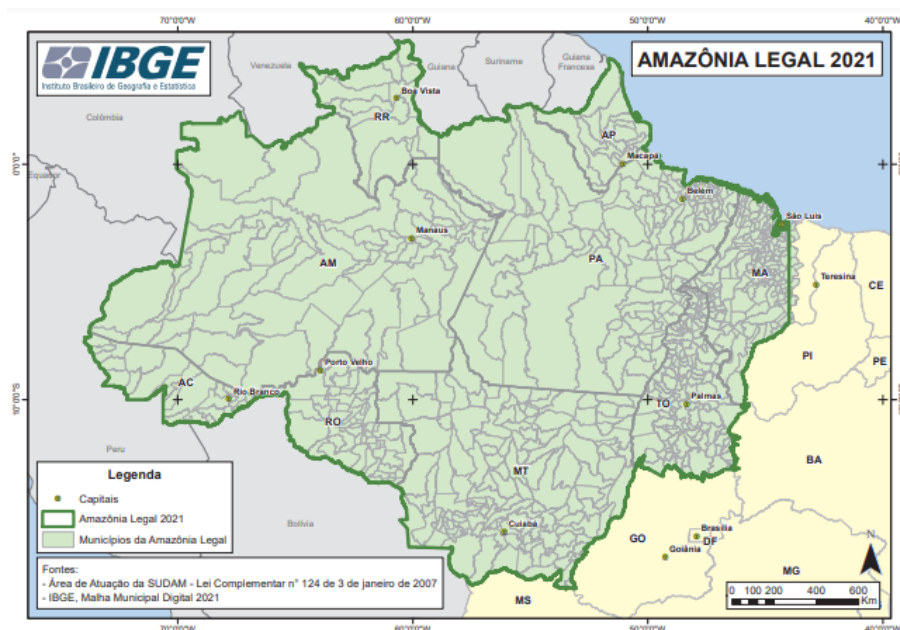


Figure 1.11. Brazilian Legal Amazon States: Acre (AC), Amapá (AP), Amazonas (AM), Maranhão (MA), Mato Grosso (MT), Pará (PA), Rondônia (RO), Roraima (RR), Tocantins (TO) (ancient north of Goiás).

The legislation also says that the Legal Reserve (LR) must be registered in property deed in the Real Estate Registry Office, its location must be publicly known, and future landowners must know where it is located, its boundaries and frontiers. The LR can be located anywhere inside a rural estate. Once allocated, the LR may not be changed even in cases of real estate transfer, land dismembering or area rectification.

The LR allocation is a prerequisite to obtaining permission to exploit the native vegetation existing inside the rural estate. In compliance with Brazilian Forest Code, the farms have officially allocated even more 80% of its total area as LR, once the only economic activity that takes place in the property is the forest management, which conservates the vegetation characteristics in the region.

In the Reference Area, although 80% of native vegetation in land properties must be preserved as LR, there is a general non-compliance with Brazilian Forest Code, as 33.19% of the original forest has already been deforested and is occupied by anthropic activities (i.e. there is a deficit of 13.19% of native forest that should not have been suppressed in the Reference Area). Despite the legal provisions intended to preserve at least 80% of the Amazon Forest coverage, lack of law enforcement by local authorities along with public policies seeking to increase commodities production and encourage land use for agricultural, bio energy and cattle breeding purposes created a scenario of almost complete disregard of the mandatory provisions of the Forest Code. High rates of criminality associated with land disputes usually jeopardize efforts concerning law enforcement improvement (HRW, 2019). In addition to that, to cover vast distances of areas with low demographic density makes tracking illegal activities and land surveillance very difficult for the authorities.

Even though the Brazilian Forest Code being the more specific environmental legislation in a national level regarding the use of land in the legal Amazon, other legislations are also necessary. Rural activities have several perspectives that are not resumed only by the environmental one. Here all other legislations consulted that guided and are assisted by the due diligence process of this project:

- Brazilian Federal Constitution of 1988 (Brasil, 1988).
- Brazilian Imperial Law, Law 601/1850 (Brasil, 1850).
- Rural Land Statute, Law 4,504/1964 (Brasil, 1964).
- Law of Public Records, Law 6,015/1973 (Brasil, 1973).
- Law of Civil Action, Law 7,347/1985 (Brasil, 1985).
- Law of Rural Property Tax, Law 9,393/1996 (Brasil, 1986).
- Federal Environmental Crimes Law, Law 9,605/1998 (Brasil, 1998).
- Brazilian Civil Code, Law 10,406/2002 (Brasil, 2002b).

Together, all those laws can be complex for those who are not familiar with them. But the main objective of them, in a simpler way, is to demand from the landowner: (i) proof of their legal right to have and possess their land for different government agencies, (ii) guarantee that financially all taxes are being paid, (iii) there are no legal or civil lawsuits that could compromise the landowner.

State Laws and Regulatory Frameworks

ITERPA is the Pará state agency responsible to coordinate the rural land regularization process. By Law N° 8,878 of 2019 (Pará/Brasil, 2019), the institute provides the necessary requirements to all those who wish to be legal landowners of the land they possess.

Table 1.15 shows the entire Brazilian legislation that needs to be attended by the project and the complete documentation necessary to the TdX project be in accordance with current legislation framework and the attendance of each one of these laws is available attached¹⁵.

Table 1.15. List with all laws that need to be attended by to guarantee the project compliance.

Laws/Regulations	Comments
Brazilian Civil Code, Law 10,406/2002 (Brasil, 2002b).	Updated Real Estate Records indicate liens, debt, or court lawsuits to the property regarding the past 20 years. It proves the regularity of the property and if it is free and clear of any liens and encumbrances.
Law of Public Records, Law 6,015/1973 (Brasil, 1973).	
Brazilian Civil Code, Law 10,406/2002 (Brasil, 2002b).	Certificate issued by the Real Estate Registry Office with the complete chain of domains and ins transfer from public domain to private domain. Since all the rural land in Brazil was a state-owned asset and must fulfill with

¹⁵ Land_documents.zip

Laws/Regulations	Comments
Law of Public Records, Law 6,015/1973 (Brasil, 1973). Brazilian Federal Constitution of 1988 (Brasil, 1988). Brazilian Imperial Law, Law 601/1850 (Brasil, 1850)	specific requirement to be transferred to the private domain, the chain of domain is necessary to verify the regularity of the land.
Rural Land Statute, Law 4,504/1964 (Brasil, 1964)	The Rural Property Registry (CCIR) is important to attest that the property is regular to the National Institute of Colonization and Agrarian Reform (INCRA).
Law of Public Records, Law 6,015/1973 (Brasil, 1973)	According to the Law of Public Records, to validate property transfer, rural properties with more than 100 have had a geodesic survey approved by INCRA.
Law of Rural Property Tax, Law 9,393/1986 (Brasil, 1986)	The Rural Property Tax Filings (DITR) must be delivered annually by every rural property owner. It is important to verify the regularity before tax authorities.
Brazilian Forest Code, Law 12,651/2012 (Brasil, 2012)	The CAR is a legal obligation that provides properties' environmental information related to the existence of environmentally protected areas, place of the legal reserve, as well as the existence of native vegetation that exceeds the minimum required for legal reserve purposes.
Federal Environmental Crimes Law, Law 9,605/1998 (Brasil, 1998).	In accordance with the Federal Environmental Crimes Law, certificates issued by the competent state and federal Environmental Authority, which in this case is SEMAS-PA and IBAMA, respectively, are necessary to provide information of existing environmental assessments, penalty and procedures.
Law of Civil Action, Law 7,347/1985 (Brasil, 1985). Brazilian Civil Code, Law 10,406/2002 (Brasil, 2002b).	To the Law of Civil Action, it is important to verify the existence of civil action related to the property issued by the Federal and State Prosecutors Office. By its time, the Brazilian Civil Code demands certificates issued by the State Court of Justice of the property(s) and the domicile of the owner(s), covering a period of 10 years.

Commitment of the landowners

As an additional safeguard, the owners of the areas have expressly committed to respecting labor legislation and ethical standards. These obligations are expressed in the project contracts, and if they are not met, penalties may be applied to the owners^{16,17}.

1.16 Double Counting and Participation under Other GHG Programs

The Brazilian Greenhouse Gas Emissions Trading System (SBCE), established by Law No. 15,042/2024, explicitly prohibits double counting and establishes mechanisms to ensure the integrity of credits in jurisdictional systems.

Pursuant to Article 2 of the law, the SBCE guarantees that legitimate usufructuaries, concessionaires, and landowners — as in the case of the Triunfo do Xingu Grouped REDD+ Project (TdX) — maintain the exclusive right to exploit their areas. To this end, it mandates the exclusion of these properties from jurisdictional REDD+ programs, preventing the double counting of Greenhouse Gas (GHG) emission reductions. The obligation to exclude private areas from jurisdictional REDD programs lies with the state that instituted the program.

Furthermore, the legislation expressly provides that landowners in Brazil, even without REDD projects, may request the exclusion of their lands from non-market state programs or jurisdictional REDD+ programs at any time, based on Article 43, § 13.

Reinforcing this directive, Article 41, paragraph 6, item IV of the same law prohibits the early commercialization of future results by public entities responsible for developing jurisdictional REDD+ programs, ensuring integrity and transparency in carbon credit accounting.

Despite these provisions of Brazilian law, it is important to emphasize that the jurisdictional certification standard adopted by the state of Pará, namely ARTREES (<https://www.artredd.org/trees/>), also mandates the exclusion of private projects carried out within the jurisdiction from state accounting and, consequently, from the deduction of these assets in the issuance of jurisdictional credits.

Thus, it has been confirmed that there is no double counting or double claiming between the TdX project and the Jurisdictional REDD+ Program. The TdX project and its activities focused on reducing emissions from the AUDD category are solely aimed at generating credits under Verra's VCS program.

1.16.1 No Double Issuance

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

☐ Yes

☒ No

1.16.2 Registration in Other GHG Programs

¹⁶ 221014_Systemica-Didácio contract.pdf

¹⁷ 221226_Systemica-Sefer contract.pdf

Has the project registered under any other GHG programs?

☐ Yes ☒ No

Is the project active under the other program?

☐ Yes ☒ No

1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

☐ Yes ☒ No

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

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

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

☐ Yes ☒ No

1.17.2 No Double Claiming with Other Forms of Environmental Credit

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

☐ Yes ☒ No

1.17.3 Supply Chain (Scope 3) Emissions

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

☐ Yes ☒ No

If yes:

Is the project proponent(s) or authorized representative a buyer or seller of the product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

If yes:

Has the project proponent(s) or authorized representative posted a public statement on their website saying, "Carbon credits may be issued through Verified Carbon Standard project [project

ID] for the greenhouse gas emission reductions or removals associated with [project proponent or authorized representative organization name(s)] [name of product(s) whose emissions footprint is changed by the project activities].”

☐ Yes

☒ No

1.18 Sustainable Development Contributions

The TdX project aims to achieve specific Sustainable Development Goals (SDG). The investment of part of the revenues generated by the sales of VCUs will be carried out to implement positive actions for the local community and biodiversity also considering the SDG adaption to the Brazilian reality (IPEA, 2018).

We seek with these investments to contribute to the following goals (but not limited to the ones described) in Table 1.16. Project activities from SDGs 4 and 8 are already in execution as described through section 2. The project's existence by itself would already contribute with SDGs 13 and 15, project monitoring activities that are going to be implemented are detailed in Section 5.

Table 1.16. TdX Sustainable Development Contributions.

SDG	National Goal	Project Activity
4	4.4, for promoting the relevant skills, including technical and professional skills, for employment, decent work, and entrepreneurship.	Development of Environmental Education projects aimed at strengthening and empowering communities to take sustainable attitudes and develop productive alternatives that ensure the preservation of forest and local biodiversity, and the deconstruction of the custom of using fire for the cleaning/treatment of arable areas.
	4.7, because the project will promote inclusive education for sustainable development.	
8	8.3, for promoting activities that lead to decent job creation.	Stakeholder consultation to identify the community priorities, look for decent job creation, and promote sustainable tourism, culture, and local products.
	8.6, by identifying the culture and local products potentialities.	
13	13.2, by avoiding unplanned deforestation in the project area	The project is taking urgent action to combat climate change and its impacts, by reducing the net GHG emission of 513,023.82 t CO _{2e} until 2052, as well as raising the community's awareness of the topic.
	13.3, by raising climate change awareness	
15	15.1, because the conservation of the ecosystem is guaranteed	The project consists of the implementation of a REDD+ project in the Amazon rainforest biome, reducing the potential drivers of unplanned deforestation in the project area.

SDG	National Goal	Project Activity
	15.5, because conserving the ecosystem is helping to prevent the loss of biodiversity.	Then, it is going to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.
	15.5, as by halting deforestation measures are being taken to reduce habitat degradation and biodiversity loss	
	15.7, because protecting this project area and keeping it under surveillance would be contributing to the control of illegal wildlife hunting (local plates).	

1.19 Additional Information Relevant to the Project

1.19.1 Leakage Management

The main leakage management activities are described in Section “1.12 – Description of the Project Activity”, especially in the items of Leakage Control, where the project proponent, together with the landowners, will adopt a proactive initiative for reducing the risk of leakage, based on a cooperative effort with local stakeholders to promote a new approach to forest use and land use in the region, raising awareness among them about environmental education. The project proponent plans a continuous remote monitoring of the region surrounding the project area (Leakage Belt) and interventions with the local stakeholders residing in the Leakage Management Area, which is defined as the non-forest region where the housing and infrastructure of Caboclo Village is located, as shown in Section 3.3.7.

There are no settlements, indigenous lands or traditional communities within the project area or surrounding areas, instead there are two main villages: Caboclo Village and Canopus Village (Figure 1.12).

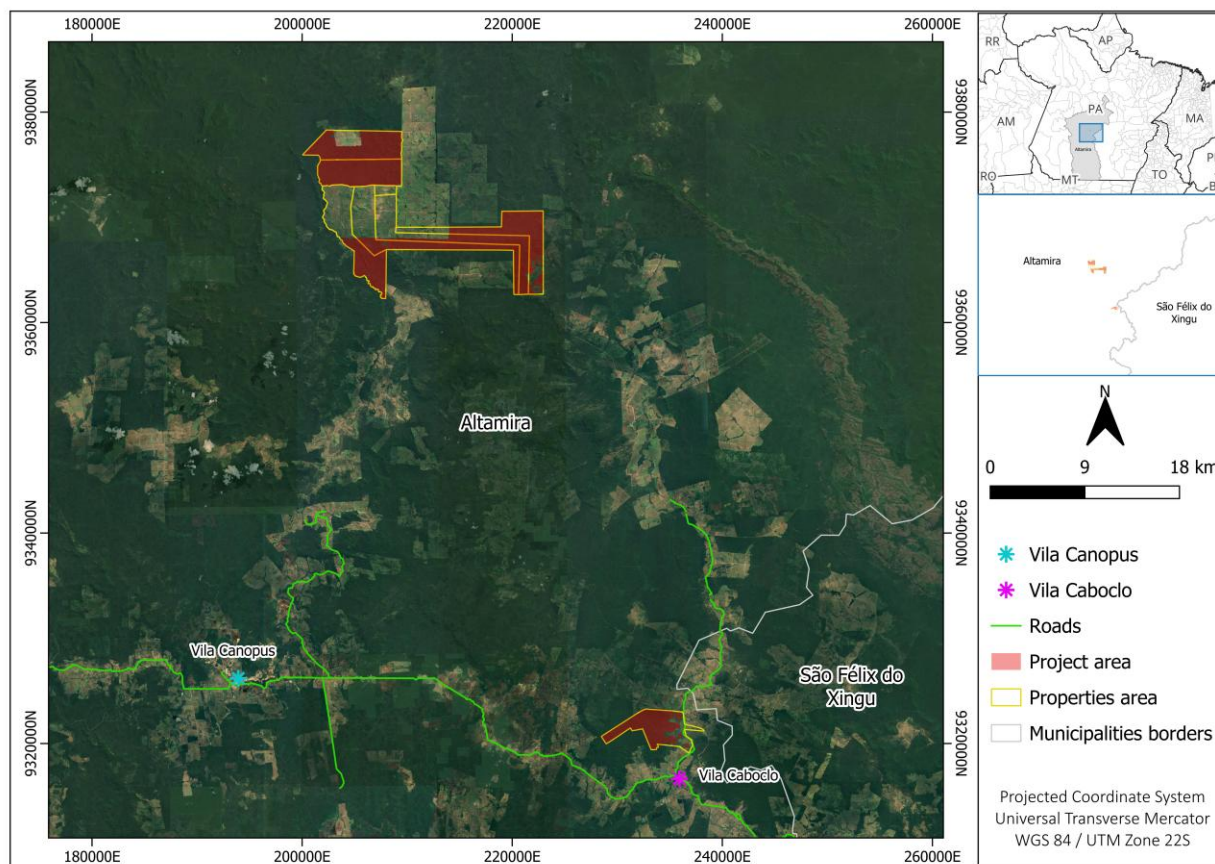


Figure 1.12. Location of Caboclo and Canopus village, the main villages close to the project area.

These communities belong to the territory of Altamira, 1,400 km away from the municipal seat. Cabloco Village is located close to the properties that are part of the Triunfo do Xingu Grouped REDD+ Project: Belcon, Campo Limpo, Patacho, Retiro Encantado, Santa Marta and Vó Lina Farms; at a distance of 60 km, and 8 km from Nossa Senhora Aparecida Farm. Canopus Village is located about 60 km from the headquarters of the Nossa Senhora Aparecida Farm. Therefore, due to the proximity of the project area and being close to the project boundary, Caboclo village was selected as the leakage management area.

It is important to highlight that the Caboclo Village encompasses not only the central cluster of houses, but also the surrounding area, including adjacent properties where other members live, with the central village being the main gathering area. As such, the village also serves as a hub on the Canopus highway, providing access roads to properties in the region, especially in the leakage belt, where members of the community live or work. In fact, according to the social diagnosis¹⁸, the Caboclo Village is a rural village, where most of the residents make a living from subsistence farming and providing rural services, linked to farms in the region. Moreover, some interviewees discreetly reported that they owned more land than the lot on which they lived in the village. Around 18% of the interviewees reported owning cattle, indicating that their form of income is livestock farming. It is worth mentioning that obtaining information on land ownership and size has proved sensitive in the region, which is under constant pressure from land

¹⁸ SocialDiagnosis.zip

grabbing and invasions, as well as the fear of having part of these lands claimed, since they are undeniably part of the Xingu Triumph Environmental Protection Area.

Figure 1.13 shows the leakage belt close to Caboclo Village, its properties registered in CAR, the roads leading out of the village to Nossa Senhora Aparecida Farm and the properties located in the leakage belt, and the land cover classified as pasture by MapBiomass Collection 9 (MapBiomass, 2022). The map thus corroborates the information provided by the social diagnosis, indicating that Caboclo Village is a local hub for logistics and coexistence between residents of the region, including the properties located within the leakage belt. This connects the village to the deforestation dynamics in the region, which is also observed by the distribution of pasture lands. Therefore, the village is a strategic location for engagement, awareness-raising and partnerships aimed at reducing deforestation, both to protect the project area and to mitigate deforestation in the leakage belt.

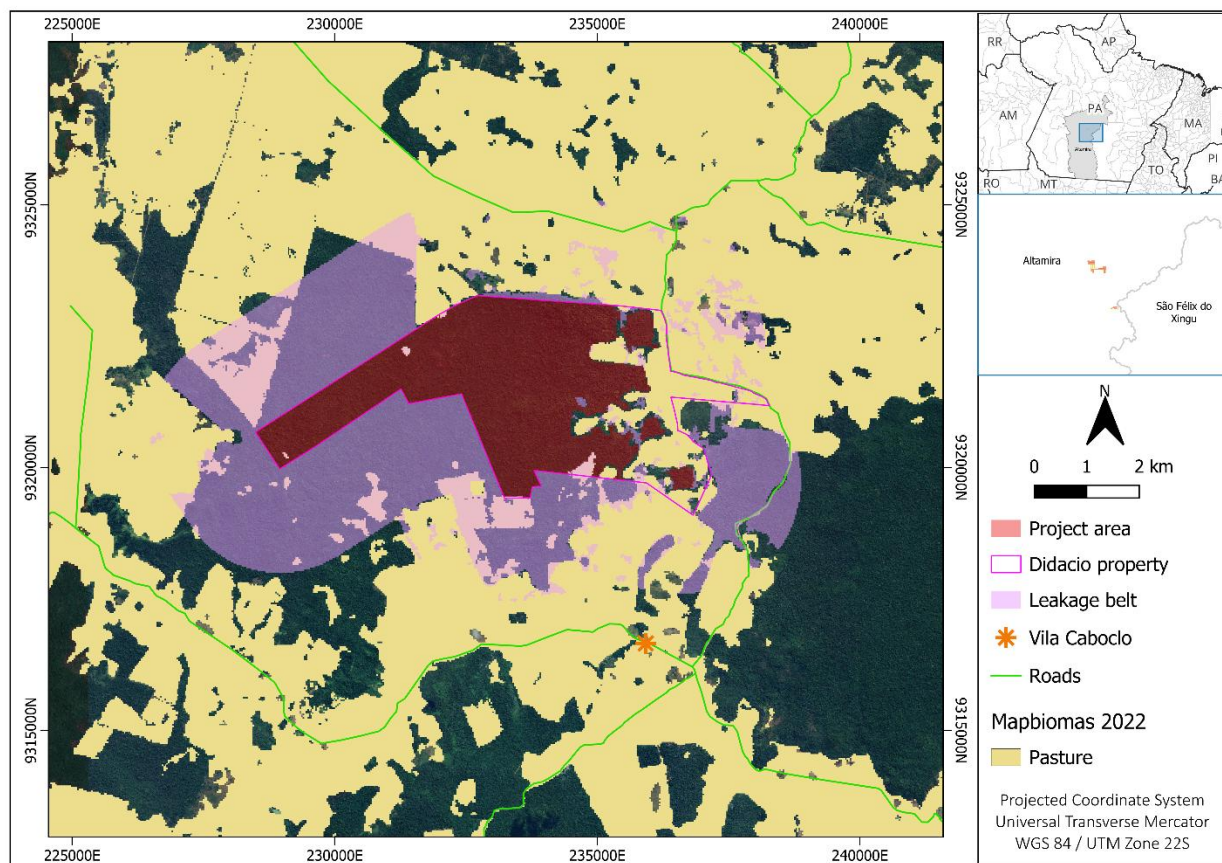


Figure 1.13. Access roads to the leakage belt and surrounding areas.

To reduce the risk of activity displacement leakage, baseline deforestation agents should be given the opportunity to participate in activities within the project area and in specially designated leakage management areas (outside the project area) that together will replace baseline income, product generation and livelihood of the agents as much as possible, so that deforestation will be reduced and the risk of displacement minimized. In the leakage management area, educational activities will be

implemented with the community to reduce the risk of leakage in the vicinity of the project area and leakage belt.

The boundaries of these areas should be established based on a management plan. This plan¹⁹ was provided to the VCS Validation/Verification Body (VVB) at the time of validation. Briefly, the plan aims to reduce the risk of leakage by implementing integrated actions both within the LB and in the LM. The actions in the plan include:

- Inclusion of baseline deforestation agents in productive and conservation activities (LM).
- Implementation of educational actions with the community to raise awareness about environmental conservation and alternative income opportunities (LM).
- Continuous monitoring through satellite imagery (LB).
- Training and capacity building for workers and community agents, ensuring the transfer of knowledge even in cases of turnover (LM).
- Wide dissemination of job opportunities, prioritizing social inclusion and equal opportunities (LM).

For further details on the Leakage Management Plan—including its objectives, targets, deadlines, and responsible parties—please refer to the attached document¹⁹.

1.19.2 Commercially Sensitive Information

Information supporting the internal cost assumptions was considered as commercially sensitive information; such information can be found in the additional and non-permanent internal risk sections and will be available to the auditor at the time of the project validation. No commercially sensitive information has been excluded from the rest of the public version of the Project Description. Through the entire Section 1 of the Project Description document, all relevant and necessary information regarding the project proponent and the conditions before the implementation of the project has been made available. The same affirmation is valid for the rest of the PD, as in the development of the safeguards and baseline topics.

1.19.3 Further Information

The project has already undergone validation through the VM0015 methodology, as can be verified on the Verra website. However, the project decided to migrate to the new VM0048 methodology to seek the best techniques for applicability, additionality, and calculation. The VM0048 methodology ensures the integrity of greenhouse gas accounting for individual projects within a jurisdiction and allows for the use of the most up-to-date science, data, and technologies.

VM0015 is a methodology that estimates greenhouse gas emissions from areas where unplanned deforestation occurs and quantifies the emission reductions achieved by curbing deforestation. VM0015

¹⁹ 250203_LeakageManagementPlan.pdf

is among the older REDD+ methodologies that account for most REDD+ credits on the market, but these older methodologies will not be assessed by ICVCM and credits issued under them will not be able to receive the CCP (Core Carbon Principles) label. In contrast, VM0048 is the new REDD methodology that will strengthen the VCS Program for issuing carbon credits to Avoided Unplanned Deforestation projects and has been approved by the Integrity Council for the Voluntary Carbon Market as meeting the requirements of the Core Carbon Principles Assessment Framework. Under VCS' new VM0048, project developers no longer set their own baselines based on self-selected reference areas, as VCS has agreed to establish project baselines based on jurisdictional deforestation data combined with an assessment of deforestation risk in the specific area. This represents a significant improvement since VM0048 improved the baseline methods, a change that will likely substantially reduce the very high levels of over-crediting found in previous methodologies. Verra requires operational Avoiding Unplanned Deforestation REDD+ projects using the older methodologies to transition across to VM0048, ensuring higher standards and integrity in carbon credit generation moving forward.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Stakeholder Identification

The process for identifying stakeholders involved searching for secondary data and, in the case of the Caboclo Village community, interviews were also conducted to enable a social diagnosis to be made. The Caboclo Village is considered the main stakeholder of TdX project, since it is the community that depends indirectly on the project area to maintain its well-being and cultural values.

The TdX project involves a wide range of other stakeholders, who play important roles at different administrative levels, including municipal, state, and deliberative council institutions. In the municipality of Altamira, for example, the relevance of relationships with various secretariats was identified, such as the Municipal Secretariat of Environmental Management (SEMMA), which oversees local environmental issues, the Secretariat of Public Works and Infrastructure (SEMOVI), focused on development and infrastructure, as well as the Secretariats of Education and Health, which can contribute to discussions on environmental issues by incorporating the dimensions of well-being and education. The Rural Union of Altamira (SIRALTA), which represents the interests of rural producers in the region, is

	also relevant, along with the Municipal Government of Altamira (PMA), which integrates the local management perspective. In the municipality of São Félix do Xingu, the Fire Department and the Municipal Secretariat of Environment and Mining (SEMMAS) are other stakeholders, which may be relevant for establishing partnerships, particularly for firefighting and ensuring the balance between economic activities and environmental preservation. Additionally, at the state level, the project could count on the support of institutions such as the National Rural Learning Service (SENAR) can also act as an important partner by promoting education and training in the rural sector.
Legal or customary tenure/access rights	The legal (statutory) and traditional (customary) rights of occupation, use, access, and management over lands, territories, and resources in the project zone were mapped through the analysis of geographic information obtained from The Land Management System (SIGEF, acronym in Portuguese). This was developed by INCRA aiming to promote the management of land information in the Brazilian rural environment. The reception, validation, organization, and regularization of georeferenced data of registered rural properties are carried out through the SIGEF system, which also makes the data publicly available. The database on protected areas from the Brazilian Institute of Geography and Statistics (IBGE) and the Chico Mendes Institute for Biodiversity Conservation (ICMBio) was also used. The legal information available, and primary data obtained in the social diagnosis of the community of the Caboclo Village and legal documentation provided by the other entities involved of the project were also used. Thus, statutory tenure, use, and access rights to lands, territories, and resources in the project zone, including individual and collective rights and overlapping are presented below in the images
Stakeholder diversity and changes over time	The Caboclo Village is a rural community in the municipality of Altamira, 1,400 kilometers away from the municipal seat, but located close to the properties that are part of the Triunfo do Xingu Grouped REDD+ Project. The village is situated in the Environmental Protection Area (Área de Proteção Ambiental) of the Triunfo do Xingu (ATX). The village has around 25 residences, of which 21 are occupied by permanent residents and 4 by temporary members. Also, a questionnaire survey was conducted to collect socioeconomic data and subjective perceptions of the villagers, and the representatives of 17 of the 21 households answered the survey. This number is over 80% of the households in the community, so the sampling

	effort of this research was maximum, i.e., all representatives of households that could be interviewed were interviewed, therefore, this sample is representative of the community as a whole. The village has about 69 inhabitants, as orally informed by local leaders, and most residents live from subsistence farming and the provision of rural services with most of the local labor being allocated to harvest periods or to jobs linked to the farms in the region. Most Caboclo Village inhabitants are originally from the north and northeast regions of Brazil. Two other community groups were identified within Caboclo Village, that is, sub-groups that share similarities in terms of income, livelihood, and/or cultural values. One of them is also a vulnerable sub-group and consists of those living below the national poverty line (with an income equal to or less than half the minimum wage) and is the most significant group in the community, comprising approximately 62% of the population in this condition. This group is considered vulnerable because economic restrictions affect their access to basic nutrition, leisure, health, and other necessities. The third sub-group is the one of local leaders, who are individuals with significant influence in the community due to the relevant positions they hold, such as the school or health post coordinator, as well as their leadership profiles, exemplified by the village representative. Local leaders are trusted by the residents of Caboclo Village and, therefore, play an important role as facilitators in communication between Systemica Inteligência em Sustentabilidade S.A.
Expected changes in well-being	The local economy will be strengthened by activities that promote environmental and formal/informal education (for example, awareness campaigns, alignment meetings with teachers, and the implementation of a school garden). These efforts will generate outcomes such as improved teaching conditions and increased community income, made possible by outputs like hiring people for the project's activities (including women), providing materials for courses and classes, and creating food production spaces (the school garden). The combination of these factors will enable the community to develop more job and income-generating opportunities, thus strengthening its local economy. With greater access to education and training, the community will become involved in productive activities that increase their income and diversify their sources of livelihood. At the same time, improved food security—made possible by the school garden and the use of more sustainable techniques—helps reduce costs and dependence on external inputs. Thus, the impact of strengthening the local economy is achieved through bolstering productive chains, expanding job opportunities, and promoting local entrepreneurship.

Location of stakeholders	According to the social diagnosis, there are no settlements, indigenous lands or traditional communities within the project area or surrounding areas, instead there are one main villages: Caboclo Village (Figure 2.10). This community belongs to the territory of Altamira, 1,400 kilometers away from the municipal seat. Caboclo Village is located close to the properties that are part of the Triunfo do Xingu Grouped REDD+ Project: Belcon, Campo Limpo, Patacho, Retiro Encantado, Santa Marta and Vó Lina Farms; at a distance of 60 kilometres, and 8 km from Nossa Senhora Aparecida Farm.			
Location of resources	Ownership	Properties	Centroid location coordinates	
			Longitude	Latitude
	Rafael Bemerguy Sefer	Belcon Farm	-53° 39' 38.852"	-5° 37' 55.445"
		Campo Lindo Farm	-53° 31' 58.888"	-5° 41' 56.909"
		Patacho Farm	-53° 39' 21.781"	-5° 39' 22.873"
		Retiro Encantado Farm	-53° 34' 45.974"	-5° 42' 42.604"
		Santa Marta Farm	-53° 37' 48.865"	-5° 43' 2.404"
		Vó Lina Farm	-53° 40' 38.524"	-5° 41' 15.775"
	Didácio Milhomens Barros	Nossa Senhora Aparecida Farm	-53° 24' 18.419"	-6° 8' 1.763"

2.1.2 Stakeholder Consultation and Ongoing Communication

Date of stakeholder consultation	18- June - 2023
Stakeholder engagement process	The informational meetings with communities and local stakeholders aim to enable the circulation of information and mutual dissemination of content regarding the TdX project and Caboclo Village. The meetings are publicized in advance to the community through the communication channels specified in the Communication Procedure of Systemica Inteligência em Sustentabilidade S.A. with the community, and with other stakeholders through email, phone, or WhatsApp, according to the preference of the respective stakeholder.

As instructed by the Communication Procedure, the local assistants hired by the project work to publicize the Systemica team's visits and meetings in Caboclo Village as well as using other communication channels.

Up to the present moment, several meetings with the community have been conducted in person during six different field visits:

between August and September 2022 - marking the start of the project;

in April 2023 - audit to validate the TdX VCS project description;

in June 2023 - to hold the first meetings related to the community governance structure, to apply questionnaires with the community, among other dissemination and research activities involving the population;

in September 2023 - for participatory impact assessment with the community and training of local agents.

in November 2023 - for training local agents and delivering materials.

in January 2024 - for carrying out participatory activities with the community, especially governance meetings and training.

In September 2024 - a meeting was held with the Caboclo Village community at the Novo Pacto Municipal School to discuss community governance. The purpose of the meeting was to reintroduce the project, reinforce the Climate, Community, and Biodiversity pillars, clarify doubts, and ensure that new participants understood the concepts.

With local institutional stakeholders, numerous online meetings were also conducted, serving different purposes and occurring at various times. These stakeholders include the municipal departments of environment, health, and education, representatives from the Altamira and São Félix do Xingu municipalities, as well as state-level institutions from Pará responsible for forests, biodiversity, and the regularization of public areas. These meetings occur as needed throughout the project. For instance, meetings were held with these stakeholders because of

	the audit process initiated in April 2023²⁰ and because of some project's activities, which are detailed below²¹: in March 2023 – meeting with SEMMAS, ATX, ITERPA and SEMMA, via video call to present the project and audit dates. in April 2023 - meeting with SESMA, SEMAS and STTR, via video call to present the project and audit dates. in July 2023 - meeting with SEMED and SEPLAN, via video call to present the project and strategies to sign the cooperation agreement between the secretariat and the project. In May 2024 – meetings with SEMMA, SEMOVI, SESMA, and SEMED, face-to-face and via video call to present the project, sharing project documentation, and initiate a dialogue on a possible cooperation agreement between the secretariats and the project. In June 2024 – meeting with SEMMA, via video call to present the project again and to continue the dialogue on the establishment of a possible cooperation agreement. In July 2024 – Participation in the III Environmental Concert in Altamira included an informative presentation of the Triunfo do Xingu Grouped REDD+ Project and the work carried out by Systemica, attended by various stakeholders and potential future stakeholders.
Consultation outcome	Relevant information regarding potential costs, risks, and benefits for the community has been and continues to be transparent since the beginning of the project. During the social diagnosis construction process, the team from Systemica Inteligência em Sustentabilidade S.A. engaged with the residents of Caboclo Village to address any questions they might have had regarding the carbon project, as well as to investigate their perceptions of potential risks and benefits at that time. In alignment with the Theory of Change development and project activities, subsequent meetings were held with the community, allowing them to provide input on the project activities. These inputs were then used to adjust the activities to better align with the benefits expected by the community. For example, face-to-face meetings that took place between June 18th and 20th, 2023,

²⁰ 231006_On-siteAuditPlanTdXv3.pdf

²¹ 240402_OtherStakeholdersMeetings.zip

	resulted in project activity adaptations based on the community's reported priorities. The TdX project does not impose any costs on the community. All risks and benefits identified by the project team were presented to the community via video and later reinforced in a face-to-face meeting for them to provide input or seek clarification. Additionally, in the same fieldwork on September 24th, 2023, the project team, in collaboration with Caboclo Village, conducted a participatory impact assessment activity, ensuring that all impacts (risks, costs, benefits) identified by the community are integrated into the Theory of Change, with mitigation measures outlined by the project. Systemica Inteligência em Sustentabilidade S.A. ensures that the community and other stakeholders are informed about the VCS validation and verification process. The Systemica team respects all relevant laws related to ensuring anti-discrimination, as set out in the company's Code of Conduct document. Likewise, Systemica Inteligência em Sustentabilidade S.A. requires service providers to comply with the code of conduct for the activities they perform. In addition, the landowner and the other entity have signed documents stating that all parties must follow all applicable laws regarding the implementation and management of the project. Therefore, all project entities are not involved in or complicit in any form of discrimination based on gender, race, religion, sexual orientation, or other habits and sexual harassment related to the project. Furthermore, in a non-discriminatory manner, the communication procedure of the TdX project team towards the community and other stakeholders addresses communication principles, which are: ethical treatment, clarity and transparency, communication safety, inclusion and promotion of equality, attention to vulnerable groups, communication governance, freedom of expression, engagement, and equality.
Ongoing communication	Consultations with stakeholders and ongoing communication are conducted through established communication channels, both in Portuguese and in accessible language, following the consultation and communication procedures of the TdX project.
Stakeholder input	The TdX project, since its inception, has encouraged the community and other stakeholders to provide suggestions and opinions about

	the project. To facilitate this, various communication channels have been made available and shared with stakeholders, ensuring this is an ongoing action. It has also been shown that the project has been adapted based on stakeholder influences, particularly by Caboclo Village. The communication procedure of the TdX project formalizes the process of receiving a suggestion from a stakeholder, the time required by the team for analyzing the suggestion, and then the response time to the requester, which is 60 working days. As for the incorporation or rejection of a suggestion into the project, after analysis by Systemica Inteligência em Sustentabilidade S.A., the process involves a joint decision with the proponent and approval of the change by those potentially affected by it. Through adaptive management, Systemica Inteligência em Sustentabilidade S.A. believes that new inputs will emerge over the project's lifespan.
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2.1.3 Free Prior and Informed Consent

Obtaining consent	The Triunfo do Xingu Grouped REDD+ Project adheres to the perspective that the consent is developed continuously, through a multiple and systematic process. Therefore, it is crucial to say that the FPIC is not limited to a single act, moment, or stage. Although in the Triunfo do Xingu Grouped REDD+ Project, traditional communities recognized as such by national or international legislation do not participate nor are affected in their property rights, the guidelines given in the Program Definitions CCB Version 3.0 and the Program Definitions VCS Version 4.4 on FPIC were followed. The consent process with the landowners of the TdX project consisted of three main phases: prospecting, contract negotiation and technical viability. In the first phase, initial contacts were made, and the prospects of the proposed project were presented. In the second phase, the necessary documents were requested, the contractual clauses, benefits, costs, and risks of the project were discussed, and technical and legal doubts were clarified. In the last phase, the environmental component and the technical viability of the project were discussed in depth, as well as the prospect of gains or not continuing the contract between the parties²². In this sense, consent to participate was obtained from the landowners in the
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²² 240516_FPIC_Landowners.zip

project, where the project area is located, through the contract signed with Systemica Inteligência em Sustentabilidade S. A²³. In the future, the same stages will be followed in the FPIC process with other participants such as landowners.

Also, consent was obtained from the Caboclo Village community to participate in CCB activities through a series of meetings.

Due to the lack of community organization and governance, the process required multiple sessions to explain the project and inquire whether the community would like to participate. The first moment took place between August 28, 2022, and September 8, 2022²⁴, during which social diagnosis, community and local stakeholder engagement was conducted. Throughout this period, meetings were held with the Caboclo Village Community and Santa Marta Farm. These meetings involved community diagnostic questionnaires and providing explanations about the project, aiming to communicate its key points, concepts, and implications regarding the implementation of a carbon credit project. It is noteworthy that there was also dissemination of summarized project documents, including the distribution and posting of flyers in the Caboclo Village and Santa Marta Farm. During these sessions, questions were clarified, and project communication channels were publicized. Thus, it can be concluded that during this initial contact, efforts were made to provide transparent information about the project in an appropriate language, along with conducting collective workshops and participatory diagnostic activities aimed at incorporating the community's demands and opinions.

The second phase took place on June 19th, 2023, the project and its concepts were explained once again²⁵. During this moment, project activities were also discussed, with the most relevant ones for the community highlighted, and the consent for the initiation of some of these activities was obtained. Additionally, on June 30th, 2023, communication procedures, code of ethics and conduct, and suggestion box procedures were also discussed. Therefore, during this second consent moment the community consented to participate in the activities and made some suggestions.

²³ 240528_Contract_PP_landowner.zip

²⁴ 231023_SocialDiagnosisAnnexes.zip

²⁵ 231019_ReportGovernanceMeeting.zip

	Lastly, the third phase occurred in September 2023¹⁷¹. On September 23rd, 2023, the participatory impact assessment of the project took place alongside the women of the Caboclo Village community. It's worth noting that the project's risks, costs, and benefits had been previously discussed on the project's YouTube channel, along with other relevant information (https://www.youtube.com/channel/UCgcAvRpmmy10x5mj9e1ArA). However, project activities, their risks, costs, and benefits were presented again, and the participatory assessment was conducted. Then, on September 24th, 2023, the impact assessment of the project's activities was conducted with the Caboclo Village community. Additionally, during the meeting, project communication channels were highlighted once again. It's important to mention that during this meeting, there was a reaffirmation of the community's consent regarding the project and its activities. Thus, it can be concluded that consent regarding the project and its activities was obtained from the Caboclo Village community through an informative and dialogical process consisting of three main phases, in August 2022, June 2023 and September 2023.
Outcome of FPIC	Regarding the landowners in the project, the outcome of the process was the obtention of consent for participation in the project and formalization through contract signing. Regarding the Caboclo Village community, consent was obtained, through a dialogical and informative process, for their participation in the VCS activities of the project, through a verbal agreement with the community members, which was evidenced in the presented in this section.

2.1.4 Grievance Redress Procedure

Development process	The communication procedure of the TdX project has formalized recommendations for conflict resolution that were agreed upon in consultation with the Caboclo Village. The aim was to ensure that the community did not already possess its own conflict resolution method, a fact that was confirmed during an in-person meeting with the community members. Conflict resolution aims to mitigate and sometimes eliminate the negative impacts of potential conflicts on the dynamics of interactions promoted by the project within a reasonable timeframe, following the established resolution stages.
Grievance redress procedure	Once a complaint or report is received, the project representative and coordinator may act as follows:

	a. In cases of suggestions, questions, or complaints: Depending on the preference of the person who submitted it, the response will be given individually or through a community assembly. b. Minimum elements for reporting a crime: If the minimum elements exist to establish the materiality and plausibility of the report, it must be immediately referred to the competent judicial authorities. c. Conflict involving only a Systemica employee or service provider: The issue will be directed to Systemica's internal legal department at the following email: juridico@systemica.digital describing the nature of the conflict and previous attempts to resolve it. The legal department will review the facts and, if necessary, will call on the Ethics Committee to jointly seek a resolution in the quickest and fairest way possible. d. Resolution of comments: All the channels presented here are available to receive suggestions and comments about the project. However, WhatsApp community groups, the suggestion box, in-person meetings in Caboclo village, the official project phone number, and the project's email are recommended as the best ways to express ideas. Any person, group, or institution may access these channels and submit their comments.
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2.1.5 Public Comments

Comments received	Actions taken
The VCS PDD does not bring the specific activities that will be developed in the leak management area.	The Triunfo do Xingu Grouped REDD+ Project, the proactive measures to combat leakage sources will be: (i) identified neighbors in the leakage region to propose partnerships and passively avoid deforestation, (ii) supported by a collaborative effort with regional stakeholders to advance a new strategy for the region's land use and forestry, and (ii) mapping by satellite for monitoring interventions in the areas surrounding the project (the Leakage Belt). In this project, reducing carbon stocks from deforestation or increasing emissions from increased grazing operations are not part of

	leakage prevention activities. Therefore, the current project activity does not entail reducing carbon stocks or increasing GHG emissions linked to activities to avoid leakage.
Secondary data from Nogueira et al (2015) are used, which aggregates averages by forest type from other older studies, most from 2008, more than 10 years before the year the project started. Although the article shows in detail the list of studies that originated each average, no effort was made to try to obtain more localized estimates, limiting itself to using global averages. However, an uncertainty analysis is carried out for the averages of the forest typologies in the project area and a conservative discount is applied in accordance with the Methodology. The PD states that forest inventories are planned to be carried out in the project area	The project used ex ante secondary data from Nogueira et al. (2015), which consolidates averages by forest type from previous studies. However, an uncertainty analysis is performed for the averages of forest typologies within the project area, and a cautious discount is applied according to the methodology (lower range of the confidence interval). It is planned to carry out forest inventories in the project area. The data will be used for the monitoring report.
A factor of 0.5 is used to convert carbon to biomass. The source of this factor is not reported and it is greater than the IPCC standard factor. No uncertainty estimate for this factor is provided nor is a discount applied.	The factor of 0.47 was used for carbon to biomass conversion. The source used was the most current IPCC report.
Regarding additionality, in the VCS PD, 3 land use scenarios are presented (i- continuation of land use without project implementation; ii- implementation of deforestation containment activities financed by landowners; iii- conducted logging through sustainable forest management), in the CCB PD, only 2 scenarios are presented, I and iii.	According to the comments, the additionality scenarios of the VCS PD and final version of the CCB PD were standardized.
In the PDD VCS 2 communication channels were defined (e-mail and WhatsApp), however, it was not presented how these channels were constructed nor whether	Regarding community comments, the CCB v.3.1 project description has used such as field reports, to detail the processes carried out regarding the construction of the communication

interested parties participated in this construction. The PD CCB mentions a communication procedure as an annex to the project, where the channels are detailed. None of the PD versions (VCS and CCB) have evidence (photos, attendance list, etc.) of the consultation process.	procedure with the community and the consultation, response to feedback, and consent of the community to participate in the project. However, in response to comments and to provide even more transparency about these processes, they were detailed in the CCB PD and added in the VCS PD.
Relevant information about the Triunfo do Xingu REDD+ Cluster Project: The Properties that make up the Project overlap with APA Triunfo do Xingu, as well as REDD+ Ateles 1 (ID 4034), however the proponent states that there are no land problems in the location, not even in overlapping areas. There is a need for more information on this situation.	Relevant information about overlapping other areas can be checked in VCS PD and CCB PD. More specifically, it can be seen in Figure 2.22 of the PD CCB that there is no overlap between the APA Triunfo do Xingu and the project area. Another point raised was the overlap with another REDD project. The Ateles REDD+ Project (4689) is being developed in the Municipality of São Félix do Xingú, southeast of the State of Pará. However, Triunfo do Xingu Grouped REDD+ Project is composed of seven private rural properties located in the Municipality of Altamira, in the south region of the State of Pará.
Communication about the VCS validation process was made prior to the VVB visit. For CCB validation, this communication has not yet been made but will be carried out before the VVB visit.	Regarding the communication of the audit process and the dissemination of the project summary to the community, the PD made clearer that these processes have taken place or are underway.

2.2 Risks to Stakeholders and the Environment

2.2.1 Management Experience

The expertise of the Systemica Inteligência em Sustentabilidade S.A. team has been consolidated since 2012, the year of its foundation. Since then, several projects in different segments have been conducted in the following areas: ecosystem services, insertion of sustainability in governance strategies with a focus on value creation, public policies, and forestry projects for the voluntary carbon market. This shows that, for the present project, experience in all these areas provides a fundamental basis for its design and execution. Below is a summary of some of the projects developed by Systemica Inteligência em Sustentabilidade S.A.:

Vale Florestar, reforestation of degraded tropical lands in the Brazilian Amazon²⁶: project evaluation and validation to ensure that it complies with the requirements of the Clean Development Mechanism for generating Carbon Credits. The project's objective is to create a local market for renewable wood and, at the same time, contribute to the expansion of forestry, attracting forest-based industries and other associated productive activities to the region.

Agrocortex REDD Project²⁷: guidance on the decision to acquire carbon credits related to the project through technical and legal due diligence, with an assessment of the project's environmental integrity. The main objective of the Agrocortex REDD project is to avoid the unplanned deforestation of the project area that belonged entirely to the territory of the Amazon Forest, in the Brazilian states of Acre and Amazonas.

CIKEL REDD Brazilian Amazon APD Project²⁸: technical analysis of the project and development of its continuity strategy. The project aims to avoid emissions from planned deforestation on a property in Paragominas, in the Brazilian state of Pará.

Amazon Biome Conservancy Grouped REDD+ Project²⁹: responsible for this carbon project as one of its proponents. This project contributes to preserving the most extensive tropical forest in the world in the Brazilian territory while providing significant improvements in the social interface. It is registered under the Verified Carbon Standard (VCS) and the first project activity instance is in the Itacoatiara municipality, the state of Amazonas, near its capital Manaus.

Florestal Santa Maria Project (FSM-REDD PROJECT)³⁰: The FSM Forest property, a rural property exclusively dedicated to the sustainable management of natural forests, is in the municipality of Colniza. The FSM-REDD Project was designed to give this forest management company the opportunity to take full advantage of the REDD regulatory system being developed through the VCS standard. The specific area of the carbon project is part of a larger colonization initiative, started in 1975, through the state's legally established effort to develop the northern region of the State of Mato Grosso.

The Systemica Inteligência em Sustentabilidade S.A. team directly involved in the project is multidisciplinary, with experience relevant to and qualified for the project. It has professionals from different areas of knowledge, such as biological, social, and exact sciences. Additionally, several members have specializations, graduate degrees, and professional experience in areas directly related to the project, such as the carbon market, extension, rural communication, forest inventory, statistics, and geoprocessing.

²⁶ 230509_PDValeReflorestar.pdf

²⁷ 230509_PDAgrocortexREED.pdf

²⁸ 230509_PDCIKELREDD.pdf

²⁹ 230509_PDABC.pdf

³⁰ 230719_ProjDesc24Feb2012.pdf

Table 2.1. Summarizes the professional team's experience working.

Management Team Experience	
Name	Munir Soares ³¹
Role	Chief Executive Officer (CEO)
Summary	Munir is the co-founder and CEO of Systemica, a developer of socio-environmental asset projects. With over fifteen years of experience as a Low Carbon Strategist, Team Leader, and Portfolio Manager, he has extensive expertise in serving large corporations and NGOs across Latin America. Throughout his career, he has gained unparalleled field experience in Brazil, with a particular focus on the Amazon region, managing and working with multicultural teams. Munir also holds a master's and PhD in Energy and Climate Change from the University of São Paulo (USP).
Contact	munir@systemica.digital
Name	Tiago Gonçalves de Oliveira Ricci ³²
Role	Legal Director and Prospecting
Summary	Tiago Ricci is a lawyer with an LLM in Financial and Capital Markets Law and a specialist in Tax Law, with over 17 years of experience in structuring and developing public policies, projects, and corporate ventures focused on technological innovation and climate change. His expertise ranges from conducting due diligence on carbon projects to international negotiations for large investments. He has served as a specialist consultant in the development of public policies on climate change, being one of the key contributors to the formulation of climate legislation in various Brazilian states.
Contact	tiago.ricci@systemica.digital
Name	Ricardo Zwarg ³³
Role	General Director of Restoration Projects
Summary	Environmental Engineer from the Faculty of Technology at UNICAMP. Master's degree in Science and Technology from the Federal University of São Paulo - UNIFESP. Completed an academic exchange at the Helmholtz Centre for

³¹ 250801_ResumeMunirSoares.pdf

³² 250801_ResumeTiagoRicci.pdf

³³ 250801_ResumeRicardoZwarg.pdf

Table 2.1. Summarizes the professional team's experience working.

	Environmental Research, Leipzig, Germany. Has worked as a project coordinator for NBS (Nature-Based Solutions) in private areas and traditional communities. Currently serves as Technical Director at Systemica, working on the development of carbon projects, MRV (Monitoring, Reporting, and Verification), and various modeling for REDD and ARR.
Contact	ricardo@systemica.digital
Name	Thiago de Freitas Viscondi ³⁴
Role	Project Intelligence Supervisor
Summary	Bachelor's, Master's, and Doctor's degree in Physics at the University of Campinas. Former postdoctoral researcher at the Institute of Physics and at the Escola Politécnica of the University of São Paulo. Practical experience in developing and managing projects targeting the voluntary carbon market. Extensive knowledge of methodologies and documentation required for certifying carbon projects, especially those aimed at reforestation and avoiding deforestation. Proficiency in the conceptualization and implementation of technological tools for geospatial assessment of territories and management of carbon projects, such as models for predicting deforestation and evaluating reforestation suitability.
Contact	thiago@systemica.digital
Name	Larissa Oliveira Paulista ³⁵
Role	Conservation Project Manager
Summary	Larissa Oliveira Paulista holds a PhD in Environmental Engineering from the Faculty of Engineering of the University of Porto (FEUP), Porto, Portugal. She also holds a double degree from the Polytechnic Institute of Bragança (IPB), Portugal, and a Masters in Environmental Technology. With over five years of experience in CO ₂ , she currently works as Conservation Project Manager at Systemica. Her work focuses on conservation projects within the voluntary carbon market, using certifications such as Verified Carbon Standard (VCS) and Climate, Community & Biodiversity (CCB). She has experience in standards

³⁴ 250801_ResumeThiagoViscondi.pdf

³⁵ 250801_ResumeLarissaPaulista.pdf

Table 2.1. Summarizes the professional team's experience working.

	and methodologies focused on REDD and IFM projects, as well as other methodologies and scopes related to nature-based solutions (NBS).
Contact	larissa@systemica.digital
Name	Adriano Grigolo ³⁶
Role	Modelling specialist
Summary	Adriano Grigolo holds a PhD in Physics from UNICAMP, specializing in computational methods applied to molecular systems. He has been with Systemica since 2021, where he works as a specialist in the development of geospatial models and tools for the technical and economic feasibility analysis of carbon projects.
Contact	adriano@systemica.digital
Name	Nathalia Virginia Veloso Aguiar ³⁷
Role	Technical Specialist I
Summary	Environmental Engineer, graduated from the Federal University of São Carlos, with international experience in technology and programming through an exchange program at Universidad San Buenaventura. Holds a Master's degree in Forest Resources from the University of São Paulo and works as a specialist in geospatial technologies within the carbon market and environmental solutions. Has extensive experience in spatial analysis and monitoring using Google Earth Engine (GEE) to handle large datasets, integrating remote sensing with advanced algorithms. Additionally, has led teams in geoprocessing projects for the energy sector and environmental services.
Contact	nathalia@systemica.digital
Name	Pedro Henrique Presumido ³⁸
Role	Technical Analyst III

³⁶ 250801_ResumeAdrianoGrigolo.pdf

³⁷ 250801_ResumeNathaliaAguiar.pdf

³⁸ 250801_ResumePedroPresumido.pdf

Table 2.1. Summarizes the professional team's experience working.

Summary	Pedro Henrique Presumido holds a PhD in Environmental Engineering from the Faculty of Engineering at the University of Porto (Portugal), with a focus on environmental issues and treatment solutions. With three years of experience in conservation and forest restoration projects, he specializes in the voluntary carbon market. He is well-versed in standards and methodologies (VERRA - AUD, APD, IFM) designed to support Reducing Emissions from Deforestation and Forest Degradation (REDD), as well as other methodologies and frameworks for Nature-Based Solutions (NBS). Currently, Pedro serves as a climate specialist for REDD projects at Systemica.
Contact	pedro@systemica.digital
Name	Laura Juanita del Pilar Rodriguez Ayala ³⁹
Role	Community Intelligence Analyst
Summary	Juanita Rodriguez Ayala is a Social or Community Specialist at Systemica, with extensive experience in socio-environmental research, the development and application of methodologies, as well as the design and evaluation of activities and outcomes aimed at improving the social well-being of communities. For approximately four years, she has been involved in the development of Nature-Based Solutions (NbS) projects for the voluntary carbon market, focusing on the Brazilian Amazon and the Colombian Orinoquía. The carbon projects she has participated in follow internationally recognized standards. She holds a degree in Social Anthropology and a master's in Sociology from the National University of Colombia. Currently, she is a PhD candidate at the Center for Sustainable Development at the University of Brasília, specializing in Policy and Sustainability Management.
Contact	juanita@systemica.digital
Name	João Carlos Simonetti ⁴⁰
Role	Technical Analyst I
Summary	João Carlos Simonetti, a geoprocessing analyst at Systemica, holds a degree in Forestry Engineering from the Luiz de Queiroz College of Agriculture (ESALQ-USP) and a postgraduate degree in Data Science & Analytics from the

³⁹ 250801_ResumeJuanitaRodriguez.pdf

⁴⁰ 250801_ResumeJoãoSimonetti.pdf

Table 2.1. Summarizes the professional team's experience working.

	University of São Paulo. He has worked in various sectors, such as environmental consulting focused on forest resources, supporting small producers in forest restoration, and the pulp and paper industry, with an emphasis on Geographic Information Systems (GIS) tools.
Contact	joao.simonetti@systemica.digital
Name	João Paulo Ferreira ⁴¹
Role	Community Intelligence Coordinator
Summary	João Paulo holds a degree in Law from the Pontifical Catholic University of São Paulo and in Philosophy from the University of São Paulo. He is a specialist in Administrative Law and holds a master's degree in Constitutional Law from PUC-SP. With over fifteen years of experience in public law and human rights, he has worked in both the private sector and public administration. João Paulo has been with Systemica since April 2022, currently serving as the coordinator of the Community Intelligence department.
Contact	joao.swf@systemica.digital
Name	Iêda Tenório ⁴²
Role	Supply Analyst
Summary	Graduated in Production Engineering, with over 15 years of professional experience, 9 of which were spent working in logistics and supply chain in the aerospace and technology/oil and gas industries. She later worked in technology and, subsequently, in project development and the construction of clean rooms, focusing on planning, control, and project management. She has experience in team coordination, interfacing with strategic areas such as project development and finance, and managing contracts/projects. Currently, she works in the contracts/supply chain area, focusing on carbon credits and socio-environmental transformation at Systemica.
Contact	ieda.tenorio@systemica.digital

⁴¹ 250801_ResumeJoãoFerreira.pdf

⁴² 250801_ResumeIeda.pdf

Table 2.1. Summarizes the professional team's experience working.

Name	Gabriella da Silva Riberio ⁴³
Role	Project Coordination
Summary	She holds a degree in Forestry Engineering and a Master's degree in Applied Ecology from the Luiz de Queiroz College of Agriculture at the University of São Paulo (USP). She has experience in the socio-environmental field, focusing on agroforestry systems, environmental education, forest management, and public policy.
Contact	gabriella@systemica.digital
Name	Yago Alonso Cipoli ⁴⁴
Role	Project Analyst I
Summary	Yago Cipoli is a Project Analyst at Systemica with degree in Environmental and Sanitary Engineering, a master's degree in Environmental Technology, and a PhD in Environmental Engineering at the University of Aveiro (Portugal). He has over six years of international research experience focused on indoor and outdoor air pollution, exposure assessment, and environmental health. His background includes monitoring campaigns, development of mitigation strategies, scientific communication and publications, and environmental education initiatives.
Contact	yago.cipoli@systemica.digital
Name	Valéria Christina Araújo Monteiro ⁴⁵
Role	Project Analyst I
Summary	Valéria Monteiro has a degree in Forestry Engineering from the Federal University of Amazonas - UFAM/Manaus and is a Specialist in the Environment and its Technologies from the Federal Institute of Education, Science and Technology of Amazonas - IFAM/Manaus. She has experience in research and extension projects with an emphasis on conservation and forest inventory,

⁴³ 250801_ResumeGabriellaRibeiro.pdf

⁴⁴ 250801_ResumeYagoCipoli.pdf

⁴⁵ 250801_ResumeValeria Monteiro.pdf

Table 2.1. Summarizes the professional team's experience working.

	socio-environmental activities and working with traditional and riverside communities.
Contact	valeria.monteiro@systemica.digital
Name	Agatha Oliveira Ramos ⁴⁶
Role	Legal Project Analyst I
Summary	A lawyer graduated from the Escola Paulista de Direito (EPD), with a specialization in land issues and a focus on the Legal Amazon. She completed the course "Climate Change and Carbon Market: Scenarios and Perspectives" at the Escola Superior de Advocacia of OAB. She has solid experience in due diligence for private and collective properties, as well as extensive work in drafting and analyzing contracts, particularly in projects related to sustainability, land regularization, and the generation of environmental assets.
Contact	agatha@systemica.digital
Name	Laise de Jesus dos Santos ⁴⁷
Role	Project Analyst I
Summary	Master's and PhD student in Wood Science and Technology at the Federal University of Lavras (UFLA). Forest Engineer graduated from the State University of Pará (UEPA). Former coordinator of the Study Group on Wood Anatomy and Chemical Products at UFLA. Volunteered in the National Volunteer Program of ICMBio at the Conservation Units of the Carajás Mosaic and interned at the Casa da Cultura Foundation in Marabá, working with indigenous populations in southeastern Pará. Member of the Wood Science and Technology League at UEPA. Experienced in the areas of forest resources, ethnobotany, and circular economy.
Contact	laise.santos@systemica.digital

⁴⁶ 250801_ResumeAgathaORamos.pdf

⁴⁷ 250801_ResumeLaiseSantos.pdf

2.2.2 Risk Assessment

	Risks identified	Mitigation or preventative measure(s) taken
Natural and human-induced risks to stakeholders' wellbeing	Risks identified	Greater susceptibility to cybercrimes and access to disinformation This is a potential negative impact that may be caused by the improvement of access to technology, information, and leisure activity, which includes the provision of internet network for the school, the health post, and the community space. Access to the internet, while bringing great benefits, can also facilitate the actions of criminals, posing a risk of digital scams and the spread of false information, especially if this access is not accompanied by digital education initiatives. Such a risk can escalate or intensify conflicts within the community and adversely affect community members financially and psychologically.
Risks to stakeholder participation	No risks identified	The project will not affect the well-being of the other stakeholders identified, and consequently, there will be no activities implemented to mitigate negative impacts on them.
Working conditions	Risks identified	Consideration of substantial risks to worker safety that could arise due to project implementation will be considered by the TdX project. All individuals contracted for these specific activities of the project will be duly informed about the potential job risks, mitigation

		measures, and mandatory personal safety actions. In general, the following measures will be taken to ensure safety at work: Mandatory use of Personal Protective Equipment (EPI in Portuguese). Specific training for the activities to be performed. Promotion of awareness of safety standards and practices. First aid: assessment of the situation, vital signs, common occurrences, and venomous animals. Navigation, orientation, and use of firefighting tools and equipment. Requirement of certification and a code of ethics for contracted third-party companies.
Safety of women and girls	Risks identified	The women of the Caboclo Village are a vulnerable group. They may occasionally engage in paid work, either temporary or continuous, but they earn less than men and are more frequently employed informally. Gender inequality exposes women to strenuous work routines, domestic violence, and limited access to education and leisure. There will be an activity with the potential to provide adaptation benefits. The first concerns education and access to information, as the activity will provide an internet network for the

		school, the health post, and the community space. The second benefit is the promotion of community well-being, as the activity's outcomes include increased access to leisure and culture, prevention of alcohol and drug abuse, reduction in levels of domestic violence, and the expansion and strengthening of social relationships.
Safety of minority and marginalized groups, including children	Risks identified	The groups identified as marginalized are women and people living below the poverty line. The main positive impact generated by the project that primarily affects the group below the poverty threshold is the strengthening of the local economy. This will occur through activities aimed at promoting environmental and formal/informal education (such as awareness campaigns, alignment meetings with teachers, and the planned implementation of a school garden). These efforts are expected to generate outcomes or short-term benefits such as improved teaching conditions and increased community income, facilitated by outputs like hiring people for the project's activities (including women), providing materials for courses and classes, and creating food production spaces (the school garden). The combination of these factors will enable the community to develop more job

		and income-generating opportunities, thereby strengthening its local economy and impacting this community group. The main positive impact generated by the project that primarily affects the women's group is the promotion of gender equality. This will occur through activities that generate income opportunities and encourage women's social participation, such as hiring female labor for the project and implementing awareness campaigns. These outputs are expected to translate into outcomes or short-term benefits such as increased and diversified income for women and reduced levels of economic vulnerability within the community. Governance initiatives that promote women's participation in decision-making processes will further reinforce these outcomes.
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	No risks identified	The project will be exclusively conservation-oriented; therefore, no pollutants will be generated. There will be no air emissions, noise, or discharges into water bodies. Similarly, there will be no generation of solid waste, nor the release of hazardous materials, pesticides, or chemical fertilizers. All planned activities are focused on environmental preservation,

ensuring that no negative impacts related to pollution will occur.

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

Risks identified ⁴⁸		Mitigation or preventative measure(s) taken
Discrimination	No risk identified	The Systemica team respects all relevant laws related to ensuring anti-discrimination, as set out in the company's Code of Conduct document. Likewise, Systemica Inteligência em Sustentabilidade S.A. requires service providers to comply with the code of conduct for the activities they perform. In addition, the landowner and the other entity have signed documents stating that all parties must follow all applicable laws regarding the implementation and management of the project. Therefore, all project entities are not involved in or complicit in any form of discrimination based on gender, race, religion, sexual orientation, or other habits and sexual harassment related to the project. Furthermore, in a non-discriminatory manner, the communication procedure of the TdX project team towards the community and other stakeholders addresses communication principles, which are: ethical treatment, clarity and transparency, communication safety, inclusion and promotion of equality, attention to vulnerable groups, communication governance, freedom of expression, engagement, and equality.

⁴⁸ The identified risks and commensurate mitigation or preventative measure(s) for forced labor, child labor, and human trafficking, must be inclusive of staff and contracted workers employed by third parties.

Sexual harassment	No risk identified	The Systemica Inteligência em Sustentabilidade S.A., through its Code of Conduct, has as a company-level guideline the assurance of respecting the rights of communities, refraining from improper and abusive behaviors, as well as preventing sexual or moral harassment. Likewise, Systemica Inteligência em Sustentabilidade S.A. requires service providers to comply with specific codes of conduct for the activities they perform. Moreover, the workers hired by the landowners to carry out activities linked to the project have also signed the code of conduct stipulated by the project, as have the community agents hired by the project.
Equal pay for equal work	No risk identified	All employees, regardless of gender, ethnicity, or social background, receive fair and transparent compensation based on their skills, responsibilities, and performance. Salary structures are standardized to ensure that women and men performing the same job under the same conditions are paid equally, eliminating any form of wage discrimination.
Gender equity in labor and work	No risk identified	All the job opportunities for the project's activities were widely publicized in Caboclo village, so that everyone has an equal opportunity to participate in the selection process, without any discrimination against women or marginalized individuals
Forced labor	No risk identified	It is important to note that, as described the Section 2.1.8 of the CCB Project Description version 3.0, the project does not use victims of human trafficking, forced labor and child labor.

Child labor	No risk identified	The project does not use child labor.
Human trafficking	No risk identified	The project does not of human trafficking

2.3.2 Human Rights

Risks identified	Mitigation or preventative measure(s) taken
No risk identified	Free, prior, and informed consent (FPIC) is a right internationally enshrined for indigenous and tribal peoples by Convention 169 of the International Labor Organization (ILO, 1989). This convention is currently in force in Brazil through Decree No. 10,088 of November 5, 2019 (Brasil, 2019). FPIC is "the establishment of conditions under which people exercise their fundamental right to negotiate the terms of externally imposed policies, programs, and activities that directly affect their livelihoods or well-being, and to give or withhold their consent to them" (RECOFTC, 2011). Free, prior, and informed consent should not be understood as a single yes-no vote or as a veto power for a single person or group. Instead, it is a process by which Indigenous peoples, local communities, government, and companies can reach mutual agreements in a forum that gives affected communities sufficient influence to negotiate conditions under which they can proceed and an outcome that clearly leaves the community better off (RECOFTC, 2011). The Free, Prior, and Informed Consent (FPIC) process must be conducted in accordance with applicable national and international legislation, involving communities whose property rights may be affected. However, in the context of the TdX project, there is no participation of indigenous or traditional communities, as recognized by national or international law, nor any impact on their property rights, since these communities do not

	reside in or depend on the project area. Nevertheless, the TdX project follows internal guidelines as well as those established by the CCB and VCS Program regarding FPIC, ensuring consent for participation in activities by communities present in the project zone. For Systemica, the consent process is continuous and structured in multiple, systematic stages, ensuring that consent is not treated as an isolated act or limited to a single moment or phase of the project. The consent process with the landowners of the TdX project consisted of three main phases: prospecting, contract negotiation, and technical viability. In the first phase, initial contacts were made, and the prospects of the proposed project were presented. In the second phase, the necessary documents were requested, the contractual clauses, benefits, costs, and risks of the project were discussed, and technical and legal doubts were clarified. In the last phase, the environmental component and the technical viability of the project were discussed in depth, as well as the prospect of gains or not continuing the contract between the parties⁴⁹. In this sense, consent to participate was obtained from the landowners in the project, where the project area is located, through the contract signed with Systemica Inteligência em Sustentabilidade S.A.
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2.3.3 Indigenous Peoples and Cultural Heritage

Risks identified	Mitigation(s) or preventative measure taken
No risk identified	According to the social diagnosis, there are no indigenous lands or traditional communities within the project area or surrounding areas,

⁴⁹ GeneralLegalDocs.zip

instead there are one main villages: Caboclo Village.

2.3.4 Property Rights

Risks identified	Mitigation or preventative measure(s) taken
No risk identified	Project activities do not provide for the involuntary removal or relocation of property rights holders from their lands or territories and do not force rights holders to relocate activities important to their culture or livelihood, which can be demonstrated in this document by the description of project activities and through direct interviews with the communities in the field. Rather, the project was designed to respect the rights of property rights holders, strengthen activities relevant to livelihoods and cultural values, and support the Caboclo Village and other communities of the project in formalizing their property rights to the land.

2.3.5 Benefit Sharing

Process used to design the benefit sharing plan	The project does not affect the community's property rights or the use of resources in its territory, so it does not directly involve the community in the agreement on the benefit-sharing established with the landowners. However, the community is involved in planning the allocation of resources for activities that impact them. Thus, the benefit-sharing corresponds to the percentages established in the contract with the landowners for the revenues generated by the project. Since a percentage of this resource is earmarked for activities that involve the community, the project has built and validated, together with the community, a communication procedure that establishes a medium for decision-making on CCB activities that will generate non-monetary benefits for community members. Regarding this benefit-sharing mechanism, the contracts established with the landowners allocate a percentage of the project-generated revenues to the landowners, another portion to Systemica, and 10% of the revenues to the development and implementation of CCB activities,
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	aimed at generating non-monetary benefits for the community. Although the community does not have direct access to the project's financial revenue, because it is a private contract with the landowners, it has full transparency regarding the allocation of part of this revenue to the implementation of the activities that will impact on them. Regarding community participation in the allocation of resources to project activities, to ensure that the community participates in defining the decision-making process, the community, together with the project team, discussed, adjusted, and approved the project's communication procedure which includes means that guarantee a democratic and inclusive decision-making process on the project activities that will equitably generate non-monetary benefits for the entire community, as well as on the mechanisms available for suggestions, doubts and suggestions about the project. Thus, the project activities that will benefit the communities were developed in collaboration with the community and approved through face-to-face meetings between the Systemica Inteligência em Sustentabilidade S.A. team and the community.
Summary of the benefit sharing plan	The project's benefit-sharing has been formalized through private contracts established with the landowners. These contracts define the distribution of revenues generated by the project in three parts: A percentage allocated to the landowners, a percentage allocated to Systemica Inteligência em Sustentabilidade S.A., Ten percent (10%) of total project revenues dedicated to the development and implementation of CCB activities, designed to generate non-monetary benefits for the local community. Although the community does not receive direct financial revenue from the project since the contractual arrangements are private between the project proponent and the landowners, the community has full transparency regarding the allocation of the portion earmarked for activities that directly impact them. This transparency ensures that community members can participate meaningfully in decisions about how these resources are translated into tangible, non-monetary benefits.
Approval and dissemination of benefit sharing plan	Adequate information about predicted and actual benefits, costs, and risks has been communicated to the community, and there was an expression of understanding from the community. A presentation containing the project's activities and respective benefits, was shared with Caboclo Village through an explanatory video on YouTube. The

presentation's content can be found in annex⁵⁰ "230905_TdXCostsRisksBenefits". This information was reiterated later in an in-person meeting with the community. The project's benefit-sharing has been formalized through private contracts⁵¹ established with the landowners.

2.4 Ecosystem Health

	Risks identified	Mitigation or preventative measure(s) taken
Impacts on biodiversity and ecosystems	Use of information on endangered fauna and flora for exploitation. Practicing activities that could be detrimental to biodiversity during fauna and flora monitoring campaigns.	In order to discourage the misuse of information from fauna lectures and workshops for hunting and exploitation purposes, a focused approach will be employed. The approach will highlight the ecological significance of endangered species in the region, the detrimental effects of predatory exploitation of biodiversity, and the benefits of sustainable practices. In order to participate in the project, all service providers must give their consent by agreeing to the code of conduct⁵² and integrity protocols embedded in the standard operating procedures.
Soil degradation and soil erosion	No risk identified	The project keeps the forest standing, ensuring vegetation cover that protects the soil against erosion. This conservation prevents nutrient loss and soil structure degradation. With less risk of erosion, environmental stability is strengthened. In addition, the impact of extreme events, such as

⁵⁰ ValidationMeetings.zip

⁵¹ 230810_SystemicaDContract.pdf

⁵² 230519_Systemica's Code of Ethics and Conduct.pdf

		heavy rains, is reduced. This ensures long-term soil quality maintenance.
Water consumption and stress	No risk identified	One of the forest areas of TdX project, protects multiple springs and tributaries of the Caboclo stream, ensuring essential ecosystem services of water regulation, climate regulation, and soil protection that indirectly affect the community. Caboclo stream, which encompasses along its extent between the project area and the community and is used by the community for fishing, recreation, and water usage. To date, a workshop on water security and sustainable agriculture, and livestock farming has been conducted with the community. This workshop is the first step to empowering community members to become active participants in the conservation of the Caboclo stream.

2.4.1 Rare, Threatened, and Endangered Species

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

☒ Yes

☐ No

Table 2.2 Vulnerable, Near threatened and Threatened species considering detection in systematic sampling in the project, regarding national ICMBio (2024) and international IUCN (2023) classifications.

Species	ICMBio (2024)	IUCN (2023)
<i>Anodorhynchus hyacinthinus</i>	Near threatened	Vulnerable
<i>Penelope pileata</i>	Vulnerable	Vulnerable
<i>Pyrrhura amazonum</i>	Endangered	Near threatened
<i>Ramphastos tucanus</i>	Least concern	Vulnerable

Species	ICMBio (2024)	IUCN (2023)
<i>Ramphastos vitellinus</i>	Least concern	Vulnerable
<i>Tinamus tao</i>	Vulnerable	Vulnerable
<i>Lepidothrix iris</i>	Endangered	Vulnerable
<i>Primolius maracana</i>	Least concern	Near threatened
<i>Spizaetus ornatus</i>	Least concern	Near threatened
<i>Tapirus terrestris</i>	Vulnerable	Vulnerable
<i>Ateles marginatus</i>	Endangered	Endangered
<i>Panthera onca</i>	Vulnerable	Near threatened
<i>Alouatta belzebul</i>	Vulnerable	Vulnerable

Table 2.3 Endemic species identified in the project area.

Species	Endemism
<i>Automolus paraensis</i>	Amazon
<i>Dendrexetastes paraensis</i>	Amazon
<i>Dendrocolaptes ridgwayi</i>	Tapajós river
<i>Hypocnemis striata</i>	Amazon
<i>Megascops stangiae</i>	State of Pará
<i>Myrmelastes rufifacies</i>	Amazon
<i>Nystalus torridus</i>	Amazon
<i>Penelope pileata</i>	Amazon
<i>Pyriglena similis</i>	Tapajós river
<i>Pyrrhura amazonum</i>	Brazil
<i>Willisornis vidua</i>	Amazon
<i>Rhinophylla fischeræ</i>	Amazon
<i>Hsunycteris thomasi</i>	Amazon

	Risks identified	Mitigation or preventative measure(s) taken
Habitats for rare, threatened, and endangered species	No risk identified	<i>Training activities and lectures, cautionary approaches were used that emphasized the need to conserve fauna and flora. Suppliers and local agents who worked on biodiversity activities signed the conduct and ethics term in the contracting procedure that declares the use of information and equipment solely and exclusively for conservation purposes, preventing the practice of activities harmful to biodiversity during activities, and agreeing with the fundamental pillars for the project of no harm to fauna, minimal impacts to the environment and integrity. , These measures are consistent with the precautionary principle, as it was taken regardless of whether this negative impact is observed.</i>
Areas for habitat connectivity	No risk identified	<i>Most of the activities developed and planned by the project are aimed precisely at maintaining and conserving the original forest cover and preserving biodiversity. There are therefore no or species of flora and fauna adversely affected. The maintenance of the project area in its original condition provides for the conservation of flora species (including endemic species at risk of conservation) and consequently the maintenance of habitats for fauna species. In addition to the benefits within the project area, forest conservation also allows for connectivity between the different types of conservation units near the project area.</i>

2.4.2 Introduction of Species

Table 2.4 Species used in the project.

Species introduced	Classification	Justification for use	Adverse effects and mitigation
N/A	N/A	N/A	N/A

Existing invasive species	Mitigation measures to prevent the spread or continued existence of invasive species
Does not exist	Considering the Invasive Alien Species National Database Network from Horus Institute (Instituto Hórus, 2023) and the fauna inventory ⁵³ carried out, the project has not identified any invasive species of flora or fauna, nor does it foresee the introduction of non-native species.

	Risks identified	Mitigation or preventative measure(s) taken
Invasive species	No risk identified	The project has not identified any invasive species of flora or fauna, nor does it foresee the introduction of non-native species.

2.4.3 Ecosystem Conversion

	Risks identified	Mitigation or preventative measure(s) taken
Ecosystem conversion	No risk identified	The project is a forest conservation project (REDD+), not involving planting, drainage, or land use change. The area is already covered by native forest, and the project activity consists of preventing deforestation and promoting the maintenance of the existing ecosystem.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The Triunfo do Xingu Grouped REDD+ Project applies the following methodology and tool (Table 3.1):

⁵³ 230919_FaunaInventoryReport.pdf

Table 3.1. Methodology and tools applied in the project.

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	VM0048	VM0048 Reducing Emissions from Deforestation and Forest Degradation	1.0
Tool	VT0001	VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities	3.0
Tool	VT0007	VT0007 Unplanned Deforestation Allocation (UDef-A)	1.0
Tool	NPRT	AFOLU Non-Permanence Risk Tool	4.2
Module	VMD0055	VMD0055 Estimation of Emission Reductions from Avoiding Unplanned Deforestation	1.1
Module	VMD0001	VMD0001 Estimation of Carbon Stocks in the Above- and Belowground Biomass in Live Tree and Non-tree Pools (CP-AB)	1.2
Module	VMD0013	VMD0013 Estimation of Greenhouse Gas Emissions from Biomass and Peat Burning (E-BPB)	1.2

3.2 Applicability of Methodology

It was demonstrated and justified how the project activities meet each of the applicability conditions of the methodology, tools and modules applied by the project (Table 3.2). Each applicability condition was addressed separately.

Table 3.2. Applicability conditions.

Methodology ID	Applicability condition	Justification of compliance
VM0048	This methodology may only be used for eligible REDD projects and activities described in the VCS Methodology Requirements. The	The project complies with the applicability of this methodology, as it qualifies under the AUDef category and meets all VCS Program requirements, including

Methodology ID	Applicability condition	Justification of compliance
	applicability conditions for each activity type are listed in AUDef, and will be listed in APDef and AUDef.	legal compliance (Section 1.15). Furthermore, the project is located in an area identified as being under deforestation pressure according to the jurisdictional allocated deforestation risk map for the State of Pará (PADA Report – VCS 3738 ⁵⁴), developed in accordance with VM0048 and VMD0055. This reinforces the project's relevance and eligibility under the AUDef classification.
VT0001	The tool is applicable under the following conditions: a) AFOLU activities the same or like the proposed project activity on the land within the proposed project boundary performed with or without being registered as the VCS AFOLU project shall not lead to violation of any applicable law even if the law is not enforced; b) The use of this tool to determine additionality requires the baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario. Project proponent(s) proposing new baseline methodologies shall ensure consistency between the determination of a baseline scenario and the	a) The proposed project activities (Section 1.12) do not result in any violation of applicable laws, even if those laws are not enforced. Systemica maintains a qualified legal department (Section 2.2.1) that conducts ongoing compliance assessments to ensure the project activities remain in accordance with current legislation. b) The stepwise approach outlined in VM0048 and VMD0055 has been followed to determine the most plausible baseline scenario. Three scenarios were evaluated: (i) continuation of pre-project land use (BAU activities occurring); (ii) project activity on the land within the project boundary was performed without being registered as the VCS AFOLU

⁵⁴ VCS_3738_PADA_REQUEST.zip

Methodology ID	Applicability condition	Justification of compliance
	determination of additionality of a project activity.	project; and (iii) logging being conducted through sustainable forest management. Following the stepwise approach, scenario (i) was considered to be the most plausible baseline scenario, as the project would not be financially viable without carbon credit revenue. Detailed information is provided in Section 3.5.2.
VT0007	This tool is applicable under either of the following conditions: 1. The project is a standalone project meeting the applicability conditions for projects that aim to avoid unplanned deforestation as defined in VMD0055 and is seeking allocation of jurisdictional unplanned deforestation activity data; or 2. A higher-level jurisdiction is seeking to allocate their FREL to projects or lower-level jurisdictions aiming to avoid unplanned deforestation.	The project is applicable under condition '1' as the project activities aim to prevent Unplanned Deforestation (UDef), as defined in VMD0055, and seek the allocation of jurisdictional UDef activity data. Detailed information can be found in the PADA Report ⁵⁵ .
AFOLU Non-Permanence Risk Tool (NPRT)	The tool is mandatory for REDD project activities.	The project followed the applicability of this tool to determine the number of buffer credits that will be deposited into the AFOLU pooled buffer account. The report VCS AFOLU

⁵⁵ VCS_3738_PADA_REQUEST.zip

Methodology ID	Applicability condition	Justification of compliance
		Non-Permanence Risk Tool can be found in the attachment ⁵⁶ .
VMD0055	The land use transition in the baseline scenario is forest land to non-forest land, meeting the definition of unplanned deforestation.	The project has adopted as its baseline the land use change resulting from unplanned deforestation within the project's jurisdiction. The project area consists of forest land that has remained continuously forested and stable for more than 10 years prior to the project start date. Analysis of post-deforestation land use in a 10-km-wide buffer around the project area reveals that 97.5% of historical deforestation events resulted in conversion from forest to pasture (Section 4.1.2.1). This predominant pattern clearly indicates agent-driven unplanned deforestation as the main driver in the region. Therefore, in the absence of project intervention, the baseline scenario is expected to result in similar conversion of forest land to non-forest uses, thereby satisfying the definition of unplanned deforestation as established under VMD0055.
VMD0055	The project involves activities aimed at avoiding unplanned deforestation.	The project activities focus on preventing unplanned deforestation, with details on how this is achieved outlined in Section 1.12, "Description of the Project Activity".

⁵⁶ VCS_NPR_REP_3738_31_08_2022_15_08_2025.pdf

Methodology ID	Applicability condition	Justification of compliance
VMD0055	Agents of deforestation in the baseline scenario clear the land for tree harvesting, settlements, roads, unsanctioned expansion of roads or other infrastructure, agricultural crop production, ranching, or aquaculture.	The deforestation agents in the project area are the operators of livestock activities. This conclusion is also reinforced by forest fire report data, since the use of fires to “clean” the land to make room for pastures is known to be a common practice in the region, due to the logistical and legal difficulties of using other methods such as tractors. Additional information on the drivers of deforestation is described in Section 3.4.3.
VMD0055	This module is not applicable under any of the following conditions: a) The project harvests trees for wood products (e.g., timber, fuelwood, charcoal, fiber), unless the trees have been demonstrably planted during the project lifetime as part of project activities for leakage mitigation or community development. b) More than two percent of the vegetation cover in the project area is peatland or tidal wetland vegetation. c) Wetlands are being drained in the baseline scenario or wetland drainage occurs in the project scenario (including the use of trenches	Below are the justifications for each item: a) Not applicable. The project does not intend to harvest trees for timber products. Project activities are described in Section 1.12. b) The project area comprises exclusively forest land. As a conservative approach, any overlaps involving peatlands or tidal marsh areas were excluded from the project boundary. Further information is provided in Section 3.3.4. Supporting GIS files are available in Annex⁵⁷. c) The project area comprises exclusively forest land, excluding any overlaps involving peatlands or tidal marsh areas. Further

⁵⁷ 260115_TdX_UdefPA_Annex.zip

Methodology ID	Applicability condition	Justification of compliance
	or ditches for the purpose of wetland drainage). d) More than ten percent of the vegetation cover in a 10-kilometer-wide buffer around the project area is peatland or tidal wetland vegetation; or e) Implemented leakage mitigation measures include Flooding agricultural lands to increase production (e.g., for rice paddies), or Intensifying livestock production using feed-lots and/or manure lagoons.	information is provided in Section 3.3.4. d) The 10-kilometer-wide buffer around the project area comprises exclusively forest land. As a conservative approach, any overlaps involving peatlands or tidal marsh areas were excluded from the project boundary. Further information is provided in Section 3.3.4. Supporting GIS files are available in Annex⁵⁸. e) Not applicable. The measures proposed to mitigate leakage (Section 1.19.1) do not include flooding agricultural lands to increase production (e.g., for rice paddies), or Intensifying livestock production using feed-lots and/or manure lagoons.
VMD0001	This module is applicable to all forest types and age classes.	The project complies with the applicability of this module. The project area is composed of native Amazon Rainforest vegetation, containing phytophysognomies of open canopy ombrophilous forest and dense canopy ombrophilous forest. As required by VM0048 and VMD0055, the forested project area includes only land that has qualified as forest for at least 10 years prior to the project start date. VMD0001 is applicable to these forest types

⁵⁸ 260115_TdX_UdefPA_Annex.zip

Methodology ID	Applicability condition	Justification of compliance
		and age classes. The baseline carbon stock assessment is described in Section 4.1.2.1.
VMD0013	This module is applicable to REDD project activities with emissions from biomass burning and REDD-WRC project activities with emissions from biomass and/or peat burning. This module is also applicable to RWE and ARR-RWE project activities with emissions from peat burning.	The project complies with the applicability of this module because fire is used in the baseline scenario to clear the land following deforestation, resulting in GHG emissions. These emissions must be accounted for in both the baseline and project scenarios across the project area and leakage belt. Where fires occur ex post in areas that coincide with areas deforested in the baseline scenario, this module is used to quantify the resulting GHG emissions.

3.3 Project Boundary

3.3.1 Carbon Pools

The carbon pools included in or excluded from the boundary of REDD project activities are shown in Table 3.3. The selection of carbon pools and the appropriate justification were presented in the project description (Table 3.3).

Table 3.3. Carbon pools included in or excluded from the REDD project boundary.

Pool	Included?	Justification/Explanation
Aboveground tree biomass	Included	Major carbon pool that will significantly decrease in the baseline scenario in the case of deforestation or forest degradation
Belowground tree biomass	Included	Major carbon pool that will significantly decrease in the baseline scenario in the case of deforestation or forest degradation

Pool	Included?	Justification/Explanation
Aboveground non-tree biomass	Included	The stratum referring to this carbon pool was measured in the field and carefully processed, making its analysis more accurate.
Belowground non-tree biomass	Included	The stratum referring to this carbon stock was measured in the field and carefully processed, making its analysis more accurate.
Dead wood	Excluded	Conservative to exclude
Litter	Excluded	Conservative to exclude
Soil organic carbon	Excluded	Conservative to exclude
Harvested wood products	Excluded	Not included because of baseline dynamics.

3.3.2 Sources of GHG Emissions

The project has taken account for any significant increases in emissions of carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄), relative to the baseline, that are reasonably attributable to project activity.

The GHG emission sources included in or excluded from the boundary of the REDD project activity are shown in Table 3.4. The selection of sources and the appropriate justification were provided in the project description (Table 3.4). Avoiding the conversion of forests to pasture can reduce emissions of N₂O and CH₄ associated with biomass burning, which is used to clear the land. These emissions have been included in emission reduction calculations. However, emissions attributed to fertilizer use, and other agricultural practices that would have occurred if the forests had been converted, were conservatively omitted. In addition, the pasture carbon pool is conservatively considered in the baseline calculation.

Table 3.4. GHG sources included in or excluded from the REDD project boundary.

Source		Gas	Included?	Justification/Explanation
Baseline	Burning of woody biomass	CO ₂	Included	Major emissions source
		CH ₄	Included	CH ₄ emissions during burning of biomass for land clearance
		N ₂ O	Included	N ₂ O emissions during burning of biomass for land clearance
	Combustion of fossil fuels	CO ₂	Excluded	Potential emissions are negligible
		CH ₄	Excluded	Potential emissions are negligible
		N ₂ O	Excluded	Potential emissions are negligible

Source		Gas	Included?	Justification/Explanation
Project	Use of fertilizers	CO ₂	Excluded	Not applicable
		CH ₄	Excluded	Not applicable
		N ₂ O	Excluded	Not applicable
	Burning of woody biomass	CO ₂	Included	Major emissions source
		CH ₄	Included	Major emissions source
		N ₂ O	Included	Major emissions source
	Combustion of fossil fuels	CO ₂	Excluded	Emissions associated with the combustion of fossil fuels due to leakage prevention activities are always considered insignificant.
		CH ₄	Excluded	Potential emissions are negligible
		N ₂ O	Excluded	Potential emissions are negligible

3.3.3 Jurisdiction Boundary

The jurisdiction of relevance to the project is the State of Pará, Brazil, as defined and allocated by Verra under the VMD0055 Project Activity Data Allocation (PADA) process and communicated to the project proponent in the PADA Report VCS-3738⁵⁹. This jurisdiction corresponds to the area used by Verra for the derivation of activity data allocation parameters, area-weighted emission factors and the jurisdictional forest cover benchmark and deforestation risk maps that are applied in the project's baseline calculations, in accordance with Appendix 1 of VMD0055. The jurisdiction has been defined by Verra following the criteria described in Section A1.2.1 of Appendix 1 (VMD0055, (VERRA, 2024c)) and provided to the project proponent together with the UDefLB boundary, Forest Cover Benchmark Maps and risk maps specific to Pará State. Figure 3.1 shows the project area and its leakage belt in relation to the jurisdictional boundary (Pará), according to Section 3.12.1 of the VCS Standard.

⁵⁹ VCS_3738_PADA_REQUEST.zip

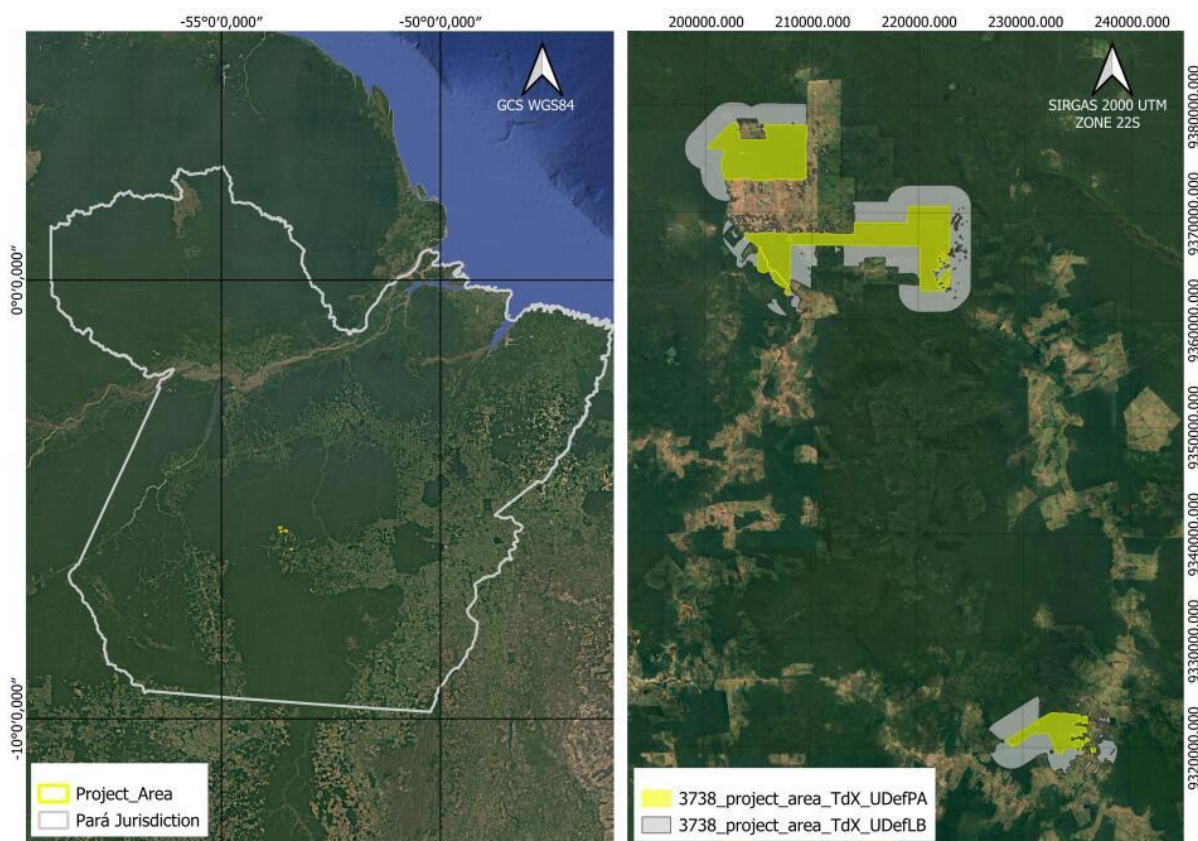


Figure 3.1. Location of the Triunfo do Xingu Grouped REDD Project area and its leakage belt (UDefLB) in relation to the jurisdictional boundary of the State of Pará, Brazil.

3.3.4 Avoiding Unplanned Deforestation Project Area (UDef PA)

The project area was structured according to methodology VM0048 (VERRA, 2023a) and its module VMD0055 (VERRA, 2024c). In accordance with VM0048, the forested project area within each discrete activity must be continuous, clearly delineated, and include only land that has qualified as forest for at least 10 years before the project start date, without arbitrary exclusions of adjacent forest areas where deforestation could reasonably occur. During the transition from VM0015 to VM0048, the project boundaries were reviewed under these requirements, resulting in a more precise definition of the forest extent. The mapping process applied updated datasets from MapBiomass Collection 9 (2022), which improved spectral discrimination and corrected previous classification inconsistencies found in older collections. In the Amazon, forest areas classified under MapBiomass Collection 6 (2020) may appear expanded in newer collections solely due to algorithmic updates and methodological refinements, not because of real land-cover changes. These improvements, along with the requirement under VM0048 to maintain continuous forest polygons, explain the minor difference between the originally validated area (10,636.02 ha) and the updated project area (10,704.58 ha). The final polygon was confirmed after removing overlaps with public and private lands, conservation units, and non-forest areas (peatlands and tidal marshes), in line with VMD0055 criteria. Therefore, the updated area represents a more accurate,

high-resolution representation of the forested lands under project implementation, fully compliant with the methodological and definitional requirements of VM0048.

Therefore, three stages were carried out: (i) land reconstitution, (ii) modeling of the project area and (iii) fine-tuning via GIS tools.

I - Land reconstitution

In the first stage, the property registrations were restored using the coordinates in the land documents⁶⁰, using the most recent versions of the property registrations, with these coordinates being tabulated and replicated in the QGis software. In addition, an analysis was made of overlaps with public and private areas, based on the Rural Environmental Registry (SiCAR, 2024), Land Management System (INCRA, 2024), National Property Certification System (INCRA, 2024), National Registry of Conservation Units (CNUC, 2024), National Foundation for Indigenous Peoples (FUNAI, 2024) and the Pará Land Institute (ITERPA, 2024), which were removed. At the end of this stage, the “Dissolve” tool was applied to unite the polygons into a single feature, eliminating overlaps between properties and avoiding errors in duplicating the project area.

Figure 3.2 and Figure 3.3 represent the project area in relation to the public and private areas to verify the overlaps.

⁶⁰ Land_documents.zip

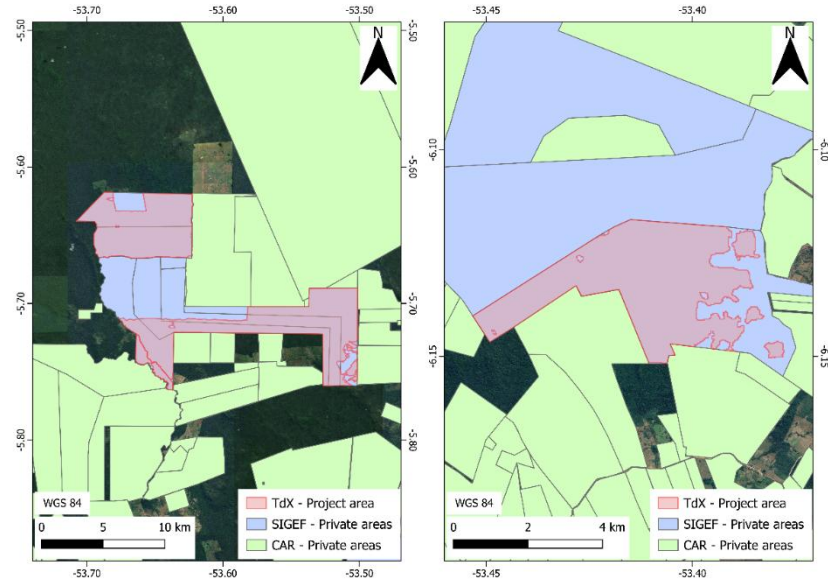


Figure 3.2. Project area in relation to the base of private areas.

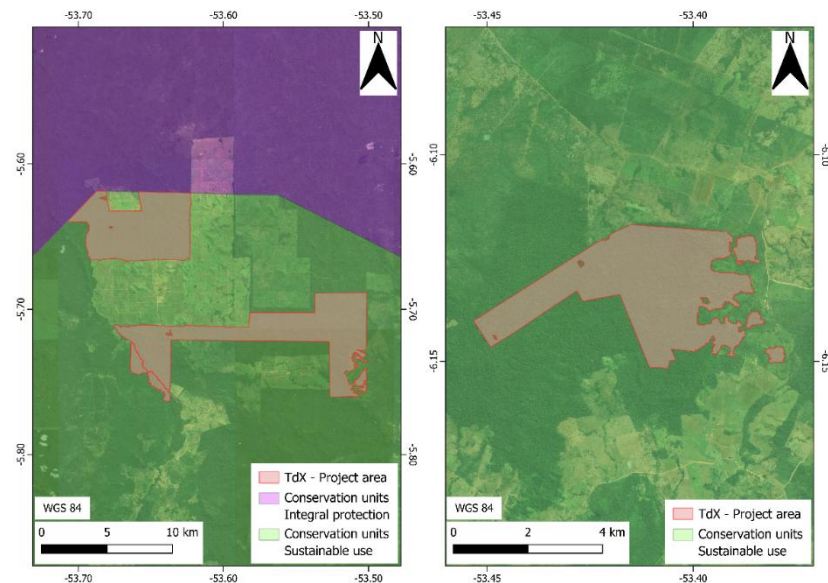


Figure 3.3. Project area in relation to the base of public areas.

II - Modeling of the project area

In the next step, the areas of the properties were processed to identify the forest regions⁶¹. The areas classified as forest were based on Mapbiomas Collection 9, for the year 2022, considering classes 3 (“forest”) and 6 (“floodable forest”), both belonging to classification level 1, with an accuracy of over 90% (Ferreira Jr et al., 2024). The use of class 6 is due to changes in the classification methodology for class 3 in Mapbiomas Collection 9.

⁶¹ 260109_TdX_CL18_item4_Annex.zip

After this selection, overlaps with peatland and wetland areas were removed, following the criteria of methodology VM0048 (VERRA, 2023a), in module VMD0055 (VERRA, 2024c). These areas were identified using the peatland/wetland distribution dataset developed by Gumbrecht et al. (2017) and are provided as GIS files in Annex⁶².

With the final raster file, the “rasterio.features.shapes” function conversion tool was applied, and the layer was projected to the WGS84 coordinate system (EPSG:4326).

For a final treatment and to facilitate the calculation of areas, the shape was separated into simpler parts and only contiguous areas were considered⁶³, following VM0048 (VERRA, 2023a) and the FAO definition of forest⁶⁴ (FAO, 2018), totaling 15 final features.

Figure 3.4 shows Mapbiomas 2022, from collection 9, peatland areas and the final project area, with the high-resolution satellite image that was used to validate the final area.

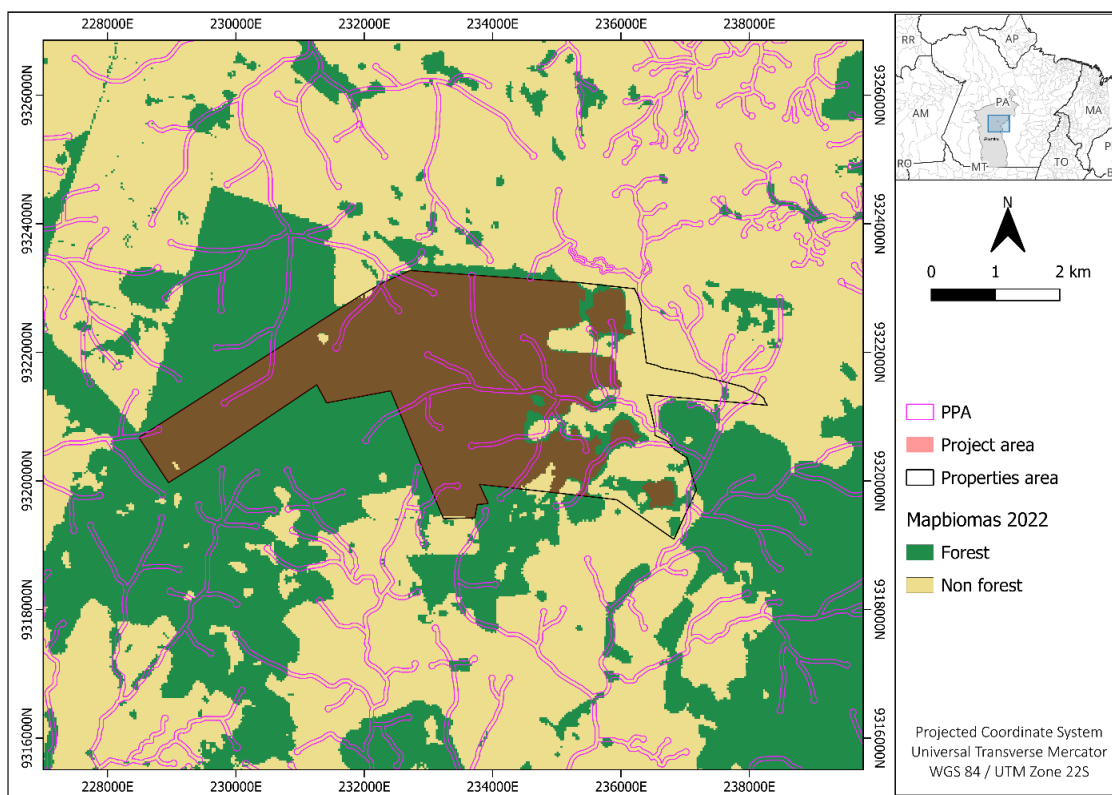


Figure 3.4. Project area, Mapbiomas collection 9 classification, peatland areas and high-resolution image.

⁶² 260115_TdX_UdefPA_Annex.zip

⁶³ VM0048: “The forested project area (within each discrete area of project activity) must be continuous without arbitrary exclusions of forests in the same geography (e.g., without excluding forests next to villages around which deforestation is likely to occur).”

⁶⁴ FAO (2020): “Forest: land spanning more than 0.5 ha with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.”

III - Fine-tuning via GIS tools

A clearing area was also removed, on the Fazenda Belcon property, registered by owner Rafael Sefer, with a total area of 365.49 ha, according to documentation⁶⁵ issued on August 26, 2020, prior to the start date of the project. In this document, there is a map with the respective clearing area polygon, which was georeferenced and replicated as a shapefile, so that areas classified as forest, which are in the project area and intersect with this polygon, were removed.

Based on high-resolution images made available by Planet, in August 2022, a validation of the forest⁶⁶ areas, defined according to the VMD0055 methodology (VERRA, 2024c), was carried out in the rocky outcrop regions, located to the east of the Fazenda Campo Lindo property.

In a final analysis, two shapefiles were downloaded with two official versions of the zoning of the conservation unit “Estação Ecológica Terra do Meio”, bordering the project in the northern portion: one on the website of the National Registry of Conservation Units (CNUC) and the other on the website of the area's administrator, the Chico Mendes Institute for Biodiversity Conservation (ICMBio). With these files, the overlaps with the project area were removed.

Therefore, the project area totals 10,704.58 ha as shown in Figure 3.4⁶⁷.

3.3.5 Avoiding Unplanned Deforestation Project Leakage Belt (UDef LB)

The avoiding unplanned deforestation project leakage belt (UDef LB) delimitates the area to which unplanned deforestation by geographically constrained agents may be displaced and is monitored as part of the project's leakage assessment. For this project, the UDef LB was provided by Verra via the PADA request process, its geometry contained in the file ‘3738_TdX_Project_Area_V2_UDefLB.gpkg’⁶⁸. The boundary of the UDef LB was determined by Verra following the criteria described in Section A1.2.2 of Appendix 1 of VMD0055 (VERRA, 2024c), and corresponds to the Stable Forest class of Verra's forest cover benchmark map at the start of the jurisdictional baseline validity period (Pará State BVP1, 2019-2024) within a buffer region surrounding the project area (the minimum buffer distance of 2 km was used). The baseline activity data (UDef LB AD) allocated to the leakage belt, provided in PADA report, was also determined by Verra in accordance with Section A1.4.3 of Appendix 1 of VMD0055. The UDef LB spatial extent and AD allocation are presented in Table 3.5. The spatial relationship between the UDef PA and UDef LB, is presented in Figure 3.5.

⁶⁵ Clearing area documentation

⁶⁶ VM0048: “In addition to the definition set out in the VCS Program Definitions and the requirements of the VCS Methodology Requirements, for this methodology, “forest” must include woody vegetation with a canopy cover of between 10 and 30 percent, as used in the relevant country's international reporting to the UNFCCC”

⁶⁷ 260115_TdX_UdefPA_Annex.zip

⁶⁸ VCS_3738_PADA_REQUEST.zip

Table 3.5. UDef PA and UDef LB areas and baseline AD

Layer	Area [ha]	Baseline AD [ha/year]
UDef PA	10,704.58	256.356
UDef LB	15,924.51	367.784

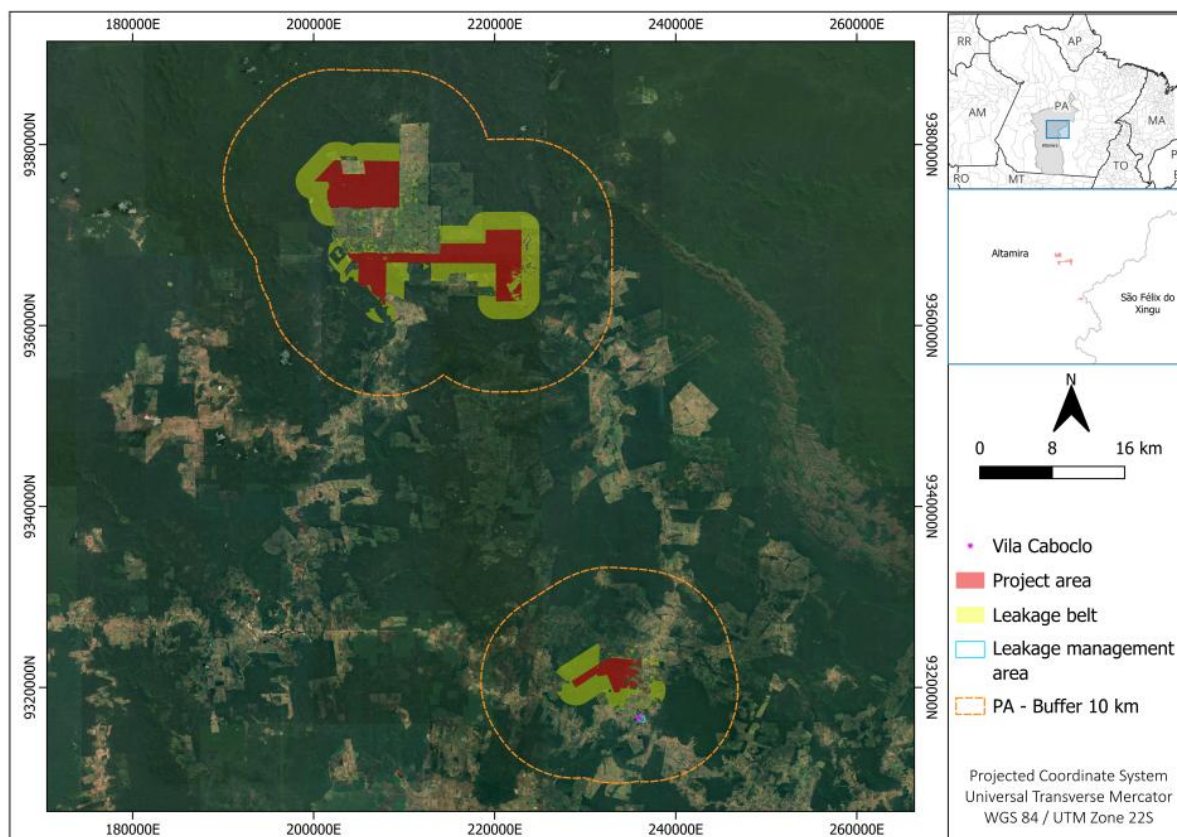


Figure 3.5. Location of the Triunfo do Xingu Grouped REDD Project area (red) and its avoiding unplanned deforestation leakage belt (UDef LB, green) as defined by Verra through the PADA allocation for Pará (PADA Report VCS-3738)

The project proponent will apply any necessary subtractions from the UDef LB AD and implement the related monitoring and discounting procedures exactly as described in VMD0055, ensuring that any excluded areas and associated baseline adjustments are transparently documented and subject to VVB assessment as deviations from the project description

3.3.6 Land Available for Activity-Shifting Leakage

Geographically mobile agents may displace their activities outside the UDef PA and beyond the UDef LB. Under VMD0055, the area relevant to such geographically mobile activity shifting – the parameter $A_{Available}$ – is assessed by Verra and, according to Section 5.1.4 of VMD0055 (VERRA, 2024c), it corresponds to all “potentially arable, physically accessible, and unprotected land in the country” at the start of the jurisdictional baseline validity period. The associated emission factor for activity shifting outside the UDef LB – the parameter ΔC_{OLB} – is then determined by Verra following the criteria and

procedures described in Sections A2.1 and A2.2 of Appendix 2 of VMD0055 (VERRA, 2024c). The emission factor value is $\Delta C_{0LB} = 424.99 \text{ tCO}_2\text{eq ha}^{-1}$ (provided in the PADA Report VCS-3738⁶⁹), and the available area is $A_{Available} = 37,796,398.08 \text{ ha}$ (informed by Verra upon request by the project proponent).

3.3.7 Leakage Management Zones

Leakage management zones are part of the overall project design. These are areas under the control of the project, and where the project proponent intends to implement activities to minimize the risk of activity-shifting leakage, such as afforestation, reforestation, sustainable forest management, enhanced cropping, or grazing land management. Leakage management zones may overlap with another VCS AFOLU project. Emissions associated with the implementation of leakage mitigation measures may be omitted for portions of leakage management zones that fall within another VCS AFOLU project when these emissions are accounted for by the other project.

The leakage management zone for this project was defined as the non-forest area encompassing Caboclo's Village residences and infrastructure and has an area of 41.9 ha. The criteria considered selecting the leakage management zones were described in Section 1.19.

Briefly, there are no settlements, indigenous lands or traditional communities within the project area or surrounding areas, instead there are two main villages: Caboclo Village and Canopus Village. These communities belong to the territory of Altamira, 1,400 kilometers away from the municipal seat. Caboclo Village is located close to the properties that are part of the Triunfo do Xingu Grouped REDD+ Project: Belcon, Campo Limpo, Patacho, Retiro Encantado, Santa Marta and Vó Lina Farms; at 60 kilometres, and 8 km from Nossa Senhora Aparecida Farm. Canopus Village is located about 60 km from the headquarters of the Nossa Senhora Aparecida Farm. Therefore, due to the proximity of the project area and being close to the project boundary, Caboclo village was selected as the leakage management zone.

In this matter, it is important to highlight that the Caboclo Village encompasses not only the central cluster of houses, but also the surrounding area, including adjacent properties where other members live, with the central village being the main gathering area. As such, the village also serves as a hub on the Canopus highway, providing access roads to properties in the region, especially in the leakage belt, where members of the community live or work. See Section 1.19 for evidence and maps showing more details on the relationship between Caboclo village and the dynamics of deforestation in the region. Therefore, the village is a strategic location for engagement, awareness-raising and partnerships aimed at reducing deforestation, both to protect the project area and to mitigate deforestation in the leakage belt.

Educational activities will be implemented in this location with the community to reduce the risk of leakage near the project area and its surrounding belt. A detailed plan of activities at the leakage management zones can be found in the attached document⁷⁰. Leakage management in this zone, as defined in leakage management plan⁷⁰, focuses on environmental initiatives in collaboration with Caboclo Village residents and TdX local stakeholders actively involved in the leakage management zones.

⁶⁹ PADA Report - VCS 3738.pdf

⁷⁰ 250203_LeakageManagementPlan.pdf

The leakage management zone boundaries are indicated in Figure 3.6, whose corresponding vector files are presented in annex⁷¹.

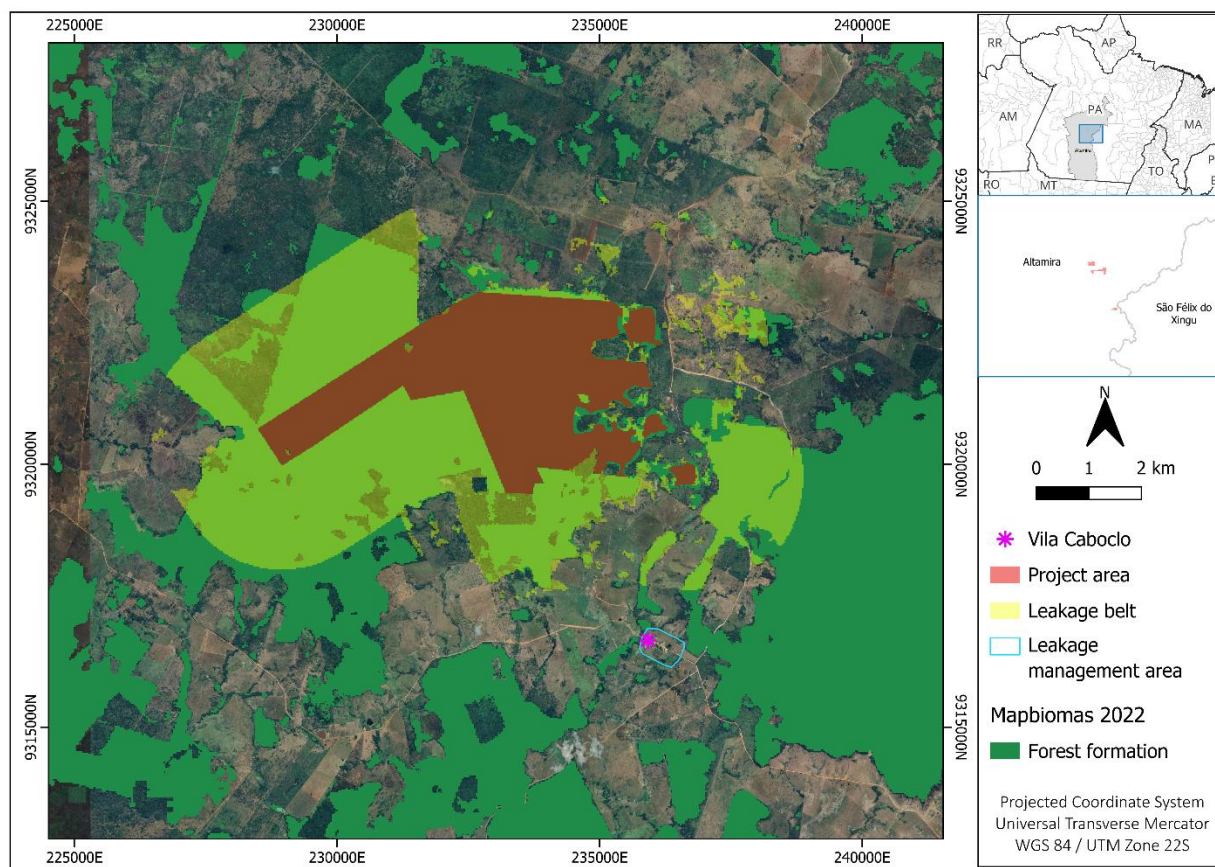


Figure 3.6. TdX leakage management zone.

Leakage management activities in the leakage management zone are defined in Section 1.12, where it will focus on environmental initiatives in collaboration with the Caboclo Village residents, TdX local stakeholders with direct actuation in the leakage management zone. Emissions related to the implementation of leak mitigation are addressed in Section 4.3.

3.3.8 Project Activities Region

The project activities region comprises the avoiding unplanned deforestation project area (UDef PA), the avoiding unplanned deforestation project leakage belt (UDef LB), and the surrounding deforested areas extending 10 km from the UDef PA, consistent with the definition provided in VMD0055. This is the region in which the historical agents and drivers of deforestation are analyzed to determine the most plausible baseline scenario and to assess the risk of activity-shifting leakage. The determination of the most plausible baseline scenario was based on the results of the additionality analysis and is consistent with the description of the conditions prior to the project start date. The VT0001 tool was applied to assess the project's additionality, and further details are provided in Section 3.5. The spatial extent of the project

⁷¹ 230814_TdX_LMA.zip

activities region, including the UDef PA, the UDef LB, Leakage Management Zone and the 10-km surrounding deforested area, is shown in Figure 3.5 of the PD. More information on the project activities implemented in these areas is provided in Section 1.12 of the PD.

3.4 Baseline Scenario

3.4.1 Determination of the Most Plausible Baseline Scenario

This section determines the most plausible baseline scenario follows exactly the structure and requirements set out in Section 6.1 of VM0048 and summarizes the more detailed analysis of VT0001 presented in Section 3.5 of the PD.

Step 1: Reuse the plausible alternative land use scenarios to the REDD project activity that have been listed as an outcome of Sub-step 1b of the additionality tool VT0001

Determination of the most plausible baseline scenario builds on the outcome of the additionality analysis and is consistent with the description of the conditions prior to the project start date, in accordance with Section 6.1 of VM0048. In Step 1, the project reuses the plausible alternative land-use scenarios identified in Sub-step 1b of VT0001, as detailed in Section 3.5 of this PD. The alternatives considered for the land within the project boundary are: (i) continuation of the pre-project land use with business-as-usual (BAU) activities; (ii) implementation of the same project activities without registration as a VCS AFOLU project; and (iii) logging conducted through sustainable forest management in the legal reserve. With the evidence presented in Section 3.5 on historical land-use practices, weak enforcement and economic incentives, the continuation of the pre-project land use (scenario i) is identified as the most plausible baseline alternative in the absence of carbon finance, reflecting the prevailing BAU dynamics of cattle expansion and land grabbing in the region

Step 2: Application of VT0001 investment analysis (Option II)

VT0001 requires the use of either investment analysis or barrier analysis to demonstrate additionality and identify the baseline scenario. For this project, investment analysis was selected, and VT0001 Option II (comparison of the financial attractiveness of the alternatives) was applied, since at least one land-use scenario generates financial benefits other than carbon revenues. The investment analysis confirms that, without carbon revenues, the project activity is less financially attractive than the BAU scenario, and that landowners have limited incentives to maintain forest cover beyond the level observed under current practice. Consistent with VT0001 Option II and VM0048 Section 6.1, the baseline scenario is therefore taken as the most economically attractive land-use option, which in this case is the continuation of the pre-project land use (scenario i), confirming it as the most plausible baseline scenario for the project.

Step 3: Where barrier analysis is used to demonstrate additionality

In section 6.1 of VM0048, Step 3 provides additional procedures for cases where barrier analysis is used but does not allow determination of the baseline scenario. Since the project did not apply VT0001 barrier analysis and was able to identify the most plausible baseline scenario directly through VT0001

investment analysis (Option II), Step 3 is not applicable in this case. The baseline scenario is thus fully defined by the outcomes of Steps 1 and 2 described above

3.4.2 Description of Baseline Scenario

Once determined, the baseline scenario was described through a detailed analysis of the agents, proximate causes, drivers and underlying causes of deforestation in the region of project activities. Understanding “who” is deforesting and what motivates their decision is necessary to understand the risk of activity change leakage and to design effective measures to address deforestation.

In this section, we establish the most probable future scenario for the project area in the absence of the carbon project. This is based on an assessment of agents, drivers, and historical patterns of deforestation. The baseline period is the 6-year period between 2022 and 2028, following the project start date.

3.4.3 Analysis of agents, drivers, and underlying causes of deforestation and their likely future development

According to Instituto Nacional de Pesquisas Espaciais (INPE, 2020), by the year 2020, the Amazon Biome had lost 730,000 km² of its native forests. The most affected part is found in the state of Pará, the second-largest state in Brazil, with a territorial extension of approximately 1,250,000 km². The state encompasses 144 municipalities with an estimated population of 8,777,124 inhabitants, making it the most populous in the amazon region and the ninth most populous in the country (IBGE, 2020).

The TdX-I1 project area is in the Altamira municipality, which extends over 160,000 km² in the central part of Pará. Altamira is the most deforested district in the Legal Amazon as of 2021 (G1, 2021), with an average deforestation rate of over 70,000 ha year⁻¹ (TerraBrasilis, 2022). This rate has seen an increasing trend in recent years, as shown in Figure 3.7.

In the following sections, we provide evidence that the main cause of deforestation in the region is the illegal suppression of forests for the implementation of pastureland, which is driven by the economic attractiveness of this activity and encouraged by a lack of law enforcement and overall sense of impunity.

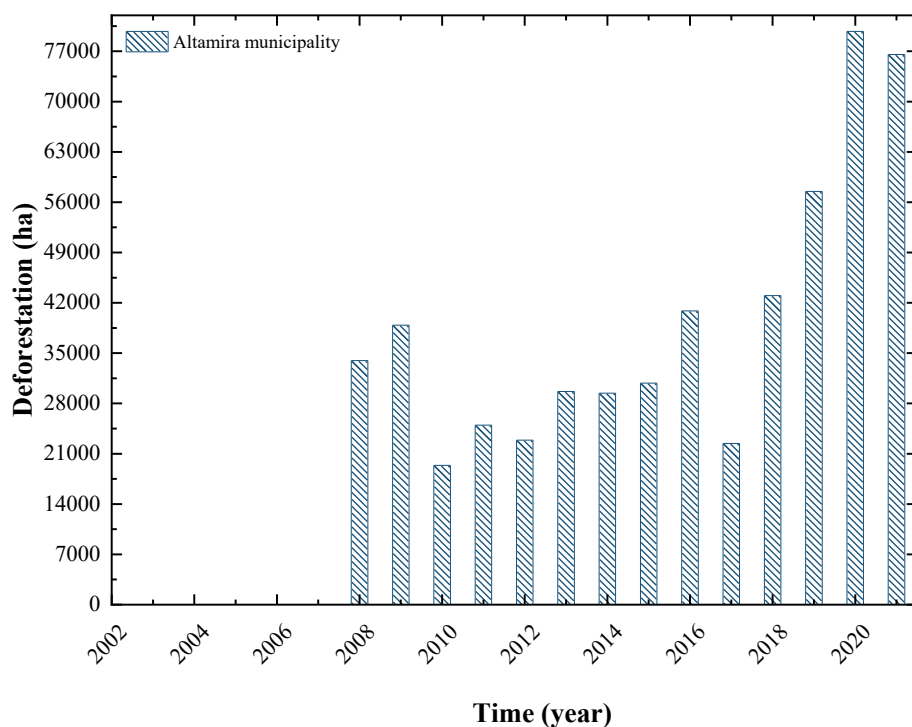


Figure 3.7. A comparison between the annual deforestation curves in the Altamira municipality, where the project is located.

3.4.3.1 Identification and Characterization of Deforestation Agents

Livestock activity in the Amazon Biome has expanded almost continuously throughout its occupation history, stimulated by the ever-increasing domestic and foreign market demands for beef and the still relatively low prices of land in the region. The evolution of the livestock size in the municipality of Altamira, displayed in Figure 3.8, reflects this expansion. It is worth noting that the herd size, which seemed to have reached a steady value by 2016, has recently taken on a new growing trend.

Figure 3.8 (bottom) also shows a comparison between the herd sizes in different municipalities of Pará and Brazil. São Félix do Xingu, a major district adjacent to Altamira, is at the top of both the regional and national ranks, holding around 2.5 million heads of cattle (IBGE, 2021a). The fact that São Félix do Xingu has consistently displayed the highest deforestation rates in Brazil during the last decade (GFW, 2022) is strongly suggestive of the link between deforestation and livestock activities in the region. The herd size of Altamira is expected to increase by up to 41% until 2032 and 66% until 2052 (the project lifetime), according to statistical projections conducted with official IBGE (2021a) data from the 5 years prior to the project start date (Figure 3.8). This significant pace of growth in cattle-related land uses is likely to increase the deforestation pressure in Altamira and nearby regions. The correlation between livestock activities and forest suppression can be more clearly established by examining historical land cover and land use maps around the project area (see Section 4.1.2.1 for details).

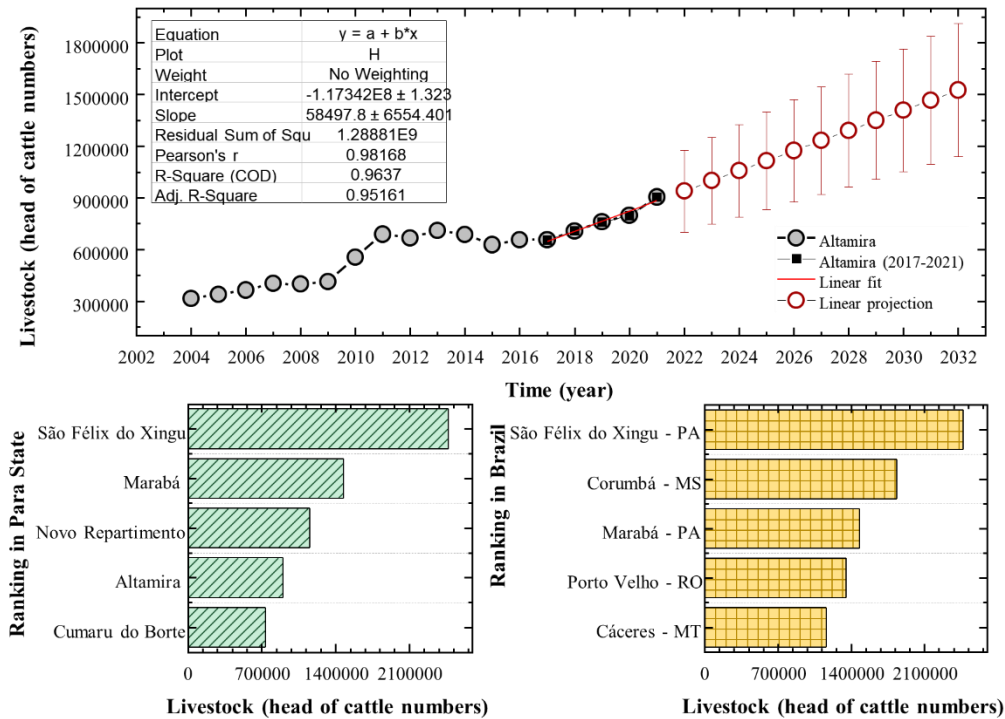


Figure 3.8. Top: herd size in the Altamira municipality as a function of time and linear extrapolation to future years. Bottom: ranking of livestock production in the state of Pará (left) and Brazil (right) by municipality, according to 2021 data (the state abbreviations are: Pará (PA), Mato Grosso do Sul (MS), Rondônia (RO), and Mato Grosso (MT)). Source: IBGE (2021a).

From this, we conclude decisively that the main agents of deforestation in the region are the operators of livestock activities, also known as cattle farmers or ranchers. This conclusion is also reinforced by forest fire report data (Figure 3.9) (INPE, 2022b), since the use of fires to “clean” the land to make room for pastures is known to be a common practice, due to the logistical and legal difficulties of using other methods such as tractors. This information can be verified in the attached field report, which describes the deforestation pattern observed in the project surroundings⁷². Historically, the fires in the southwest of Pará occurred most frequently in old areas of conversion, demonstrating that the use of fire continues to be a management tool for the maintenance of pastures (Souza et al., 2017). It is worth pointing out that the Triunfo do Xingu Conservation Unit, where the project area is located and which extends across the municipalities of São Félix do Xingu and Altamira, was the Amazon conservation unit that burned the most in August 2020, concentrating 49.60% of the total number of fire spots (INFOAMAZONIA, 2020).

⁷² 240508_TdXDeforestationPattern.pdf

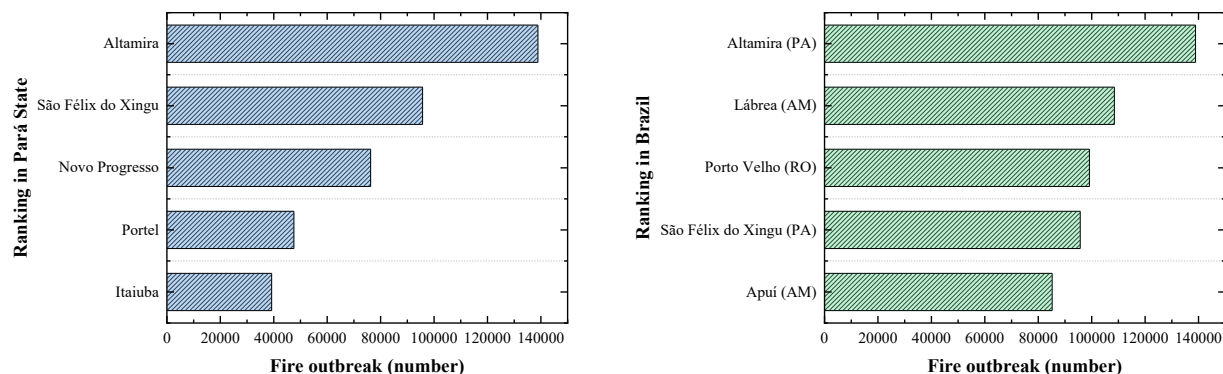


Figure 3.9. Ranking of the fire outbreak (numbers) in Pará State (left) and in Brazil (right) from October 2021 to October 2022.

It should be stressed that livestock activities are not solely advanced by individuals with regularized ownership of their land. Land grabbers or “squatters” (“grileiros”) also act as this type of agent in the region. Land grabbing (“grilagem”) is a criminal practice that involves invading, occupying, subdividing, and illicitly obtaining the ownership of either public or third-party lands, often resorting to violent means. To claim the invaded land as their own, land grabbers usually provoke fires to clear the area and implement cattle-raising operations. The cattle operation is typically precariously conducted since it serves mainly as a front scheme in their attempt to legitimize their hold of the land. Although land-grabbers may profit from livestock-related activities, their goal is to sell the land to either unsuspecting or complicit buyers, such as large-scale farm owners seeking to expand their activities by acquiring land from squatters – far from being a secondary problem, this is a widespread practice among large property owners in the region (COSTA, 2013).

From this analysis, it is concluded that livestock operators (cattle farmers or ranchers) are the main agents of deforestation in the project activities region, including property owners who clear land beyond legal limits, land-grabbers (grileiros) and large-scale ranchers who expand their herds by acquiring illegally occupied lands. The detailed characterization of this composite agent group, including its deforestation dynamics, social and economic context and expected evolution in line with projected herd growth in Altamira and surrounding municipalities, is presented in Table 3.6. In order to comply with the summary requirements of VMD0055, Section 5.2.1, this information is further organized in Table 3.7 using the same structure as Table 1 of VMD0055, explicitly distinguishing between geographically constrained cattle farmers residing within or near the UDef PA and UDef LB and geographically mobile incoming cattle ranchers and associated investors, and summarizing their baseline impacts and expected evolution under the project scenario, including potential activity-shifting leakage.

Table 3.6. Identified agents of deforestation: summary.

Information	Description
Name of agent group	Cattle farmers

Information	Description
Description of the agent	The deforestation dynamics from livestock activities is fulfilled through coordinated action carried out by three players: property owners who deforest their land beyond the limits established by law, land-grabbers, and large-scale property owners, as described above. Thus, for properly describing and analyzing the deforestation dynamics these players must be assessed jointly as a single composite agent, since there is a single deforestation mechanism, carried out by 3 components in an interdependent process. For instance, the land-grabbers invade public or private lands and clear their forests to develop a front in the attempt to legitimize their claim of the invaded land. In turn, large-scale property owners, complicit with the land grabbers' activities, acquire illegally occupied land in their property's surroundings to expand their livestock activities. This deforestation pattern and other relevant social, economic, and cultural features associated with cattle farming in the region are thoroughly described in the attached report⁷³ elaborated by Systemica's field team.
Probable development of the agent's population size	The agent's activity is related to the increasing demand for cattle livestock. Thus, this estimative can be associated with the herd size projected based on the last five years (2017-2021). Given these dynamics, the herd size is expected to increase by up to 41% until 2032 and 66% until 2052 (the project lifetime), according to statistical projections conducted with the official data from IBGE (2021a) (Figure 3.8). This significant pace of growth in cattle-related land uses will likely aggravate deforestation pressures in the region.

Table 3.7. Summary of activities of geographically constrained and geographically.

Unplanned deforestation agent type	Residing location at start of the Baseline Validity Period	Impact in the UDef PA and UDef LB under the baseline scenario	Evolution of practices due to project implementation (project scenario)
Geographically constrained – Cattle farmers (property owners, land-grabbers and large-scale ranchers)	Residing within or near the UDef PA and UDef LB in the municipalities of Altamira and São Félix do Xingu, where livestock is the dominant land-use and	Clear forest mainly for pasture expansion, using fire as a common tool for initial conversion and ongoing pasture maintenance, leading to high	A portion of agents is expected to adopt project-supported mitigation measures (improved compliance with legal reserve requirements, stronger

⁷³ 240508_TdXDeforestationPattern.pdf

Unplanned deforestation agent type	Residing location at start of the Baseline Validity Period	Impact in the UDef PA and UDef LB under the baseline scenario	Evolution of practices due to project implementation (project scenario)
	herd sizes are among the largest in Pará and Brazil.	historical deforestation rates in the Triunfo do Xingu region and surrounding areas.	enforcement and monitoring, engagement with field teams) and stop or reduce deforestation; another portion may continue deforesting at reduced levels; residual pressure may be displaced to the UDef LB, where it is monitored as activity-shifting leakage from geographically constrained agents.
Geographically mobile – Incoming cattle ranchers and associated investors	Residing elsewhere in Pará or other Brazilian states and potentially migrating into the project activities region in the absence of the project, attracted by relatively low land prices and opportunities for pasture expansion.	Under the baseline, these agents would migrate into or near the UDef PA and UDef LB, acquire land (often from land-grabbers) and convert forest to pasture, reinforcing the regional trend of herd and deforestation growth projected for Altamira and neighboring municipalities.	Project implementation (protection of the UDef PA, increased monitoring and enforcement, and reduced availability of forest land for illegal expansion) is expected to reduce the attractiveness of migrating into the project area; some agents will not migrate or will shift their activities to non-forest or already converted areas outside the UDef PA and UDef LB (no leakage), while any remaining migration-related

Unplanned deforestation agent type	Residing location at start of the Baseline Validity Period	Impact in the UDef PA and UDef LB under the baseline scenario	Evolution of practices due to project implementation (project scenario)
			deforestation occurring outside the UDef LB is accounted for as leakage from geographically mobile agents using the jurisdiction-level ΔC_{OLB} parameter from VMD0055.

3.4.3.2 Identification of Drivers of Deforestation

Once the deforestation agent is identified, the next step is to analyze the motivations and factors influencing which forest areas are more likely to be affected. These factors, referred to as "deforestation drivers," determine the extent and location of deforestation within the region of interest.

Drivers explaining the quantity of deforestation

Economical attractiveness of livestock farming

It can be established directly that the primary driver is the economic attractiveness of livestock farming. The implementation of the extensive type of cattle ranching practiced in most of the Pará state is relatively straightforward and requires only low levels of capital investment (IMAZON, 2015; Láu, 2006; Rivero et al., 2009). Furthermore, it is an activity with high liquidity and short-term revenues. It is also of low risk since the global demand for cattle products has been steadily increasing over the years (WWF, 2018). This provides sufficient incentive for the ranchers' decision to continue to engage in illegal deforestation for land clearance. The fact that the herd size within the Amazon Biome grew from 130 to 220 million heads between 1985 and 2020, more than 150% in 35 years (IBGE, 2020), provides a measure of the development of livestock activity in the region and, as evidenced by the data in Figure 3.8, there is no indication that this trend will slow down in future years. Since project measures can't influence market demands we expect the deforestation pressure imposed by this driver to remain active throughout the project years. However, as pointed out in Section 1.12, the carbon project might stimulate other landowners to adhere to its concept (especially considering that this is a grouped project), possibly generating an increased number of sustainably managed areas. In this way, the project might tackle this deforestation driver indirectly, as it presents to local stakeholders a well-succeeded example of income alternatives that are equally or more attractive than livestock farming.

The overall perception of impunity

The non-compliance with environmental laws, the intense activity of land grabbers, and the willingness of large-scale farmers to partake in and even boost such illicit schemes – these are all enabled by inapt governance concerning land ownership and a generalized lack of law enforcement in the Amazon region,

as will be discussed in more details in the subsection “Land-use policies and their enforcement” (see references therein). Thus, the overall perception of impunity and the perspective of turning high profits from criminal enterprises can also be listed as a significant deforestation driver in the region. Unfortunately, there is no indication on the part of governmental institutions that effective measures will be taken to alleviate this situation, so this driver is also expected to persist during project years. While planned project measures, such as patrolling, surveillance and community engagement, may have a positive impact concerning this issue, the effects will be limited to the immediacies of project properties.

Identification of the Underlying Causes of Deforestation

Deforestation agents act according to conditions set in a broader context involving social, political, and economical factors – these constitute the underlying causes of deforestation to be discussed in this section. For the TdX-I1 Project – and, in fact, for the entire state of Pará – the main underlying causes can be traced to inadequate land-use policies, worsened by a lack of law enforcement and poverty.

Land-use policies and their enforcement

According to the Brazilian Forest Code, landowners in the amazon region are required to have 80% of their property area covered with forest. However, the lack of law enforcement by local authorities, alongside an increasing need for pastureland has created a scenario of almost complete disregard for this mandatory provision (COSTA, 2013). Moreover, the prevalence of scarcely populated areas and the vast distances to be covered for proper surveillance makes tracking illegal activities extremely difficult and the control of unplanned deforestation has proven to be ineffective so far. Only 45% of deforestation in the region is detected in such a way that inspectors can respond promptly, and the violators are made accountable only in 24% of the occurrences. Among these, 26% are judged in the first instance, a process that may drag on for years (three years on average, according to data obtained from the analysis of 11,823 assessments from 2008 to 2013). Fines, seizure of products involved in environmental violations, the embargo on deforested areas, and blocking of assets are some of the possible punishments. However, the actual application of these sanctions under current policies is often slow and ineffective. Therefore, the economic advantage obtained by exploring illegal activities is perceived as greater than the punitive risk (Margulis, 2003; UnBCiência, 2016; WWF, 2022). Given such circumstances, we may confidently state that inadequate policies and lack of law enforcement are and will continue to be underlying causes of deforestation in the region during the project's lifetime, which sets its likely future development. Although the project cannot solve this deeply rooted problem through its activities, it can set an example of a profitable and sustainable land-use alternative in the region and encourage neighbors to adopt similar practices.

Poverty

In 2020, the average monthly salary in the municipality of Altamira was about 2.1 times the minimum wage (or approximately R\$ 2,200) with 13.4% of its total population formally employed. In terms of these indicators, Altamira performs relatively well when compared to other municipalities in the state of Pará, or even in Brazil. However, by 2010, 41.5% of its population lived in households where the average monthly income per capita was only half a minimum wage or less, a situation that likely has not changed (IBGE, 2020). This metric, depicted in Figure 3.10, shows that the district of Altamira faces poverty issues.

Poverty has a major impact on deforestation since the main agents (cattle ranchers, operationally supported by loggers and land-grabbers) can easily recruit cheap manpower, consisting of workers struggling to sustain their families. Therefore, poverty is recognized as an underlying cause of deforestation, and its likely future development is that it will persist during the project's lifetime. While the project activity obviously cannot solve the pervading poverty issue, it may provide new jobs for local workers who will be able to support their families through a legal and sustainable initiative.

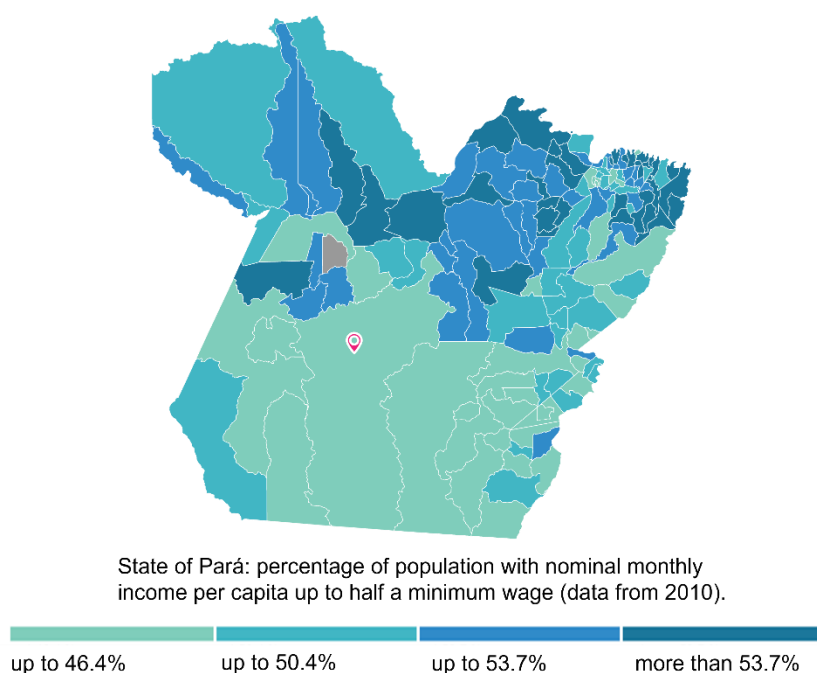


Figure 3.10. Map showing the metric "percentage of the population with monthly income per capita of half a minimum wage or less" for each of the municipalities in the state of Pará (adapted from IBGE).

Analysis of Chain of Events Leading to Deforestation

In light of the points raised above, we may now identify the chain of events that lead to deforestation in the project region and its surroundings. It can be summarized as follows: The high market demand for livestock products and the availability of cheap labor due to prevailing poverty makes cattle ranching an economically attractive activity in the region. This creates pressure for converting forest areas into pastureland. At the same time, policies and laws intended to prevent widespread deforestation within private properties are hindered both by difficulties associated with the monitoring of the region and by a slow and ineffective juridical system. This makes illegal deforestation to be generally perceived as a low-risk activity, encouraging land-grabbers who engage in criminal methods to take hold of land seeking to profit from its subsequent sale, destroying the forest in the process. To aggravate, large-scale property owners often partake in this illicit scheme, acquiring land from squatters to expand their activities into neighboring areas. Finally, most of the pasture areas in the state of Pará tend to be poorly managed, with no concern for the soil's health, and once the soil is degraded new pasture areas must be opened thus propagating further deforestation.

In this conjuncture, an investigation of historical deforestation patterns suggests that the only factors that seem to partially deter deforestation outside fully protected conservation units are those associated with terrain constraints, such as the presence of high elevation and high declivity areas, inadequate for cattle raising.

Presently, there is no indication that any of these causal links are likely to change in the future; quite the opposite, the trend indicates that the pressure posed by deforestation drivers is likely to increase in the nearby areas. Thus, the fate of the region is expected to correspond to a scenario where forest areas are suppressed up to the saturation point when anthropic activities reach their limit due to the abovementioned landscape constraints.

Conclusion

The analysis carried out in this section leads to conclusions that are consistent with literature and field studies, and all assertions related to historical land use and land cover data are verifiable by either direct inquiries or standard statistical methods.

In particular, the annual deforestation rates in the PA observed can be understood in terms of the dynamics between the identified players that act as a single composite deforestation agent and their motivations, as laid out in the chain of events discussed above. At the same time, there is no indication that the behavior of such players and the circumstances enabling that behavior are likely to change in the future.

Therefore, there is conclusive evidence that the baseline deforestation of the TdX-I1 project will continue to follow an overall increasing trend.

3.4.4 Projection of the deforestation

The development of the project to prevent unplanned deforestation using the VM0048 methodology required establishing an emissions baseline using AD allocated by Verra. As described in Appendixes 1 and 2 (VMD0055), the jurisdictional average annual unplanned deforestation rate and the jurisdictional emission factor for land cover transition in areas available for activity shifting outside the UDef LB are produced by Verra. Project proponents use the procedure described in this appendix to get AD for their project from Verra, then convert it into emission baselines using project-specific emission factors for the carbon pools and sources selected for the project according to sections 5.2 Carbon Pools and 5.3 Sources of GHG Emissions of VM0048 (as set out in Section 5.3.2.3). Figure 3.11 illustrates the high-level process to avoid unplanned deforestation projects by applying this module.

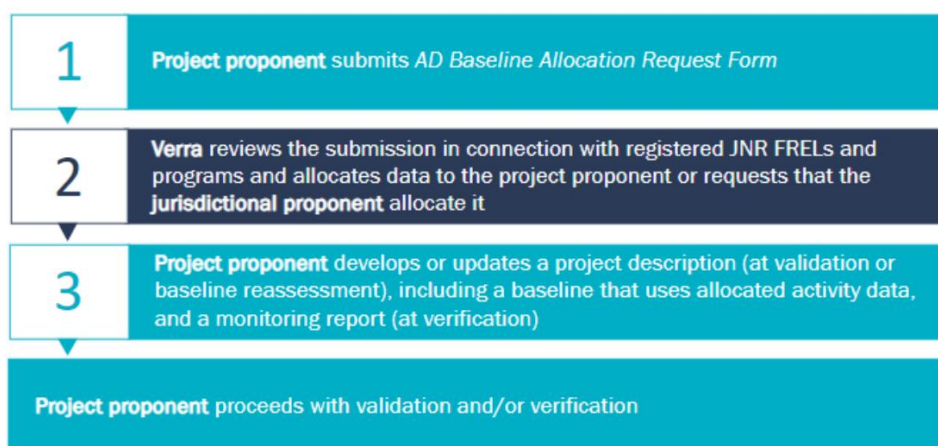


Figure 3.11. High-level baseline generation process.

The deforestation projection for the Triunfo do Xingu Grouped REDD+ Project is based on a spatial and temporal analysis covering the Historical Reference Period (HRP) from January 1, 2009, to December 31, 2018, and extends through the Baseline Validity Period (BVP) from January 1, 2019, to December 31, 2024.

The activity data allocation reveals significant annual deforestation rates within the project boundaries, with the Unplanned Deforestation Project Area (ADPA-UDef) experiencing an average of 256.356 ha year⁻¹ of forest loss, while the Unplanned Deforestation Leakage Belt (ADLB-UDef) shows a higher deforestation rate of 367.784 ha year⁻¹. These figures establish baseline deforestation patterns that inform the projection methodology and demonstrate the urgent need for conservation intervention in the region.

The Forest Cover Baseline Maps (FCBM) provide critical spatial information at 30-meter resolution using Brazil Data Cube Equal Albers Equal Area Projection, categorizing the landscape into stable forest, stable non-forest, and areas that experienced deforestation during different periods of the HRP. This temporal stratification, distinguishing between deforestation occurring in the first and second halves of the reference period, enables more precise modeling of deforestation trends and spatial patterns that drive future projections.

Risk mapping data, delivered at the same 30-meter spatial resolution and measured in ha per year, incorporates spatially explicit deforestation risk assessments that account for factors such as proximity to roads, agricultural frontiers, and historical deforestation patterns. These risk maps serve as fundamental inputs for projecting where future deforestation is most likely to occur within both the project area and leakage belt boundaries, providing the spatial dimension necessary for accurate baseline scenario development.

The area-weighted emission factor for activity shifting outside the Unplanned Deforestation Leakage Belt (ΔC_{OLB}) of 424.99 t CO₂e reflects the carbon stock changes associated with deforestation activities and provides the basis for quantifying emissions reductions achieved through project implementation.

The projection methodology recognizes forests as areas with minimum coverage of 0.5 ha, tree heights of at least 5 meters, and minimum canopy coverage of 10 percent, ensuring consistency with international definitions while accounting for local ecological conditions. Deforestation is defined as the permanent conversion to less than 10% canopy cover over 0.5 ha, treated as a gross measure that captures the full extent of forest loss without accounting for potential regrowth or restoration activities.

The spatial delineation of the Unplanned Deforestation Leakage Belt (UDefLB), following the requirements of section A1.2.2 of VCS Module VMD0055, establishes the geographical boundaries within which deforestation projections are calculated and monitored. This boundary definition ensures that the projection accounts for potential displacement effects while maintaining methodological consistency with verified carbon standards requirements for REDD+ projects operating in the Brazilian Amazon region.

3.5 Additionality

3.5.1 Regulatory Surplus

Is the project located in an UNFCCC Annex 1 or Non-Annex 1 country?

☐ Annex 1 country ☒ non-annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

☐ Yes ☒ No

If the project is located inside a non-annex 1 country and the project activities are mandated by a law, statute, or other regulatory framework, are such laws, statutes, or regulatory frameworks systematically enforced?

☐ Yes ☒ No

The above question does not apply to the case of the Triunfo do Xingu Grouped REDD+ project, since the activities are not mandated by any law, statute, or other regulatory framework.

3.5.2 Additionality Methods

The project additionally assessment was carried out according to the most recent version of the VCS tool “VT0001 – Tool for the Demonstration and Assessment of Additionally in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities, version 3.0, 1 February 2012, Sectorial Scope 14.

Both applicability conditions from the tool are met because the project AFOLU activity the same or similar to the proposed project activity on the land within the proposed project boundary performed with or without being registered as the VCS AFOLU project does not lead to violation of any applicable law even if the law is not enforced, and the most plausible baseline scenario is justified below.

3.5.2.1 Step 1. Identification of alternative land use scenarios to the proposed VCS AFOLU project activity

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

All realistic and credible land use scenarios were identified considering relevant national and/or sectoral policies and circumstances, such as historical land uses practices and economic trends. The list of credible alternative land use scenarios that would have occurred on the land within the project boundary of the VCS AFOLU project is described below:

i. Continuation of the pre-project land use (BAU activities occurring)

This scenario involves the maintenance of the preserved forest area by the landowners, without any source of supplementary income. However, no REDD+ activities are implemented, nor any stakeholder engagement to prevent the drivers of deforestation from acting as a source of carbon loss. Monitoring and surveillance measures, taken by the landowners, will be made to privilege primarily livestock activities, then to avoid any eventual external agents land invasion being conducted by forest clearing with fire, followed by cattle ranching (business as usual scenario). Only the surveillance already done by the landowners would be applied, but not enough to stop the deforestation patterns identified in Section 3.4. BAU activities that already take place in the rest of the property – and outside of the project area - will continue to occur, and no social or biodiversity activity will be carried forward.

Then, considering the context it is expected that part of the properties will be deforested by external agents considering the ratio of unplanned deforestation activity in the reference area, and because the related environmental legislation is systematically not enforced. The first actor in this process is the squatter, who does the practice of “grilagem”, as it is called in Portuguese. Once the squatters cleared the land covered with fire, without the benefits of logging, some cattle heads are placed in the area to start the domain process. Then, the ranchers take the livestock activities even in a rudimentary way.

Evidence shows that 40% of the APA Triunfo do Xingu have already been converted to other land use different from the native vegetation, being livestock the most common use (Xingumais, 2021). It was also the environmental protection area most pressured by unplanned deforestation in the first quarter of 2022 (IMAZON, 2022a).

Of the 1.68 million ha total area of APA Triunfo do Xingu, 66% of them are inside the São Felix do Xingu municipality, adjacent to the Altamira municipality, where are located the other 34% forest area of the APA (Pará State Decree Nº 2,612/2006 (SEMA, 2006)). São Felix do Xingu is the region of Brazil with the biggest number of cattle heads, having 2.468 million of them (IBGE, 2021a). For comparison purposes: the second municipality with the second highest number of cattle heads in Brazil is the municipality of Corumbá, with 1.838 million. Although Altamira does not have the amount of São Felix do Xingu's cattle heads, it is in the tenth position of Brazil with 904,271. Cattle ranching is a usual practice in the region (Xingumais, 2021), and farms can be implemented within the limits of the Forest Code, being able to deforest up to 20% of the property for pasture.

ii. Project activity on the land within the project boundary was performed without being registered as the VCS AFOLU project.

The scenario would be the same one as described in option (i), but in this second scenario, effective measures would happen to curb local illegal deforestation. Such measures were presented in Section 1.12 of this PD, they involve:

- Frequent patrolling and surveillance activities are taken by employees with this specific task. Monitoring checkpoints and the necessary equipment (food, water, motorcycles, mobile phones) will be provided to support the task.
- Satellite monitoring will be done to identify fire alarms disclosed by the Mapbiomas Alert initiative. Geospatial analysis can help to anticipate fires by tracking their advances. A deforestation pattern or regions with higher risk near the properties can be identified and provide information to create a mitigation plan.

Although being an interesting scenario, it also has the important characteristic of being completely financed by the landowners, which wouldn't receive any kind of additional revenue executing those actions.

iii. Logging being conducted through Sustainable Forest management.

Logging in the State of Pará is a practice that occurs legally and illegally. This is because the related environmental legislation is systematically not enforced, and for that logging could take place through or not the approval of the sustainable forest management plan. In a study conducted by Sistema de Monitoramento da Exploração de Madeira - Simex (IMAZON, 2022b), it was detected in the State of Pará the timber farm for an area of 57,079 ha in the period (Aug/2020 – Jul/2021), being 59% of the total area legally exploited. While for the unauthorized activity, most of it was identified within registered rural properties (17.496 ha or 75% of total illegally logging) (IMAZON, 2022b).

According to the legislation on the subject, there is the possibility to execute forest management activities in the forest areas from a Legal Reserve (LR) inside an APA. In this scenario, the landowner would have to develop and approve a sustainable forest management plan under the competent environmental agency to explore his legal reserve area. Executing forest management to benefit from timber resources is an expensive activity but that would generate some revenue for the landowners. Those resources could be used to maintain the integrity of the forest area once they start to have economic value. Actions to prevent illegal deforestation would be easier to take than patrolling and satellite monitoring, maybe not as strong and effective as in scenario (ii), but much better than doing nothing as in scenario (i).

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

Considering the three credible alternative land use scenarios from sub-step 1a, a demonstration of compliance with all mandatory applicable legal and regulatory requirements was made in the next paragraphs.

i. Continuation of the pre-project land use (BAU activities occurring).

Maintaining the activities already done before the TdX project, the landowner would continue to be in accordance with the pertinent legislation, already detailed in Section 1.15. Both Sefer and Didacio have the rights to explore 20% of their lands in the most appropriate way they decide to, according to the Brazilian Forest Code, that's what they already do and would continue to execute in this scenario. All the unplanned activities that would take place in the forest area are done by external agents, such as

squatters and ranchers that invade private and public land for cattle ranching. According to the exposed before, all the legislation that prevents unplanned deforestation in the Amazon is systematically not enforced in the project zone.

As evidenced by Figure 3.12, unplanned deforestation makes no distinction between permanent protection areas (PPAs) and other forest areas. Moreover, according to the following discussion and Figure 3.13, in which classified land use maps from the MapBiomass's Collection 6 for the year 2021 are considered, the same situation is found in the municipality of Altamira and in the APA Triunfo do Xingu, which are respectively the smallest administrative unit and the environmental conservation unit encompassing the project area.

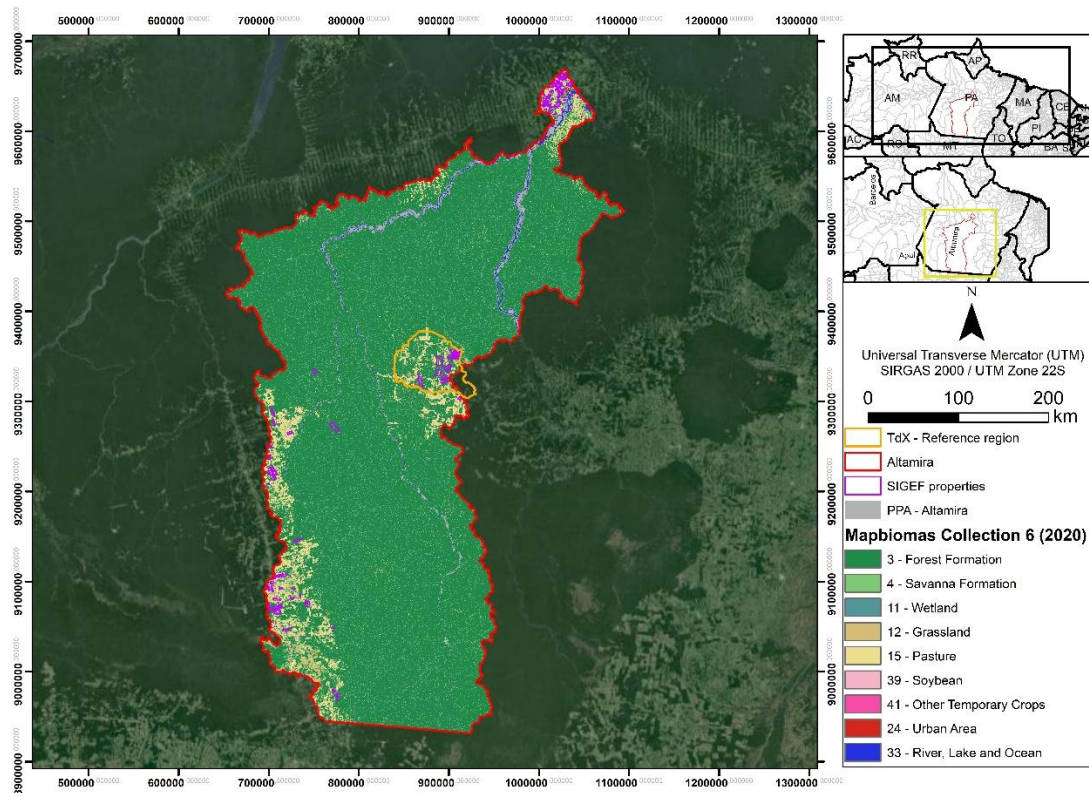


Figure 3.12 Altamira's Forest cover map with PPAs.

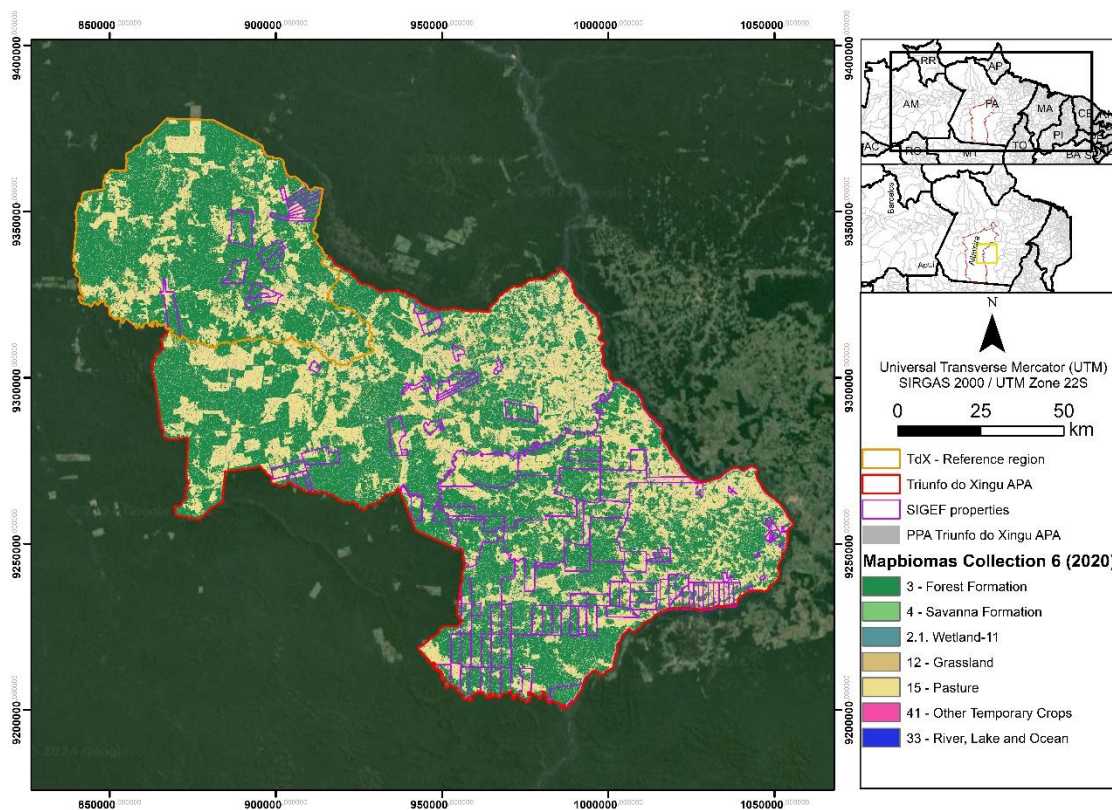


Figure 3.13 Triunfo do Xingu APA Forest cover map with PPAs.

Following Sub-step 1b, set out in Section 2.1.2. a). ii) of the VT0001, version 3.0, an analysis was carried out to verify regulatory surplus related to PPAs and legal reserve preservation. The analysis encompassed 100% of the properties within Altamira and APA Triunfo do Xingu that are registered on SIGEF, as they represent areas that are more like the project area (which are already registered on SIGEF or are advancing in the registration process). Using MapBiomas Collection 6 as the land use database, forest class was vectorized and extracted. Property data for Altamira and APA Triunfo do Xingu used as reference in this study were downloaded in July 2022, from the Land Management System (SIGEF). Additionally, Permanent Preservation Areas (PPAs) were collected from the database of the Brazilian Foundation for Sustainable Development (FBDS), complementing information about protected areas in the study region. Subsequently, APP data were intersected with the forest classification obtained from MapBiomas, identifying overlapping areas between PPAs and forested areas. Furthermore, property area data were intersected with the forest classification, allowing the identification of forested areas within the properties and the calculation of Legal Reserve requirements to comply with legislation, as well as surplus and deficit areas. Finally, various parameters were calculated, including forested PPA area in ha, PPA area covered by non-forest classes, total forest area, Legal Reserve area, total property area, Legal Reserve deficit area, and the number of properties with Legal Reserve deficits. This process is thoroughly described in the attached report and respective annexes⁷⁴.

⁷⁴ 240517_Finding_RL_APP_TdX.zip

As a result, it was observed that 43.6% of the total area of the properties within Altamira have been deforested. In this case, 34.1% of the PPAs present in SIGEF properties within Altamira have been deforested, while 26.6% of the areas that were supposed to be preserved as legal reserves are deforested. Overall, 86.3% of the properties within Altamira have a deficit in PPAs, 89% have legal reserve deficit, and 78.3% present deficits in both PPAs and legal reserves, as PPAs were not identified in some of the properties.

Further on, we can evaluate the APA Triunfo do Xingu in the same way, which is a relevant analysis because it encompasses the properties that follow strictly the same environmental rules as the project area. It was observed that 35.8% of the total area of those properties has been deforested. In this case, 33.1% of the PPAs present in SIGEF properties within the conservation unit have been deforested, while 16.9% of the areas that were supposed to be preserved as legal reserves are deforested in the area's SIGEF properties. Overall, 96.5% of the properties within APA Triunfo do Xingu have a deficit in PPAs, 76.3% have legal reserve deficit, and 75.4% present deficits in both PPAs and legal reserves.

Therefore, the combination of the information presented makes it clear and unequivocal that the Brazilian Forest Code (Law 12,651/2012), which mandates the preservation of PPAs and legal reserves, is systematically not enforced and non-compliance with it is widespread, which has been observed in way more than 30% of the properties within the municipality, as well as APA Triunfo do Xingu, in agreement with the regulatory surplus criteria established in VT0001, version 3.0.

According to the concept of additionality brought by the VCS standard, version 4.5, a project activity is additional if its resulting emission reductions represent an excess of what would be achieved under the "business as usual" scenario, and such activity would not have occurred in the absence of the financial incentives of the carbon market. Therefore, it is concluded that the deforestation of PPAs is part of the common practice and, consequently, of the "business as usual" scenario in the project's region. Although the Brazilian Forest Code (Law 12,651/2012) mandates the preservation of PPAs, their actual protection and resulting emission reductions would not occur in the absence of AUD project activities, which in turn are not required by law. Consequently, the inclusion of PPAs in the project area is indeed additional.

ii. Project activity on the land within the project boundary was performed without being registered as the VCS AFOLU project.

In terms of compliance, both landowners from the TdX-I1 comply with the legality already described in Section 1.15. Besides the economic activities done in 20% of their lands, the additional activities executed to avoid invaders do not imply compliance with any legislation that has not already been complied with.

iii. Logging being conducted through Sustainable Forest management

The Brazilian Forest Code (Law N° 12,651, 2012 (Brasil, 2012)) allows forest management practices inside the LR area of rural property, meaning that additional revenues could be generated by the landowner. The Legal Reserve is an administrative limitation that is provided for in Law 12.651/2012, in its article 12, as below *in verbis*:

"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 Permanent Preservation Areas, observing the following minimum percentages in relation to the area of the property, except in the cases provided for in Art. 68 of this Law: (Redrafted by Law No. 12727 of 2012).

I - located on the Legal Amazon

*(a) 80% (eighty percent), on the property located in a forest area"*In the same norm, with the purpose of encouraging the environmental regularization of properties, chapter XIII of the Native Vegetation Protection Law provides for the Environmental Regularization Program (PRA). Through this program, it is possible for landowners with environmental liabilities related to the irregular suppression of Permanent Preservation Areas, Restricted Use and Legal Reserves, which occurred before July 22, 2008, to adapt their properties.

Adhesion to the program is by registering in the Rural Environmental Registry (CAR), as determined by § 2nd of article 59 and § 29 of the Brazilian Forest Code, below in verbis:

"Art. 59 The Union, the States and the Federal District shall implement Environmental Regularization Programs (PRAs) for rural properties and possessions, with the aim of bringing them into line with the terms of this Chapter. (...) § 2 The registration of rural properties in the CAR is a mandatory condition for joining the PRA, which will be requested by the owner or possessor of the rural property within 180 (one hundred and eighty) days, as of the summons by the competent body, subject to the provisions of § 4 of art. 29."

(...)

"Art. 29 - The Rural Environmental Registry (CAR) is created, within the scope of the National Environmental Information System (SINIMA), as a national electronic public registry, mandatory for all rural properties, with the purpose of integrating environmental information from rural properties and possessions, making up a database for control, monitoring, environmental and economic planning and combating deforestation. (...) § 4 Owners and possessors of rural properties that register them in the CAR by December 31, 2020 will be entitled to join the Environmental Regularization Program (PRA), referred to in art. 59 of this Law." (Brasil, 2012)

Obligation that the rural properties included in the project are compliant. This is proven through a statement extracted from the National Rural Property Registration System (SICAR)⁷⁵. Therefore, according to article 60 of the Forest Code, the Legal Reserve deficit has its punishability suspended due to adhesion to the PRA, *in verbis*:

"Art. 60 - The signing of a term of commitment to regularize property or rural possession before the competent environmental agency, mentioned in art. 59, will suspend the punishability of the crimes foreseen in arts. 38, 39 and 48 of Law n° 9.605, of February 12, 1998, while the term is being complied with. (See ADIN N° 4.937) (See ADC N° 42) (See ADIN N° 4.902)"

⁷⁵ Land_documents.zip

In this same regard, it is possible to attest to the environmental regularity of Mr. Rafael Sefer and Mr. Didácio Milhomens vis-a-vis the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), an autarchy in charge of environmental preservation, since there are no fines or debts related to the referred owners in its database. Therefore, their compliance with the rules in force is proven by the negative certificate.

Some other important articles of the Brazilian Forest Code also state that:

“Art. 17. The Legal Reserve must be conserved with native vegetation cover by the rural property owner, owner or occupant in any capacity, individual or legal entity, public or private law.

§ 1 The economic exploitation of the Legal Reserve is admitted through management sustainability, previously approved by the competent body of SISNAMA, in accordance with the modalities provided for in art. 20.

(...)

Art. 20. In the sustainable management of the forest vegetation of the Legal Reserve, practices of selective exploitation adopted in the modalities of sustainable management without purpose commercial for consumption on the property and sustainable management for forest exploitation with commercial purpose.

(...)

Art. 22. Sustainable forest management of the Legal Reserve vegetation with purpose commercial activity depends on authorization from the competent body and must comply with the following guidelines:

I – do not de-characterize the vegetation cover and do not harm the conservation of the native vegetation of the area.

II - ensure the maintenance of species diversity.

III - conduct the management of exotic species with the adoption of measures that favor the regeneration of native species.” (Brasil, 2012)

Article 225, § 1st, III, of the Federal Constitution states that the government is responsible for *"defining, in all units of the federation, territorial spaces and their components to be specially protected, with alteration and suppression only allowed by law, and any use that compromises the integrity of the attributes that justify their protection being forbidden"* (Brasil, 1988). This precept is regulated by Law 9.985/2000, which established the National System of Nature Conservation Units - SNUC.

The federal law Nº 9,985/2000 also (Brasil, 2000) creates the National System of Conservation Units (Sistema Nacional de Unidades de Conservação – SNUC). By themselves, the Conservation Units (UC) may range from fully protected, where human use is restricted, to those of sustainable use, where economic exploitation compatible with environmental conservation is permitted. According to it, the classification of Conservation Units for Sustainable Use has the Area of Environmental Protection (Área

de Proteção Ambiental – APA) as one of its kind. After the SNUC conception as a mechanism of environmental protection, the Pará State Law N°2,612/2006 (SEMA, 2006) created the APA Triunfo do Xingu, where the project's properties are located. Configuring as a Conservation Unit, three articles from the SNUC legislation are relevant to being considered about forest management activities inside the property in the Legal Reserve area:

"Art. 14 - The following conservation unit categories constitute the Sustainable Use Units Group:

I - Environmental Protection Area;"

(...)

Art. 15. The Environmental Protection Area is a generally extensive area, with a certain degree of human occupation, endowed with abiotic, biotic, aesthetic or cultural attributes especially important for the quality of life and the well-being of human populations, and its basic objectives are to protect the biological diversity, discipline the occupation process and ensure the sustainability of the use of natural resources.

(...)

Art. 27. Conservation units must have a Management Plan.

(...)

§ 2 In the preparation, updating and implementation of the Management Plan for Extractive Reserves, Sustainable Development Reserves, Environmental Protection Areas and, when applicable, the National Forests and Areas of Relevant Ecological Interest, the broad participation of the resident population.

§ 3 The Management Plan for a conservation unit must be prepared within five years from the date of its creation."

Article 15 of the SNUC is regulated by Decree 4.340/2002. Therefore, it is understandable that there is the possibility of exploitation of forest products, including timber, in accordance with the redaction given to article 25 of the decree, below in verbs:

"Art. 25 - The exploration of products, sub-products or services inherent to the conservation units is subject to authorization, in accordance with the objectives of each unit category.

Sole paragraph. For the ends of this Decree, products, sub-products or services inherent to conservation units are understood as follows

(...)

II - the exploitation of forest resources and other natural resources in Sustainable Use Conservation Units, within the limits established by law." (Brasil, 2002a)

At last, the Law N° 11,284/2006 (Brasil, 2006) have in its article 83 the requirement of an approval from the state public environmental agency to execute forest management activities in the forested area. Accordingly, in the light of the above, it is understood that even without a management plan to establish

the norms that guide the use of natural resources within the APA, there is legal basis for the approval of a management plan for the area. However, if the competent body denies this, it is possible to appeal to the Judiciary to guarantee compliance with these norms.

To reinforce the legal argument presented above that even though the APA does not yet have an approved management plan, it is possible to observe that other SFMPs have already been approved within the APA (Figure 3.14).

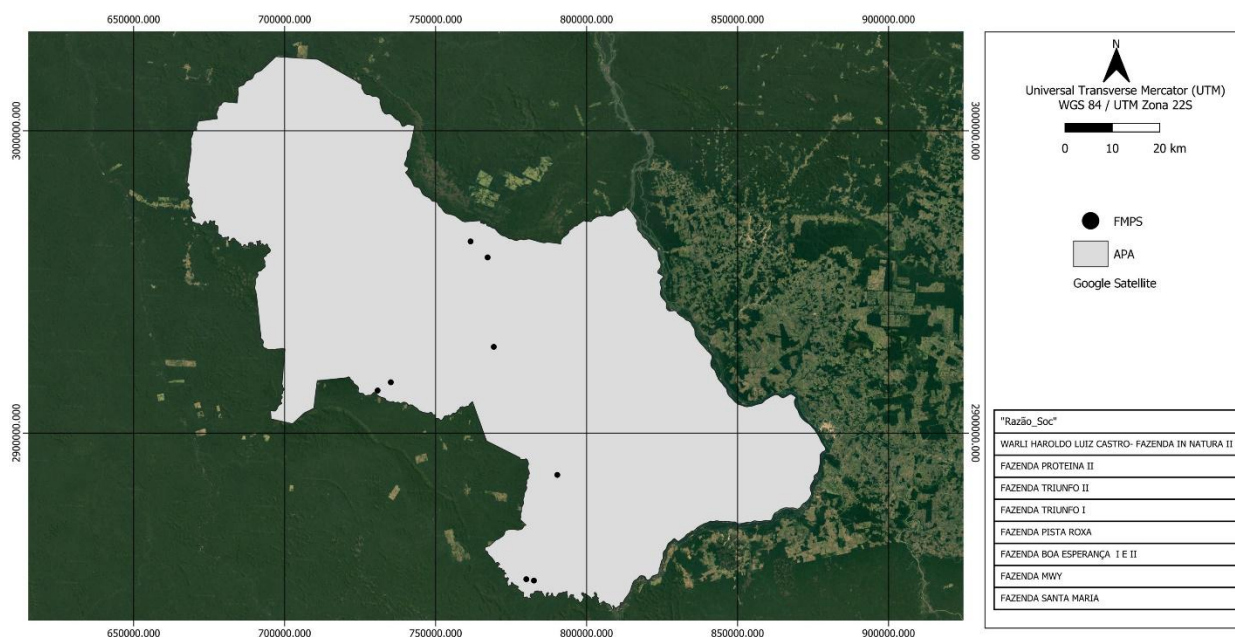


Figure 3.14 Approved Forest Management Plans inside APA Triunfo do Xingu (SEMAS, 2023).

It is also worth mentioning that in the specific case of landowner Rafael Sefer's farms, for this scenario to be considered credible and for the approval of a sustainable forest management plan, there is the need for the conclusion of the due land regularization process within ITERPA.

Considering all this legal framework, the conclusion is that despite the project area configuring a LR area inside an APA conservation unit, forest management activities could occur. The main requirement to it is the approval of a Sustainable Forest Management Plan (Plano de Manejo Florestal Sustentável – SFMP) by the competent environmental agency, and even without a management plan to establish the norms that guide the use of the natural resources within the APA, there is legal basis for the approval of a management plan for the area. Then, this scenario needs to be considered as a baseline credible option.

Sub-step 1c. Selection of baseline scenario

Based on the identified drivers of deforestation described in Section 3.4 and all the common practices and the BAU scenario, the most credible scenario for TdX to happen without the revenue of the carbon credits would be scenario (i), the continuation of the pre-project land use scenario.

Scenario (ii) is easily rejected considering that it would add only costs to the landowners, and no additional revenue to them.

Scenario (iii) was discarded mainly because of the lack of local infrastructure for the forest management production chain, resulting in higher investments and lower incomes. This affirmation is done after talking to the landowners and understanding their practical difficulties implementing a forest management regime. Also, literature research was made to better understand the scenario. According to da Silva et al. (2014), one of the main causes of disincentive forest management is the high cost of log transportation from the forest to the sawmill, representing 40% of the total logging costs. In addition, the lack of supervision over illegal timber and the bureaucracy for issuing a forest management plan makes legal timber to be less competitive in local markets.

Corroborating this analysis, (Bartholomeu et al., 2012) made a detailed assessment of the main waterways, highways, and ports necessary for wood production transportation. The result is that there are bottlenecks involving each one of them: some highways are still not asphalted, are lacking signage and bridges are in poor condition, some waterways have strong river currents and are poorly integrated with other modes of transport, some ports also are not asphalted, don't have access ramps and cargo transport equipment. Summing up those facts, scenario (iii) was discarded.

3.5.2.2 Step 2. Investment analysis

The proposed project activity, without the revenue from the sales of VCUs, is financially less attractive than scenario 1 (defined as the BAU scenario), to demonstrate that, according to VT0001 (VERRA, 2012), an investment analysis will be performed.

Sub-step 2a. Determine appropriate analysis method

According to VT0001 (VERRA, 2012), to determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis, it's required to identify if the VCS AFOLU project generates no financial or economic benefits other than VCS related income.

As the VCS AFOLU project does not generate any financial or economic benefits other than VCS related income, it was applied the simple cost analysis (Option I).

Sub-step 2b. – Option I. Apply simple cost analysis

The costs to implement REDD+ activities involve community engagement, monitoring and surveillance of the property's areas against illegal squatters, a decent infrastructure for the local workers, etc. All the most relevant costs for implementing structured monitoring, surveillance, and fire protection system were identified in partnership with the landowners and are described in Table 3.8 and Table 3.9 below. Supporting financial information is available attached⁷⁶.

Table 3.8 General CAPEX for infrastructure and equipment.

CAPEX	Unit cost [R\$]	Units required	Total cost [R\$]
Planning of the proposed activities	R\$ 144.880,00	1	R\$ 144.880

⁷⁶ 230314_Simple_costs.zip

CAPEX	Unit cost [R\$]	Units required	Total cost [R\$]
Social Diagnosis	R\$ 138.000,00	1	R\$ 138.000
Forest inventory	R\$ 235.000,00	1	R\$ 235.000
Fauna Inventory	R\$ 348.671,14	1	R\$ 348.671
Vehicles	R\$ 277.591,00	1	R\$ 277.591
Signaling Plate	R\$ 417,59	20	R\$ 8.352
Motorcycle	R\$ 29,645.00	2	R\$ 59,290

Table 3.9 General OPEX for maintaining the surveillance and monitoring system.

OPEX [R\$]	Annual cost/unit	Units required	Total annual cost [R\$]
Field Team	R\$ 25.740,00	2	R\$ 51.480,00
Vehicle Fuel	R\$ 3.000,00	2	R\$ 6.000,00
Generator Fuel	R\$ 14.600,00	1	R\$ 14.600,00
Motorcycle Fuel	R\$ 2.400,00	2	R\$ 4.800,00
Motorcycle Maintance	R\$ 12.000,00	2	R\$ 24.000,00
Surveillance and Patrolling	R\$ 42.900,00	2	R\$ 85.800,00
Courses and Training (Fire Brigade)	R\$ 20.000,00	2	R\$ 40.000,00
Social Investments (activities)	R\$ 100.000,00	1	R\$ 100.000,00
Remote Monitoring	R\$ 65.000,00	1	R\$ 65.000,00
Firebreak maintance (R\$/km)	R\$ 1.000,00	115	R\$ 115.000,00
Stakeholder consultation and community engagement	R\$ 75.000,00	1	R\$ 75.000,00

Considering that the AFOLU Project activity does not generate any financial or economic benefits other than VCS related income, as the conservation of the project area is an obligation defined by law without any financial incentive available for the APA Triunfo do Xingu, without the revenues of carbon credits, a systematic conservation activity for the areas would not be possible to occur.

3.5.2.3 Step 3. Barrier Analysis

The VT0001 (VERRA, 2012) requires investment analysis (Step 2) or Barrier Analysis (Step 3). In this case, we opted for the Investment Analysis, already described in Step 2.

3.5.2.4 Step 4. Common practices analysis

The practice of implementing a structured monitoring system by private landowners in the Amazon without the benefit of carbon credits is a rare practice, being commonly observed on public lands, by measures adopted by the State Governments for biodiversity conservation. The APA Triunfo do Xingu was created in 2006, but without an approved management plan regulating the use of the APA, nor any indication of conservation mechanisms that should be followed by private landowners.

The SNUC law allows the creation of conservative units in private lands (e.g. Private Reserve of Natural Heritage - *Reserva Particular do Patrimônio Natural* - RPPN), other mechanisms such as environmental servitude (Law N° 6,938, 1981 (Brasil, 1981)) and payment for environmental services (Law N° 14,119, 2021 (Brasil, 2021)) can be seen as mechanisms for preserving and encouraging owners to take similar measures, however less effectively compared to a REDD+ project. In the case of Environmental servitude, however, the benefits are limited to 20% of the land that the landowner has the right to explore, the preservation activity applied to an area essentially distinct from the AFOLU project area. The implementation of payment for environmental services in the region is not yet effective to implement the proposed VCS AFOLU project activities, as the financial barrier exists while there were only found 5 institutional projects in Pará State but with no reports of the same proposed VCS AFOLU project activity (PTS, 2022).

According to the Brazilian government, the RPPN are important because contribute to the expansion of protected areas in the country; have highly positive indices for conservation, especially if considered the cost and benefit ratio; are easily created in relation to the other categories of UC; enable the participation of private initiative in the national conservation effort; contribute to the protection of the biodiversity of Brazilian biomes. The general benefits of adhering to the program are preserved property rights; exemption from the ITR related to the area created as RPPN; priority in the analysis of projects by the National Environment Fund (FNMA); preference in the analysis of agricultural credit applications, with official credit institutions, for projects to be implemented in properties that contain RPPN in its perimeter; possibilities of cooperation with private and public entities in the protection, and management of the Unit (ICMBio, 2020). Despite being apparently beneficial to landowners, the creation of an RPPN on the property is ineffective to stop local deforestation, considering both the high cost of opportunity in the face of cattle ranching, as well as the dismantling of environmental agencies seen in recent years in Brazil. It is also a mechanism that presents essential distinctions between the proposed AFOLU project activity, as the resources from the RPPN are insignificant given the REDD+ project costs, and there is no MRV-A system that would give the landowner any capability in implementing a structured monitoring and surveillance system around the properties. Furthermore, no RPPN records were found in Altamira nor in Félix do Xingu (ICMBio, 2022).

The main alternative mechanism for carbon credit in the Amazon comes from the Amazon Fund, which “is a REDD+ mechanism created to raise donations for non-reimbursable investments in efforts to prevent, monitor and combat deforestation, as well as to promote the preservation and sustainable use in the Brazilian Amazon” (FundoAmazonia, 2022). However, there are some fundamental differences between the accounting and financing mechanism of projects available in Amazon fund versus the VCS REDD+ projects. In the first one, the project would only be possible if it was provided within the available

budget of the fund, furthermore, the mechanism of accounting for the GHG emissions reductions adopts different MRV-A mechanisms, besides that the program has had no more projects approval since 2019 (CNN, 2022).

In an analysis of the base data of the VCS registry, made on 10/03/2022, 23 projects registered in Brazil with some REDD activity being developed were identified, and 55 projects in total considering registered projects and pipeline projects. Of the 23 registered, the projects are in the states of Acre, Amapá, Amazonas, Pará, Mato Grosso, and Mato Grosso do Sul, States with a predominance of the Amazon biome, except for Mato Grosso do Sul. Considering the extensions of the state of Pará, no REDD+ project recorded in the VERRA registry database for the APA Triunfo do Xingu region was identified, thus characterizing an unusual practice for the region.

As it's possible to observe there are some forest conservation mechanisms available in the market with a limited applicability range, and with essential distinctions between the proposed VCS AFOLU project activity and with low effectiveness in avoiding deforestation, especially to the APA Triunfo do Xingu, the proposed VCS AFOLU project activity is not the baseline scenario and, hence, the TdX project is additional.

3.6 Methodology Deviations

There were no methodological deviations in the design and development of the project until the completion of this document. The project has already undergone validation through the VM0015 methodology, as can be verified on the Verra website. However, the project decided to migrate to the new VM0048 methodology to seek the best techniques for applicability, additionality, and calculation, with further details available in Section 1.19.3.

4 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

4.1.1 Initial Project Baseline Validity Period (BVP)

According to VMD0055 v 1.1 (VERRA, 2024c), where a project validates or transitions to VM0048 (VERRA, 2023a) and this module after the initial year of a jurisdictional BVP, an initial baseline validity period will be applied. There are two options when moving to the jurisdictional BVP:

- 1) Option 1: The project proponent chooses to be allocated UDef AD from the subsequent jurisdictional BVP (e.g., BVP 2) when that BVP begins; or
- 2) Option 2: The initial project BVP is extended into the subsequent jurisdictional BVP for the duration set out in the VCS Standard or two years, whichever is shorter. After the initial project BVP ends, the project must adopt an allocation from the respective jurisdictional baseline. This option only applies where there has been no Verra-endorsed jurisdictional BVP for five years or more.

The project will adopt Option 2 for the baseline validity period transition, as outlined in VMD0055 v 1.1 (VERRA, 2024c). This decision is primarily driven by the fact that the jurisdictional BVP 2 has not yet been released by the relevant jurisdiction.

Under Option 2, the initial project BVP 1 will be extended into the subsequent jurisdictional BVP for the duration set out in the VCS Standard or two years, whichever is shorter. This approach allows the project to maintain its current baseline framework while awaiting the availability of updated jurisdictional baseline data and allocation methodologies. Once the initial project BVP period concludes, the project will transition to adopt an allocation from the respective jurisdictional baseline when it becomes available. This approach ensures continuity in project monitoring and reporting while maintaining alignment with the jurisdictional framework requirements, providing a practical solution during the interim period before new jurisdictional baseline data becomes accessible.

4.1.2 Baseline Emissions

The main steps that were taken to estimate the project baseline are outlined in Figure 4.1.

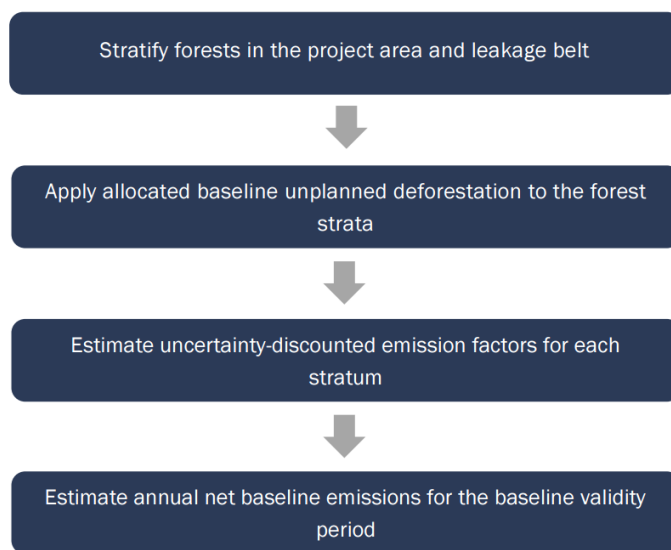


Figure 4.1. Process for estimation of the project baseline.

4.1.2.1 Estimation of Emissions from Carbon Stock Changes

The carbon stocks before and after deforestation for the forest stratum within the UDef PA and UDef LB were estimated to allow estimation of the change in carbon stocks resulting from deforestation within each forest stratum.

Biomass estimation

A forest inventory⁷⁷ was carried out to estimate forest biomass in the tree and palm stock. To do this, 56 cluster plots were systematically distributed throughout the area according to the biomass inventory SOP⁷⁸. The geographical coordinates⁷⁹ with the central point of the cluster plots are available for consultation by the auditors.

The Figure 4.2 shows the distribution of the plots in the area, with 9 cluster plots installed in Didácio's area and 47 cluster plots installed in Séfer's area.

⁷⁷ 251218_ForestInventoryTdX.xlsx

⁷⁸ SOP_IF_TDX_version_1.2.pdf

⁷⁹ 240216_ClusterPlotsPoints.zip

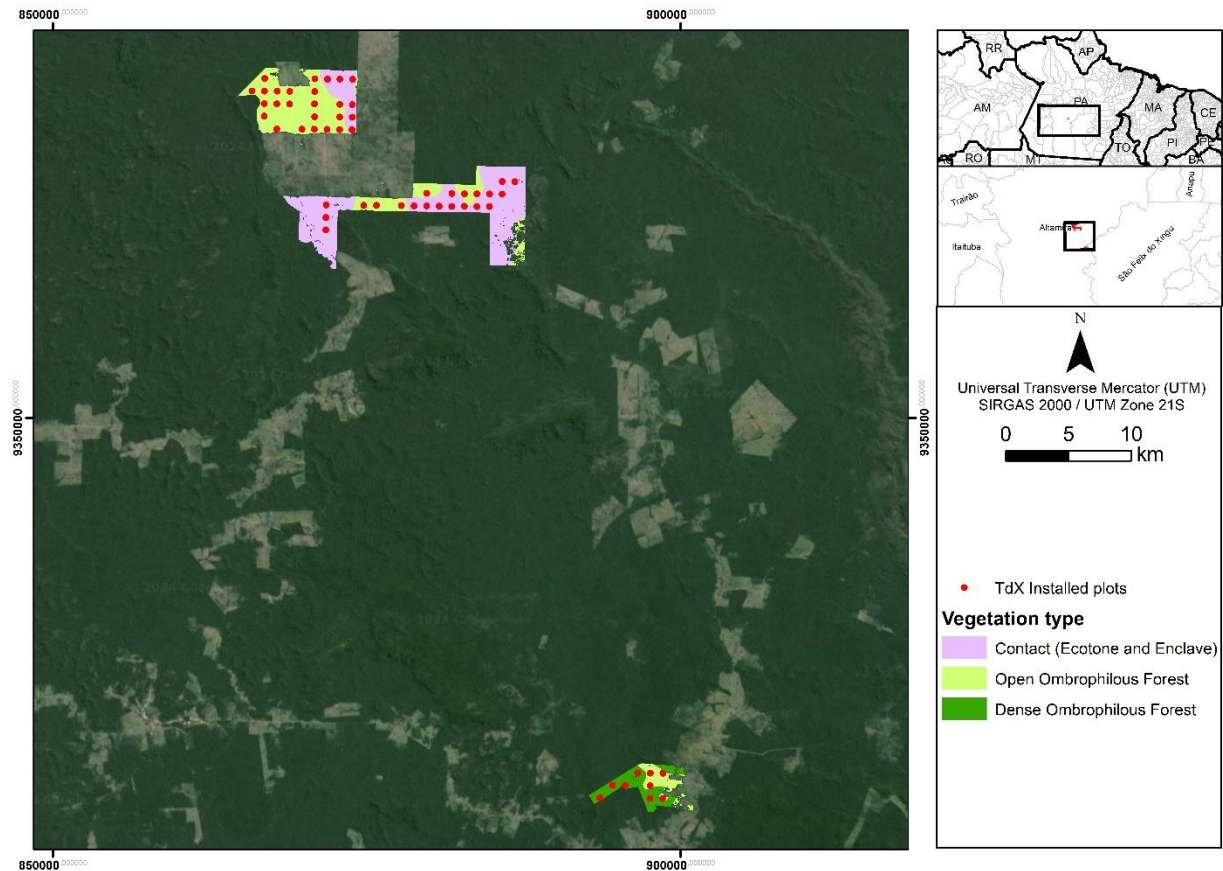


Figure 4.2. Distribution of the forest inventory cluster plots.

Initially, a test of means (t-test, 95% confidence interval) was applied to evaluate whether there are statistically significant differences in biomass means between the Open Ombrophilous Forest and Dense Ombrophilous strata. In this test, the null hypothesis assumes that the means of the two strata are equal, while the alternative hypothesis assumes that the means are different. The results showed a p-value greater than 0.05. Therefore, the null hypothesis is not rejected, indicating no statistically significant difference between the strata. For analytical purposes, the fragment can be considered as a single sampling unit.

The result of the inventory complies with the requirements of the methodology, showing an overall relative error of 5.44% on the mean value for a 90% confidence interval. The Table 4.1 shows the statistical parameters of the biomass inventory.

Table 4.1. Forest inventory statistical parameters.

Parameters	Unit	Global
Area	ha	10,704.58
n		56

Parameters	Unit	Global
Aboveground biomass	t.d.m.ha ⁻¹	275.37
Aboveground tree biomass	t.d.m.ha ⁻¹	263.99
Aboveground palm tree biomass	t.d.m.ha ⁻¹	11.39
Variance within	(t.d.m.ha ⁻¹) ²	9,489.62
Variance between	(t.d.m.ha ⁻¹) ²	2,229.43
Variance	(t.d.m.ha ⁻¹) ²	11,719.05
Standard deviation	t.d.m.ha ⁻¹	108.25
r		0.19
Correction factor		1.57
Mean variance	(t.d.m.ha ⁻¹) ²	82.18
Standard error	t.d.m.ha ⁻¹	9.07
Absolute sampling error	t.d.m.ha ⁻¹	15.17
Relative sampling error	%	5.75%
Coefficient of Variation	%	41.01%
Upper confidence interval	t.d.m.ha ⁻¹	279.15
Lower confidence interval	t.d.m.ha ⁻¹	248.82

The forest inventory showed a negative exponential diameter distribution for both strata (Figure 4.3). It is usually in an uneven-aged stands (Skovsgaard, 2004) in the Amazon biome. This distribution is common in forests with no intensive disturbance with a larger number of individuals with smaller DBH values (Rubin et al., 2006).

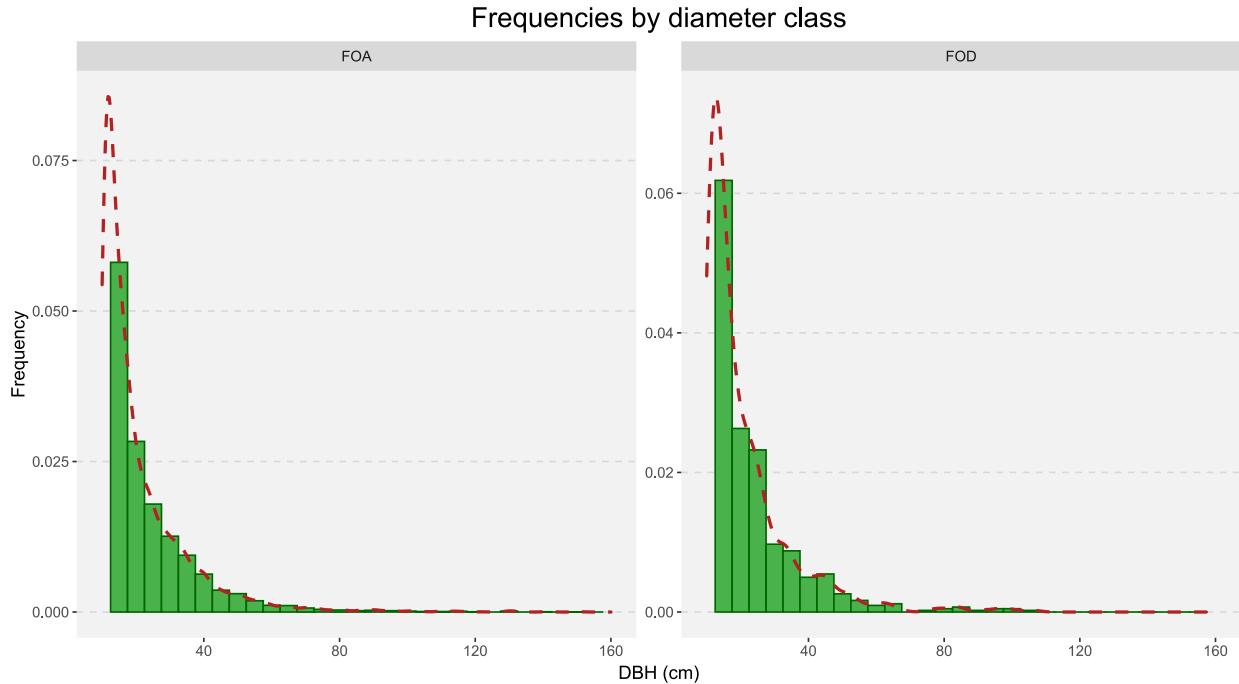


Figure 4.3 Histogram and frequency curves of DBH in both strata.

When the analysis is stratified by species groups (Figure 4.4), *Cecropia sp.* is strongly concentrated in the smallest diameter classes, consistent with its pioneer status and rapid growth dynamics. Palm trees also occur predominantly in the smaller diameter classes but display a narrower distribution and lower density compared to *Cecropia sp.* The remaining species (“General”) exhibit the broadest diameter distribution, spanning from small to large DBH classes and encompassing the few individuals that attain the largest diameters within the fragment. Collectively, these patterns underscore ongoing regeneration processes, the coexistence of pioneer and non-pioneer species, and the structural complexity of the forest across both strata.

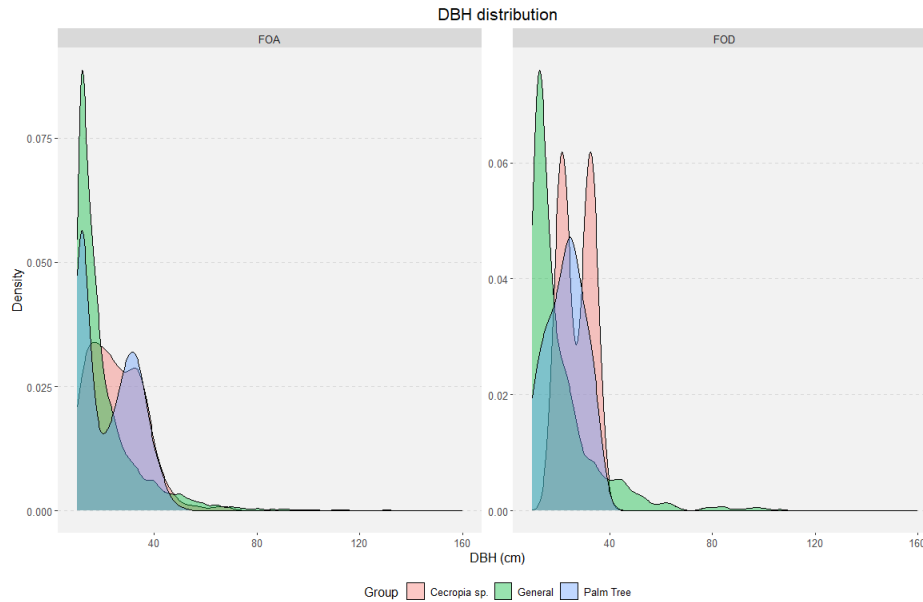


Figure 4.4. Diameter distribution of individuals in FOA and FOD strata.

Regarding the percentage of biomass by group (Figure 4.5), the 'General' group accounted for approximately 95% of the total biomass and encompasses a wide range of species, including pioneers, secondary, and climax species. In contrast, palm trees contributed about 4%, and *Cecropia* sp. represented only 0.5%. Fitting separate models for each species group ensures greater precision in the results. By applying allometric models tailored to the specific characteristics of each group, biomass estimates become more consistent with the actual structure and composition of the vegetation.

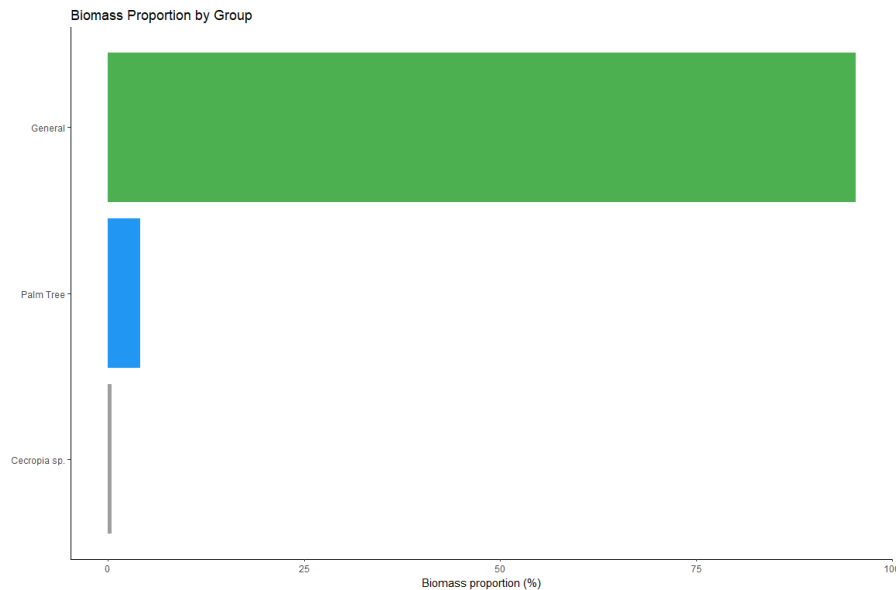


Figure 4.5. Proportional biomass per group in percentage.

Step 1: Estimation of Carbon Stocks per Forest Stratum

Estimation of Forest Carbon Stocks

Carbon stocks in all pools and carbon sources selected for the project are estimated to use VCS modules applicable to the project.

Table 4.1. Carbon pools used in this module, with originating modules and resulting parameters.

Pool	Module	Parameters	Parameter Description
Aboveground tree biomass	VMD0001	$C_{AB_tree,i}$	Mean carbon stock in the aboveground tree biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
		$C_{AB_tree,post,i}$	Mean carbon stock in the post-deforestation aboveground tree biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
Belowground tree biomass	VMD0001	$C_{BB_tree,i}$	Mean carbon stock in the belowground tree biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
		$C_{BB_tree,post,i}$	Mean carbon stock in the post-deforestation belowground tree biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
Aboveground non-tree biomass	VMD0001	$C_{AB_nontree,i}$	Mean carbon stock in the aboveground non-tree woody biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
		$C_{AB_nontree,post,i}$	Mean carbon stock in the post-deforestation aboveground non-tree woody biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
Belowground non-tree biomass	VMD0001	$C_{BB_nontree,i}$	Mean carbon stock in the belowground non-tree woody biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
		$C_{BB_nontree,post,i}$	Mean carbon stock in the post-deforestation belowground non-tree woody biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)

Estimation of Non-Forest Carbon Stocks

Post-deforestation carbon stocks were assumed to be the area-weighted average stocks of all post-deforestation land use classes present in a 10 km wide area around UDef PA, referencing the most current land use/land cover classification covering the jurisdiction. This area-weighted average stock of post-deforestation land uses was calculated for a single area-weighted average stock of the post-deforestation land use class, according to VMD0055 v1.1.

One notable aspect is the project's endeavor to maintain conservative estimations of emission reduction. Agents for deforestation operate within a variable timeframe dictated by land demand. It is important to highlight that land grabbers use livestock as a tool for occupation (real estate speculation) and, therefore, are not interested or do not have the resources to develop high-productivity livestock farming, with high-quality pastures and good maintenance. In this way, pastures are generally degraded and have regenerating vegetation. Therefore, the majority of post-deforestation land uses present in a 10 km wide area around UDef PA are pastures, with 97.50% (Table 4.2)⁸⁰. The calculations considered land uses after deforestation. This percentage is in line with the baseline and deforestation drivers proposed by the project.

To estimate post-deforestation carbon stocks, the average carbon stocks of pasturelands and secondary forests were sourced from Silva Neto et al. (2012) – Table 1 – 7.87 ± 0.53 t d.m. ha⁻¹ (aboveground and belowground: 9.61 ± 0.61 t d.m. ha⁻¹, considering root-shoot ratio of 0.221 (IPCC, 2019) and Heinrich et al. (2021) – Supplementary Table 8 – $2.7 \times 20 = 54 \pm 23$ t C ha⁻¹ (or 108 ± 46 t d.m. ha⁻¹), respectively. Conservatively for the growth of secondary forests, very low water deficit and recovery in 20 years were selected. The study considered that all analysis was carried out in the original product units but expressed as aboveground carbon by assuming a 2:1 ratio of biomass to carbon. Therefore, the carbon fraction was transformed into biomass and then converted to the values and parameters present in the PD. The value above ground and below ground, considering a root-to-shot of 0.221 (IPCC, 2019), was 131.87 ± 47.27 t d.m. ha⁻¹.

Table 4.2. Post-deforestation land is used present in a 10 km wide area around UDef PA.

Land use/land cover	Coverage area (%)	Biomass (t d.m. ha ⁻¹)	Carbon stock (t CO _{2e} ha ⁻¹)
Pasturelands	97.50%	Aboveground: 7.87 ± 0.53 Belowground: 1.74 ± 0.31 Total: 9.61 ± 0.61	Aboveground: 13.56 ± 1.08 Belowground: 3.00 ± 0.55 Total: 16.56 ± 1.32
Secondary Forests	2.50%	Aboveground: 108 ± 46 Belowground: 23.87 ± 10.88 Total: 131.87 ± 47.27	Aboveground: 186.12 ± 79.67 Belowground: 41.14 ± 18.83 Total: 227.26 ± 97.28
Area-weighted average stock			Aboveground: 17.87 ± 2.25 Belowground: 3.96 ± 0.71 Total: 21.83 ± 2.36

Forest carbon stock in aboveground tree biomass was estimated using the biomass inventory (Step 1). The carbon component of dry matter of 0.47 t C t d.m.⁻¹ was used when converting biomass measured in Mg ha⁻¹ to t C ha⁻¹ (IPCC, 2006b). The value of t CO_{2e} ha⁻¹ was obtained considering the molar weight of CO₂ (44 g mol⁻¹) divided by C (12 g mol⁻¹). The aboveground was converted into belowground biomass through a root-shoot ratio. According to the updated IPCC report (IPCC, 2019), the value used for the ratio

⁸⁰ 250925_Post-deforestation.xlsx

of belowground biomass to aboveground biomass was 0.221 for the tropical forest of natural origin. Post-deforestation carbon stock in aboveground tree biomass was taken from peer-reviewed literature, considering average degradation and the total dry mass (as described in the subsection "Estimation of Non-Forest Carbon Stocks"). The total values for the carbon stock in the aboveground and belowground biomass were indicated in Table 4.3.

Table 4.3. Estimation of Carbon Stocks per Forest Stratum.

Parameter	Forest stratum*			
	As	Standard error	Ds	Standard error
Average biomass stock in the above-ground biomass pool (AB_tree) (Mg ha ⁻¹)	263.99	9.07	263.99	9.07
Average biomass stock in the above-ground non-tree biomass pool (AB_nontree) (Mg ha ⁻¹)	11.39	1.09	11.39	1.09
Average total biomass stock in the above-ground biomass pool (Mg ha ⁻¹)	275.37	8.96	275.37	8.96
Average biomass stock in the below-ground biomass pool (BB_tree) (Mg ha ⁻¹)	58.34	3.55	58.34	3.55
Average biomass stock in the below-ground non-tree biomass pool (BB_nontree) (Mg ha ⁻¹)	2.52	0.31	2.52	0.31
Average total biomass stock in the below-ground biomass pool (Mg ha ⁻¹)	60.86	3.60	60.86	3.60
Mean carbon stock in the aboveground tree biomass pool (C _{AB_tree,i}) (t CO ₂ e ha ⁻¹)	454.94	24.88	454.94	24.88
Mean carbon stock in the belowground tree biomass pool (C _{BB_tree,i}) (t CO ₂ e ha ⁻¹)	100.54	7.47	100.54	7.47
Mean carbon stock in the aboveground non-tree woody	17.74	1.81	17.74	1.81

Parameter	Forest stratum*			
	As	Standard error	Ds	Standard error
biomass pool ($C_{AB_nontree,i}$) (t CO ₂ e ha ⁻¹)				
Mean carbon stock in the belowground non-tree woody biomass pool ($C_{BB_nontree,i}$) (t CO ₂ e ha ⁻¹)	3.92	0.50	3.92	0.50
Average carbon stock in the total biomass carbon pool ($C_{total,i}$) (t CO ₂ e ha ⁻¹)	577.14	17.44	577.14	17.44

*As – Open Ombrophylous Forest; Ds – Dense Ombrophylous Forest.

Step 2: Estimation of Emissions from Carbon Stock Changes

Stock changes (ΔC_p) in each carbon pool were calculated by subtracting post-deforestation carbon stocks from forest carbon stocks. Stock changes were calculated for each pool in each forest stratum using Equation 1, which was applied to all parameters included in Table 4.1.

$$\Delta C_{p,i} = C_{p,i} - C_{p,post,i} \quad \text{Equation 1}$$

Where:

$\Delta C_{p,i}$	Estimated emissions from carbon stock change in pool p in forest stratum i (t CO ₂ e ha ⁻¹)
$C_{p,i}$	Estimated carbon stock in pool p of forest stratum i (t CO ₂ e ha ⁻¹)
$C_{p,post,i}$	Estimated carbon stock in post-deforestation pool p in forest stratum i (t CO ₂ e ha ⁻¹)
p	Carbon pool: aboveground tree biomass (AB_tree), aboveground non-tree biomass (AB_nontree), belowground tree biomass (BB_tree), belowground non-tree biomass (BB_nontree)
i	1, 2, 3, ..., M forest stratum

The results for estimating emissions from changes in carbon stock considering the post-deforestation stock as well as the errors associated with them can be seen in Table 4.4.

Table 4.4. Estimation of Emissions from Carbon Stock Changes.

Carbon stock	$C_{p,i}$ t CO ₂ e ha ⁻¹	$U(C_{p,i})$ t CO ₂ e ha ⁻¹	$C_{p,post,i}$ t CO ₂ e ha ⁻¹	$U(C_{p,post,i})$ t CO ₂ e ha ⁻¹	$\Delta C_{p,i}$ t CO ₂ e ha ⁻¹	$U(\Delta C_{p,i})$ t CO ₂ e ha ⁻¹
C _{AB_tree,As}	454.94	24.88	17.20	2.17	437.74	24.97
C _{AB_tree,Ds}	454.94	24.88	17.20	2.17	437.74	24.97
C _{BB_tree,As}	100.54	7.47	3.81	0.68	96.73	7.50
C _{BB_tree,Ds}	100.54	7.47	3.81	0.68	96.73	7.50
C _{AB_nontree,As}	17.74	1.81	0.64	0.08	17.10	1.81
C _{AB_nontree,Ds}	17.74	1.81	0.64	0.08	17.10	1.81
C _{BB_nontree,As}	3.92	0.50	0.15	0.03	3.77	0.50
C _{BB_nontree,Ds}	3.92	0.50	0.15	0.03	3.77	0.50

*As – Open Ombrophylous Forest ; Ds – Dense Ombrophylous Forest.

Step 3: Evaluation of Uncertainty of Carbon Stock Estimates

Estimates of carbon stocks in each carbon pool were accompanied by an uncertainty estimate. The percentage uncertainty of each carbon stock estimate was defined as half the width of the two-sided 90% confidence interval divided by the estimate. The following applies:

- 1) Where carbon stock estimates were derived from sampling, the uncertainty was derived from the sampling uncertainty.
- 2) Where literature sources (including IPCC guidance) were used for carbon stock estimates, these sources also included an estimate of the uncertainty and/or data ranges.
- 3) A table of carbon stock estimates in each pool and forest stratum (mean and 90% confidence interval) and an indication of which sources of uncertainty were included were included in the project documentation.
- 4) The uncertainty of the parameters used in the stock estimate (e.g. carbon fraction, wood density, soil organic carbon stock change factors and root-to-shoot ratio) was included and propagated.
- 5) Uncertainty derived from allometric equations for above- or below-ground tree biomass, or from the variables used to parameterize the equations, was not included. According to VMD0055 v1.1, it is not necessary to estimate uncertainty associated with measurement error (e.g., tree height or diameter measurements).

To assess uncertainty, the standard error of each estimate was calculated. The standard error of estimate A is denoted as S(A). Error propagation is necessary to track uncertainty through the various computational steps involved in estimating carbon stocks. The error propagation equations used are in accordance with VMD0055 v1.1 (VERRA, 2024c).

Estimation of Uncertainty for Each Pool and Stratum

The uncertainty of the estimated emissions from stock change in each carbon pool and stratum was calculated using the error propagation equation as described in Equation 2. The calculated values for uncertainty are described in Table 4.4.

$$U(\Delta C_{p,i}) = U(C_{p,i} - C_{p,post,i}) = \sqrt{U(C_{p,i})^2 + U(C_{p,post,i})^2} \quad \text{Equation 2}$$

Where:

$U(\quad)$	Uncertainty as half-width of the two-sided 90 percent confidence interval (t CO ₂ e ha ⁻¹)
$\Delta C_{p,i}$	Estimated emissions from carbon stock change in pool p of forest stratum i (t CO ₂ e ha ⁻¹)
$C_{p,i}$	Estimated carbon stock in pool p of forest stratum i (t CO ₂ e ha ⁻¹)
$C_{p,post,i}$	Estimated carbon stock in post-deforestation pool p in forest stratum i (t CO ₂ e ha ⁻¹)
p	Pool: aboveground tree biomass (AB_tree), aboveground non-tree biomass (AB_nontree), belowground tree biomass (BB_tree), belowground non-tree biomass (BB_nontree)
i	1, 2, 3, ..., M forest stratum

Step 4: Estimation of an Uncertainty Discount Factor

Conservative estimation of changes in carbon stocks is achieved by applying an uncertainty discount factor.

Averaging Carbon Stock Changes Over Forest Strata and Carbon Pools

To establish the uncertainty discount factor, first stock changes were averaged over forest strata and carbon pools. Stock changes were averaged over the area of UDef AD within each forest stratum over the base period for each pool separately, using an area-weighted average. Stock changes were calculated according to Equation 3.

$$W\Delta C_p = \frac{\sum_{i=1}^M AD_{BSL,PA-UDef,i,t} \times \Delta C_{p,i}}{\sum_{i=1}^M AD_{BSL,PA-UDef,i,t}} \quad \text{Equation 3}$$

Where:

$W\Delta C_p$	UDef AD baseline weighted average emissions from carbon stock change in pool p (t CO ₂ e ha ⁻¹)
$AD_{BSL,PA-UDef,i,t}$	UDef AD in the baseline scenario allocated to forest stratum i in the UDef PA for year t (ha)

$\Delta C_{p,i}$	Estimated emissions from carbon stock change in pool p in forest stratum i (t CO ₂ e ha ⁻¹)
p	Pool: aboveground tree biomass (AB_tree), aboveground non-tree biomass (AB_nontree), belowground tree biomass (BB_tree), belowground non-tree biomass (BB_nontree)
i	1, 2, 3, ..., M forest stratum
t	1, 2, 3, ..., t^* years elapsed since the start of the project

The weighted stock changes from the UDef AD baseline are then summed across all relevant carbon pools. To establish the discount factor, this must be done for all pools together (Equation 4). The equation was adapted with the carbon stocks applied to the project.

$$W\Delta C = W\Delta C_{AB_{tree}} + W\Delta C_{BB_{tree}} + W\Delta C_{AB_{nontree}} + W\Delta C_{BB_{nontree}} \quad \text{Equation 4}$$

Where:

$W\Delta C$	Overall UDef AD baseline weighted average emissions from carbon stock changes (t CO ₂ e ha ⁻¹)
$W\Delta C_{AB_{tree}}$	UDef AD baseline weighted average emissions from carbon stock change in the aboveground tree biomass pool (t CO ₂ e ha ⁻¹)
$W\Delta C_{BB_{tree}}$	UDef AD baseline weighted average emissions from carbon stock change in the belowground tree biomass pool (t CO ₂ e ha ⁻¹)
$W\Delta C_{AB_{nontree}}$	UDef AD baseline weighted average emissions from carbon stock change in the aboveground non-tree woody biomass pool (t CO ₂ e ha ⁻¹)
$W\Delta C_{BB_{nontree}}$	UDef AD baseline weighted average emissions from carbon stock change in the belowground non-tree woody biomass pool (t CO ₂ e ha ⁻¹)

Uncertainty has been propagated appropriately according to VMD0055 v1.1 (VERRA, 2024c). Furthermore, area AD values are considered, for simplicity, as simple multiplication factors without uncertainty (Equation 5).

$$U(W\Delta C_p) = \frac{\sqrt{\sum_{i=1}^M (AD_{BSL,PA-UDef,i,t} \times U(\Delta C_{p,i}))^2}}{\sum_{i=1}^M AD_{BSL,PA-UDef,i,t}} \quad \text{Equation 5}$$

Where:

$U()$	Uncertainty as half-width of the two-sided 90 percent confidence interval (t CO ₂ e ha ⁻¹)
--------	---

$W\Delta C_p$	UDef AD baseline weighted average emissions from carbon stock change in pool p (t CO ₂ e ha ⁻¹)
$AD_{BSL,PA-UDef,i,t}$	UDef AD in the baseline scenario allocated to forest stratum i in the UDef PA for year t (ha)
$\Delta C_{p,i}$	Estimated emissions from carbon stock change in pool p in forest stratum i (t CO ₂ e ha ⁻¹)
p	Pool: aboveground tree biomass (AB _{tree}), aboveground non-tree biomass (AB _{nontree}), belowground tree biomass (BB _{tree}), belowground non-tree biomass (BB _{nontree}), dead wood (DW), litter (LI), organic carbon soil (SOC), and harvested wood products (WP)
i	1, 2, 3, ..., M forest stratum
t	1, 2, 3, ..., t^* years elapsed since the start of the project

Furthermore, uncertainty was propagated using the addition and subtraction equations as per Equation 6 and Equation 7.

$$U(W\Delta C) = \sqrt{U(W\Delta C_{AB_{tree}})^2 + U(W\Delta C_{BB_{tree}})^2 + U(W\Delta C_{AB_{nontree}})^2 + U(W\Delta C_{BB_{nontree}})^2} \quad \text{Equation 6}$$

$$U\%(W\Delta C) = 100 \times \frac{U(W\Delta C)}{W\Delta C} \quad \text{Equation 7}$$

Where:

$U()$	Uncertainty as half-width of the two-sided 90 percent confidence interval (t CO ₂ e ha ⁻¹)
$U\%()$	Percentage uncertainty (i.e., uncertainty expressed as a percentage of the estimate) (%)
$W\Delta C$	Overall UDef AD baseline weighted average emissions from carbon stock changes (t CO ₂ e ha ⁻¹)
$W\Delta C_{AB_{tree}}$	UDef AD baseline weighted average emissions from carbon stock change in the aboveground tree biomass pool (t CO ₂ e ha ⁻¹)
$W\Delta C_{BB_{tree}}$	UDef AD baseline weighted average emissions from carbon stock change in the belowground tree biomass pool (t CO ₂ e ha ⁻¹)
$W\Delta C_{AB_{nontree}}$	UDef AD baseline weighted average emissions from carbon stock change in the aboveground non-tree woody biomass pool (t CO ₂ e ha ⁻¹)

$W\Delta C_{BB_{nontree}}$

UDef AD baseline weighted average emissions from carbon stock change in the belowground non-tree woody biomass pool (t CO₂e ha⁻¹)

The results for the equations described above can be consulted in the spreadsheet⁸¹ in more detail and summarized in Table 4.5.

⁸¹ 250912_GHGReductionEx-ante.xlsx

Table 4.5. Estimation of an Uncertainty Discount Factor.

$W\Delta C_{AB_tree}$ (t CO ₂ e ha ⁻¹)	$U(W\Delta C_{AB_tree})$ (t CO ₂ e ha ⁻¹)	$W\Delta C_{BB_tree}$ (t CO ₂ e ha ⁻¹)	$U(W\Delta C_{BB_tree})$ (t CO ₂ e ha ⁻¹)	$W\Delta C_{AB_nontree}$ (t CO ₂ e ha ⁻¹)	$U(W\Delta C_{AB_nontree})$ (t CO ₂ e ha ⁻¹)	$W\Delta C_{BB_nontree}$ (t CO ₂ e ha ⁻¹)	$U(W\Delta C_{BB_nontree})$ (t CO ₂ e ha ⁻¹)	$W\Delta C$ (t CO ₂ e ha ⁻¹)	$U(W\Delta C)$ (t CO ₂ e ha ⁻¹)	$U\%(W\Delta C)$ (%)	$DF_{W\Delta C}$
437.74	24.97	96.73	7.50	17.10	1.81	3.77	0.50	555.34	26.14	5%	0

Estimation of an Uncertainty Discount Factor

The discount factor for carbon stock change emissions ($DF_{W\Delta C}$) was calculated based on the uncertainty resulting from the weighted average carbon stock change UDef AD from the baseline ($U\%(W\Delta C)$). The discount factor is calculated using Equation 8 and Equation 9, depending on the value of the percentage uncertainty.

$$\text{If } U\%(W\Delta C) \leq 10\% \text{ then } DF_{W\Delta C} = 0 \quad \text{Equation 8}$$

$$\text{If } U\%(W\Delta C) > 10\% \text{ then } DF_{W\Delta C} = \frac{U\%(W\Delta C) \times t_{\alpha=66.67\%}}{100 \times t_{\alpha=10\%}} \quad \text{Equation 9}$$

Where:

$DF_{W\Delta C}$	Uncertainty discount factor for stock changes
$U\%(W\Delta C)$	Percentage uncertainty in emissions from carbon stock change (%)
$t_{\alpha=10\%}$	Value of the t distribution for a two-sided 90 percent confidence interval
$t_{\alpha=66.67\%}$	Value of the T distribution for a one-sided 66.67 percent confidence interval

The $DF_{W\Delta C}$ parameter for this first baseline can be checked in the spreadsheet and the result in Table 4.5. Since $U\%(W\Delta C) \leq 10\%$, then the $DF_{W\Delta C}$ factor was considered zero and there was no need to correct the carbon stock values.

Step 5: Conservative Estimation of Emissions from Carbon Stock Change

Conservative estimates of emissions from carbon stock change in UDef PA were calculated by summing the carbon stock pools and applying the discount factor. This adjustment was performed separately for each carbon pool: aboveground biomass (Equation 10) and belowground biomass (Equation 11).

$$\Delta C_{AB-LI,i} = \left((\Delta C_{AB_{tree},i} - C_{WP,i}) + \Delta C_{AB_{nontree},i} + \Delta C_{LI} \right) \times (1 - DF_{W\Delta C}) \quad \text{Equation 10}$$

Where:

$\Delta C_{AB-LI,i}$	Conservatively estimated emissions from carbon stock change in the UDef PA in aboveground biomass and litter pools in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{AB_{tree},i}$	Emissions from carbon stock change in the aboveground tree biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{AB_{nontree},i}$	Emissions from carbon stock change in the aboveground non-tree woody biomass pool in stratum i (t CO ₂ e ha ⁻¹)
ΔC_{LI}	Emissions from carbon stock change in the litter pool in forest stratum i (t CO ₂ e ha ⁻¹)

$C_{WP,i}$	Carbon stock entering the wood product pool in forest stratum i (t CO ₂ e ha ⁻¹)
$DF_{W\Delta C}$	Uncertainty discount factor for stock changes
i	1, 2, 3, ..., M forest stratum

$$\Delta C_{BB-DW,i} = (\Delta C_{BB_{tree},i} + \Delta C_{BB_{nontree},i} + \Delta C_{DW,i}) \times (1 - DF_{W\Delta C}) \quad \text{Equation 11}$$

Where:

$\Delta C_{BB-DW,i}$	Conservatively estimated emissions from carbon stock change over a 10-year period in the UDef PA in belowground biomass and dead wood pools in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{BB_{tree},i}$	Emissions from carbon stock change in the belowground tree biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{BB_{nontree},i}$	Emissions from carbon stock change in the belowground non-tree biomass pool in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{DW,i}$	Emissions from carbon stock change in the dead wood pool in forest stratum i (t CO ₂ e ha ⁻¹)
$DF_{W\Delta C}$	Uncertainty discount factor for stock changes
i	1, 2, 3, ..., M forest stratum

Conservative estimates of emissions per carbon stock change for the stocks applicable to this project are shown in Table 4.6. All previous steps were considered to obtain the most conservative value according to the VM0048 methodology (VERRA, 2023a) and the VCS standard (VERRA, 2024b).

Table 4.6. Conservative estimation of emissions from carbon stock change.

	Carbon stock	Value
Project area	$\Delta C_{CAB-LI,As}$ (t CO ₂ e ha ⁻¹)	454.84
	$\Delta C_{CAB-LI,Ds}$ (t CO ₂ e ha ⁻¹)	454.84
	$\Delta C_{CBB-DW,As}$ (t CO ₂ e ha ⁻¹)	100.50
	$\Delta C_{CBB-DW,Ds}$ (t CO ₂ e ha ⁻¹)	100.50
Leakage belt	$\Delta C_{LB,AB-LI,As}$ (t CO ₂ e ha ⁻¹)	454.84
	$\Delta C_{LB,AB-LI,Ds}$ (t CO ₂ e ha ⁻¹)	454.84
	$\Delta C_{LB,BB-DW,As}$ (t CO ₂ e ha ⁻¹)	100.50

	Carbon stock	Value
	$\Delta C_{LB,BB-DW,Ds}$ (t CO ₂ e ha ⁻¹)	100.50

Step 6: Estimation of Annual Baseline Emissions from Carbon Stock Changes

The sum of emissions projected to occur in UDef PA was estimated using the AD area and emissions from carbon stock changes resulting from unplanned deforestation.

Stock changes in above-ground carbon pools and litter are assumed to be emitted at the time of land-use transition. After land-use transition, emissions from belowground pools, deadwood, soil organic carbon, and wood products are assumed to occur gradually over time; those from belowground biomass pools and deadwood at an annual rate of 1/10 of the stock change, and those from soil organic carbon and wood products at an annual rate of 1/20 of the stock change. For a given year t (the year for which emissions are to be estimated), emissions from unplanned deforestation are summed from time $t - 10$ to time t (for belowground biomass and dead wood) and from time $t - 20$ to time t (for soil organic carbon and wood products).

For carbon pools in the UDef PA strata (Equation 12):

$$\begin{aligned} \Delta C_{BSL,PA-UDef,i,t} = & (AD_{BSL,PA-UDef,i,t} \times \Delta C_{AB-LI,i}) \\ & + \sum_{t-10}^t (AD_{BSL,PA-UDef,i,t}) \times \frac{\Delta C_{BB-DW,i}}{10} \\ & + \sum_{t-20}^t (AD_{BSL,PA-UDef,i,t}) \times \frac{\Delta C_{SOC-WP,i}}{20} \end{aligned} \quad \text{Equation 12}$$

Where:

$\Delta C_{BSL,PA-UDef,i,t}$	Total emissions from the baseline carbon stock change in all carbon pools in forest stratum i within the UDef PA in year t (t CO ₂ e)
$AD_{BSL,PA-UDef,i,t}$	UDef AD in the baseline scenario allocated to forest stratum i in the UDef PA for year t (ha)
$\Delta C_{AB-LI,i}$	Conservatively estimated emissions from carbon stock change in the UDef PA in aboveground biomass and litter pools in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{BB-DW,i}$	Conservatively estimated emissions from carbon stock change over a 10-year period in the UDef PA in belowground biomass and dead wood pools in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{SOC-WP,i}$	Conservatively estimated emissions from carbon stock change over a 20-year period in the UDef PA in the soil organic carbon and wood product pools in forest stratum i (t CO ₂ e ha ⁻¹)

i	1, 2, 3, ..., M forest stratum
t	1, 2, 3, ..., t^* years elapsed since the start of the project

For carbon pools in UDef LB strata (Equation 13):

$$\begin{aligned} \Delta C_{BSL, LB-UDef, i, t} = & (AD_{BSL, LB-UDef, i, t} \times \Delta C_{LB, AB-LI, i}) \\ & + \sum_{t=10}^t (AD_{BSL, LB-UDef, i, t}) \times \frac{\Delta C_{LB, BB-DW, i}}{10} \\ & + \sum_{t=20}^t (AD_{BSL, LB-UDef, i, t}) \times \frac{\Delta C_{LB, SOC-WP, i}}{20} \end{aligned} \quad \text{Equation 13}$$

Where:

$\Delta C_{BSL, LB-UDef, i, t}$	Total emissions from baseline carbon stock change in all carbon pools in forest stratum i within the UDef LB in year t (t CO ₂ e)
$AD_{BSL, LB-UDef, i, t}$	UDef AD in the baseline scenario allocated to forest stratum i in the UDef LB for year t (ha)
$\Delta C_{LB, AB-LI, i}$	Estimated emissions from carbon stock change in the UDef LB in aboveground biomass and litter pools in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{LB, BB-DW, i}$	Estimated emissions from carbon stock change over a 10-year period in the UDef LB in belowground biomass and dead wood pools in forest stratum i (t CO ₂ e ha ⁻¹)
$\Delta C_{LB, SOC-WP, i}$	Estimated emissions from carbon stock change over a 20-year period in the UDef LB in organic carbon soil and wood product pools in forest stratum i (t CO ₂ e ha ⁻¹)
i	1, 2, 3, ..., M forest stratum
t	1, 2, 3, ..., t^* years elapsed since the start of the project

The Table 4.7 summarizes all the values needed to calculate the Equation 12 for baseline, and Table 4.8 summarizes Equation 13 for the leakage belt, as well as the final results for $\Delta C_{BSL, PA-UDef, i, t}$ and $\Delta C_{BSL, LB-UDef, i, t}$, respectively.

Table 4.7. Estimation of annual baseline emissions from carbon stock changes for the baseline.

Start	End	As*				Ds*				$\Delta C_{BSL,PA-Udef,t}$ (t CO ₂ e)
		$AD_{BSL,PA-Udef,As,t}$ (ha)	$\Delta C_{AB-LI,As}$ (t CO ₂ e ha ⁻¹)	$(1/10) \times AD_{BSL,PA-Udef,As,t} \times \Delta C_{CB-DW,As}$ (t CO ₂ e)	$\Delta C_{BSL,PA-Udef,As,t}$ (t CO ₂ e)	$AD_{BSL,PA-Udef,Ds,t}$ (ha)	$\Delta C_{AB-LI,Ds}$ (t CO ₂ e ha ⁻¹)	$(1/10) \times AD_{BSL,PA-Udef,Ds,t} \times \Delta C_{CB-DW,Ds}$ (t CO ₂ e)	$\Delta C_{BSL,PA-Udef,Ds,t}$ (t CO ₂ e)	
31-Aug-2022	31-Dec-2022	77.49	454.84	778.84	36,026.12	8.89	454.84	89.39	4,134.77	40,160.89
1-Jan-2023	31-Dec-2023	229.96	454.84	3,090.02	107,685.61	26.39	454.84	354.65	12,359.24	120,044.85
1-Jan-2024	31-Dec-2024	229.96	454.84	5,401.21	109,996.79	26.39	454.84	619.90	12,624.50	122,621.29
1-Jan-2025	31-Dec-2025	229.96	454.84	7,712.39	112,307.98	26.39	454.84	885.16	12,889.76	125,197.73
1-Jan-2026	31-Dec-2026	229.96	454.84	10,023.57	114,619.16	26.39	454.84	1,150.42	13,155.01	127,774.18
1-Jan-2027	31-Dec-2027	0.00	454.84	10,023.57	10,023.57	0.00	454.84	1,150.42	1,150.42	11,173.99
1-Jan-2028	31-Dec-2028	0.00	454.84	10,023.57	10,023.57	0.00	454.84	1,150.42	1,150.42	11,173.99
1-Jan-2029	31-Dec-2029	0.00	454.84	10,023.57	10,023.57	0.00	454.84	1,150.42	1,150.42	11,173.99
1-Jan-2030	31-Dec-2030	0.00	454.84	10,023.57	10,023.57	0.00	454.84	1,150.42	1,150.42	11,173.99
1-Jan-2031	31-Dec-2031	0.00	454.84	10,023.57	10,023.57	0.00	454.84	1,150.42	1,150.42	11,173.99
1-Jan-2032	31-Dec-2032	0.00	454.84	9,244.74	9,244.74	0.00	454.84	1,061.03	1,061.03	10,305.77
1-Jan-2033	31-Dec-2033	0.00	454.84	6,933.55	6,933.55	0.00	454.84	795.77	795.77	7,729.33
1-Jan-2034	31-Dec-2034	0.00	454.84	4,622.37	4,622.37	0.00	454.84	530.52	530.52	5,152.88
1-Jan-2035	31-Dec-2035	0.00	454.84	2,311.18	2,311.18	0.00	454.84	265.26	265.26	2,576.44
1-Jan-2036	31-Dec-2036	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2037	31-Dec-2037	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2038	31-Dec-2038	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2039	31-Dec-2039	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00

Start	End	As*				Ds*				
		AD _{BSL,PA-UDef,As,t} (ha)	ΔC _{CAB-LI,As} (t CO ₂ e ha ⁻¹)	(1/10) x AD _{BSL,PA-UDef,As,t} x ΔC _{CBB-DW,As} (t CO ₂ e)	ΔC _{BSL,PA-UDef,As,t} (t CO ₂ e)	AD _{BSL,PA-UDef,Ds,t} (ha)	ΔC _{CAB-LI,Ds} (t CO ₂ e ha ⁻¹)	(1/10) x AD _{BSL,PA-UDef,Ds,t} x ΔC _{CBB-DW,Ds} (t CO ₂ e)	ΔC _{BSL,PA-UDef,Ds,t} (t CO ₂ e)	ΔC _{BSL,PA-UDef,t} (t CO ₂ e)
1-Jan-2040	31-Dec-2040	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2041	31-Dec-2041	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2042	31-Dec-2042	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2043	31-Dec-2043	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2044	31-Dec-2044	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2045	31-Dec-2045	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2046	31-Dec-2046	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2047	31-Dec-2047	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2048	31-Dec-2048	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2049	31-Dec-2049	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2050	31-Dec-2050	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2051	31-Dec-2051	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
1-Jan-2052	30-Aug-2052	0.00	454.84	0.00	0.00	0.00	454.84	0.00	0.00	0.00
Total						553,865.37			63,567.96	617,433.33

*As – Open Ombrophylous Forest ; Ds – Dense Ombrophylous Forest.

Table 4.8. Estimation of annual baseline emissions from carbon stock changes for the leakage belt.

Start	End	$AD_{BSL, LB-UDef, I, t}$ (ha)	$\Delta C_{BSL, LB, AB-LI, I}$ (t CO ₂ e ha ⁻¹)	$(1/10) \times AD_{BSL, LB-UDef, I, t} \times \Delta C_{BSL, LB, BB-DW, I, t}$ (t CO ₂ e)	$\Delta C_{BSL, LB-UDef, I, t}$ (t CO ₂ e)
31-Aug-2022	31-Dec-2022	123.94	454.84	1,245.61	57,617.22
1-Jan-2023	31-Dec-2023	367.78	454.84	4,941.93	172,223.55
1-Jan-2024	31-Dec-2024	367.78	454.84	8,638.25	175,919.87
1-Jan-2025	31-Dec-2025	367.78	454.84	12,334.56	179,616.19
1-Jan-2026	31-Dec-2026	367.78	454.84	16,030.88	183,312.51
1-Jan-2027	31-Dec-2027	0.00	454.84	16,030.88	16,030.88
1-Jan-2028	31-Dec-2028	0.00	454.84	16,030.88	16,030.88
1-Jan-2029	31-Dec-2029	0.00	454.84	16,030.88	16,030.88
1-Jan-2030	31-Dec-2030	0.00	454.84	16,030.88	16,030.88
1-Jan-2031	31-Dec-2031	0.00	454.84	16,030.88	16,030.88
1-Jan-2032	31-Dec-2032	0.00	454.84	14,785.27	14,785.27
1-Jan-2033	31-Dec-2033	0.00	454.84	11,088.96	11,088.96
1-Jan-2034	31-Dec-2034	0.00	454.84	7,392.64	7,392.64
1-Jan-2035	31-Dec-2035	0.00	454.84	3,696.32	3,696.32
1-Jan-2036	31-Dec-2036	0.00	454.84	0.00	0.00
1-Jan-2037	31-Dec-2037	0.00	454.84	0.00	0.00
1-Jan-2038	31-Dec-2038	0.00	454.84	0.00	0.00
1-Jan-2039	31-Dec-2039	0.00	454.84	0.00	0.00
1-Jan-2040	31-Dec-2040	0.00	454.84	0.00	0.00
1-Jan-2041	31-Dec-2041	0.00	454.84	0.00	0.00
1-Jan-2042	31-Dec-2042	0.00	454.84	0.00	0.00

Start	End	$AD_{BSL, LB-UDef, I, t}$ (ha)	$\Delta C_{BSL, LB, AB-LI, I}$ (t CO ₂ e ha ⁻¹)	$(1/10) \times AD_{BSL, LB-UDef, I, t} \times \Delta C_{BSL, LB, BB-DW, I, t}$ (t CO ₂ e)	$\Delta C_{BSL, LB-UDef, I, t}$ (t CO ₂ e)
1-Jan-2043	31-Dec-2043	0.00	454.84	0.00	0.00
1-Jan-2044	31-Dec-2044	0.00	454.84	0.00	0.00
1-Jan-2045	31-Dec-2045	0.00	454.84	0.00	0.00
1-Jan-2046	31-Dec-2046	0.00	454.84	0.00	0.00
1-Jan-2047	31-Dec-2047	0.00	454.84	0.00	0.00
1-Jan-2048	31-Dec-2048	0.00	454.84	0.00	0.00
1-Jan-2049	31-Dec-2049	0.00	454.84	0.00	0.00
1-Jan-2050	31-Dec-2050	0.00	454.84	0.00	0.00
1-Jan-2051	31-Dec-2051	0.00	454.84	0.00	0.00
1-Jan-2052	30-Aug-2052	0.00	454.84	0.00	0.00
Total					885,806.94

*As – Open Ombrophylous Forest ; Ds – Dense Ombrophylous Forest.

4.1.2.2 Estimation of Other Baseline GHG Emissions

Other GHG emissions that would occur in the baseline scenario within UDef PA were estimated. The VCS module VMD0013 Estimation of Greenhouse Gas Emissions from Biomass and Peat Burning (E-BPB) was used for calculation of $E_{BSL,BiomassBurn,i,t}$, $E_{BSL,FC,i,t}$ and $N2O_{BSL,direct-N,i,t}$ were not applied to the project and were conservatively excluded from the baseline.

Therefore, other GHG emissions within UDef PA are estimated as (Equation 14):

$$GHG_{BSLPA-UDef,E,t} = \sum_{t=1}^{t^*} \sum_{i=1}^M (E_{BSL,FC,i,t} + E_{BSL,BiomassBurn,i,t} + N2O_{BSL,direct-N,i,t}) \quad \text{Equation 14}$$

Where:

$GHG_{BSLPA-UDef,E,t}$	Cumulative other GHG emissions in the baseline in year t resulting from unplanned deforestation within the UDef PA since the project start (t CO ₂ e)
$E_{BSL,FC,i,t}$	Emissions from fossil fuel combustion in forest stratum i in the UDef PA in year t (t CO ₂ e)
$E_{BSL,BiomassBurn,i,t}$	Non-CO ₂ emissions due to biomass burning as part of unplanned deforestation activities in forest stratum i in year t (t CO ₂ e)
$N2O_{BSL,direct-N,i,t}$	Direct N ₂ O emission as a result of nitrogen application on an alternative land use in forest stratum i in year t (t CO ₂ e)
i	1, 2, 3, ..., M forest stratum
t	1, 2, 3, ..., t^* years elapsed since the start of the project

Table 4.9 shows the parameters used in calculating biomass burning for the baseline scenario, as well as results accounted for CH₄ and N₂O emissions generated and the average aboveground biomass stock before burning for stratum As and Ds.

Table 4.9. Cumulative other GHG emissions in the baseline in year t resulting from unplanned deforestation within the UDef PA since the project start.

		As*				Ds*				
		B _{As,t} = t d.m. ha ⁻¹				B _{Ds,t} = t d.m. ha ⁻¹				
Start	End	A _{burn,As,t} (ha)	E _{BiomassBurn,CH4,As,t} (t CO ₂ e)	E _{BiomassBurn,N2O,As,t} (t CO ₂ e)	E _{BSL,FC,As,t} (t CO ₂ e)	A _{burn,Ds,t} (ha)	E _{BiomassBurn,CH4,Ds,t} (t CO ₂ e)	E _{BiomassBurn,N2O,Ds,t} (t CO ₂ e)	E _{BSL,FC,Ds,t} (t CO ₂ e)	GHG _{BSLPA-UDef,E,t} (t CO ₂ e)
31-Aug-2022	31-Dec-2022	77.49	1,300.19	361.92	0	8.89	149.23	41.54	0	1,852.88
1-Jan-2023	31-Dec-2023	229.96	3,858.30	1,074.00	0	26.39	442.82	123.26	0	5,498.39
1-Jan-2024	31-Dec-2024	229.96	3,858.30	1,074.00	0	26.39	442.82	123.26	0	5,498.39
1-Jan-2025	31-Dec-2025	229.96	3,858.30	1,074.00	0	26.39	442.82	123.26	0	5,498.39
1-Jan-2026	31-Dec-2026	229.96	3,858.30	1,074.00	0	26.39	442.82	123.26	0	5,498.39
1-Jan-2027	31-Dec-2027	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2028	31-Dec-2028	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2029	31-Dec-2029	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2030	31-Dec-2030	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2031	31-Dec-2031	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2032	31-Dec-2032	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2033	31-Dec-2033	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00

		As*				Ds*				
		B _{As,t} = t d.m. ha ⁻¹				B _{Ds,t} = t d.m. ha ⁻¹				
		A _{burn,As,t} (ha)	E _{BiomassBurn,CH4,As,t} (t CO ₂ e)	E _{BiomassBurn,N2O,As,t} (t CO ₂ e)	E _{BSL,FC,As,t} (t CO ₂ e)	A _{burn,Ds,t} (ha)	E _{BiomassBurn,CH4,Ds,t} (t CO ₂ e)	E _{BiomassBurn,N2O,Ds,t} (t CO ₂ e)	E _{BSL,FC,Ds,t} (t CO ₂ e)	
Start	End									GHG _{BSLPA-UDef,E,t} (t CO ₂ e)
1-Jan-2034	31-Dec-2034	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2035	31-Dec-2035	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2036	31-Dec-2036	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2037	31-Dec-2037	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2038	31-Dec-2038	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2039	31-Dec-2039	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2040	31-Dec-2040	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2041	31-Dec-2041	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2042	31-Dec-2042	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2043	31-Dec-2043	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2044	31-Dec-2044	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2045	31-Dec-2045	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2046	31-Dec-2046	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2047	31-Dec-2047	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00

		As*				Ds*				
		B _{As,t} = t d.m. ha ⁻¹				B _{Ds,t} = t d.m. ha ⁻¹				
Start	End	A _{burn,As,t} (ha)	E _{BiomassBurn,CH4,As,t} (t CO ₂ e)	E _{BiomassBurn,N2O,As,t} (t CO ₂ e)	E _{BSL,FC,As,t} (t CO ₂ e)	A _{burn,Ds,t} (ha)	E _{BiomassBurn,CH4,Ds,t} (t CO ₂ e)	E _{BiomassBurn,N2O,Ds,t} (t CO ₂ e)	E _{BSL,FC,Ds,t} (t CO ₂ e)	GHG _{BSLPA-UDef,E,t} (t CO ₂ e)
1-Jan-2048	31-Dec-2048	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2049	31-Dec-2049	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2050	31-Dec-2050	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2051	31-Dec-2051	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
1-Jan-2052	30-Aug-2052	0.00	0.00	0.00	0	0.00	0.00	0.00	0	0.00
Total										23,846.45

*As – Open Ombrophylous Forest ; Ds – Dense Ombrophylous Forest.

4.1.2.3 Estimation of Net Baseline Emissions

Net emissions under baseline conditions for UDef PA were calculated using Equation 15 and the results are shown in Table 4.10. More information can be found in the calculation spreadsheet⁸².

$$\Delta C_{BSL,PA-UDef,t} = \left(\sum_{t=1}^{t^*} \sum_{i=1}^M \Delta C_{BSL,PA-UDef,i,t} \right) + GHG_{BSLPA-UDef,E,t} \quad \text{Equation 15}$$

Where:

$\Delta C_{BSL,PA-UDef,t}$ Cumulative net GHG emissions since the project started within the UDef PA in the baseline in year t (t CO₂e)

$GHG_{BSLPA-UDef,E,t}$ Cumulative other GHG emissions in the baseline in year t resulting from unplanned deforestation within the UDef PA since the project start (t CO₂e)

$\Delta C_{BSL,PA-UDef,i,t}$ Sum of the baseline emissions from carbon stock change in all carbon pools in forest stratum i within the UDef PA in year t (t CO₂e)

i 1, 2, 3, ..., M forest stratum

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

Table 4.10. Cumulative net GHG emissions since the project start within the UDef PA in the baseline in year t .

Start	End	$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)	$GHG_{BSLPA-UDef,E,t}$ (t CO ₂ e)	$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)
31-Aug-2022	31-Dec-2022	40,160.89	1,852.88	42,013.77
1-Jan-2023	31-Dec-2023	120,044.85	5,498.39	125,543.24
1-Jan-2024	31-Dec-2024	122,621.29	5,498.39	128,119.68
1-Jan-2025	31-Dec-2025	125,197.73	5,498.39	130,696.12
1-Jan-2026	31-Dec-2026	127,774.18	5,498.39	133,272.57
1-Jan-2027	31-Dec-2027	11,173.99	0.00	11,173.99
1-Jan-2028	31-Dec-2028	11,173.99	0.00	11,173.99
1-Jan-2029	31-Dec-2029	11,173.99	0.00	11,173.99
1-Jan-2030	31-Dec-2030	11,173.99	0.00	11,173.99
1-Jan-2031	31-Dec-2031	11,173.99	0.00	11,173.99
1-Jan-2032	31-Dec-2032	10,305.77	0.00	10,305.77

⁸² 250912_GHGReductionEx-ante.xlsx

Start	End	$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)	$GHG_{BSLPA-UDef,E,t}$ (t CO ₂ e)	$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)
1-Jan-2033	31-Dec-2033	7,729.33	0.00	7,729.33
1-Jan-2034	31-Dec-2034	5,152.88	0.00	5,152.88
1-Jan-2035	31-Dec-2035	2,576.44	0.00	2,576.44
1-Jan-2036	31-Dec-2036	0.00	0.00	0.00
1-Jan-2037	31-Dec-2037	0.00	0.00	0.00
1-Jan-2038	31-Dec-2038	0.00	0.00	0.00
1-Jan-2039	31-Dec-2039	0.00	0.00	0.00
1-Jan-2040	31-Dec-2040	0.00	0.00	0.00
1-Jan-2041	31-Dec-2041	0.00	0.00	0.00
1-Jan-2042	31-Dec-2042	0.00	0.00	0.00
1-Jan-2043	31-Dec-2043	0.00	0.00	0.00
1-Jan-2044	31-Dec-2044	0.00	0.00	0.00
1-Jan-2045	31-Dec-2045	0.00	0.00	0.00
1-Jan-2046	31-Dec-2046	0.00	0.00	0.00
1-Jan-2047	31-Dec-2047	0.00	0.00	0.00
1-Jan-2048	31-Dec-2048	0.00	0.00	0.00
1-Jan-2049	31-Dec-2049	0.00	0.00	0.00
1-Jan-2050	31-Dec-2050	0.00	0.00	0.00
1-Jan-2051	31-Dec-2051	0.00	0.00	0.00
1-Jan-2052	31-Dec-2052	0.00	0.00	0.00
Total		617,433.33	23,846.45	641,279.78

On the other hand, net emissions under baseline conditions for the UDef LB were calculated according to Equation 16. The values for this parameter can be found in Table 4.8.

$$\Delta C_{BSL,LB-UDef,t} = \sum_{t=1}^{t*} \sum_{i=1}^M \Delta C_{BSL,LB-UDef,i,t} \quad \text{Equation 16}$$

Where:

$\Delta C_{BSL, LB-UDef, t}$	Cumulative net GHG emissions since the project start within the UDef LB in the baseline in year t (t CO ₂ e)
$\Delta C_{BSL, LB-UDef, i, t}$	Cumulative emissions from baseline carbon stock change in all carbon pools in forest stratum i within the UDef LB in year t (t CO ₂ e)
i	1, 2, 3, ..., M forest stratum
t	1, 2, 3, ..., t^* years elapsed since the start of the project

4.2 Project Emissions

The main steps taken to estimate project emissions are: i) Estimate ex ante emission reductions anticipated by the project; ii) Determine AD per stratum per monitoring period; iii) Multiply AD by emission factors; iv) Sum with estimated other project emissions.

4.2.1 Ex Ante Estimations of Emission Reductions

Ex ante estimates were performed using the baseline deforestation allocation provided by Verra and the emission factors as calculated in Section 4.1.2.1. Emission reductions were projected over the entire crediting period, but for planning purposes only; in this case, projected annual emission reductions beyond the initial BVP are not expected to increase and are instead expected to remain constant (or decrease). A value for ex ante effectiveness ($EA_{EF, t}$) was detailed for each year, reflecting the percentage by which the project is expected to reduce deforestation relative to the baseline. $EA_{EF, t}$ was applied to estimate annual emission reductions over the lifetime of the project. The estimated ex-ante effectiveness considered the analysis of agents and drivers of deforestation in the current project, as well as the measures implemented to reduce deforestation. Ex ante leakage was calculated separately (see Section 4.3).

Some unplanned deforestation may happen in the project area despite the AUD project activity. The level at which deforestation will be reduced, in the project case, depends on the effectiveness of the proposed activities, which cannot be measured ex-ante. As reported in Section 1.12, the proposed activities are (i) Identification of strategic points to establish surveillance checkpoints, prioritizing zones bordering areas with high probability of invasion; (ii) establishment of surveillance checkpoints; (iii) establishment of frequent surveillance rounds; (iv) contact with neighboring communities in order to develop environmental education activities; (v) maintenance of firebreaks for fire protection; and (vi) Identification of neighboring landowners in order to prevent leakage. Therefore, the ex-ante project effectiveness index parameter ($EA_{EF, t} = 10\%$) was considered taking into account the six items listed above, and leakage management activities (and consequently the local community engagement – Section 1.19 of PD). Consequently, the project will target an EI of 90%, primarily relying on patrolling, surveillance and satellite monitoring activities to mitigate the impact of the deforestation agent involved. Additional project activities outlined in Section 1.12 will further support and validate this target.

This is because patrol, surveillance and satellite monitoring activities play a crucial role in curbing unplanned deforestation by enabling continuous, real-time monitoring of land use changes. These

initiatives can quickly detect illegal forest clearings and the early signs of pastureland expansion — a pattern closely associated with cattle farming, land grabbing, and the subsequent use of fire to maintain pastures. This rapid detection allows for immediate intervention by regulatory authorities, effectively disrupting the coordinated actions of cattle farmers, land grabbers, and large-scale property owners. Consequently, a reduction in deforestation rates is expected as patrolling, surveillance and satellite monitoring activities can inhibit the actions of invaders and illegal occupations that lead to deforestation. Additionally, this activity increases the perception of land security in the region, reducing potential conflicts.

Patrol and field surveillance activities rely on effective project governance in collaboration with the local community. Consequently, the initial phase should focus on strengthening the community's REDD capacity (as implemented at the project's start date). This approach establishes a sequential process: robust governance promotes environmental awareness, which, in turn, enhances the community's and local workers' ability to effectively initiate patrols and field surveillance. Conversely, satellite surveillance is implemented from the beginning of the project, as it solely depends on GIS technology.

Finally, hiring and training workers from the local community for patrolling and surveillance provides alternative sources of income, which will contribute to reducing the community's involvement in activities that contribute to deforestation in the region. Therefore, patrol, surveillance, and satellite monitoring activities are expected to yield an EI of 90%, as demonstrated by the benchmarking analysis of previously executed projects.

Therefore, the ex-ante project emission values for UDef PA and UDef LB were calculated considering the parameter $EA_{EF,t}$ and the estimated baseline (Table 4.11).

Table 4.11. Total project emissions for UDef PA and UDef LB.

Start	End	UDef PA			UDef LB		
		$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)	$EA_{EF,t}$ (%)	$\Delta C_{MP,PA-UDef,i,t}$ (t CO ₂ e)	$\Delta C_{BSL,LB-UDef,i,t}$ (t CO ₂ e)	$EA_{EF,t}$ (%)	$\Delta C_{MP,LB,PA-UDef,i,t}$ (t CO ₂ e)
31-Aug-2022	31-Dec-2022	42,013.77	90%	4,201.38	57,617.22	90%	5,761.72
1-Jan-2023	31-Dec-2023	125,543.24	90%	12,554.32	172,223.55	90%	17,222.35
1-Jan-2024	31-Dec-2024	128,119.68	90%	12,811.97	175,919.87	90%	17,591.99
1-Jan-2025	31-Dec-2025	130,696.12	90%	13,069.61	179,616.19	90%	17,961.62
1-Jan-2026	31-Dec-2026	133,272.57	90%	13,327.26	183,312.51	90%	18,331.25
1-Jan-2027	31-Dec-2027	11,173.99	90%	1,117.40	16,030.88	90%	1,603.09
1-Jan-2028	31-Dec-2028	11,173.99	90%	1,117.40	16,030.88	90%	1,603.09
1-Jan-2029	31-Dec-2029	11,173.99	90%	1,117.40	16,030.88	90%	1,603.09
1-Jan-2030	31-Dec-2030	11,173.99	90%	1,117.40	16,030.88	90%	1,603.09
1-Jan-2031	31-Dec-2031	11,173.99	90%	1,117.40	16,030.88	90%	1,603.09

Start	End	UDef PA			UDef LB		
		$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)	EA _{EF,t} (%)	$\Delta C_{MP,PA-UDef,i,t}$ (t CO ₂ e)	$\Delta C_{BSL,LB-UDef,i,t}$ (t CO ₂ e)	EA _{EF,t} (%)	$\Delta C_{MP,LB,PA-UDef,i,t}$ (t CO ₂ e)
1-Jan-2032	31-Dec-2032	10,305.77	90%	1,030.58	14,785.27	90%	1,478.53
1-Jan-2033	31-Dec-2033	7,729.33	90%	772.93	11,088.96	90%	1,108.90
1-Jan-2034	31-Dec-2034	5,152.88	90%	515.29	7,392.64	90%	739.26
1-Jan-2035	31-Dec-2035	2,576.44	90%	257.64	3,696.32	90%	369.63
1-Jan-2036	31-Dec-2036	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2037	31-Dec-2037	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2038	31-Dec-2038	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2039	31-Dec-2039	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2040	31-Dec-2040	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2041	31-Dec-2041	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2042	31-Dec-2042	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2043	31-Dec-2043	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2044	31-Dec-2044	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2045	31-Dec-2045	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2046	31-Dec-2046	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2047	31-Dec-2047	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2048	31-Dec-2048	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2049	31-Dec-2049	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2050	31-Dec-2050	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2051	31-Dec-2051	0.00	90%	0.00	0.00	90%	0.00
1-Jan-2052	31-Dec-2052	0.00	90%	0.00	0.00	90%	0.00
Total		641,279.78	-	64,127.98	885,806.94	-	88,580.69

4.3 Leakage Emissions

According to VMD0055 v1.1 (VERRA, 2024c), four types of leakage should be assessed: 1) Activity shifting by geographically constrained agents; 2) Activity shifting by geographically mobile agents; 3) Market-effects leakage; and 4) Leakage mitigation emissions.

Emissions from these sources are summed up to yield an estimate of the total leakage emissions for the project activities over the monitoring period.

Leakage due to activity shifting by geographically constrained agents is monitored within the UDef LB. Baseline unplanned deforestation allocated within UDef LB is compared to the deforestation monitored ex post.

Leakage due to activity shifting by geographically mobile agents is estimated on the basis of: a) The net reduction (displacement) of deforestation from the baseline to the end of the monitoring period within the combined area of the UDef PA and UDef LB; b) The proportion of geographically mobile agents of deforestation projected in the baseline; and c) Area-weighted emission factors for areas accessible to geographically mobile deforestation agents outside of the UDef LB.

Market effects leakage occurs when, in the baseline case, commodities were produced for regional, national or international markets. Market effects leakage is estimated using VMD0011 Market Effects Emissions Estimation (LK-ME) (VERRA, 2023b). Emissions due to leakage mitigation measures correspond to non-CO₂ GHG emissions from biomass burning or fertilizer use and should be quantified, if applicable.

4.3.1 Roles in Development of Leakage Estimates

Procedures for estimating leakage depend on a combination of data and steps to be taken by Verra and the project proponent (Table 4.12). The processes and criteria for developing jurisdictional data are described in Appendix 1 of VMD0055 v1.1 (VERRA, 2024c).

Table 4.12. Roles in development of leakage estimate.

Step	Responsible party	Frequency
Definition of UDef LB boundaries	Verra (UDef LB to be adjusted by the project proponent where applicable)	Once prior to start of each jurisdictional BVP
Definition of jurisdictional emission factor for areas outside the UDef LB subject to deforestation from activity shifting by geographically mobile agents	Verra	Once prior to start of each jurisdictional BVP
Assessing emissions from activity shifting due to displacement of unplanned deforestation to the UDef LB	Project proponent	Once per monitoring event
Assessing emissions from activity shifting due to displacement of unplanned deforestation to areas outside the UDef LB	Project proponent	Once per monitoring event
Assessing emissions from leakage mitigation measures	Project proponent	Once per monitoring event
Estimation of total leakage due to the displacement of unplanned deforestation	Project proponent	Once per monitoring event

Figure 4.6 summarizes the key leakage estimation steps to be undertaken by the project proponent.

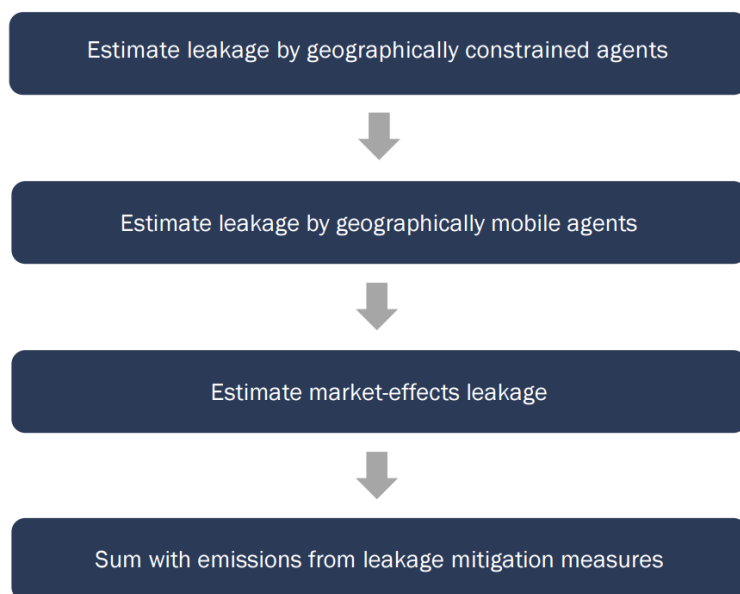


Figure 4.6. Leakage estimation steps.

4.3.2 Ex Ante Estimation of Leakage

Ex ante, activity displacement leakage was estimated based on the anticipated combined effectiveness of the proposed leakage mitigation measures and project activities. This was done by multiplying the estimated changes in the baseline carbon stock for the UDef PA by a “displacement leakage factor” (DLF) representing the percentage of deforestation expected to be displaced outside the project boundary. Where deforestation agents identified do not participate in and/or benefit from leakage mitigation measures, the displacement factor is 100 percent. Where wildfire emissions were included in the baseline, ex ante wildfire emissions due to activity displacement leakage will be calculated by multiplying the baseline wildfire emissions in the UDef PA by the same DLF used to estimate the decrease in carbon stocks.

Ex ante estimates of leakage emissions do not contribute to estimates of ex post monitored project leakage emissions. Monitored leakage emissions are described in Sections 5.3.4.3 – 5.3.4.8 of VMD0055 v1.1.

The project design team estimates that 100% of potential deforestation agents in the project zone will be given the opportunity to participate in leakage prevention activities. The project's proactive measures to combat leakage sources include: (i) identifying neighbors in the leakage region to propose partnerships and passively avoid deforestation; (ii) working in collaboration with regional stakeholders to advance a new strategy for the region's land use and forestry; and (iii) mapping by satellite for monitoring interventions in the areas around the project (the Leakage Belt)⁸³. Thus, the DLF was conservatively

⁸³ 250203_LeakageManagementPlan.pdf

defined as 10%. The value of the ex-ante estimates of leakage emissions can be verified in the spreadsheet⁸⁴ and in Table 4.13.

Table 4.13. Ex ante estimation of leakage emissions.

Start	End	$\Delta C_{BSL,PA-UDef,t}$ (t CO _{2e})	DLF (%)	$\Delta C_{LK-UDef,t}$ (t CO _{2e})
31-Aug-2022	31-Dec-2022	42,013.77	90%	4,201.38
1-Jan-2023	31-Dec-2023	125,543.24	90%	12,554.32
1-Jan-2024	31-Dec-2024	128,119.68	90%	12,811.97
1-Jan-2025	31-Dec-2025	130,696.12	90%	13,069.61
1-Jan-2026	31-Dec-2026	133,272.57	90%	13,327.26
1-Jan-2027	31-Dec-2027	11,173.99	90%	1,117.40
1-Jan-2028	31-Dec-2028	11,173.99	90%	1,117.40
1-Jan-2029	31-Dec-2029	11,173.99	90%	1,117.40
1-Jan-2030	31-Dec-2030	11,173.99	90%	1,117.40
1-Jan-2031	31-Dec-2031	11,173.99	90%	1,117.40
1-Jan-2032	31-Dec-2032	10,305.77	90%	1,030.58
1-Jan-2033	31-Dec-2033	7,729.33	90%	772.93
1-Jan-2034	31-Dec-2034	5,152.88	90%	515.29
1-Jan-2035	31-Dec-2035	2,576.44	90%	257.64
1-Jan-2036	31-Dec-2036	0.00	90%	0.00
1-Jan-2037	31-Dec-2037	0.00	90%	0.00
1-Jan-2038	31-Dec-2038	0.00	90%	0.00
1-Jan-2039	31-Dec-2039	0.00	90%	0.00
1-Jan-2040	31-Dec-2040	0.00	90%	0.00
1-Jan-2041	31-Dec-2041	0.00	90%	0.00
1-Jan-2042	31-Dec-2042	0.00	90%	0.00
1-Jan-2043	31-Dec-2043	0.00	90%	0.00
1-Jan-2044	31-Dec-2044	0.00	90%	0.00
1-Jan-2045	31-Dec-2045	0.00	90%	0.00
1-Jan-2046	31-Dec-2046	0.00	90%	0.00

⁸⁴ 250912_GHGReductionEx-ante.xlsx

Start	End	$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)	DLF (%)	$\Delta C_{LK-UDef,t}$ (t CO ₂ e)
1-Jan-2047	31-Dec-2047	0.00	90%	0.00
1-Jan-2048	31-Dec-2048	0.00	90%	0.00
1-Jan-2049	31-Dec-2049	0.00	90%	0.00
1-Jan-2050	31-Dec-2050	0.00	90%	0.00
1-Jan-2051	31-Dec-2051	0.00	90%	0.00
1-Jan-2052	31-Dec-2052	0.00	90%	0.00
Total		641,279.78	-	64,127.98

As defined in Section 1.12, the activities implemented in the leakage management area do not lead to direct carbon stock changes. In the TdX project, the proactive measures to combat leakage sources are:

- (i) Implementation of environmental education activities with identified stakeholders in the leakage management area; and
- (ii) Satellite remote monitoring of areas surrounding the project, i.e., the leakage belt.

Therefore, this part of the calculation does not apply in the context of this project activity, and all possible GHG emissions were considered null.

4.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals

The total net GHG emissions reductions of the avoiding unplanned deforestation project activity are calculated as follows (Equation 17).

$$NER_{UDef,t} = \Delta C_{BSL,PA-UDef,t} - \Delta C_{MP,PA-UDef,t} - \Delta C_{LK-UDef,t} \quad \text{Equation 17}$$

Where:

$NER_{UDef,t}$	Cumulative total net GHG emission reductions of the project activity in year t (t CO ₂ e)
$\Delta C_{BSL,PA-UDef,t}$	Cumulative net GHG emissions in the baseline within the UDef PA in year t (t CO ₂ e)
$\Delta C_{MP,PA-UDef,t}$	Total emissions from carbon stock change in all pools in the UDef PA in year t (t CO ₂ e)
$\Delta C_{LK-UDef,t}$	Cumulative net GHG emissions due to leakage from the UDef PA in year t (t CO ₂ e)
t	1, 2, 3, ..., t^* years elapsed since the start of the project

The final values can be checked in the spreadsheet⁸⁵ and in Table 4.14.

Table 4.14. Estimation of ex-ante GHG emission reductions.

Start	End	$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)	$\Delta C_{MP,PA-UDef,t}$ (t CO ₂ e)	$\Delta C_{LK-UDef,t}$ (t CO ₂ e)	$NER_{UDef,t}$ (t CO ₂ e)
31-Aug-2022	31-Dec-2022	42,013.77	4,201.38	4,201.38	33,611.02
1-Jan-2023	31-Dec-2023	125,543.24	12,554.32	12,554.32	100,434.59
1-Jan-2024	31-Dec-2024	128,119.68	12,811.97	12,811.97	102,495.75
1-Jan-2025	31-Dec-2025	130,696.12	13,069.61	13,069.61	104,556.90
1-Jan-2026	31-Dec-2026	133,272.57	13,327.26	13,327.26	106,618.05
1-Jan-2027	31-Dec-2027	11,173.99	1,117.40	1,117.40	8,939.20
1-Jan-2028	31-Dec-2028	11,173.99	1,117.40	1,117.40	8,939.20
1-Jan-2029	31-Dec-2029	11,173.99	1,117.40	1,117.40	8,939.20
1-Jan-2030	31-Dec-2030	11,173.99	1,117.40	1,117.40	8,939.20
1-Jan-2031	31-Dec-2031	11,173.99	1,117.40	1,117.40	8,939.20
1-Jan-2032	31-Dec-2032	10,305.77	1,030.58	1,030.58	8,244.62
1-Jan-2033	31-Dec-2033	7,729.33	772.93	772.93	6,183.46
1-Jan-2034	31-Dec-2034	5,152.88	515.29	515.29	4,122.31
1-Jan-2035	31-Dec-2035	2,576.44	257.64	257.64	2,061.15
1-Jan-2036	31-Dec-2036	0.00	0.00	0.00	0.00
1-Jan-2037	31-Dec-2037	0.00	0.00	0.00	0.00
1-Jan-2038	31-Dec-2038	0.00	0.00	0.00	0.00
1-Jan-2039	31-Dec-2039	0.00	0.00	0.00	0.00
1-Jan-2040	31-Dec-2040	0.00	0.00	0.00	0.00
1-Jan-2041	31-Dec-2041	0.00	0.00	0.00	0.00
1-Jan-2042	31-Dec-2042	0.00	0.00	0.00	0.00
1-Jan-2043	31-Dec-2043	0.00	0.00	0.00	0.00
1-Jan-2044	31-Dec-2044	0.00	0.00	0.00	0.00
1-Jan-2045	31-Dec-2045	0.00	0.00	0.00	0.00
1-Jan-2046	31-Dec-2046	0.00	0.00	0.00	0.00
1-Jan-2047	31-Dec-2047	0.00	0.00	0.00	0.00

⁸⁵ 250912_GHGReductionEx-ante.xlsx

Start	End	$\Delta C_{BSL,PA-UDef,t}$ (t CO ₂ e)	$\Delta C_{MP,PA-UDef,t}$ (t CO ₂ e)	$\Delta C_{LK-UDef,t}$ (t CO ₂ e)	$NER_{UDef,t}$ (t CO ₂ e)
1-Jan-2048	31-Dec-2048	0.00	0.00	0.00	0.00
1-Jan-2049	31-Dec-2049	0.00	0.00	0.00	0.00
1-Jan-2050	31-Dec-2050	0.00	0.00	0.00	0.00
1-Jan-2051	31-Dec-2051	0.00	0.00	0.00	0.00
1-Jan-2052	31-Dec-2052	0.00	0.00	0.00	0.00
Total		641,279.78	64,127.98	64,127.98	513,023.82

4.4.1 Calculation of AFOLU Pooled Buffer Account Contribution

The number of credits to be held in the AFOLU pooled buffer account is determined as a percentage of the total carbon stock benefits. For avoiding unplanned deforestation project activities, this is calculated using Equation 18. Leakage emissions do not factor into the buffer calculations.

$$Buffer_{Total,t} = (\Delta C_{BSL,PA-UDef,t} - \Delta C_{MP,PA-UDef,t}) \times Buffer\% \quad \text{Equation 18}$$

Where:

$Buffer_{Total,t}$	Cumulative total permanence risk buffer withholding in year t (t CO ₂ e)
$\Delta C_{BSL,PA-UDef,t}$	Cumulative net GHG emissions in the baseline within the UDef PA in year t (t CO ₂ e)
$\Delta C_{MP,PA-UDef,t}$	Total emissions from carbon stock change in all pools in the UDef PA in year t (t CO ₂ e)
$Buffer\%$	Buffer withholding percentage, from VCS AFOLU Non-Permanence Risk Tool (%)
t	1, 2, 3, ..., t^* years elapsed since the start of the project

According to the VCS AFOLU Non-Permanence Risk Tool⁸⁶, the buffer is 15%.

4.4.2 Calculation of Verified Carbon Units

To calculate the number of potential Verified Carbon Units (VCUs) for years in which monitoring has been conducted and submitted for verification, this module uses the following equation (Equation 19):

$$VCU_{AUDef,t} = (NER_{UDef,t} - NER_{UDef,t-1}) - (Buffer_{Total,t} - Buffer_{Total,t-1}) \quad \text{Equation 19}$$

Where:

$VCU_{AUDef,t}$	Number of potential Verified Carbon Units generated in year t (VCU)
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⁸⁶ VCS_NPR_REP_3738_31_08_2022_15_08_2025.pdf

$NER_{UDef,t}$	Cumulative total net GHG emission reductions of the project activity in year t (t CO ₂ e)
$NER_{UDef,t-1}$	Cumulative total net GHG emission reductions of the project activity in year $t - 1$ (t CO ₂ e)
$Buffer_{Total,t}$	Cumulative total permanence risk buffer withholding in year t (t CO ₂ e)
$Buffer_{Total,t-1}$	Cumulative total permanence risk buffer withholding in year $t - 1$ (t CO ₂ e)
t	1, 2, 3, ..., t^* years elapsed since the start of the project

Where this equation results in a decimal number, the number must be rounded down. More information about the non-permanence risk rating can be seen in the Table 4.15. Therefore, the estimate of the calculation of the ex-ante Verified Carbon Units is detailed in the calculation spreadsheet⁸⁷ and can be seen in Table 4.16.

Table 4.15. Information about the non-permanence risk rating.

State the non-permanence risk rating (%)	15%
Has the non-permanence risk report been attached as either an appendix or a separate document?	☒ Yes ☐ No
For ARR and IFM projects with harvesting, state, in t CO ₂ e, the Long-term Average (LTA).	N/A
Has the LTA been updated based on monitored data, if applicable?	N/A
State, in t CO ₂ e, the expected total GHG benefit to date.	513,023.82
Is the number of GHG credits issued below the LTA?	N/A

Table 4.16. Summary of estimated total VCU issuance.

Vintage period	Estimated baseline emissions (t CO ₂ e)	Estimated project emissions (t CO ₂ e)	Estimated leakage emissions (t CO ₂ e)	Estimated buffer pool allocation (t CO ₂ e)	Estimated reduction VCUs (t CO ₂ e)	Estimated removal VCUs (t CO ₂ e)	Estimated total VCU issuance (t CO ₂ e)
31-Aug-2022 to 31-Dec-2022	42,013.77	4,201.38	4,201.38	5,671.86	27,939	-	27,939

⁸⁷ 250912_GHGReductionEx-ante.xlsx

Vintage period	Estimated baseline emissions (t CO ₂ e)	Estimated project emissions (t CO ₂ e)	Estimated leakage emissions (t CO ₂ e)	Estimated buffer pool allocation (t CO ₂ e)	Estimated reduction VCUs (t CO ₂ e)	Estimated removal VCUs (t CO ₂ e)	Estimated total VCU issuance (t CO ₂ e)
01-Jan-2023 to 31-Dec-2023	125,543.24	12,554.32	12,554.32	16,948.34	83,486	-	83,486
01-Jan-2024 to 31-Dec-2024	128,119.68	12,811.97	12,811.97	17,296.16	85,199	-	85,199
01-Jan-2025 to 31-Dec-2025	130,696.12	13,069.61	13,069.61	17,643.98	86,912	-	86,912
01-Jan-2026 to 31-Dec-2026	133,272.57	13,327.26	13,327.26	17,991.80	88,626	-	88,626
01-Jan-2027 to 31-Dec-2027	11,173.99	1,117.40	1,117.40	1,508.49	7,430	-	7,430
01-Jan-2028 to 31-Dec-2028	11,173.99	1,117.40	1,117.40	1,508.49	7,430	-	7,430
01-Jan-2029 to 31-Dec-2029	11,173.99	1,117.40	1,117.40	1,508.49	7,430	-	7,430
01-Jan-2030 to 31-Dec-2030	11,173.99	1,117.40	1,117.40	1,508.49	7,430	-	7,430
01-Jan-2031 to 31-Dec-2031	11,173.99	1,117.40	1,117.40	1,508.49	7,430	-	7,430
01-Jan-2032 to 31-Dec-2032	10,305.77	1,030.58	1,030.58	1,391.28	6,853	-	6,853
01-Jan-2033 to 31-Dec-2033	7,729.33	772.93	772.93	1,043.46	5,140	-	5,140
01-Jan-2034 to 31-Dec-2034	5,152.88	515.29	515.29	695.64	3,426	-	3,426
01-Jan-2035 to 31-Dec-2035	2,576.44	257.64	257.64	347.82	1,713	-	1,713
01-Jan-2036 to 31-Dec-2036	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2037 to 31-Dec-2037	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2038 to 31-Dec-2038	0.00	0.00	0.00	0.00	0	-	0

Vintage period	Estimated baseline emissions (t CO ₂ e)	Estimated project emissions (t CO ₂ e)	Estimated leakage emissions (t CO ₂ e)	Estimated buffer pool allocation (t CO ₂ e)	Estimated reduction VCUs (t CO ₂ e)	Estimated removal VCUs (t CO ₂ e)	Estimated total VCU issuance (t CO ₂ e)
01-Jan-2039 to 31-Dec-2039	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2040 to 31-Dec-2040	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2041 to 31-Dec-2041	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2042 to 31-Dec-2042	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2043 to 31-Dec-2043	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2044 to 31-Dec-2044	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2045 to 31-Dec-2045	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2046 to 31-Dec-2046	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2047 to 31-Dec-2047	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2048 to 31-Dec-2048	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2049 to 31-Dec-2049	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2050 to 31-Dec-2050	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2051 to 31-Dec-2051	0.00	0.00	0.00	0.00	0	-	0
01-Jan-2052 to 30-Aug-2052	0.00	0.00	0.00	0.00	0	-	0
Total	641,279.78	64,127.98	64,127.98	86,572.77	426,444	0	426,444

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$A_{PA-UDef}$
Data unit	ha
Description	Area of project where activities aimed at avoiding unplanned deforestation will take place ⁸⁸
Source of data	Calculated within a GIS
Value applied	10,704.58
Justification of choice of data or description of measurement methods and procedures applied	The accuracy of the mapped coordinates was demonstrated in the satellite monitoring report and the best techniques used are described in the GIS SOP ⁸⁹
Purpose of data	Calculation of project emissions
Comments	None

Data / Parameter	AJ
Data unit	ha
Description	Area of the jurisdiction
Source of data	Digital map of jurisdictional boundaries
Value applied	To be determined by Verra
Justification of choice of data or description of measurement methods and procedures applied	Prior to the start of each BVP

⁸⁸ TdX_Project_Area_V2.kml

⁸⁹ SatelliteMonitoring.zip

Purpose of data	Calculation of baseline emissions
Comments	AJ should be calculated using the same projected coordinate system as that used for the digital map of jurisdictional boundaries

Data / Parameter	DLF
Data unit	%
Description	Displacement leakage factor
Source of data	Estimated and justified by project proponent
Value applied	90
Justification of choice of data or description of measurement methods and procedures applied	The parameter was determined based on the extent of implementation of deforestation mitigation activities and the expected impact of the activities on leakage
Purpose of data	Calculation of leakage
Comments	Must be tied to $EA_{EF,t}$

Data / Parameter	$EA_{EF,t}$
Data unit	%
Description	Ex ante effectiveness of halting baseline emissions in year t
Source of data	Estimated and justified by project proponent
Value applied	90
Justification of choice of data or description of measurement methods and procedures applied	The parameter was determined based on the extent of implementation of deforestation mitigation activities and the expected impact of the activities on baseline deforestation. See Section 4.2.1.
Purpose of data	Calculation of project emissions

Comments	None
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Data / Parameter	$t_{\alpha=10\%}$
Data unit	unitless
Description	Value of the Student's t distribution for a two-sided 90 percent confidence interval
Source of data	Common statistical tables or software
Value applied	1.6449
Justification of choice of data or description of measurement methods and procedures applied	Based on the central limit theorem, sample estimates are assumed to approach a normal distribution, from which a confidence interval may be constructed. The student's t distribution is used to allow for small sample sizes
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions
Comments	None

Data / Parameter	$t_{\alpha=66.67\%}$
Data unit	unitless
Description	Value of the Student's t distribution for a one-sided 66.67 percent confidence interval
Source of data	Common statistical tables or software
Value applied	0.4307
Justification of choice of data or description of measurement methods and procedures applied	Based on the central limit theorem, sample estimates are assumed to approach a normal distribution, from which a confidence interval may be constructed. The student's t distribution is used to allow for small sample sizes

Purpose of data	- Calculation of baseline emissions - Calculation of project emissions
Comments	None

Data / Parameter	CF_j
Data unit	t C t.d.m. ⁻¹
Description	Carbon fraction of biomass for species group <i>j</i>
Source of data	Values from the literature (e.g. IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3) shall be used if available, otherwise default value of 0.47 t C t⁻¹ d.m. can be used Tree: IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3; Non-tree: Derived from Gehring et al. (2011).
Value applied	Tree: 0.47 Non-tree: 0.425
Justification of choice of data or description of measurement methods and procedures applied	Values from the literature: Tree: Default value equivalent to 0.47, according to Table 4.3 of IPCC 2006 INV GLs AFOLU (Chapter 4); Non-tree: Value equivalent to 0.425 derived from Gehring et al. (2011), representing the most conservative approach among peer-reviewed studies analyzed. This value ensures carbon stock estimates are not overestimated, as supported by other studies reporting higher carbon fractions: Goodman et al. (2013) found 48.1% for Amazon palm biomass across nine species; Miranda et al. (2012) reported 43.1% for açaí palm in Pará, Brazil; Cambronero et al. (2018) measured 43.9% for seven neotropical palm species in Costa Rica; and Avalos et al. (2022) estimated 43.3% for Arecaceae species in similar tropical ecosystems.
Purpose of data	- Calculation of baseline emissions - Calculation of project emissions

Comments	Where new species are encountered while monitoring, new carbon fraction values must be sourced from the literature or otherwise use the default value
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Data / Parameter	R
Data unit	root d.m. t^{-1} shoot d.m.
Description	Root to shoot ratio appropriate to species or forest type / biome; note that as defined here, root to shoot ratio is applied as belowground biomass per unit area: aboveground biomass per unit area (not on a per stem basis)
Source of data	IPCC (2019), Chapter 4, page 4.18, Table 4.4
Value applied	0.221
Justification of choice of data or description of measurement methods and procedures applied	None
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions
Comments	None

Data / Parameter	$COMF_i$
Data unit	dimensionless
Description	Combustion factor for stratum i (vegetation type)
Source of data	IPCC (2006a), Table 2.6, page 2.55
Value applied	0.32
Justification of choice of data or description of	Default values in Table 2.6 of IPCC for Primary tropical forest.

measurement methods and procedures applied	Given that the project area comprises the vegetation type of open-canopy rainforest and dense-canopy rainforest, the default value of 0.32 for primary tropical forest (Table 2.6, IPCC 2006) was adopted. Although Table 2.6 (IPCC 2006) does not explicitly specify "Rainforest", the references that support this value focus on tropical rainforests in geographically proximate and ecologically similar regions to the project area. The value is conservative, in accordance with VCS Standard v4.5 (Section 3.2.3), since 0.32 is substantially lower than the aggregated value for all primary tropical forests (0.36) and the stratum-specific values (0.5 for Primary Tropical Moist Forest and 0.45 for Primary Tropical Open Forest) provided in Table 2.6 (IPCC 2006), leading to underestimation of combustion completeness and thus more conservative GHG emission estimates under VM0048.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions
Comments	None

Data / Parameter	$G_{g,i}$
Data unit	g kg ⁻¹ dry matter burnt
Description	Emission factor for stratum i for gas g
Source of data	IPCC (2006a), Table 2.5, page 2.54
Value applied	$G_{g,CH_4} = 6.80$ $G_{g,N_2O} = 0.20$
Justification of choice of data or description of measurement methods and procedures applied	Default values in Table 2.5 of IPCC - Chapter 2
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions

Comments	None
Data / Parameter	GWP_g
Data unit	dimensionless
Description	Global warming potential for gas g
Source of data	IPCC (2014), Box 3.2, Table 1, page 87
Value applied	$GWP_{CH_4} = 28$ $GWP_{N_2O} = 265$
Justification of choice of data or description of measurement methods and procedures applied	Default factor from the latest IPCC Assessment Report. Table 1, page 87
Purpose of data	- Calculation of baseline emissions - Calculation of project emissions
Comments	None

5.2 Data and Parameters Monitored

Data / Parameter	$A_{Available}$
Data unit	ha
Description	Area of jurisdiction mapped as available for activity shifting outside the UDef LB
Source of data	Verra (Appendix 2)
Value applied	37,796,398.08 ha
Description of measurement methods and procedures to be applied	Digital map of land available for activity shifting

Frequency monitoring/recording of	Every six years at baseline renewal
Value monitored	N/A
Monitoring equipment	Data provided by Verra.
QA/QC procedures to be applied	None
Purpose of data	Calculation of leakage
Calculation method	GIS
Comments	The value was not originally included in VCS 3738 PADA Report, but it was provided by Verra via email ⁹⁰ , upon request of the project proponent.

Data / Parameter	A_i
Data unit	ha
Description	Area of stratum i
Source of data	Project proponent (determined during spatial analysis)
Description of measurement methods and procedures to be applied	None
Frequency monitoring/recording of	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	A_{AS} : 9,602.49 ha (Area of stratum A_s - Open-canopy rainforest) A_{DS} : 1,102.09 ha (Area of stratum D_s - Dense-canopy rainforest, submontane) Total area: 10,704.58 ha
Monitoring equipment	Remote sensing and GIS (QGIS and ArcGIS, latest versions)

⁹⁰ 260316_AnnexCL17_Systemica-Verra_emails-annotated.pdf

QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using Sentinel satellites images with resolution 10 meters validating through a pixel-by-pixel based machine learning algorithms classification using Google Earth Engine. 2) The Mapbiomas methodology uses image with minimal cloud cover product of Landsat scenes mosaicked from various months of the year (MapBiomas, 2022). 3) An independent verifiable accuracy assessment was performed using high-resolution image with 5 m resolution from Planet Image to confirm the minimum map accuracy of 90% for each land use class used. 4) Conservatively the secondary forest is eliminated of the forest class according to (Silva Junior et al., 2020).
Purpose of data	• Calculation of project emissions
Calculation method	GIS
Comments	None

Data / Parameter	A_{PSF}
Data unit	ha
Description	Area of project sampling frame
Source of data	Project proponent (determined during spatial analysis).
Description of measurement methods and procedures to be applied	None
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	Please see Section 4.2
Monitoring equipment	Remote sensing and GIS (QGIS and ArcGIS, latest versions)
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using Sentinel satellites images with resolution 10 meters validating through a

	pixel-by-pixel based machine learning algorithms classification using Google Earth Engine. - The Mapbiomas methodology uses image with minimal cloud cover product of Landsat scenes mosaicked from various months of the year (MapBiomas, 2022). - An independent verifiable accuracy assessment was performed using high-resolution image with 5 m resolution from Planet Image to confirm the minimum map accuracy of 90% for each land use class used. - Conservatively the secondary forest is eliminated of the forest class according to (Silva Junior et al., 2020).
Purpose of data	Calculation of project emissions
Calculation method	GIS
Comments	None

Data / Parameter	$AD_{LB-UDef}$
Data unit	ha
Description	Unplanned deforestation activity data allocated to the UDef LB
Source of data	Verra (VT0007 and Appendix 1 of VMD0055)
Description of measurement methods and procedures to be applied	None
Frequency of monitoring/recording	Every six years at baseline renewal. Note that a project's initial BVP may be shorter than six years, as provided for in Section 5.3.1; subsequent baselines will be renewed every six years
Value monitored	367.784 ha yr ⁻¹ (please see PADA Report – VCS 3738 ⁹¹)
Monitoring equipment	Data provided by Verra.
QA/QC procedures to be applied	None
Purpose of data	Calculation of leakage

⁹¹ VCS_3738_PADA_REQUEST.zip

Calculation method	Appendix 1 (VMD0055) and VT0007 by Verra
Comments	None

Data / Parameter	A_{ss}
Data unit	ha
Description	Area of sampling stratum ss in the project sampling frame (ha)
Source of data	Project (calculated in a GIS from spatial stratification of the project sampling frame)
Description of measurement methods and procedures to be applied	None
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	Please see Section 4.2.
Monitoring equipment	Remote sensing and GIS (QGIS and ArcGIS, latest versions)
QA/QC procedures to be applied	None
Purpose of data	Calculation of project emissions
Calculation method	GIS
Comments	None

Data / Parameter	$AD_{PA-UDef}$
Data unit	ha
Description	Unplanned deforestation activity data allocated to the UDef PA in the jurisdiction

Source of data	Verra (through the AD Baseline Allocation Report and VT0007)
Description of measurement methods and procedures to be applied	Approach to be determined and applied by DSP selected by Verra
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	256.356 ha yr ⁻¹ (please see PADA Report – VCS 3738 ⁹²)
Monitoring equipment	Data provided by Verra.
QA/QC procedures to be applied	None
Purpose of data	Calculation of baseline emissions
Calculation method	Application of Appendix 1 by Verra (VMD0055)
Comments	None

Data / Parameter	<i>Buffer%</i>
Data unit	%
Description	Buffer withholding percentage
Source of data	VCS AFOLU Non-Permanence Risk Tool
Description of measurement methods and procedures to be applied	See VCS AFOLU Non-Permanence Risk Tool
Frequency of monitoring/recording	Every verification event
Value monitored	15%
Monitoring equipment	VCS AFOLU Non-Permanence Risk Tool

⁹² VCS_3738_PADA_REQUEST.zip

QA/QC procedures to be applied	None
Purpose of data	Calculation of VCUs
Calculation method	VCS AFOLU Non-Permanence Risk Tool
Comments	None

Data / Parameter	$C_{p,i}$
Data unit	t CO ₂ e ha ⁻¹
Description	Estimated carbon stock in pool <i>p</i> of forest stratum <i>i</i>
Source of data	Project proponent (VMD0001, VMD0002, VMD0003, VMD0004, VMD0005)
Description of measurement methods and procedures to be applied	None
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1 and the calculation spreadsheet ⁹³ .
Monitoring equipment	None
QA/QC procedures to be applied	See VMD0001, VMD0002, VMD0003, VMD0004, VMD0005
Purpose of data	- Calculation of baseline emissions - Calculation of project emissions - Calculation of leakage
Calculation method	See VMD0001, VMD0002, VMD0003, VMD0004, VMD0005
Comments	None

⁹³ 250912_GHGReductionEx-post.xlsx

Data / Parameter	$C_{p,post,i}$
Data unit	t CO ₂ e ha ⁻¹
Description	Estimated carbon stock in post-deforestation pool p in forest stratum <i>i</i>
Source of data	Project proponent Published and/or peer-reviewed studies selected from the following, in descending order of preference: 1) Within 5 km of the project boundary 2) Subnational jurisdiction 3) National jurisdiction 4) National data from neighboring countries with similar conditions 5) Global Where these data are inadequate or not appropriate, field sampling may take place within the jurisdiction. Field sampling design must result in an estimate that produces conservative estimates of the carbon stocks
Description of measurement methods and procedures to be applied	See VMD0001, VMD0002, VMD0003, VMD0004, VMD0005
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1 and the calculation spreadsheet ⁹⁴ .
Monitoring equipment	None
QA/QC procedures to be applied	See VMD0001, VMD0002, VMD0003, VMD0004, VMD0005
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	Stock estimates of each non-forest land use class represented must be equal to the long-term average stocks (time-weighted average of stocks in cyclical post-deforestation land-use systems such as shifting agriculture with fallow)
Comments	None

⁹⁴ 250912_GHGReductionEx-post.xlsx

Data / Parameter	$C_{AB_{nontree,i}}$
Data unit	t CO ₂ e ha ⁻¹
Description	Forest carbon stock in aboveground non-tree woody vegetation in stratum <i>i</i>
Source of data	Forest carbon stock in aboveground non-tree woody vegetation in stratum <i>i</i>
Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1 and the calculation spreadsheet ⁹⁵ .
Monitoring equipment	Parameter derived from forest biomass inventory ⁹⁶ (uncertainty <10%).
QA/QC procedures to be applied	See VMD0001
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See VMD0001
Comments	None

Data / Parameter	$C_{AB_{nontree,post,i}}$
Data unit	t CO ₂ e ha ⁻¹
Description	Post-land use transition carbon stock in aboveground non-tree woody vegetation in stratum <i>i</i>
Source of data	Project proponent

⁹⁵ 250912_GHGReductionEx-post.xlsx

⁹⁶ 251218_ForestInventoryTdX.xlsx

	Published and/or peer-reviewed studies selected from the following, in descending order of preference: 1) Within 5 km of the project boundary 2) Subnational jurisdiction 3) National jurisdiction 4) National data from neighboring countries with similar conditions 5) Global Where these data are inadequate or not appropriate, field sampling may take place within the jurisdiction. Field sampling design must result in an estimate that produces conservative estimates of the carbon stocks
Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1 and the calculation spreadsheet ⁹⁷ .
Monitoring equipment	Parameter derived from forest biomass inventory ⁹⁸ (uncertainty <10%).
QA/QC procedures to be applied	See VMD0001
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	Stock estimates of each non-forest land use class represented must be equal to the long-term average stocks (time-weighted average of stocks in cyclical post-deforestation land-use systems such as shifting agriculture with fallow)
Comments	None

Data / Parameter	$C_{ABtree,i}$
Data unit	t CO ₂ e ha ⁻¹
Description	Forest carbon stock in aboveground tree biomass in stratum <i>i</i>

⁹⁷ 250912_GHGReductionEx-post.xlsx

⁹⁸ 251218_ForestInventoryTdX.xlsx

Source of data	Project proponent (as delineated in VMD0001)
Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1 and the calculation spreadsheet ⁹⁹ .
Monitoring equipment	Parameter derived from forest biomass inventory ¹⁰⁰ (uncertainty <10%).
QA/QC procedures to be applied	See VMD0001
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See VMD0001
Comments	None

Data / Parameter	$C_{ABtree,post,i}$
Data unit	t CO ₂ e ha ⁻¹
Description	Post-land use transition carbon stock in aboveground tree biomass in stratum <i>i</i>
Source of data	Project proponent Published and/or peer-reviewed studies selected from the following, listed in descending order of preference: 1) Within 5 km of the project boundary 2) Sub-national jurisdiction 3) National jurisdiction 4) National data from neighboring countries with similar conditions 5) Global Where these data are inadequate or not appropriate, field sampling may take place within the jurisdiction. Field sampling design must result in an estimate that produces conservative estimates of the carbon stocks

⁹⁹ 250912_GHGReductionEx-post.xlsx

¹⁰⁰ 251218_ForestInventoryTdX.xlsx

Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1 and the calculation spreadsheet ¹⁰¹ .
Monitoring equipment	Parameter derived from forest biomass inventory ¹⁰² (uncertainty <10%).
QA/QC procedures to be applied	See VMD0001
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	Stock estimates of each non-forest land use class represented must be equal to the long-term average stocks (time-weighted average of stocks in cyclical post-deforestation land-use systems such as shifting agriculture with fallow)
Comments	None

Data / Parameter	$C_{BB_{nontree},i}$
Data unit	t CO ₂ e ha ⁻¹
Description	Forest carbon stock in the belowground non-tree woody biomass pool in stratum <i>i</i>
Source of data	Project proponent (field measurements as delineated in VMD0001)
Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal

¹⁰¹ 250912_GHGReductionEx-post.xlsx

¹⁰² 251218_ForestInventoryTdX.xlsx

Value monitored	Please see Section 4.1 and the calculation spreadsheet ¹⁰³ .
Monitoring equipment	Parameter derived from forest biomass inventory ¹⁰⁴ (uncertainty <10%).
QA/QC procedures to be applied	See VMD0001
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See VMD0001
Comments	None

Data / Parameter	$C_{BB_{nontree,post,i}}$
Data unit	t CO ₂ e ha ⁻¹
Description	Post land use transition carbon stock in the belowground non-tree woody biomass pool in stratum <i>i</i>
Source of data	Project proponent Published and/or peer-reviewed studies selected from the following, in descending order of preference: 1) Within 5 km of the project boundary 2) Subnational jurisdiction 3) National jurisdiction 4) National data from neighboring countries with similar conditions 5) Global Where these data are inadequate or not appropriate, field sampling may take place within the jurisdiction. Field sampling design must result in an estimate that produces conservative estimates of the carbon stocks
Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal

¹⁰³ 250912_GHGReductionEx-post.xlsx

¹⁰⁴ 251218_ForestInventoryTdX.xlsx

Value monitored	Please see Section 4.1 and the calculation spreadsheet ¹⁰⁵ .
Monitoring equipment	Parameter derived from forest biomass inventory ¹⁰⁶ (uncertainty <10%).
QA/QC procedures to be applied	See VMD0001
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	Stock estimates of each non-forest land use class represented must be equal to the long-term average stocks (time-weighted average of stocks in cyclical post-deforestation land-use systems such as shifting agriculture with fallow)
Comments	None

Data / Parameter	$C_{BBtree,i}$
Data unit	t CO ₂ e ha ⁻¹
Description	Forest carbon stock in belowground tree biomass in stratum <i>i</i>
Source of data	Project proponent (field measurements as delineated in VMD0001)
Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1 and the calculation spreadsheet ¹⁰⁷ .
Monitoring equipment	Parameter derived from forest biomass inventory ¹⁰⁸ (uncertainty <10%).
QA/QC procedures to be applied	See VMD0001

¹⁰⁵ 250912_GHGReductionEx-post.xlsx

¹⁰⁶ 251218_ForestInventoryTdX.xlsx

¹⁰⁷ 250912_GHGReductionEx-post.xlsx

¹⁰⁸ 251218_ForestInventoryTdX.xlsx

Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	See VMD0001
Comments	None

Data / Parameter	$C_{BB_{tree},post,i}$
Data unit	t CO ₂ e ha ⁻¹
Description	Post land use transition carbon stock in belowground tree biomass in stratum <i>i</i>
Source of data	Project proponent Published and/or peer-reviewed studies selected from the following, listed in descending order of preference: 1) Within 5 km of the project boundary 2) Subnational jurisdiction 3) National jurisdiction 4) National data from neighboring countries with similar conditions 5) Global Where these data are inadequate or not appropriate, field sampling may take place within the jurisdiction. Field sampling design must result in an estimate that produces conservative estimates of the carbon stocks
Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1 and the calculation spreadsheet ¹⁰⁹ .
Monitoring equipment	Parameter derived from forest biomass inventory ¹¹⁰ (uncertainty <10%).
QA/QC procedures to be applied	See VMD0001
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions

¹⁰⁹ 250912_GHGReductionEx-post.xlsx

¹¹⁰ 251218_ForestInventoryTdX.xlsx

	Calculation of leakage
Calculation method	Stock estimates of each non-forest land use class represented must be equal to the long-term average stocks (time-weighted average of stocks in cyclical post-deforestation land-use systems such as shifting agriculture with fallow)
Comments	None

Data / Parameter	<i>MPL</i>
Data unit	years
Description	Length of monitoring period
Source of data	Project proponent (metadata of imagery used to undertake plot interpretation for project monitoring)
Description of measurement methods and procedures to be applied	None
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	2.9570 yr. According to the monitoring period.
Monitoring equipment	None
QA/QC procedures to be applied	None
Purpose of data	Calculation of project emissions
Calculation method	Calculated as the difference between the average dates of imagery used to assess sample plots at the start and end of the monitored period
Comments	None

Data / Parameter	$\Delta C_{LK-ME,t}$
Data unit	t CO ₂ e
Description	Cumulative net GHG emissions due to market-effects leakage in year <i>t</i>
Source of data	Project proponent (as delineated in VMD0011)
Description of measurement methods and procedures to be applied	See VMD0011
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	Zero
Monitoring equipment	None
QA/QC procedures to be applied	See VMD0011
Purpose of data	Calculation of leakage
Calculation method	See VMD0011
Comments	Net GHG emissions due to market-effects leakage summed up to year <i>t</i>

Data / Parameter	$\Delta C_{OLB,t}$
Data unit	t CO ₂ e ha ⁻¹
Description	Emissions from carbon stock change due to land cover transition in areas available for activity shifting outside the UDef LB, as calculated for year <i>t</i>
Source of data	Verra (see Appendix 2 Section A2.2; derived by Verra from average carbon stocks in pixels available for deforestation from a global carbon stock map, where relevant with addition of belowground biomass from IPCC root-to-shoot ratios)

Description of measurement methods and procedures to be applied	See Appendix 2 A2.2 of VMD0055
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	424.99 t CO ₂ e ha ⁻¹ (please see PADA Report – VCS 3738 ¹¹¹)
Monitoring equipment	Data provided by Verra
QA/QC procedures to be applied	None
Purpose of data	Calculation of leakage
Calculation method	See Appendix 2 A2.2 (VMD0055)
Comments	None

Data / Parameter	$CountJ_{CHC,ss}$
Data unit	Sampling units
Description	Total count of the sample units that fall into sampling stratum ss and change category CHC (UDef/SF/SNF/Reg)
Source of data	Verra (interpretation of high-resolution satellite imagery and/or ground measurements)
Description of measurement methods and procedures to be applied	See Appendix 1 (VMD0055)
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	N/A
Monitoring equipment	None

¹¹¹ VCS_3738_PADA_REQUEST.zip

QA/QC procedures to be applied	Imagery Interpretation Method The interpretation and recordkeeping approach must be documented through SOPs, allowing the process to be reproduced by individuals not involved in initial data generation. The methods employed must meet the following minimum characteristics: • The interpretation approach provides sufficient objective criteria to allow interpreters to independently and consistently produce similar interpretations for the same samples. Interpretation criteria should relate to the physical definitions of land cover classes, as far as those criteria may be interpreted from high-resolution imagery. • Multiple analysts are employed to interpret each plot through blindly repeated observations or team-based interpretation. • Observation focuses on identifying a sample's class at each of two single points in time, the beginning and end of the HRP. The change is determined by the difference between the start and end classes. • Where there is analyst disagreement over the interpretation of a sample, an objective process is put in place to either adjudicate the dispute and resolve the plot to a single class or reject the plot as unclear. Adjudication must always be attempted before rejection. Information on all rejected plots must be retained, and it must be demonstrated that the rejection of plots does not bias the results
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method	Appendix 1 (VMD0055)
Comments	CHC = UDef, SF, SNF, Reg (unplanned deforestation, stable forest, stable nonforest, regrowth)

Data / Parameter	$Count_{ss}$
Data unit	Sample units
Description	Total count of sample units in sampling stratum ss
Source of data	Project proponent (interpretation of high-resolution satellite imagery and ground measurements)
Description of measurement methods and procedures to be applied	See Appendix 1 (VMD0055)

Frequency monitoring/recording of	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	Please see Section 4.2 and the attached document ¹¹² .
Monitoring equipment	Remote sensing and GIS (QGIS and ArcGIS, latest versions)
QA/QC procedures to be applied	As described in Standard Operating Procedures for Sample Plot Interpretation
Purpose of data	• Calculation of project emissions • Calculation of leakage
Calculation method	Approach must comply with all relevant requirements of Appendix 1 (VMD0055)
Comments	None

Data / Parameter	$Count_{CHC,ss}$
Data unit	Sample units
Description	Count of the sample units within the project sampling frame that fall into sampling stratum ss and are classified as change category CHC (UDef/SF/SNF/Reg)
Source of data	Project (interpretation of high-resolution satellite imagery and ground measurements)
Description of measurement methods and procedures to be applied	See Appendix 1 (VMD0055)
Frequency monitoring/recording of	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	Please see Section 4.2 and the attached document ¹¹³ .
Monitoring equipment	Remote sensing and GIS (QGIS and ArcGIS, latest versions)

¹¹² SatelliteMonitoring.zip

¹¹³ SatelliteMonitoring.zip

QA/QC procedures to be applied	As described in Standard Operating Procedures for Sample Plot Interpretation
Purpose of data	• Calculation of project emissions • Calculation of leakage
Calculation method	Approach must comply with all relevant requirements of Appendix 1 (VMD0055)
Comments	CHC = UDef, SF, SNF, Reg (unplanned deforestation, stable forest, stable nonforest, regrowth)

Data / Parameter	$E_{BSL,BiomassBurn,i,t}$
Data unit	t CO ₂ e
Description	Non-CO ₂ emissions due to biomass burning as part of project activities in forest stratum <i>i</i> in year <i>t</i>
Source of data	Project proponent (as delineated in VMD0013)
Description of measurement methods and procedures to be applied	See VMD0013
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	Please see Section 4.1.2.2
Monitoring equipment	None
QA/QC procedures to be applied	See VMD0013
Purpose of data	• Calculation of baseline emissions
Calculation method	See VMD0013
Comments	None

Data / Parameter	$E_{MP,BiomassBurn,i,t}$
Data unit	t CO ₂ e
Description	Non-CO₂ emissions due to biomass burning as part of project activities in forest stratum i in year t Note – in application in the leakage management zones, there are no strata and subscript i should be omitted
Source of data	Project proponent (as delineated in VMD0013)
Description of measurement methods and procedures to be applied	See VMD0013
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	Please see Section 4.1.2.2 and the attached document ¹¹⁴ .
Monitoring equipment	Remote sensing and GIS (QGIS and ArcGIS, latest versions)
QA/QC procedures to be applied	See VMD0013
Purpose of data	Calculation of project emissions
Calculation method	See VMD0013
Comments	None

Data / Parameter	$E_{Cstocks,LMZ,t}$
Data unit	t CO ₂ e
Description	Net CO ₂ e emissions from carbon stock changes due to the implementation of leakage mitigation measures in the leakage management zone in year t

¹¹⁴ SatelliteMonitoring.zip

Source of data	Project proponent (as delineated in VMD0001)
Description of measurement methods and procedures to be applied	See VMD0001
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	N/A
Monitoring equipment	None
QA/QC procedures to be applied	See VMD0001
Purpose of data	Calculation of leakage
Calculation method	See VMD0001
Comments	None

Data / Parameter	$PROP_{MIG}$
Data unit	Proportion
Description	Proportion of households living in the project activities region that are recent migrants and are engaging in land use activities identified as a baseline driver of unplanned deforestation
Source of data	Project proponent (through participatory rural appraisal)
Description of measurement methods and procedures to be applied	For sampling requirements refer to CDM Guideline: Sampling and surveys for CDM project activities and programmes of activities. $PROP_{MIG}$ may always be assigned a conservative value of 1.0.
Frequency of monitoring/recording	Every six years at baseline renewal
Value monitored	$1/17 \approx 0.06$

Monitoring equipment	CDM Guideline: Sampling and surveys for CDM project activities and programmes of activities
QA/QC procedures to be applied	For sampling requirements refer to CDM Guideline: Sampling and surveys for CDM project activities and programmes of activities
Purpose of data	Calculation of leakage
Calculation method	Survey
Comments	None

Data / Parameter	$t_{start,ss,s}$
	$t_{end,ss,s}$
Data unit	Decimal year
Description	Date of image used to interpret the start and end dates of sample s classified in sampling stratum ss
Source of data	Project proponent (from metadata provided with high resolution imagery used in sample plot interpretation, or for ground observations, date of field visit)
Description of measurement methods and procedures to be applied	None
Frequency of monitoring/recording	Monitoring must be conducted at least every five years, or prior to each verification event where verification occurs more frequently
Value monitored	N/A
Monitoring equipment	Remote sensing and GIS (QGIS and ArcGIS, latest versions)
QA/QC procedures to be applied	None
Purpose of data	- Calculation of project emissions - Calculation of leakage

Calculation method	None
Comments	For images that are composites of multiple imaged dates, the midpoint of the time period represented in the composite must be taken as the collection date

5.3 Monitoring Plan

The TdX-I1 Monitoring Plan was developed according to the approved VCS methodology VM0048 Reducing Emissions from Deforestation and Forest Degradation v1.0, published on 27-November-2023. The monitoring plan must address the following tasks:

- Monitoring of project implementation.
- Monitoring of actual carbon stock changes and greenhouse gas emissions.
- Monitoring of leakage carbon stock changes and greenhouse gas emissions; and
- Estimation of ex post net carbon stock changes and greenhouse gas emissions.

For each of these tasks, the monitoring plan must include the following information:

- Technical description of the monitoring task.
- Data to be collected (data and parameters to be collected must be listed in the project description).
- Overview of data collection procedures.
- Quality control and quality assurance procedures.
- Data archiving; and
- Organization and responsibilities of the parties involved in all the above.

The parties involved in monitoring activities are represented in Figure 5.1. The work between the project proponent and landowners' entities is very often interlinked, and their smooth cooperation results in effective monitoring practices.

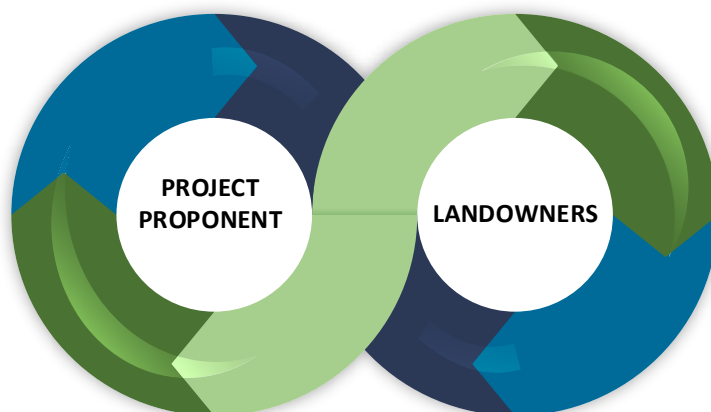


Figure 5.1. The parties involved in monitoring activities.

To clarify the general roles and responsibilities of the parties involved in the project, the following section seeks to describe each general role (Figure 5.2). The project proponent is responsible for REDD+ activities advisory through strategic planning, verification, instructions, accounting, and development of PD and monitoring report documents. General Systemica’s quality control and quality assurance procedures are described in the “Sistema de Gestão de Qualidade Interna – Systemica”¹¹⁵. The landowners are responsible for the execution and reporting of information through tactical planning, patrolling, surveillance, local infrastructure, and on-site project management. Therefore, this structure involves collaborative work for monitoring activities.

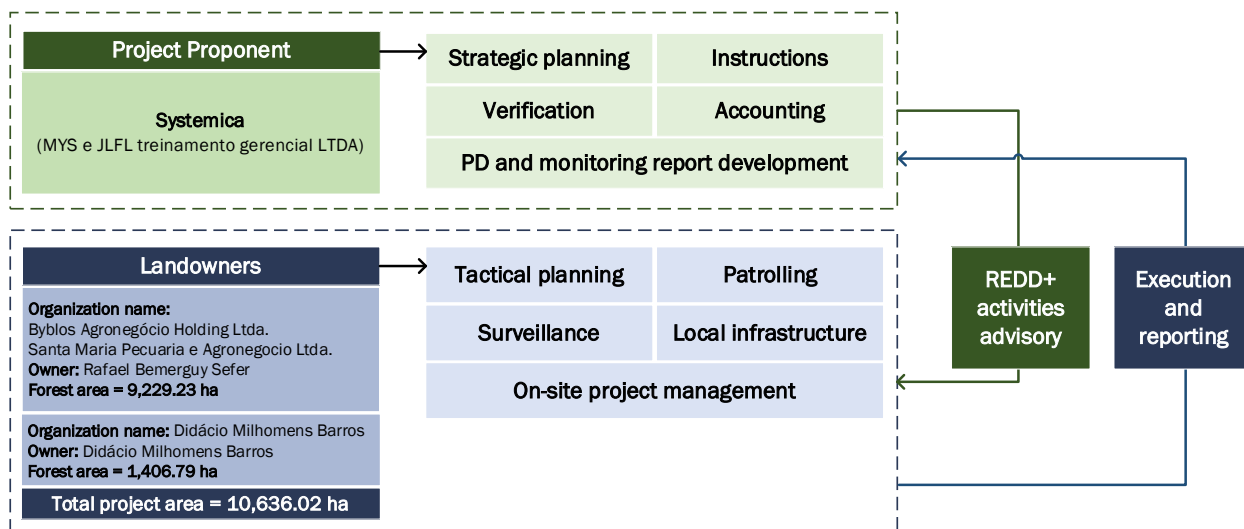


Figure 5.2 General overview of parties involved in monitoring activities.

5.3.1 Monitoring of actual carbon stock changes and greenhouse gas emissions

¹¹⁵ 230921_QAQC.pdf

5.3.1.1 Technical description of the monitoring task

Monitoring actual changes in carbon stock and GHG emissions within the Project Area involves four main scopes, which are: (i) monitoring of project implementation, (ii) monitoring of land use and land cover change, (iii) monitoring of carbon stocks and non-CO₂ emissions, and (iv) monitoring of impacts from natural disturbances and other catastrophic events. These tasks are described below:

- **Monitoring of project implementation:** Project activities implemented within the project area will be consistent with the management plans of the project area and the PD. All maps and records generated during the project implementation will be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has been implemented.
- **Monitoring land-use and land-cover change:** The project area is not located in a region subjected to MRV by a jurisdictional program. Monitoring of LU/LC change within the project area will be performed annually by analyzing using images of the medium resolution, generated by MapBiomass. The large-scale monitoring will be done through satellite images made available by INPE (PRODES) and MapBiomass Alert data, which is a system that validates and refines deforestation alerts with high-resolution images.
- **Monitoring of carbon stocks and non-CO₂ emissions:** For carbon stocks, monitoring is mandatory within the project area for areas subject to unplanned and significant carbon stock decrease, e.g. due to uncontrolled forest fires and other catastrophic events. In these areas, carbon stock losses must be estimated as soon as possible after the catastrophic event. For non-CO₂ emissions from forest fires, the TdX will proceed with monitoring and accounting when the event is significant, according to VM0048 (VERRA, 2023a);
- **Monitoring of impacts of natural disturbances and other catastrophic events:** Decreases in carbon stocks and increases in GHG emissions due to natural disturbances (e.g. in case of forest fires and other catastrophic events) or man-made events (such as acts of terrorism), including those over which the project proponent has no control, are subject to monitoring, when significant. If the area (or a subset of it) affected by natural disturbances or man-made events generated VCUs in past verifications, the total net change in carbon stocks and GHG emissions in the area(s) that generated VCUs will be estimated, and an equivalent amount of VCUs will be canceled from the VCS buffer. No VCUs can be issued for the project until all carbon stock losses and increases in GHG emissions have been offset.

5.3.1.2 Data to be collected.

It is important to emphasize here the best practices in remote sensing and GIS to obtain consistent data using the conservative approach: (i) land use and land cover mapping is assessed using Sentinel satellite images with resolution of 10 meters validating through a pixel-by-pixel based machine learning algorithms classification using Google Earth Engine; (ii) the Mapbiomas methodology uses image with minimal cloud cover product of Landsat scenes mosaicked from various months of the year (MapBiomass, 2022); (iii) an independent verifiable accuracy assessment was performed using high-resolution image with 5 m

resolution from Planet Image to confirm the minimum map accuracy of 90% for each land use class used; (iv) conservatively the secondary forest is eliminated of the forest class according to Silva Junior et al. (2020). The data collection is covered below:

- **Monitoring of project implementation** will be performed by the monitoring of deforestation-avoidance activities through evaluations of the surveillance rounds and continuous monitoring activities with advanced remote sensing techniques and satellite images analysis. Social consultation data and signed attendance lists are and will be collected while the community engagement occurs and will be made available to VCS verifiers.
- **Monitoring of land-use and land-cover change within the project area** will be subject to MRV-A (monitoring, reporting, verification and accounting) to the “Area of forest land converted to non-forest land” (mandatory for this AUD project) and the “Area of forest land undergoing carbon stock increase” if the carbon stock increase is significant according to ex-ante assessment and will be only accounted on areas that will be deforested in the baseline case.

Monitoring carbon stock changes and non-CO₂ emissions from forest fires: An estimation of carbon stocks using Forest Inventory data within the project area will be performed to generate more accurate carbon stock values, which will be made available to VCS verifiers at verification for inspection. The field inventory methodology and data to be collected are described in a Standard Operating Procedure (SOP)¹¹⁶, which is available for consultation by the auditors. The results of monitoring activity data and carbon stocks will be reported using the same formats and tables used for the ex-ante assessment, according to Methodology VM0048 (VERRA, 2023a).

Non-CO₂ emissions from forest fires will be subject to monitoring and accounting, when significant. In this case, under the project scenario.

Monitoring of impacts of natural disturbances and other catastrophic events: Decreases in carbon stocks and increases in GHG emissions (e.g., in case of forest fires) due to natural disturbances (such as hurricanes, earthquakes, volcanic eruptions, tsunamis, flooding, drought, fires, tornados or winter storms) or man-made events, including those over which the project proponent has no control (such as acts of terrorism or war), are subject to monitoring and must be accounted under the project scenario, when significant. The catastrophic events will be monitored using INMET (2022) and INPE (2022b) platform data and through periodic reports from the area supervisor.

If the area (or a subset of it) is affected by natural disturbances or man-made events that generated VCUs in past verifications, the total net change in carbon stocks and GHG emissions in the area(s) that generated VCUs will be estimated, and an equivalent amount of VCUs will be canceled from the VCS buffer.

The results of all ex-post estimations will be summarized in the project area using the same table format used for the ex-ante assessment.

¹¹⁶ SOP_IF_TDX_version_1.2.pdf

5.3.1.3 Overview of data collection procedures.

General remote monitoring will be done with remote sensing methods, using images of medium resolution. The large-scale monitoring will be done through satellite images made available by INPE (PRODES) and MapBiomas Alert data, which is a system that validates and refines deforestation alerts with high-resolution images by integrating and analyzing multiple alert systems, such as DETER, PRODES and so on. This platform data is widely used because it integrates and validates the alerts of several products, increasing the reliability of the data and can be acquired on a daily frequency.

The forest condition within the Project Area and forest cover change due to unplanned deforestation are monitored through periodic assessment of classified satellite imagery covering the project area and is subject to monitoring the conversion of forest land to non-forest land. While increase or decrease in carbon stocks due to planned activities in the project area will also be monitored through documents and the data to be collected consists of annual satellite imagery processed by PRODES, for the entire land coverage of the Project Area.

The surveillance and patrolling will be implemented and established by the project landowners to work as monitoring at the farms, as a strategy for looking after the property and assure avoided entry of outsiders, hunters, fishermen and intrusion, the prevention of invasion, fire prevention, support the work of the field inventory, cleaning of frontiers and its milestones and internal organization of communication.

As surveillance activities may involve occupational risks, including potential interaction with illegal actors, the project adopts procedures that prioritize non-confrontation, safe retreat, and reporting through the appropriate channels. The company maintains occupational health and safety programs to identify hazards, classify risk levels, and implement control measures, including the provision of PPE and periodic training.

Monitoring of social parameters of project implementation will be based on local community consultation and mapping the community needs, which attest that foreseen activities are being effectively implemented, and documentation related to activity implementation, as well as signed attendance lists.

Monitoring of carbon stock changes and non-CO2 emissions from forest fires of areas subject to significant carbon stock decrease in the project scenario according to the ex-ante assessment, the carbon stock changes will be estimated, in case of planned deforestation, at least once after each harvest event. In case areas are subject to unplanned and significant carbon stock decrease, e.g., due to uncontrolled forest fires and other catastrophic events, in these areas, carbon stock losses will be estimated as soon as possible after the catastrophic event.

The forest inventory methodology described in the SOP¹¹⁷ was specifically designed for TdX carbon inventories, to be applied in the baseline assessment, as well as in the monitoring period. The carbon field inventory involved the installation of 55 permanent cluster plots (Figure 5.3). These permanent plots will be periodically assessed throughout the project duration.

¹¹⁷ SOP_IF_TDX_version_1.2.pdf

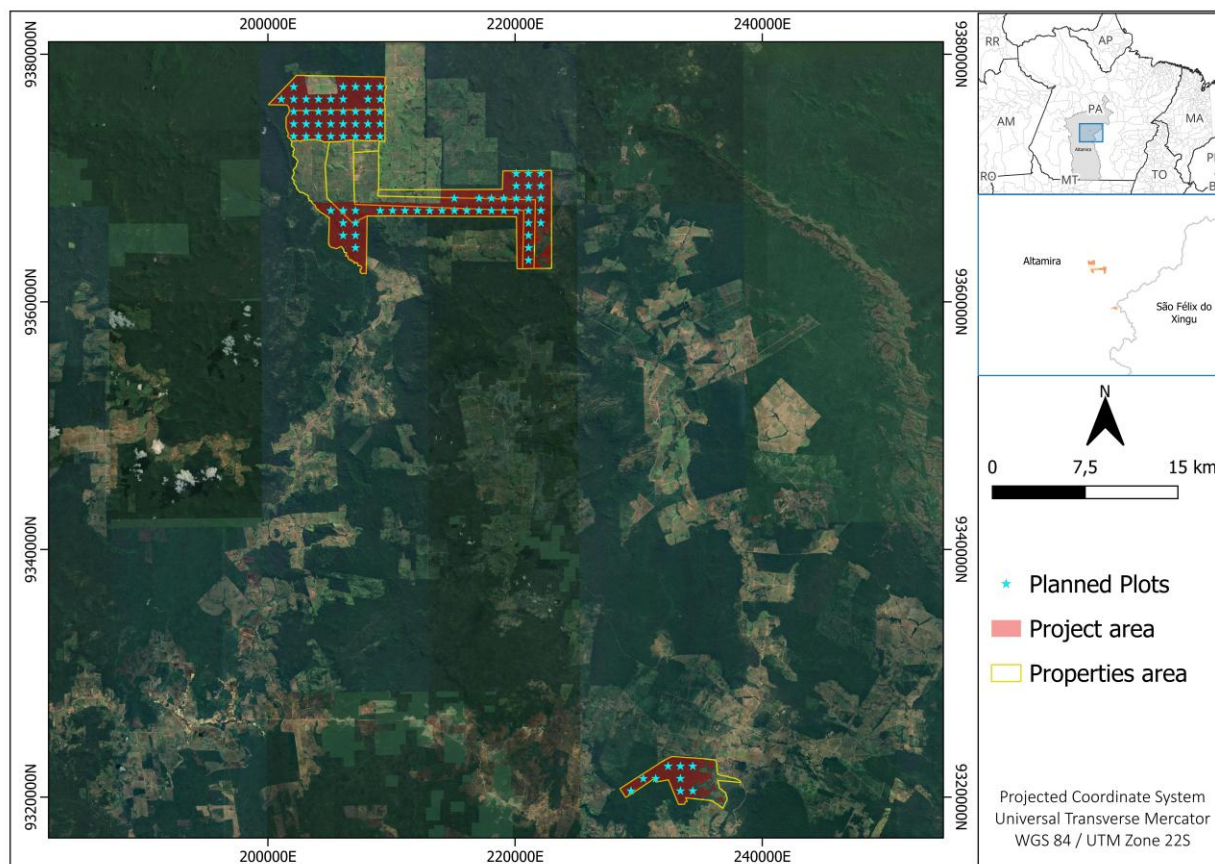


Figure 5.3 TdX Forest Biomass Inventory Permanent Cluster Plots.

The field inventory SOP¹¹⁸ describes the guidelines for the following aspects:

- Sampling method and sampling process.
- Procedures for allocation of plots in the field.
- Variables to be collected in forest inventory
- Standards for measurement of three diameters under several conditions.
- Rules to process borderline trees
- Documentation of coordinates of plots.
- Standards for identification and signalization of plots.
- Description of forest inventory team.
- Standards for measurement dynamics of the field inventory team.

¹¹⁸ SOP_IF_TDX_version_1.2.pdf

- QA/QC procedures to guarantee the application of correct field procedures (annual training, evaluation, and performance reporting).
- Items for annual evaluation of field inventory team.
- QA/QC procedures to guarantee that field data are within the range of three dimensions required in the field inventory.
- QA/QC procedures to guarantee that there was no misunderstanding in data notation in the field.
- QA/QC procedures to guarantee the reliability of data transfer.
- Model of data transfer error quantification and report.
- List of equipment and materials to be used in the field inventory.

5.3.1.4 Quality control and quality assurance procedures.

The validation of land-use data used for modeling land use will be performed by using the confusion matrix, in order to calculate the overall index of success by period and by class. Three specific classes will be used: forest, deforestation and non-forest (hydrography, not forest, clouds, roads, residues, unclassified objects, and others). The validation will be performed by using the land use mapping PRODES Digital, and the satellite images used will be scenes of satellite Landsat 8 TM to the total geographic scope of the Project Area. With the help of the "Create Random Points" tool in ArcGIS 10.0, 100 random points will be generated for each class / year as samples for evaluation, using satellite images as reference, making it possible to generate a confusion matrix for calculation of the accuracy indexes, and the Kappa index (indicators for validation of mapping accuracy). Land use classes must have higher values than 90% accuracy for the accuracy and Kappa index, as required in VM00048 (VERRA, 2023a).

5.3.1.5 Data archiving.

All images, maps and records generated during project implementation should be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has been implemented.

After the annual evaluation of the field inventory team, the team coordinator must produce an annual Evaluation Report for each field inventory technician. This Evaluation Report will be printed in two hardcopies: one for TdX records and other for the field inventory technician that was evaluated. This document will be the evidence of the annual evaluation of the field inventory team.

5.3.1.6 Organization and responsibilities of the parties involved in all the above.

The Systemica is responsible for generating maps, GIS analysis, remote monitoring of the project area, data archiving, and for providing assistance and clarification during verification audits.

The landowner will be responsible for implementing the patrolling and surveillance system and providing the necessary vehicles and infrastructure if relevant to develop the project activities, as well as being co-responsible for data archiving.

Field team inventory is responsible for providing all the required information for Systemica during the forest inventory, as well as being co-responsible for data archiving.

5.3.2 Monitoring of leakage carbon stock changes and greenhouse gas emissions

The TdX project area is not located within a jurisdiction that is monitoring, reporting, verifying and accounting for GHG emissions from deforestation under a VCS or UNFCCC registered program. Furthermore, the boundary of the leakage belt will have to be reassessed at the end of each fixed baseline period using the same methodological approaches used in the first period.

5.3.2.1 Technical description of the monitoring tasks.

All significant sources of leakage identified are subject to monitoring following the procedures outlined in the monitoring plan. Such procedures must be consistent with the applicable leakage modules. The monitoring plan must include all relevant parameters in the leakage modules.

Project Activity does not involve a decrease in carbon stocks and an increase in GHG emissions associated with leakage prevention activities, only the decrease in carbon stocks and increase in GHG emissions due to activity displacement leakage will be monitored.

5.3.2.2 Data to be collected.

To estimate the increased GHG emissions due to forest fires in the leakage belt area the assumption is made that forest clearing is done by burning the forest. The parameter values used to estimate emissions shall be the same used for estimating forest fires in the baseline, except for the initial carbon stocks which shall be those of the initial forest classes burned in the leakage belt area. Where strong evidence can be collected that forest fires in the leakage belt are attributable to deforestation agents that are not linked to the project area, the detected deforestation will not be attributed to the project activity, thus not considered leakage.

The following values must be reported using the unit in parentheses, each with an estimate of uncertainty, representing sampling error as a two-sided 90 percent confidence interval:

- 1) For projects using AUDef, the allocated annual deforestation area by stratum (ha for each year of the monitoring period).
- 2) Aggregate annual deforestation area for the verification period in the project area (ha per year).
- 3) Aggregate annual deforestation area for the verification period in the leakage belt (ha per year).
- 4) Aggregate annual emissions from deforestation for the verification period and project area (tonnes CO_{2e} per year).

5) Aggregate annual emissions from deforestation for the verification period and leakage belt (tonnes CO₂e per year); and

6) Average emission factor for deforestation for the verification period and over the project area (tonnes CO₂e per ha).

The results of all ex-post estimations of leakage are summarized using the same table format used for the ex-ante assessment.

5.3.2.3 Overview of data collection procedures.

The avoiding unplanned deforestation project leakage belt (UDef LB) is the forest area to which unplanned deforestation by geographically constrained agents may be displaced and is monitored.

The spatial extent of the UDef LB will be defined by Verra following the criteria described in Section A1.2.2 of Appendix 1 and will be provided to the project proponent. Baseline AD will be allocated by Verra to each project's UDef LB following Section A1.4.3 of Appendix 1.

The project proponent must subtract from the project's baseline UDef LB AD any activity data that is allocated to other VCS AFOLU PAs that intersect with the project's UDef LB. The subtraction enters into force once the intersecting VCS AFOLU projects have submitted an initial validation report to the Verra Registry and no sooner than the intersecting projects' start date. The onus is on the project proponent to demonstrate this and on the VVB to confirm it. Once the UDef LB AD allocated to the intersecting VCS AFOLU PAs has been excluded from the project's baseline, the project may stop monitoring the UDef LB AD in the intersecting area and related leakage emissions may be omitted.

5.3.2.4 Quality control and quality assurance procedures.

Geographically mobile agents may displace their activities outside the UDef PA and beyond UDef LB. The area available for this kind of activity shifting corresponds to all potentially arable, physically accessible, and unprotected land in the country.

The spatial extent of land available for geographically mobile activity shifting will be defined by Verra following the criteria and procedures described in Section A2.1 of Appendix 2. This will be provided by Verra to the project proponent upon receipt of the AD Baseline Allocation Request Form.

5.3.2.5 Data archiving

All images, maps and records generated during project implementation should be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has been implemented.

5.3.2.6 Organization and responsibilities of the parties involved in all the above.

The Systemica is responsible for generating the maps, GIS analysis and remote monitoring of the project area, data archiving, and for helping and clarification during verification audits.

5.3.3 Estimation of ex post net carbon stock changes and greenhouse gas emissions

5.3.3.1 Technical description of the monitoring tasks

If new and more accurate carbon stock data become available, these can be used to estimate the net anthropogenic GHG emission reduction, provided that these data are in accordance with the requirements established by the applied methodology VM0048 (VERRA, 2023a). The calculation of ex-post net anthropogenic GHG emission reductions is like the ex-ante calculation.

5.3.3.2 Data to be collected.

The report of ex-post estimated net anthropogenic GHG emissions and calculation of Verified Carbon Units will apply the same table format used for the ex-ante assessment.

5.3.3.3 Overview of data collection procedures.

The data collection procedures involve the compilation of data from previous procedures to calculate ex-post net anthropogenic GHG emission reduction.

5.3.3.4 Quality control and quality assurance procedures.

All the previous relevant QC/QA procedures are applicable for the ex-post calculation of net anthropogenic GHG emission reduction. The cumulative areas credited map within the project area shall be updated and presented to VCS verifiers at each verification event. The cumulative area cannot generate additional VCU in future periods.

5.3.3.5 Data archiving.

All maps and records generated during the project implementation will be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has been implemented. The procedures meet the highest levels of control, and the main purpose is to minimize the risk of error, obtaining reliable data on which to base the monitoring results, and thus, minimizing non-conformities (Table 5.1). If non-conformities exist during the internal or external auditing processes, the data should be reviewed, and the non-conformities addressed.

Table 5.1. Data to be collected for monitoring changes in carbon stock and GHG emissions.

Data/ Parameter	Description	Unit	Source	Frequency
Buffer%	Buffer withholding percentage	%	VCS Non-Permanence Risk Report	Every verification event

5.3.3.6 Organization and responsibilities of the parties involved in all the above.

Systemica is responsible for calculating and reporting the ex-post estimated net anthropogenic GHG emissions, data archiving, and for providing assistance and clarification during verification audits.

5.3.4 Revisiting the baseline projections for future fixed baseline period

The Systemica is responsible for revisiting the baseline projections for a fixed baseline period. The current baseline is valid for 6 years, i.e. through August 2028. The baseline will be reassessed every 6 years, and it will be validated at the same time as the subsequent verification.

Updating information on agents, drivers and underlying causes of deforestation in the project zone will be collected at the end of each fixed baseline period, as these are essential for improving future deforestation projections and the design of the project activity.

Adjusting the land-use and land-cover change component of the baseline involves reassessing components of the baseline projections, such as the adjustment of annual areas and the location of baseline deforestation. Updating of the Carbon component of the baseline will only be carried out if more accurate methods for carbon stock estimates are available on baseline revision.

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