



UNITOR REDD+ PROJECT



Document Prepared by CARBONEXT

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1 PROJECT DETAILS

1.2 Summary Description of the Implementation Status of the Project

The UNITOR REDD+ PROJECT is located in Lábrea, Amazonas State, Brazil, which is the municipality with the fourth highest aggregate deforestation rate in Brazil between 2008 – 2020, according to PRODES data¹. Municipal deforestation rates have risen year on year, from 3.8% in 2017 to 5.3% in 2020, making this a priority area for forest conservation worldwide. A new consortium of 15 neighbouring rural properties comprises the Unitor REDD+ Project area, together covering 99,035.20 ha of forest area, to develop forest carbon activities under the guidance and inspiration of the nearby Fortaleza Ituxi REDD Project. The main Project activities that have been implemented during this first monitoring period are listed below with their respective dates, for more detailed on the implementation of each Project Activity see Section 3.1.

- 1. Intensify and improve the efficiency of surveillance actions:** patrolling of the proprieties was already carried out before the REDD+ project, but since 2018 it has been improving and intensifying, to be continued throughout the project lifetime. The patrolling is done by land, air and river, inhibiting illegal invasion and quickly detecting fires and invasions.
- 2. Construction of 3 monitoring posts:** Three bases were built before start date of the project (Santa Maria, São José I, and Santa Luzia). Another 3 bases were built in São Manoel, Três Barras and São José, in July 2019, July 2020 and July 2021, respectively.
- 3. Acquisition of vehicles for ground patrols:** A motorcycle was purchased in April 2020, two pickups in September 2020, and another pickup in June 2021. The vehicles are used for monitoring and for the mobility of workers.
- 4. Fire brigade training:** the first training was held on March 9, 2019
- 5. Forest management:** The management were carried out at Três Barras, Santa Catarina, Presidente Prudente and São Manoel farms between 2019 and July 2021, as described in Table 8. A training about good forest management practices was also carried out with the teams between September 1st and 2nd, 2020.

The activities developed so far play a fundamental role in minimizing deforestation and curbing invasions, bringing benefits for climate and biodiversity. Future activities will be developed to engage and benefit residents close to the project, such as training in livestock and sustainable forest management, in addition to workshops about health and well-being.

The net GHG emission reductions for this monitoring period are estimated to be 2,282,826 tCO₂e.

¹ http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates

1.3 Sectoral Scope and Project Type

Sectoral Scope: 14 - Agriculture, Forestry, Land Use

Project Category: Avoided Unplanned Deforestation (AUD project activity)

This is a grouped project.

1.4 Project Proponent

Organization name	Ituxi Administração e Participação Ltda.
Contact person	Ricardo Stoppe Junior
Title	Project Proponent (Landowner)
Address	Av. Calama N. 5040 Sala 01, Porto Velho, Rondônia
Telephone	55 (92) 3634-7521
Email	aamericardo@ig.com.br

Organization name	Carbonext Consultoria Ltda.
Role in the project	Managing partner
Contact person	Janaína Dallan, Luiz Fernando de Moura & David Swallow
Title	Project developer
Address	Rua Tabapuã, 1123 cj 107 Sao Paulo – SP, Brazil www.carbonext.com.br
Telephone	+55 (11) 2339-6931
Email	janaina@carbonext.com.br

Organization name	Green Forest Carbon Consultoria Empresarial Ltda
Contact person	Élcio Aparecido Moço
Title	Project Proponent (Landowner)

Address	Av Professor Nilton Lins, 1591, sala 6B Manaus – AM, Brazil
Telephone	+55 92 9121-8933
Email	admin@rionegroagro.com.br

1.5 Other Entities Involved in the Project

Organization name	Avix Engenharia e Estudos Técnicos
Role in the project	Satellite imagery analysis for baseline assessment
Contact person	Mateus Trez
Title	Technology, Remote Sensing and Geoprocessing Coordinator
Address	www.avix.com.br
Telephone	+55 (19) 3427-2438
Email	janaina@carbonext.com.br

1.6 Project Start Date

The Unitor Project's Start Date is defined as the date of implementation of the first Sustainable Forest Management (SFMP) activities on the ground. The first property to implement its SFMP was the Santa Maria on 26/04/2018. Various instances of the project became active on different dates, as described in the VCS PD.

SFMPs have the explicit intention of contributing to conservation and to atmospheric carbon sequestration, they are key to forest surveillance by providing personnel on the ground. Furthermore, critically, SFMPs are an explicit component of the Brazilian National REDD+ Strategy². Therefore, the initiation of the respective SFMP activities are defined as the Project Start Dates.

1.7 Project Crediting Period

Start date: 26/04/2018

² http://redd.mma.gov.br/images/publicacoes/enredd_documento_web.pdf, page 8

End date: 25/04/2048

30 years.

1.8 Project Location

The UNITOR REDD+ PROJECT consists of a 99,035.20 hectares total Project Area of protected native forests, located in a region with the fourth highest deforestation rate in the Amazon Biome³ at the time of writing: the municipality of Lábrea. Being one of the southernmost municipalities in the Brazilian state of Amazonas, Lábrea is geographically located close to the “Arc of Deforestation” and borders with other highly deforested municipalities to the South (Rio Branco, State of Acre; and Porto Velho, State of Rondônia)

Table 1: Breakdown of properties in the Project Area

	Property Name	Ownership	Total property Area (ha)	REDD PA Area (all forest) (ha)	PA area composition (%)
i	Fazenda Santa Catarina	Ituxi Administração e Participação LTDA	10,031.37	10,009.53	10.1%
ii	Fazenda Santa Maria	Rio Grande Produção Florestal Ltda	6,046.67	6,016.63	6.1%
iii	Fazenda Bahia	Castanhal Agro Industria de Produtos Não Madeireiros Ltda	9,906.94	6,000.23	6.1%
iv	Fazenda Paraná	Odair Augustinho Dall' Agnol Junior	5,855.24	5,842.97	5.9%
v	Fazenda Santa Fé	Rio Grande Produção Florestal Ltda	11,310.39	11,237.47	11.3%
vi	Fazenda Presidente Prudente	Veridiana Taina dos Santos Moço de Oliveira	1,045.59	1,009.15	1.0%
vii	Fazenda Jardim Alegre	Rio Grande Produção Florestal Ltda	7,000.23	6,546.37	6.6%
viii	Fazenda Santa Luzia	Elcio Aparecido Moço	9,792.14	9,786.09	9.9%
ix	Fazenda São José	Marilda Aparecida Lot Stoppe	8,764.00	7,780.87	7.9%

³ Source PRODES (accessed 22/03/21): http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates

x	Fazenda Recanto	Rio Negro Gestão e Comercio de Produtos Agroflorestais	2,025.01	2,024.38	2.0%
xi	Fazenda São Manoel	Henrique Manoel dos Santos Moço	1,472.33	1,468.86	1.5%
xii	Fazenda São Sebastião	Henrique Manoel dos Santos Moço	2,450.02	2,441.62	2.5%
xiii	Fazenda União	Rio Negro Gestão e Comercio de Produtos Agroflorestais	1,642.41	1,631.63	1.6%
xiv	Fazenda Panorama	Rio Negro Gestão e Comercio de Produtos Agroflorestais	1,110.74	1,108.45	1.1%
xv	Fazenda Três Barras	Castanhal Agro Indústria de Produtos Não Madeireiros Ltda	33,504.60	26,130.96	26.4%
TOTAL			111,957.69	99,035.20	100.0%

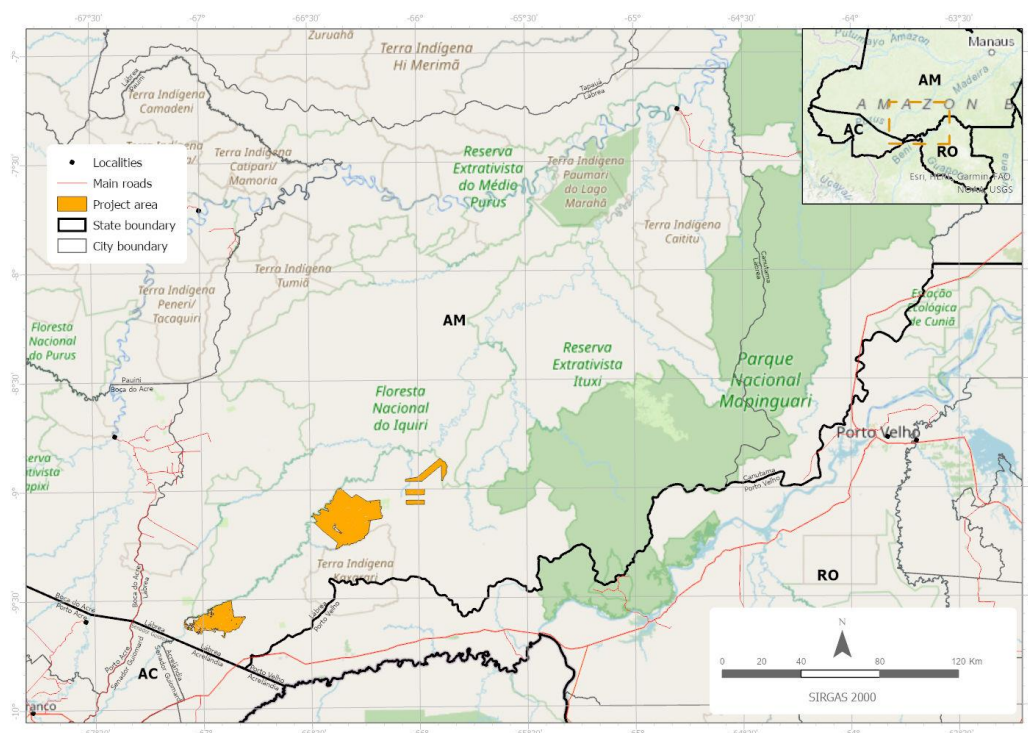


Figure 1. Map of the project area. Source: IBGE (2019)⁴

⁴ Source: IBGE: <https://portaldemapas.ibge.gov.br/portao.php#homepage>

The property boundaries were created using the land limit assigned by the owners and registered with INCRA.⁵

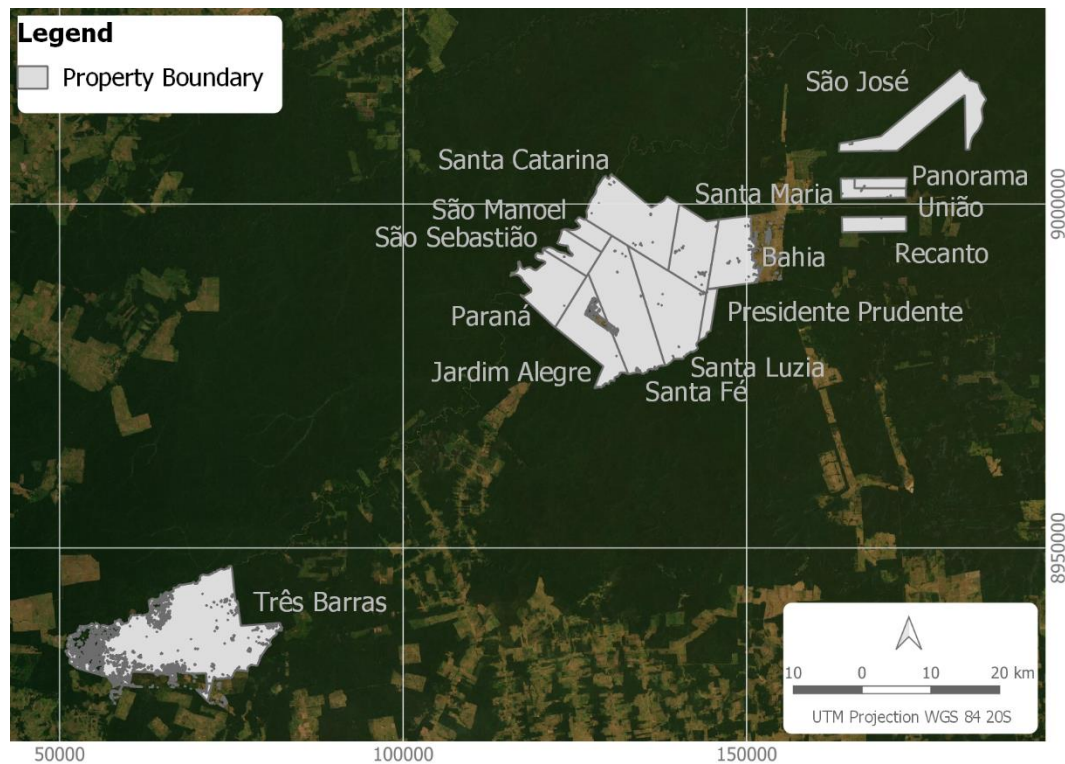


Figure 2. Location of each of the properties within the project area

The main geodetic coordinates of the Project Area, separated into three main zones, are as follows, applying the Lat; Long coordinate system. The complete set of 1,671 coordinates, is available upon request.

The zones were created using data from the delimitation of the project area minus the areas that were deforested between 2009 and 2018 in the properties. The geographic coordinates of the main vertices of each zone were calculated and can be seen at tables bellow.

⁵ Source: SIGEF: <https://sigef.incra.gov.br/consultar/parcelas/>

Project Zone 1:

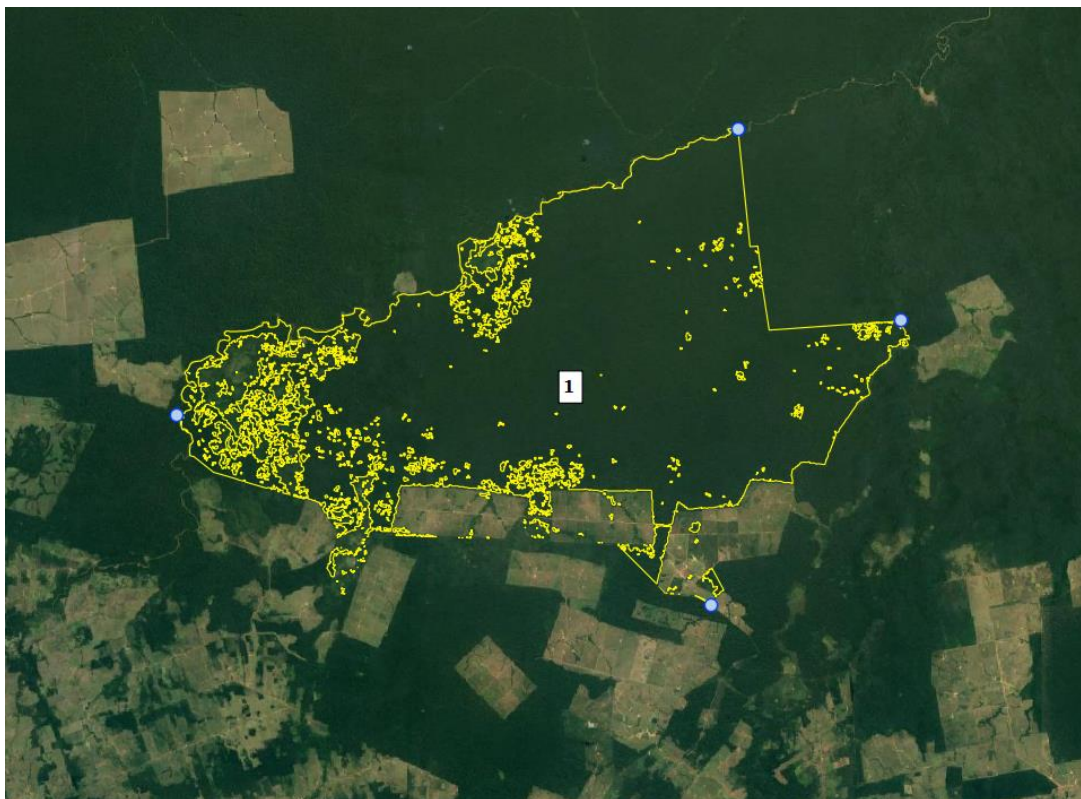


Figure 3: Area of the project Zone 1

Table 2: Latitude and Longitude of Project Zone 1

Latitude	Longitude
-9,57635	-66,8059
-9,68594	-66,8814
-9,60964	-67,0903
-9,50126	-66,8689

Project Zone 2:

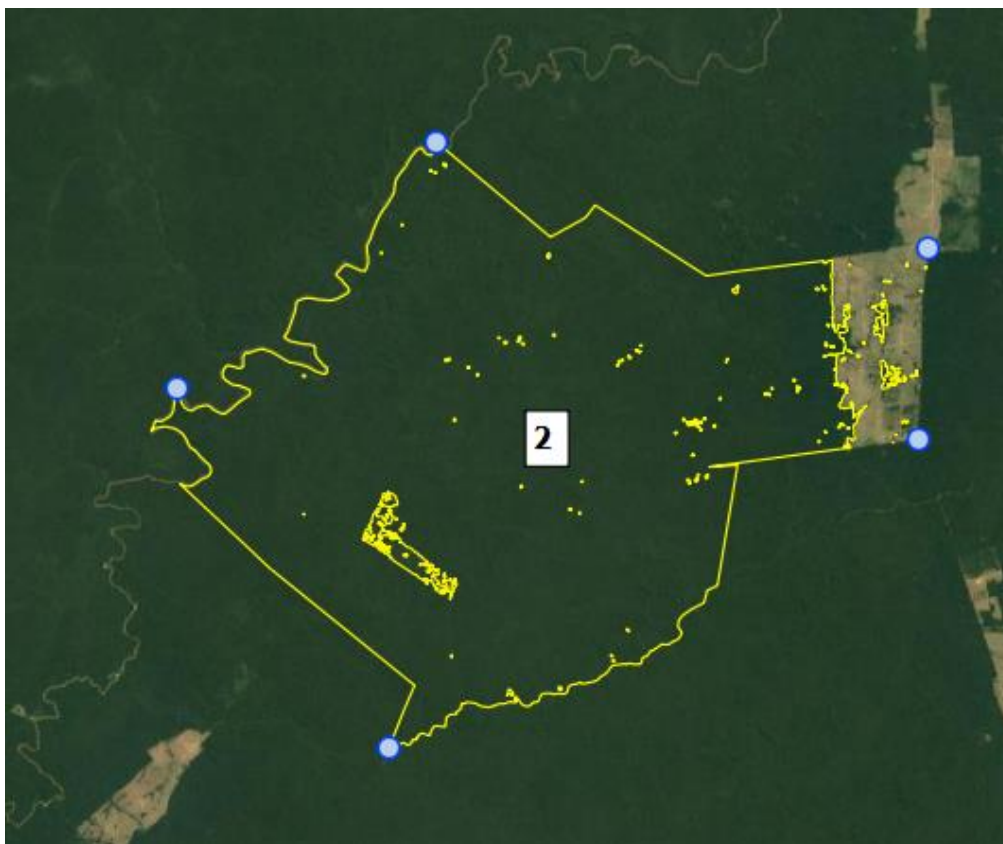


Figure 4: Area of the project Zone 2

Table 3: Latitude and Longitude of Project Zone 2

Latitude	Longitude
-9,1317	-66,138
-9,2724	-66,387
-9,1051	-66,484
-8,9915	-66,362

Project Zone 3:

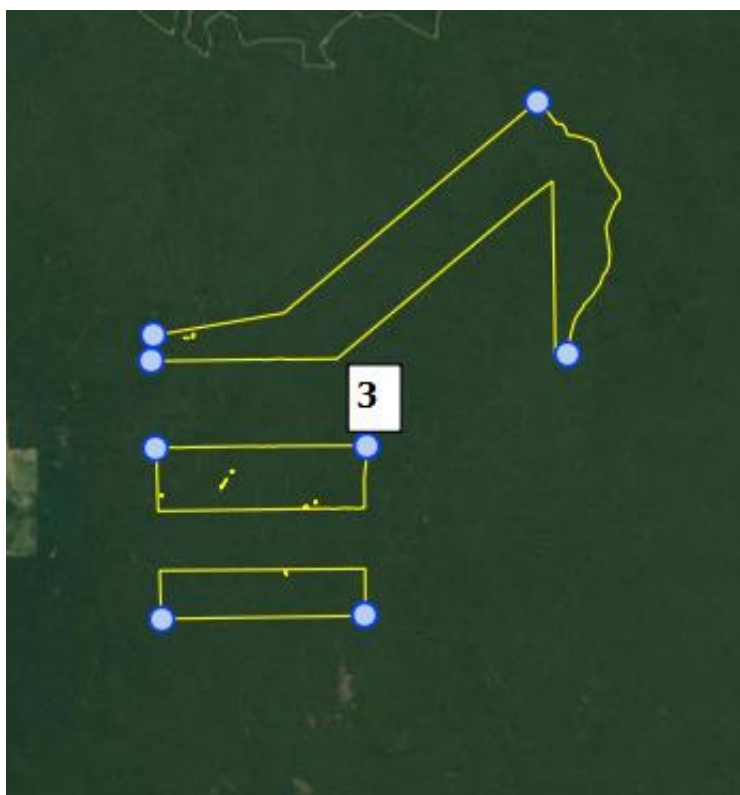


Figure 5: Area of the project Zone 3

Table 4: Latitude and Longitude of Project Zone 3

Latitude	Longitude
-9,00007	-65,9707
-9,00006	-66,0583
-9,00007	-65,9707
-8,96355	-65,8877
-8,96468	-66,0603
-8,95416	-66,0595
-8,85916	-65,8994
-9,0701	-65,9722
-9,07068	-66,0569
-9,0701	-65,9722

1.9 Title and Reference of Methodology

Approved VCS Methodology VM0015 “Methodology for Avoided Unplanned Deforestation”, Version 1.1, 3 December 2012. At: <http://www.v-c-s.org/methodologies/VM0015> (last visited 03/03/2021).

Tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities Version 3.0, 1 February 2012. At: <http://www.v-cs.org/methodologies/VT0001> (last visited 03/03/2021).

AFOLU “Non-Permanence Risk Tool” VCS Version 4, Procedural Document, 19 September 2019, v4.0. At: <http://www.v-c-s.org/program-documents> (last visited 03/03/2021).

1.10 Participation under other GHG Programs

Not applicable: the project is not engaged in any other emissions trading program and the host country has no binding limits on GHG emissions as yet. The project has not been registered, nor is seeking registration under any other GHG programs.

1.11 Other Forms of Credit

The project neither has nor intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program. The project has not sought nor received another form of GHG-related environmental credit, including renewable energy certificates.

1.12 Sustainable Development

The map below shows the strategic zone for “Containment of the expansion fronts with protected areas and alternative uses”, which was established by the MacroZEE/AL (Macrozoneamento Ecológico-Econômico da Amazônia Legal; Ecological and Economic Macro-zoning of Amazon) developed by the Brazilian Ministry of Environment⁶, which encompasses the Project Area. The MacroZEE/AL aims to establish strategic indications of occupation and use of land on a sustainable basis to guide, at the regional scale, the development and spatial distribution of public development policies, territorial and environmental planning, as well as the decisions of private agents. Due to its shield function for the heart forest protection, this territorial unit deserves strengthening policies. In this context, the Unitor REDD+ Project aligns with the strategies set up by the MacroZEE/AL of the Brazilian Ministry of Environment.

⁶ Source MMA (accessed 23/03/21): <https://antigo.mma.gov.br/component/k2/item/8200-figuras>



Figure 6. Containment of the expansion fronts with protected areas and alternative uses (Source: Brazilian Ministry of the Environment – MMA)

Due to the increase in deforestation in the Legal Amazon, the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAM: Plano de Ação para a Prevenção e Controle do Desmatamento na Amazônia Legal) came into effect, starting mitigation and ongoing actions to reduce deforestation. The Unitor REDD+ Project is in line with main PPCDAM premises⁷.

At the international level, the Unitor REDD+ Project complies with the logic of the environmental priorities defined by the Brazilian Federal Administration at COP 14 in December 2008, where a deforestation reduction goal of 70% by the year 2018 was declared, and following that, further goals of achieving zero illegal deforestation by 2030, and offsetting of greenhouse gas emissions originating from legal removal of vegetation. The latter are elements of the Brazilian NDC, which the country aims to adopt more firmly within the framework of the Paris Climate Accords (COP-21)⁸. To attain these goals, an essential component will be to ally government initiatives with independent actions such as that proposed under the present project.

Going into more detail, the Unitor project is aligned with Brazil's commitments to the UN Sustainable Development Goals (SDGs). Firstly, on the environmental side, Brazil has made

⁷ Source Brazilian Government (accessed 19/04/2021): https://www.gov.br/agricultura/pt-br/aceso-a-informacao/acoes-e-programas/ppa/plano-plurianual-ppa-2016-2019-1/relatorio_avaliacao_programa_2050-mudanca_do_clima.pdf

⁸ Source MMA (accessed 19/04/21): <http://redd.mma.gov.br/pt/redd-e-a-indc-brasileira>

commitments to SDG 13 – “Take urgent action to combat climate change and its impacts” – aligning its national goals⁹ with the UN’s, for example UN goal 13.3¹⁰:

- 13.3: Improve education, increase human and institutional awareness and capacity on climate change, its risks, mitigation, adaptation, impacts, and early warning systems.

The project activities involving technical qualification, training in forest management, and community development in the form of participative workshops, aim to increase the collective understanding of climate change and the importance of the forest. This intervention at the small-scale level has broader objectives, for a collective transformation of cultural relations lifestyles of the local community and the economy, in its relation to the environment.

Regarding goal 13, the Unitor REDD project involves the conservation of a predicted 24,031.3 hectares of forest over its lifespan and it is an essential activity for climate change mitigation.

Perhaps most importantly, the project is aligned with SDG 15 regarding Terrestrial Ecosystems, which was adopted into the Brazilian goals as follows: “15.1. By 2020, to conserve at least 30% of the Amazon, through systems of conservation units provided for in the Law on the National System of Conservation Units (SNUC), and other categories of officially protected areas such as Permanent Preservation Areas (APPs), Legal Reserves (RLs) and indigenous lands with native vegetation (...)”. The present project’s direct conservation of APPs and RLs, as well as synergistic actions with the surrounding Conservation Units are strongly aligned with this national goal.

Brazilian SDG goal 15.2, regarding sustainable forest management, tree plantation and restoration of forests, which stipulates to “eliminate illegal deforestation in all Brazilian biomes by 2030, expand the area of forests under sustainable environmental management and recover 12 million hectares of degraded forests and other forms of native vegetation, in all biomes and preferably in Permanent Preservation Areas (APPs) and Legal Reserves (RLs) and, in areas of alternative land use, expand the planted forest area by 1.4 million hectares”, is directly supported by the Unitor project’s following activities:

- Sustainable forest management within seven of the properties;
- Monitoring of illegal land occupation, illegal logging, and illegal deforestation: 6 monitoring bases have been installed so far, to serve as housing and support for the officers who carry out patrols. Ground patrols are carried out periodically with vehicles (motorcycles and pickup trucks) or on foot. River monitoring is usually done twice a week, and air monitoring is usually done once a month. Monitoring frequencies may change, especially in the rainy season when access is limited. Besides that,
- Ultimate goals of avoided deforestation of 24,769 hectares of Amazon rainforest over 30 years on private lands, preserving APPs and RLs.

⁹ Source IPEA (accessed 23/07/21): <https://www.ipea.gov.br/ods/ods13.html>

¹⁰ Source ODS Brasil (accessed 23/07/21): <https://odsbrasil.gov.br/>

On the socio-economic front, Brazil adopted “UN Goal 1: End poverty in all its forms everywhere”¹¹, “UN Goal 3: Ensure a healthy life and promote well-being for everyone, at all ages”, and “UN Goal 8: Promote inclusive and sustainable economic growth, employment and decent work for all”, and, with the most relevant Brazilian sub-goals to the project being:

- SDG 1.1: “By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than PPC\$3.20 a day”;
- SDG 1.2: “By 2030, reduce proportion of men, women and children of all ages living in monetary and non-monetary poverty by at least half, in all its dimensions, according to national definitions”;
- SDG 3.4: “By 2030, reduce premature mortality from non-communicable diseases by one third through prevention and treatment, and promote mental health and well-being”
- SDG 8.3: “Promote development with the generation of decent work; formalization; the growth of micro, small and medium companies; entrepreneurship and innovation”; and
- SDG 8.4: “Increase the efficiency of the use of global resources in consumption and production, and strive to decouple economic growth from environmental degradation, in accordance with the Action Plan for Sustainable Production and Consumption (PPCS).”

In line with objective 8.3, during the monitoring period of this report, 10 people were employed to carry out various activities, such as patrolling, forest management and general services. In addition, the project is expected to generate at least 40 job openings throughout the project period, including permanent and temporary ones:

- At least two forest monitors per each of the five deforestation monitoring bases, totaling ten jobs (SDG 1.1);
- An average of five team members per each of the six sustainable forest management areas, which are temporary positions, with an unpredictable number of total job vacancies for separate individuals, estimated at 30 jobs (SDG 1.1);
- Equal opportunities relating to gender in the project indicators will be monitored (SDG1.2);
- The organization of training events focusing on sustainable cattle ranching and forest management will be offered after the validation of the project and sales of credits (SDG 8.3 and 8.4).

This project therefore represents enormous potential to continue the work started by the neighboring Fortaleza Ituxi REDD Project: assisting the Federal Administration and state agencies to attain these national- and international-level goals and leverage further REDD projects, providing mitigation for these municipalities which are facing critical deforestation levels, as in the case for Lábrea, Nova Califórnia, and Extrema.

¹¹ Source UN (accessed 23/07/21): <https://www.un.org/sustainabledevelopment/poverty/>

2 SAFEGUARDS

2.1 No Net Harm

The project activities do not cause any potential negative offsite stakeholder impacts. The project does not result in net negative impacts on the wellbeing of other stakeholder groups. A communication channel was established for stakeholders to express their concerns and to solve potential conflicts and grievances that arise during project planning and implementation. The main communication channel is the project's own email (redditorcarbonext@carbonext.com.br), which is managed by the Carbonext team. But the residents close to the project also have the Whatsapp contact for the owners and field managers and can send messages directly to them in case of conflicts, questions or suggestions. During the period of this monitoring report, no complaints or denunciations were made by the communities.

Furthermore, technical qualification may increase the collective understanding of climate change and the importance of the forest. This understanding is essential for each individual in the process of a collective transformation of cultural relations and of the lifestyle of the local community. Training on sustainable livestock and forest management will be carried out after the validation of the project and the sales of credits.

Aiming at reducing the risk of forest fires, on March 9, 2019, a training session was carried out with 6 employees for the formation of a fire brigade. Topics on prevention and control of forest fires were addressed. This training will be conducted annually, after the validation and verification of the project.

In addition, between September 1st and 2nd, 2020, a training was carried out with the forest management teams with the objective of disseminating good management practices in order to reduce the impacts of forest exploitation. Furthermore, it was explained about the laws and normative instructions related to forest management practices.

These activities are initiatives to improve and make forestry practices more sustainable and mitigate potential any environmental impacts.

2.2 Local Stakeholder Consultation

The project proponent duly conducted assessment of the local stakeholders who are potentially impacted by the project. The response below takes into account the guidelines specified for the present section within the VCS-Monitoring-Report-Template-v4.0, listed below in italics.

“Describe the process for, and the outcomes from, ongoing communication with local stakeholders conducted prior to verification. Include details on the following:

- The procedures or methods used for engaging local stakeholders (e.g., dates of announcements or meetings, periods during which input was sought).
- *The procedures or methods used for documenting the outcomes of the local stakeholder communication.”*

The public consultation process for institutional and community stakeholders is predicted to follow the Plan of Action below, across MR1 and MR2 (as identified in the table below), as well as the status of each of these actions: completed, partially completed, or pending.

It is important to state that not all the communities included in public consultation phase 2 (see table below) will be taken forward in the context of the Unitor REDD+ Project. They are being as part of the possible complementary CCB certification being evaluated for the Unitor REDD+ project, alongside sister projects Ituxi and Evergreen. Certain communities listed in public consultation phase 2 may be assigned to one of the other two projects, according to which area they rely on most for natural resources, income, and livelihoods.

Table 5. Plan of Action for stakeholder consultations across MR1 and MR2

	Action	Completed/ Pending	Relevant MR	Parties included - Institutional	Parties included - Community
2021 - Q1	Public consultation phase 1	Completed	MR 1	Lábrea City Hall; Porto Velho City Hall (districts of Nova Califórnia and Extrema); Municipal Secretariat of Education of Lábrea; Municipal Secretariat of Education of Porto Velho (districts of Nova Califórnia and Extrema); SEMA - AM (Amazonas State Secretariat of Environment); SEDAM (Secretary of State for Environmental Development); Extractive Reserve (RESEX) of "Ituxi"; National Forest (FLONA) of "Iquiri"; National Park (PARNA) of "Mapinguari"; Community leaders of Kaxarari Indigenous Land; IFAM (Federal Institute of Science and Technology; Campus Lábrea); IDAM - Institute for Sustainable Agricultural and Forest Development of the State of Amazonas.	Communities/residents of the following properties: Presidente Prudente property Santa Maria property; Ramal do Boi community (outside the project area); Três Barras property; São José property.
2021 - Q2					
2021 - Q3					
2021 - Q4	Public consultation phase 2	Partially Completed	MR 2	Pending: Follow-up with all institutions included in phase 0 above	Pending: follow-up with all communities and residents included in phase 0.
2022 - Q1					Completed: survey and development of activities in the following communities for VCS and possible CCB certification: Boca do Querequetê; Eireli Sawmill; Nova California Cooperative.
2022 - Q2					
2022 - Q3	MR 2 audit	Pending	MR 2	Follow-up actions with all parties to be determined	Follow-up actions with all parties to be determined
2022 - Q4					

Regarding public consultation phase 1: As shown in the table above, the list of parties contacted for the Institutional Public Consultation and the Community Public Consultation is as informed in section 2.2 of the VCS-PD, conducted on February 25, 2021, and March 7th to April 2nd 2021, respectively.

The institutional stakeholders were contacted by email (redunitorcarbonext@carbonext.com.br) and their responses are documented within the same e-mail account, which was made available at audit.

Meanwhile, regarding the Community Public Consultation: As stated in the methodology, individuals, neighbours and communities living within the following areas were mapped:

- i. the project area; and
- ii. within a 20km radius of the project area (Figure 7);.



Figure 7. Project Area and the 20km radius where the neighbours were mapped

Before the consultation was carried out, the project's field managers contacted residents and local neighbors via WhatsApp or through house visits to invite them to the public consultation. The objective was to try to bring neighbors and employees together in the project's monitoring bases, to facilitate the meetings. The Ramal do Boi community was personally visited by the project's employees.

Between March 7 and April 4, 2021, project representatives visited neighbours and communities in person to explain the characteristics of the Unitor REDD+ project, as detailed in the table above.

During the meetings, the following was explained: the project's location, who the owners are, the project's objectives, the future activities that will be developed with the communities and the communication channel for questions or complaints. In addition, the following documents were also collected during the meetings:

- i. Declaration of Consent with the Project: those consulted declare that they received a visit from a project representative, that they are aware of the objectives and which properties belong to the project area. They also declare that they agree with the realization of the Unitor REDD+ Project.
- ii. Customary Resource Use Survey: Questionnaire used for neighbour and community interviews to fully understand community natural resource use and management activities within the Project Area. These data will be used to develop social activities compatible with local needs and interests (.).
- iii. Awareness of Communication Channels: respondents declare that they have received information about the communication channels to be used for complaints and questions regarding the Project.

Community: All statements are duly stored and made available during the audit.

Turning to the following items of the template

- “The mechanism for on-going communication with local stakeholders.
- How due account of all and any input received during ongoing communication has been taken. Include details on any updates to the project design or justify why updates are not appropriate”

Institutional stakeholders: ongoing contact with institutional stakeholders is carried out through project's email (redunitorcarbonext@carbonext.com.br).

Regarding the due account taken of communication and follow-up from public consultation phase 1, this was duly finalized, given that the primary institutional stakeholder expressing interest was IDAM (the Amazonas State Institute for Development in Cattle, Agriculture and Sustainable Forest Activities). Their consultation was responded to via interview call with two separate employees (presented at audit). However, the executive decision at Carbonext was that the environmental and social objectives of the project were not well aligned with those of IDAM, and that private initiatives were preferable for Unitor's continuation.

Meanwhile, SEMA (Environment Secretariat of Amazonas State) requested clarification regarding the public consultation process, on 11/03/2021, which was duly responded to with re-sending informative documents on the project via e-mail.

During the public consultation, no participant raised conflicts with the project or possible risks that could affect their interests, therefore, no risks to their rights and well-being were identified. No further comments from stakeholders were available at the time of verification.

Community stakeholders: although the e-mail contact channel is available, ongoing contact is primarily through the on-site field monitors, who are often in the project area and are accessible to speak in person or through WhatsApp. This is for the reason that many community members are illiterate or functionally

illiterate. During the period of this monitoring report, no complaints or denunciations were made by the communities.

“For AFOLU projects, also demonstrate how the project has communicated the following with local stakeholders:

- The results of project implementation, including the results of monitoring.
- Any changes, where relevant, to risks, costs and benefits the project may bring to local stakeholders.
- Any changes, where relevant, to relevant laws and regulations covering workers’ right in the host country.
- The process of VCS Program verification and the validation/verification body’s site visit.”

During public consultation phase 01, it was explained, in language comprehensible to the community who are largely illiterate. However, as these actions were performed in October 2021, they will be reported in MR2, rather than the present MR1:

- the risks, costs and benefits the project may bring to local stakeholders, as well as socio-economic benefits that the project foresees within the context of the present REDD project as, were duly communicated.
- what a carbon project is and what our objective was during the visit, thus covering the final point of the VCS template: “the process of VCS Program verification and the validation/verification body’s site visit”

During public consultation phase 02, the following actions are planned:

- communication of the results of project implementation, including that of monitoring, will be fully covered;
- and a full socio-economic census performed of communities living in the surrounding region;
- communication and development of the benefits and actions associated with planned CCB certification (improvements to the community’s livelihood source (wild harvesting – “extrativismo”; creation of a professional cooperative; and improved prices and commercial activities are all being planned).

2.3 AFOLU-Specific Safeguards

During the monitoring period, the project proponent has communicated and consulted neighbour landowners and wild-harvesters about the development of the Unitor REDD+ Project. This communication was made in person by the field agents, bringing together groups at the project's monitoring bases to realize a meeting or visiting people's homes.

During the public consultation, participants were informed about project details such as location, objectives and activities. After the explanation, all participants signed the document “Declaration of Consent with the Project”, where they give their free consent and acceptance with the project objectives and its development. In addition, given that the project is carried out in a private territory, there are no conflicts over title with the surrounding communities.

A communication channel was established with them in order to give necessary support and mitigate any possible risk due to the project implementation. As mentioned above, the ongoing communication with the neighbours and communities is made through project's email (reddunitorcarbonext@carbonext.com.br) and also through the field monitors, who are often in the project area and are accessible to chat in person or through WhatsApp. In case of complaints or denunciations, the grievance redress procedure will follow as below:

1. The Project Proponent shall attempt to amicably resolve all grievances and provide a written response to the grievances in a manner that is culturally appropriate. (Action must be taken in 7 days);
2. Any grievances that are not resolved by amicable negotiations shall be referred to mediation by a neutral third party. (Action must be taken in 30 days);
3. Any grievances that are not resolved through mediation shall be referred either to a) arbitration, to the extent allowed by the laws of the relevant jurisdiction or b) competent courts in the relevant jurisdiction, without prejudice to a party's ability to submit the grievance to a competent supranational adjudicatory body, if any. (The time to accomplish this stage is dependent on local jurisdiction delays.)

However, during the public consultation, participants did not identify any conflicts or risks caused by the project to their interests and well-being. And at the timing of the writing of this report, no complaints or suggestions have been made by neighbors or communities, thus, it is possible to conclude that there were no negative impacts on the property and land use rights of the local stakeholders during the period of this MR.

3 IMPLEMENTATION STATUS

3.2 Implementation Status of the Project Activity

The section below addresses the aspects specified by the VCS Monitoring Report template, section 3.1.

The approximate implementation schedule for the Unitor REDD+ project's first monitoring report, along with current accomplishments, is as follows:

Table 6. Implementation schedule

Pre - Monitoring Report Period	
Date	Event
July 2015	Completed the construction of the Santa Maria surveillance base
August 2018	Completed the construction of the São José I surveillance base
August 2018	Completed the construction of the Santa Luzia surveillance base
Monitoring Report Period	
Date	Event
March 9, 2019	The first training in firefighting to form a fire brigade team was carried out in March 2019 in the neighbouring Nossa Senhora das Cachoeiras do Ituxi property. The same fire brigade will be deployed for action in the Unitor REDD Project as in the Fortaleza Ituxi REDD Project. Training will be offered to employees and neighbors annually. In addition, the brigade team also works on the Ituxi REDD+ project, given that the two projects are neighbors.
July 2019	Construction of the São Manoel surveillance base
April 2, 2020	Purchase of a motorcycle for ground monitoring
July 2020	A biomass and fauna inventory were conducted in the neighbouring Fortaleza Ituxi REDD Project, providing valuable primary data for the present project, between the 11th and 24th of July 2020.
July 2020	Construction of the Três Barras surveillance base
September 1-2, 2020	Between September 1st and 2nd, 2020, a training was carried out with the forest management teams with the objective of disseminating good management practices to reduce the impacts of forest exploitation. Furthermore, it was explained about the laws and normative instructions related to forest management practices

September 8, 2020	Purchase of two pickups for ground monitoring
June 19, 2021	Purchase of one pickup for ground monitoring
July 2021	Construction of the São José II surveillance base

Table 7. Status of surveillance bases

Base Location	Implementation Date	Infrastructure	Status	Next Steps
Santa Maria	July 2015	Accommodation, kitchen, solar energy, internet, artesian well,	Built	
#1 São José	23/08/2018	Accommodation, kitchen, solar energy, internet, artesian well,	Built	
Santa Luzia	23/08/2018	The structure is completed, a few additional items still to be installed.	Built	Installation of energy, internet and artesian well
São Manoel	23/07/2019	The foundation and framing of the base have already been concluded.	Under construction	Roof installation and functionalities (kitchen, solar energy, internet, artesian well...)
Três Barras	July 2020	Accommodation, office, kitchen, solar energy, artesian well	Built	Internet installation
#2 São José	July 2021	Groundwork and foundation completed.	Under construction	Framing, roof installation and functionalities (kitchen, solar energy, internet, artesian well)

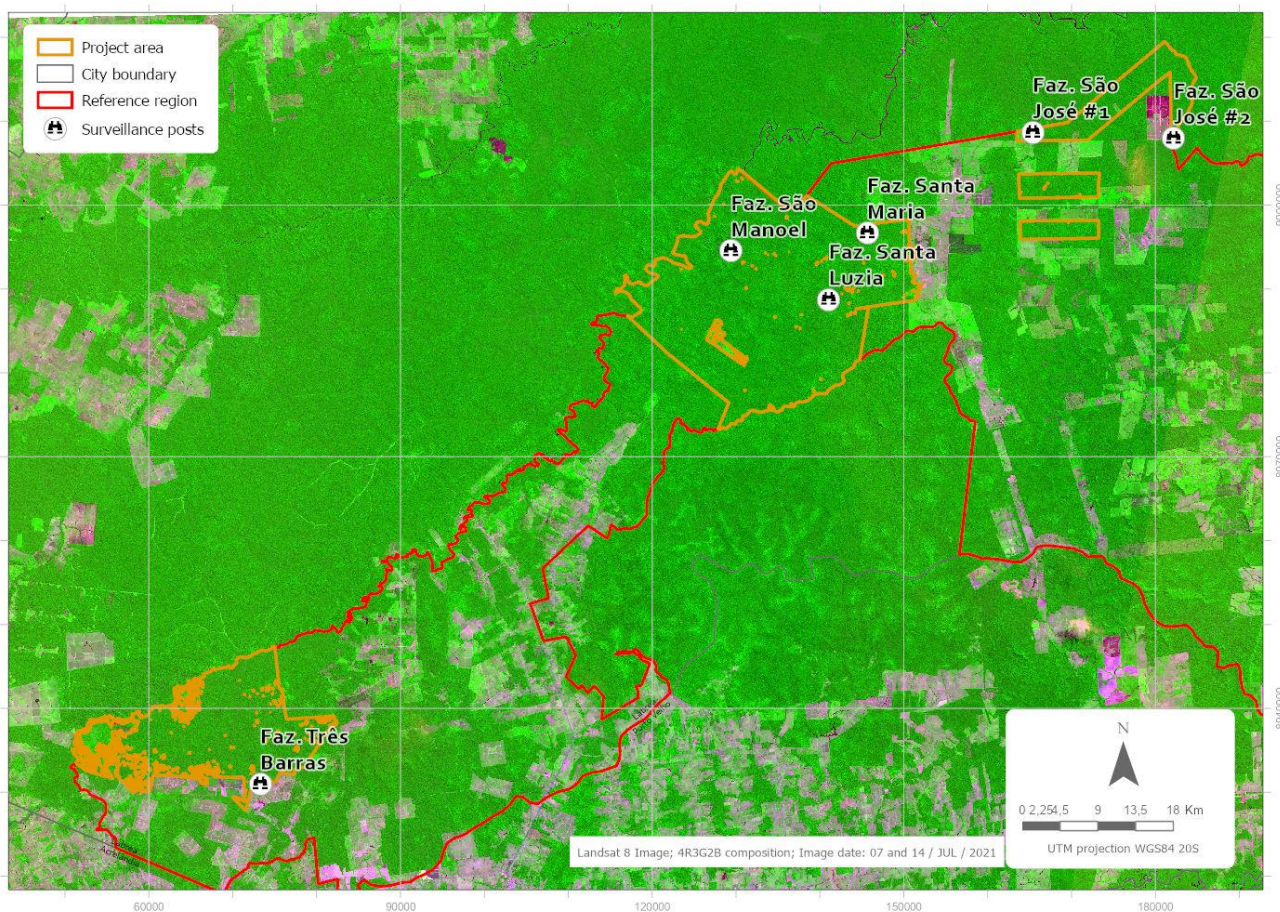


Figure 8. Location map of surveillance bases

Table 8. Period in which wood was transported from forest management areas

Property - SMFP	UMF	nov/18	2019	2020	jul/21
3 Barras - Rio Grande	UMF 1		x	x	
3 Barras - Rio Negro Matriz	UMF 2		x	x	
3 Barras - Califórnia	UMF 3			x	
3 Barras - Rio Negro Filial	UMF 4		x	x	
3 Barras - Castanhal	UMF 5			x	x
Santa Catarina	UMF 1		x		
Presidente Prudente	UMF 1			x	
São Manoel	UMF 1			x	

- Periodically, air, fluvial and terrestrial patrols are carried out in order to curb invasion, illegal deforestation and detect outbreaks of forest fires. It should be noted that all activities proposed here were always carried out informally, without presenting clear and pre-defined evidence that the activities were carried out. The Carbonext team, together with the owners, is improving the

operational procedure for forestry and property integrity to detailed action flows, assignment of responsibilities, periodicity review, evidence recording methods and training schedule.

The remote monitoring mechanism is also being improved to increase its effectiveness. It will provide increased monitoring frequency and forward automated alerts so that enforcement actions and contingency measures take place as soon as possible.

- The presence of workers in management activities is the first factor to inhibit the pressures of invasions inside the Project Area.
- In accordance with the VCS MR Template, for AFOLU projects, where no new project activities that lead to the intended GHG benefit commenced during the monitoring period, as shown in Table 5 above, the following aspects of project activities occurred prior to the MR period and the construction of other bases continued into the MR period: Santa Maria surveillance base (completed July 2015); São José I surveillance base (completed August 2018); Santa Luzia surveillance base (completed August 2018).
- There have been no changes to project proponents or other entities.
- In terms of the implementation status of the Brazilian SDGs mentioned in section 1.11, we can identify the following contributions already made:

Table 9. SDG impacts achieved by project activities to date

SDGs IMPACTED	ACTIONS	DATE
SDG 1.1: "By 2030, eradicate extreme poverty for all people everywhere (...)" SDG 1.2: "By 2030, reduce proportion of men, women and children of all ages living in monetary and non-monetary poverty by at least half (...)" SDG 8.3: "Promote development with the generation of decent work; formalization; the growth of micro, small and medium companies; entrepreneurship and innovation";	Employment of 10 people to carry out various activities, such as patrolling, forest management and general services. Forest management team training.	Of the employees in fixed job positions, 3 were hired before the project start date and the others were hired between June and December 2020.

SDG 15 regarding Terrestrial Ecosystems 15.1. By 2020, to conserve at least 30% of the Amazon	Construction of 6 monitoring bases and acquisition of vehicles for monitoring, as shown in Table 6	Dates described in Table 6
SDG goal 15.2, regarding sustainable forest management, tree plantation and restoration of forests	SFMP in Sta Catarina Property SFMP in Sta Maria Property SFMP in Três Barras Property SFMP in Presidente Prudente Property SFMP in São Manoel Property	Management according to Table 8
SDG 15 regarding Terrestrial Ecosystems 15.1. By 2020, to conserve at least 30% of the Amazon	Training of the fire brigade team in the Unitor REDD Project	March 9, 2019

Leakage will be monitored annually through analysis of satellite images and maps. The remote sensing is carried out according to the following plan:

- 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September.
- 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images.
- 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed.
- 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.

As described in section 1.17 of the VCS-PD, the leakage management activities of the project are as follows:

- Technical training on sustainable cattle raising: the objective of this initiative will be qualifying a labour force that finds little opportunity to work in the region and ends up taking part in illegal

settlements and land occupation. It is expected that this initiative will benefit 15 students every year. Students and technicians of both sexes will be eligible for registrations, with the previous requirement of having finished the basic studies (middle school). This action is dependent on sale of credits and therefore has not been carried out yet, as described in section 3.1, Table 6.

- Forest management courses: Courses on forest management methods will be offered to the internal workers for updating on techniques and practices and to train new employees. The standardization procedure for these trainings is available for auditing. This action was carried out in 2020, as described in section 3.1, Table 6.
- Training of fire brigades: training will be given to prepare fire brigade members, and in addition to the employees, the project's neighbours will be able to participate in the training event as well. This action was carried in March 2019, as described in section 3.1, Table 6.
- Support of SEMA – AM's activities (Secretaria de Estado do Meio Ambiente do Amazonas; Amazonas State Secretariat of Environment): SEMA will benefit from having, under its jurisdiction, a second example of an innovative REDD model – the first being the nearby Fortaleza Ituxi REDD Project, also developed by Carbonext – that can be further replicated on other properties. It will continue to raise the public profile of the current administration, providing visibility and methodological advances in environmental preservation. This action is dependent on sale of credits and therefore has not been carried out yet.
- Surveillance activities designed to mitigate illegal logging and land occupation in the area will be achieved through the Unitor REDD+ Project, summing with the efforts of the Fortaleza Ituxi REDD Project, thus covering a significant area of Lábrea municipality. By continuing to promote an increase in the number of REDD Projects in the region, whenever feasible, as well as sustainable forest management plans, the project aims to impact deforestation and degradation significantly. This process will be further consolidated through combined efforts with private and governmental entities, and NGOs. In this context, the project proponent will spearhead political mobilization of the regional forest sector and, continue to reinforce the engagement of all sectors involved in deforestation issues, in the long term. The main condition for execution of this activity is the approval and validation of the Unitor REDD+ Project, which will be a further important benchmark for engagement of all potential private landowners in the Lábrea region. As shown in Table 6, 3 bases were constructed, a 3 pickup trucks and 1 motorbike were purchased during the monitoring period.
- Potential Roll-out to Other Areas: Unitor already being the project proponent's second REDD activity in the region, further areas with potential for REDD projects have already been identified around the project site. At the time of this MR's publishing, one of the project owners of Unitor is developing another VCS-REDD project, which is not yet publicly available.
- Combatting illegal land occupation: The local community will be strategic in monitoring illegal land occupation and potential illegal logging. Those who are interested in being trained and carrying out local monitoring will be included in the project, an activity which may also become a

new source of income for local communities. This action is dependent on sale of credits and therefore has not been carried out yet.

Regarding the monitoring of the Non-permanence risk factors, they will be monitored through remote sensing, literature data, and internal Carbonext processes, in accordance with the Non-Permanence risk tool, completed at each monitoring event¹² approach being as follows for each risk category:

Internal risks: Carbonext internal control of project management methods and team according to adaptive management plan¹³; Financial Viability assessed through contact with project proprietors; opportunity cost assessed through financial modelling according to AFOLU Non-Permanence tool.

External risks assessed as per description in the VCS-Non-Permanence-Risk-Report-Template, broadly summarized below: *Land-tenure and Resource Access/Impacts* assessed according to contact with project owners and repeated stakeholder consultations; Community Engagement addressed via stakeholder consultation, which is repeated at each MR; and Political Risk is subject to a desk-based assessment according to AFOLU Non-Permanence Risk Tool.

Natural risks assessed via analysis of satellite images and maps, according to the VCS-Non-Permanence-Risk-Report-Template repeated at each MR. The remote sensing is carried out according to the following plan:

- 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September.
- 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images.
- 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed.
- 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.

3.3 Deviations

3.2.1 Methodology Deviations

No methodology deviations were identified during the development of the present VCS MR.

¹² Document provided at audit: "VCS-Non-Permanence-Risk-Report-Template_Unitor_MR1_10.12.21"

¹³ Document provided at audit: "Proced_Unitor_Control e Patrimonial e Combate a Incendio"

3.2.2 Project Description Deviations

No Project Description deviations were identified during the development of the present VCS MR.

3.4 Grouped Projects

No new instances were added to the project within this monitoring period.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	CF
Data unit	tC/tdm
Description	Default value of carbon fraction in biomass
Source of data	Values from the literature (e.g., IPCC 2003. Good practice guidance for land use, land-use change and forestry. Kanagawa: IGES, 2003. Available at: < http://www.ipccnggip.iges.or.jp/public/gpglulucf/gpglulucf.html >)
Value applied	0.5
Justification of choice of data or description of measurement methods and procedures applied	The default value was used for conservativeness purposes.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	If new and more accurate carbon fraction data become available, these can be used to estimate the net anthropogenic GHG emission reduction of the subsequent fixed baseline period.

Data / Parameter	44/12
Data unit	Dimensionless
Description	Carbon mass to CO ₂ e mass conversion factor

Source of data	From scientific literature: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 AFOLU
Value applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	Conversion from C to CO ₂ based on molecular weights
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	IPCC standard value

Data / Parameter	R
Data unit	t 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	Average of following references: 0.37 root-shoot ratio (R), according to “2006 IPCC Guidelines for National Greenhouse Gas Inventories”, V. 4, Ch. 4, AFOLU, pg. 4.49, Table 4-4; and 0.24 root-shoot ratio, according to VM0015, Appendix 3, Table 2. Root to shoot ratios
Value applied	0.31
Justification of choice of data or description of measurement methods and procedures applied	Local values are not known, and the IPCC and VM0015 factors are conservative values.
Purpose of Data	• <i>Calculation of baseline emissions</i> • <i>Calculation of project emissions</i> • <i>Calculation of leakage</i>
Comments	Peer-reviewed work performed in the region of the Project Area, with a similar vegetation typology. The statistical quality of model is in accordance with methodology requirements

Data / Parameter	BEF
Data unit	Dimensionless
Description	Biomass Expansion Factor
Source of data	According to “Brown, S., A. J. R. Gillespie, and A. E. Lugo, 1989. Biomass estimation methods for tropical forests with applications to forest inventory data. Forest Science, 35:881-902”. (Table 4; pg. 890; minimum value deducted from lowest limit.: $1.743 - 0.083 = 1.66$)
Value applied	1.66
Justification of choice of data or description of measurement methods and procedures applied	BEF was applied for conversion of merchantable volume to total aboveground tree biomass
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	N/A

Data / Parameter	Cab_{icl}
Data unit	tCO ₂ /ha
Description	Average carbon stock per hectare in the above-ground biomass carbon pool of initial forest class icl
Source of data	Forest biomass inventory carried out in Fortaleza Ituxi REDD Project in the municipality of Lábrea, nearby the Project area. Further details are provided in “1.13 Conditions Prior to Project Initiation” of this VCS-PD.
Value applied	577
Justification of choice of data or description of measurement methods and procedures applied	As a forest biomass inventory has been carried out in a neighbouring REDD project in the municipality of Lábrea, data have been used for this estimate. 1.66 Biomass Expansion Factor (BEF) was applied for conversion of merchantable volume to total aboveground tree biomass, according to “Brown, S., A. J. R. Gillespie, and A. E. Lugo, 1989. Biomass estimation methods for tropical forests with applications to forest inventory data. Forest Science, 35:881-

	902". (Table 4; pg. 890; minimum value deducted from lowest limit.: $1.743 - 0.083 = 1.66$). The result of this multiplication is 314.7 t/ha, whose conversion to CO₂ corresponds to 577 tCO₂/ha.
Purpose of Data	Calculation of baseline emissions
Comments	Field measurements and literature studies used for this assessment, as well as respective calculations, are available for consultation by the audit team.

Data / Parameter	Cbb_{icl}
Data unit	tCO ₂ /ha
Description	Average carbon stock per hectare in the below-ground biomass carbon pool of initial forest class icl
Source of data	Forest biomass inventory carried out in Fortaleza Ituxi REDD Project in the municipality of Lábrea, nearby the Project area. Further details are provided in "1.13 Conditions Prior to Project Initiation" of this VCS-PD.
Value applied	176
Justification of choice of data or description of measurement methods and procedures applied	As a forest biomass inventory has been carried out in a neighbouring REDD project in the municipality of Lábrea, data have been used for this estimate. In this inventory, an average biomass of 189.6 t/ha has been obtained as result. This value has been multiplied by BEF (1.66, see table above), which resulted in 314.7 t/ha (aboveground biomass). This later value has been multiplied by the root-shoot ratio (R). 0.31 root-shoot ratio (R) was applied (average of following references: 0.37 root-shoot ratio (R), according to "2006 IPCC Guidelines for National Greenhouse Gas Inventories", V. 4, Ch. 4, AFOLU, pg. 4.49, Table 4-4; and 0.24 root-shoot ratio, according to VM0015, Appendix 3, Table 2. Root to shoot ratios). The multiplication of aboveground biomass (314,7 t/ha) by the R results in 96 t/ha of biomass, which converted to CO₂ corresponds to 176 tCO₂/ha.
Purpose of Data	Calculation of baseline emissions
Comments	Literature studies used for this assessment, as well as respective calculations, are available for consultation by the audit team.

Data / Parameter	Cabfcl
Data unit	tCO ₂ /ha
Description	Average carbon stock per hectare in the above-ground biomass carbon pool of final post-deforestation class fcl
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 6: Grassland, pg. 6.27, Table 6.4 (for Pasture)
Value applied	Baseline: 16.8; Project emissions: 5.9
Justification of choice of data or description of measurement methods and procedures applied	Conservative default value from IPCC, to estimate post-deforestation land use carbon stock.
Purpose of Data	Calculation of baseline emissions
Comments	Conservative average to be used in calculations, based on uncertainties in source values. For both confidence intervals (above and belowground biomass), the upper limit has been selected to be conservative. Thus, the highest possible value of pasture biomass is adopted for conservativeness purposes.

Data / Parameter	Cbbfcl
Data unit	tCO ₂ /ha
Description	Average carbon stock per hectare in the below-ground biomass pool of final post-deforestation class fcl
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 6: Grassland, pg. 6.27, Table 6.4 (for Pasture)
Value applied	26.9
Justification of choice of data or description of measurement methods and procedures applied	Conservative default value from IPCC, to estimate post deforestation land use carbon stock.
Purpose of Data	Calculation of baseline emissions
Comments	Conservative average to be used in calculations, based on uncertainties in source values. For both confidence intervals (above and belowground biomass), the upper limit has been selected to be conservative. Thus, the highest possible value of pasture biomass is adopted for conservativeness purposes.

Data / Parameter	Deforestation
Data unit	ha
Description	Maps of forest cover areas converted into non-forest areas
Source of data	Measured through data from Mapbiomas or PRODES/INPE (if available) or supervised classification.
Value applied	Yearly variable: deforestation values are presented for the Reference Region, Leakage Belt and Project Area (projections) in the VCS-PD
Justification of choice of data or description of measurement methods and procedures applied	The project area is located within a region that is subject to a national LU/LC monitoring program such as Mapbiomas and PRODES. The data generated by those programs are able to be used in this project. Both sources are applicable for use in this project, according to the criteria listed below (Methodology VM0015): i) monitoring occurs in the entire project area and leakage belt. ii) monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period. iii) monitors conversion of forest land to non-forest land. iv) monitoring occurred during the entire fixed baseline period. v) data accuracies are acceptable according to the methodology criteria. An order of preference of data applies to the available sources of data: 1) Mapbiomas in first order of preference; 2) PRODES in second place; and 3) place self-classification of images.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	DLF
Data unit	N/A
Description	Displacement Leakage Factor
Source of data	Local assessment
Value applied	0.05
Justification of choice of data or description of measurement methods and procedures applied	If deforestation agents do not participate in leakage prevention activities and project activities, the Displacement Factor shall be 100%. Where leakage prevention activities are implemented, the factor shall be equal to the proportion of the baseline agents estimated to be given the opportunity to participate in leakage prevention activities and project activities. The project design

	team estimates that 100% of potential deforestation agents in the Reference Region will be given the opportunity to participate in leakage prevention activities. Projections of deforestation within the Leakage Belt have duly been made as part of the present project, according to projections of deforestation presented in Section 4.3 of the PD, in the Erro! Fonte de referência não encontrada. The project proponent has conservatively allowed 5% leeway on this estimate, which is unlikely to be surpassed. If this allowance is surpassed, an assessment of how much is due to the project will be conducted during monitoring. Thus, the “Displacement Leakage Factor” (DLF) was conservatively defined as 0.05. It is worthy to notice that the project proponent is continuously divulging and recruiting new landowners to participate in this grouped REDD initiative, which can be also considered as a measure to fight leakage. Other leakage fighting activities are also listed in this VCS-PD, as fire brigade trainings, sustainable cattle raising etc.
Purpose of Data	Calculation of leakage
Comments	This value is an ex-ante estimate. Accurate and actual values will be monitored and reported in verification periods

Data / Parameter	EI
Data unit	N/A
Description	Ex ante estimated effectiveness index
Source of data	Local assessment
Value applied	0.9
Justification of choice of data or description of measurement methods and procedures applied	The project design team conservatively considers that surveillance activities are able to attain 90% of effectiveness in avoiding unplanned deforestation inside the Project Area. According to studies comparing the incidence of fires in the Reference Region and the Project Area (for 2019 and 2020), it is evidenced the initial fire occurrences in PA are 74% lower than in the RR. Moreover, none of these occurrences resulted in biomass loss, as demonstrated by satellite imagery. Evidence is available to auditors.
Purpose of Data	Calculation of project emissions
Comments	This value is an ex-ante estimate. Accurate and actual values will be monitored and reported in verification periods.

Data / Parameter	LDF
Data unit	Mg C m ⁻³
Description	Logging damage factor
Source of data	Pearson et al 2014 ¹⁴
Value applied	0.71
Justification of choice of data or description of measurement methods and procedures applied	The Pearson et al 2014 study was identified as the most authoritative study on this topic relating to sustainable forest management for Brazil
Purpose of Data	Calculation of project emissions
Comments	N/A

Data / Parameter	LIF
Data unit	Mg C m ⁻³
Description	Logging infrastructure factor
Source of data	Feldpausch et al (2005) via Pearson et al 2014 ⁹⁶
Value applied	0.27
Justification of choice of data or description of measurement methods and procedures applied	Feldpausch et al (2005) is identified within the Pearson et al 2014 study as the most authoritative study on this topic relating to sustainable forest management for Bolivia and Brazil.
Purpose of Data	Calculation of project emissions
Comments	N/A

4.2 Data and Parameters Monitored

¹⁴ <https://winrock.org/wp-content/uploads/2016/03/Pearson-et-al-2014-Logging.pdf>

Data / Parameter	ACPA _t
Data unit	ha
Description	Annual area within the Project Area affected by catastrophic events at year t
Source of data	- Remote sensing data and GIS, - Supervisor reports
Description of measurement methods and procedures to be applied	The following sources will be monitored: - INMET (INMET. Instituto Nacional de Meteorologia). https://www.gov.br/agricultura/pt-br/assuntos/inmet?r=home/page&page=%20rede_estacoes_conv_graf - Periodic reports from area supervisor - INPE (INPE. Instituto Nacional de Pesquisas Espaciais). https://queimadas.dgi.inpe.br/queimadas/portal - itens 1 and 5)
Frequency of monitoring/recording	Each time a catastrophic event occurs
Value applied	0
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions
Calculation method	Remote sensing and GIS

Comments	The analysis was done considering the official data from INMET and INPE, which did not record any occurrence of catastrophic events in the project area during the period of this monitoring report. In this context, “Table 25.f Ex post carbon stock decrease due to catastrophic events” and “Table 26.f Ex post carbon stock increase on areas affected by catastrophic events” have been omitted.
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Data / Parameter	ABSLKt
Data unit	ha
Description	Annual area of deforestation within the leakage belt at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Deforestation in the leakage belt area, which is due to displaced deforestation agents from the Project Area, will be considered activity displacement leakage. Activity data for the leakage belt area will be determined using the same methods applied to monitoring deforestation activity data in the project area.
Frequency of monitoring/recording	Annually
Value applied	2018: 0 2019: 0 2020: 0 2021: 0
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 5) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 6) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 7) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 8) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.

Purpose of data	Calculation of leakage
Calculation method	Analysis of satellite images and maps
Comments	Where strong evidence can be collected that deforestation in the leakage belt is 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. As shown in calculations of this MR, a strong increase in deforestation has been observed in the entire Reference Region ex-post. Thus, it has been considered that the conjunctural increase of deforestation in the Reference Region (including the Leakage Belt) could not be attributed to this project activity, as a general change in deforestation trends has been established in the project region after the project start date, far above the initial ex-ante deforestation estimations presented in the VCS-PD. In general context, deforestation rates in the Amazon can be expected to increase even more compared to those currently observed in the region. Among the main factors for increased deforestation after 2018, with an expectation of deforestation rates even higher than those observed historically so far, the following factors can be cited: i) Trends in Brazilian legislation: there are several indications of loosening of environmental legislation in recent years, mainly in the Bolsonaro government framework; ii) Increased demand for beef in the international market.

Data / Parameter	ABSLPat
Data unit	ha
Description	Annual area of deforestation in the Project Area at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Forest cover change due to deforestation is monitored through periodic assessment of classified satellite imagery covering the project area.
Frequency of monitoring/recording	Annually
Value applied	

	2018: 48.1 2019: 149.4 2020: 454.4 2021: 375.6
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions • Calculation of baseline emissions
Calculation method	Analysis of satellite images and maps
Comments	N/A

Data / Parameter	APLPAicl,t
Data unit	ha
Description	Areas of planned logging activities in forest class icl at year t in the project area.
Source of data	SFMP documents and receipts.
Description of measurement methods and procedures to be applied	The planned logging area in the project area that result in carbon stock decrease will be subject to monitoring, when significant.

Frequency of monitoring/recording	Annually.										
Value applied	<table border="1"> <thead> <tr> <th>Year</th><th>ha</th></tr> </thead> <tbody> <tr> <td>2018</td><td>198.0</td></tr> <tr> <td>2019</td><td>3,170.3</td></tr> <tr> <td>2020</td><td>3,489.1</td></tr> <tr> <td>2021</td><td>267.8</td></tr> </tbody> </table>	Year	ha	2018	198.0	2019	3,170.3	2020	3,489.1	2021	267.8
Year	ha										
2018	198.0										
2019	3,170.3										
2020	3,489.1										
2021	267.8										
Monitoring equipment	Project proponent records according to official SFMP documents and receipts.										
QA/QC procedures to be applied	These procedures are subject to requirements and procedures defined by the State organ IPAAM (<i>Instituto de Proteção Ambiental do Estado do Amazonas</i>) ¹⁵ for SFMPs.										
Purpose of data	Calculation of project emissions										
Calculation method	For <i>ex-post</i> calculations, official SFMP documents and receipts are used to determine the total volume of wood extracted in forest management, and then the corresponding areas of planned logging activities are calculated.										
Comments	N/A.										

Data / Parameter	$\Delta CADLK_t$
Data unit	tCO ₂ e
Description	Total decrease in carbon stocks due to displaced deforestation at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Deforestation in the leakage belt area will be considered activity displacement leakage. Activity data for the leakage belt area will be determined using the same methods applied to monitoring deforestation activity data in the project area.
Frequency of monitoring/recording	Annually

¹⁵ <http://www.ipaam.am.gov.br/>

Value applied	2018: 0 2019: 0 2020: 0 2021: 0
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Emissions from deforestation are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	N/A

Data / Parameter	$\Delta\text{CPAdPat}$
Data unit	tCO ₂ e
Description	Total decrease in carbon stock due to all planned activities at year t in the project area.
Source of data	Documents, remote sensing and GIS.
Description of measurement methods and procedures to be applied	The planned activities in the project area that result in carbon stock decrease will be subject to monitoring, when significant.

Frequency of monitoring/recording	Annually.
Value applied	2018 20,825 2019 333,502 2020 367,034 2021 28,173
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions
Calculation method	Emissions from all planned activities are estimated by the sum of the emissions from planned deforestation + emissions from planned logging activities + emissions from planned fuel-wood and charcoal activities. For this project, the only source of emission is from planned deforestation, which is calculated by multiplying the detected areas of planned deforestation with the carbon stock change per unit area.
Comments	N/A
Data / Parameter	ΔCPSLk_t
Data unit	tCO ₂ e

Description	Total annual carbon stock change in leakage management areas in the project case
Source of data	- Activity reports related to leakage prevention measures. - Field assessments. - Remote sensing and GIS.
Description of measurement methods and procedures to be applied	The planned activities in leakage management areas that result in carbon stock decrease will be subject to monitoring, when significant.
Frequency of monitoring/recording	Annually
Value applied	2018: 0 2019: 0 2020: 0 2021: 0
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Emissions from planned activities in leakage management areas are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	N/A

Data / Parameter	$\Delta\text{CUDdPat}$
Data unit	tCO ₂ e
Description	Total actual carbon stock change due to unavoided unplanned deforestation at year t in the project area
Source of data	Remote sensing and GIS
Description of measurement methods and procedures to be applied	Forest cover change due to unplanned deforestation is monitored through periodic assessment of classified satellite imagery covering the project area.
Frequency of monitoring/recording	Annually
Value applied	2018: 34,033 2019: 105,746 2020: 321,625 2021: 265,851
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions
Calculation method	Emissions from unavoided unplanned deforestation are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	N/A

Data / Parameter	EBBPSPat
Data unit	tCO2e
Description	Sum of (or total) actual non-CO2 emissions from forest fire at year t in the project area
Source of data	Remote sensing data and GIS, - Supervisor reports.
Description of measurement methods and procedures to be applied	If forest fires occur, these non-CO2 emissions will be subject to monitoring and accounting, when significant.
Frequency of monitoring/recording	Annually
Value applied	2018 1,205 2019 3,743 2020 11,383 2021 9,409
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions
Calculation method	Analysis of satellite images and maps to determine the incidence of deforestation and multiplying it by the respective emission factors.
Comments	If forest fires occur, these non-CO2 emissions will be subject to monitoring and accounting, when significant.

Data / Parameter	EADLKt
Data unit	tCO2e
Description	Total ex ante increase in GHG emissions due to displaced forest fires at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	When significant, GHG emissions due displaced forest fires will be monitored.
Frequency of monitoring/recording	Annually
Value applied	0
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	The main data source is Mapbiomas Fire. The entire mapping of fire scars in Brazil is based on mosaics of images from Landsat satellites with a spatial resolution of 30 meters. The mapping period was from 1985 to 2020, with monthly and annual data on fire scars covering the entire Brazilian territory. Other fire data source such as BD QUEIMADAS (INPE) can be checked to evaluate emissions due to displaced forest fires.
Purpose of data	Calculation of leakage
Calculation method	Analysis of satellite images and maps to determine the incidence of deforestation and multiplying it by the respective emission factors.
Comments	Where strong evidence can be collected that forest fires in the leakage belt is 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.

Data / Parameter	RFt
Data unit	%
Description	Risk factor used to calculate VCS buffer credits
Source of data	- VCS Non-Permanence Risk Report (v3.1) (supplied at audit)

	- Remote sensing data and GIS, - Supervisor report. - Literature data.
Description of measurement methods and procedures to be applied	All sources of data from the VCS Non-Permanence Risk Report will be used to measure the various risk factors.
Frequency of monitoring/recording	Annually
Value applied	10
Monitoring equipment	VCS-approved AFOLU Non-Permanence Risk Tool
QA/QC procedures to be applied	Literature data from reputed sources will be used and critically checked. When possible, the average of two or more sources will be used.
Purpose of data	• Calculation of VCS buffer credits
Calculation method	All the risk factors described in the VCS Risk Report were assessed.
Comments	N/A

Data / Parameter	Deforestation in the Project Area and Leakage Belt
Data unit	ha
Description	Forest cover areas converted into non-forest areas inside the Project Area and Leakage Belt
Source of data	Calculated through remote sensing images
Description of measurement methods and procedures to be applied	The monitoring of the forest cover in the Project Area and Leakage Belt will be done through satellite image analysis. When data from Mapbiomas or PRODES system are not available, the forest cover monitoring will be carried out by automatic classification and visual interpretation of images from other optical sensors or SAR data.
Frequency of monitoring/recording	Annually
Value applied	Project Area: 2018 48.1

	2019 149.4 2020 454.4 2021 375.6 Leakage Belt: 2018 2,864.0 2019 20,132.7 2020 23,450.9 2021 35,390.2
Monitoring equipment	Remote sensing images digital processing program, geographic information systems
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions • Calculation of leakage
Calculation method	Analysis of satellite images and maps
Comments	N/A
Data / Parameter	$\Delta\text{CabBSLLKt}$
Data unit	tCO ₂ e

Description	Total baseline carbon stock changes for the above-ground biomass pool in the Leakage Belt
Source of data	Calculated
Description of measurement methods and procedures to be applied	- leakage prevention activities will be listed; - a map showing areas of intervention and type of intervention will be created; - areas where leakage prevention activities impact carbon stock will be identified; - non-forest classes existing within these areas in the baseline case will be identified; - carbon stocks will be measured on the identified classes or conservative literature estimates will be used; - carbon stock changes in the leakage management areas under the project scenario will be reported using table 30b of the VM0015; - net carbon stock changes that the leakage prevention measures cause during the fixed baseline period and, optionally, the project crediting period will be calculated; - results of the calculations will be reported in table 30.c of the VM0015.
Frequency of monitoring/recording	To be determined depending on the activity
Value applied	0
Monitoring equipment	Remote sensing images digital processing program, geographic information systems
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage

Calculation method	Analysis of satellite images and maps to determine deforestation in Leakage Belt and multiplying it by the carbon stocks previously set.
Comments	N/A

4.3 Monitoring Plan

This Monitoring Plan was developed according to Methodology VM0015 “Methodology for Avoided Unplanned Deforestation”, Version 1.1.3 The methodology encompasses three main monitoring tasks:

- i) Monitoring of actual carbon stock changes and GHG emissions within the project area;
- ii) Monitoring of leakage; and
- iii) Ex post calculation of net anthropogenic GHG emission reduction.

This Monitoring Plan describes how these tasks will be implemented. For each task, the monitoring plan includes the following aspects:

- a) Technical description of the monitoring tasks.
- b) Data to be collected.
- c) Overview of data collection procedures.
- d) Quality control and quality assurance procedures.
- e) Data archiving.
- f) Organization and responsibilities of the parties involved in all the above.

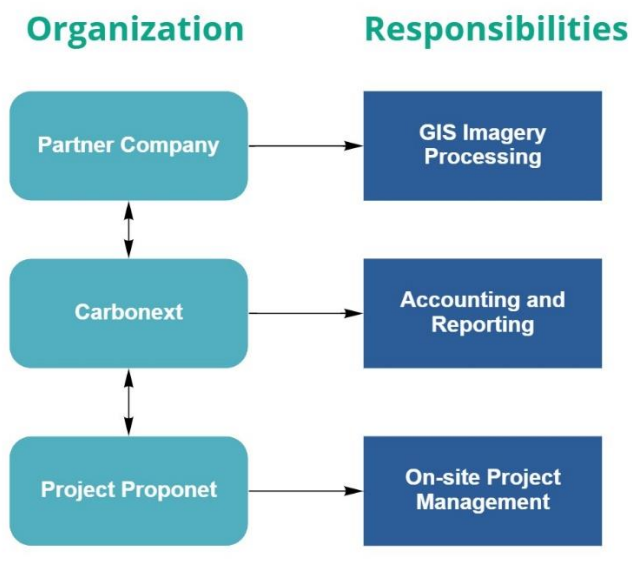


Figure 9. General overview of parties involved in monitoring activities

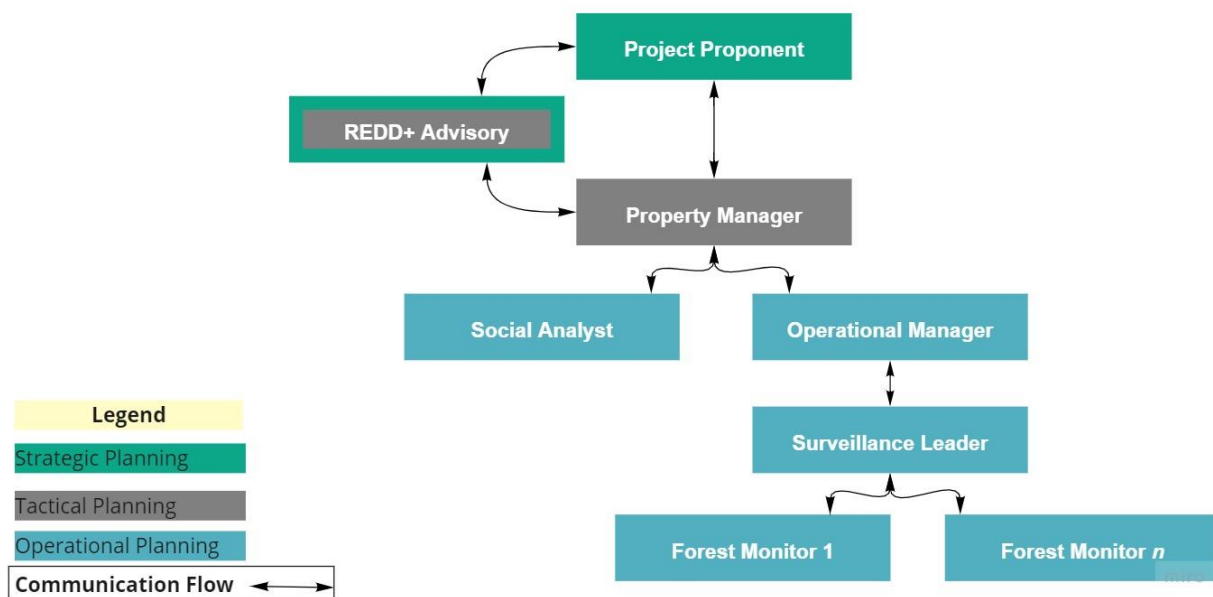


Figure 10. General overview of staff in the Project Area

4.3.1 Monitoring of actual carbon stock changes and GHG emissions within the project area

Monitoring of project implementation

a) Technical description of the monitoring tasks.

Project activities implemented within the project area will be monitored to be consistent with the management plans of the project area and the PD.

b) Data to be collected.

Monitoring of deforestation-avoidance activities will be performed by means of evaluations of the surveillance rounds, and using satellite imagery to continuously inspect the forest condition within the Project Area. 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 actually been implemented.

Monitoring of social and biodiversity parameters of project implementation will be based on data required in

Table 10

Table 10 and Table 11, which attest that foreseen activities are being effectively implemented. A system will be implemented to record data on costs and investments, based on invoices, receipts and contracts related to activity implementation, as well as signed attendance lists.

c) Overview of data collection procedures.

All invoices, receipts and contracts related to activities implemented in this REDD project shall be conserved in printed version. Whenever possible, documentation should be kept in electronic format.

d) Quality control and quality assurance procedures.

The project proponent will train personnel to collect and keep all documentation in a sure place. All electronic documentation should also be sent to CARBONEXT to further security and checking.

e) Data archiving.

All maps and records generated during project implementation will be conserved and made available to VCS verifiers at verification. Backup copies of files should be available in the project proponent facilities, as well as in CARBONEXT facilities.

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

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

The project proponent is responsible to implement this monitoring item. CARBONEXT is co-responsible in archiving, and quality control and quality assurance procedures.

Monitoring of land-use and land-cover change within the project area

a) Technical description of the monitoring tasks.

Monitoring of land-use and land-cover change within the Project Area will be performed annually by analyzing satellite imagery of the Project Area.

Imagery analysis of land use will be based on secondary information from PRODES Digital (INPE, 2014), referring mainly to the classes "Forest Land" and "Non-Forest Land".

b) Data to be collected.

The categories of change that will be subject to MRV-A (monitoring, reporting, verification and accounting) are "Area of forest land converted to non-forest land", "Area of forest land undergoing carbon stock decrease" and "Area of forest land undergoing carbon stock increase". These categories are mandatory in AUD project activities having the same characteristics as this project (i.e., planned logging above the baseline and claiming carbon credits for carbon stock increase).

In this context, data to be collected consists of annual satellite imagery processed by Mapbiomas or PRODES, if available, for the entire land coverage of Project Area.

The satellite images used will be four scenes of satellite Landsat 8 TM (orbits 001/66, 001/67, 233/66, and 233/67) to the total geographic scope of the Project Area and Reference Region.

c) Overview of data collection procedures.

The project area is located within a region that is subject to a national LU/LC monitoring program such as Mapbiomas and PRODES. The data generated by those programs are able to be used in this project. Both sources are applicable for use in this project, according to the criteria listed below (Methodology VM0015).

- i) monitoring occurs in the entire project area and leakage belt.
- ii) monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period.
- iii) monitors conversion of forest land to non-forest land.
- iv) monitoring occurred during the entire fixed baseline period.
- v) data accuracies are acceptable according to the methodology criteria.

d) Quality control and quality assurance procedures.

The validation of land-use data used for modeling of 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, accumulated deforestation and other (hydrography, not forest, clouds, roads, residues, unclassified objects, and others).

The validation will be performed by using be four scenes of satellite Landsat 8 TM (orbits 001/66, 001/67, 233/66, and 233/67) to the total geographic scope of the Project Area and Reference Region.

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 VM00015 1.1.3 methodology.

e) Data archiving.

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

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

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

All satellite imagery assessments will be performed by AVIX. CARBONEXT is responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits. The Project Proponent is co-responsible for data archiving.

Monitoring of carbon stock changes and non-CO2 emissions from forest fires

a) Technical description of the monitoring tasks.

Monitoring of carbon stocks is mandatory in the following cases:

Within the project area:

a) Areas subject to significant carbon stock decrease in the project scenario according to the *ex-ante* assessment. These will be areas subject to controlled deforestation and planned harvest activities, such as logging, fuel wood collection and charcoal production. In these areas, carbon stock changes must be estimated at least once after each harvest event.

b) 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.

Within leakage management areas:

a) Areas subject to planned and significant carbon stock decrease in the project scenario according to the ex-ante assessment. In these areas, carbon stocks must be estimated at least once after the planned event that caused the carbon stock decrease.

b) Data to be collected.

The results of monitoring activity data and carbon stocks must be reported using the same formats and tables used for the ex-ante assessment, according to Methodology VM0015 (the applicability of each table must be evaluated ex post, in the Monitoring Report):

Table 15 Ex post carbon stock per hectare of initial forest classes icl existing in the project area and leakage belt.

Table 16 Ex post carbon stock per hectare of final classes fcl existing in the project area and leakage belt.

Table 25.a Ex post carbon stock decrease due to planned and unplanned deforestation in the project area.

Table 25.b Ex post carbon stock decrease due to planned logging activities.

Table 25.c Ex post carbon stock decrease due to planned fuel-wood and charcoal activities.

Table 25.d Total ex post carbon stock decrease due to planned activities in the project area.

Table 25.e Ex post carbon stock decrease due to forest fires.

Table 25.f Ex post carbon stock decrease due to catastrophic events.

Table 25.g Total ex post carbon stock decrease due to forest fires and catastrophic events.

Table 26.a Ex post carbon stock increase due to growth without harvest.

Table 26.b Ex post carbon stock increase following planned logging activities.

Table 26.c Ex post carbon stock increase following planned fuel-wood and charcoal activities.

Table 26.d Total ex post carbon stock increase due to planned activities in the project area.

Table 26.e Ex post carbon stock increase on areas affected by forest fires.

Table 26.f Ex post carbon stock increase on areas affected by catastrophic events.

Table 26.g Ex post carbon stock increase on areas recovering after forest fires and catastrophic events.

Table 27 Ex post total net carbon stock change in the project area.

Non-CO₂ emissions from forest fires are subject to monitoring and accounting, when significant. In this case, under the project scenario it will be necessary to monitor the variables of table 23 within the project area and to report the results in table 24, according to VM0015.

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. Use tables 25.e, 25.f and 25.g to report carbon stock decreases and, optionally, tables 26.e, 26.f and 26.g to report carbon stock increases that may happen on the disturbed lands after the occurrence of an event. Use tables 23 and 24 to report emissions from forest fires.

If the area (or a sub-set of it) is 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 must be estimated, and an equivalent amount of VCUs must be cancelled from the VCS buffer.

Summarize the results of all ex-post estimations in the project area using the same table format used for the ex-ante assessment:

Table 29: Total ex post estimated actual net changes in carbon stocks and emissions of GHG gases in the project area.

c) Overview of data collection procedures.

The project area is located within a region that is subject to a national LU/LC monitoring program such as Mapbiomas and PRODES. The data generated by those programs are able to be used in this project. Both sources are applicable for use in this project, according to the criteria listed below (Methodology VM0015).

- i) monitoring occurs in the entire project area and leakage belt.
- ii) monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period.
- iii) monitors conversion of forest land to non-forest land.
- iv) monitoring occurred during the entire fixed baseline period.
- v) data accuracies are acceptable according to the methodology criteria.

d) Quality control and quality assurance procedures.

The validation of land-use data used for modeling of 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, accumulated deforestation and other (hydrography, not forest, clouds, roads, residues, unclassified objects, and others).

The validation will be performed by using the land use mapping PRODES Digital (2014). The satellite images used will be four scenes of satellite Landsat 8 TM (orbits 001/65, 001/66, 233/65, and 233/66) to the total geographic scope of the Project Area and Reference Region.

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 VM00015 1.1 methodology.

e) Data archiving.

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

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period

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

All satellite imagery assessments will be performed by a third-party specialist GIS company, currently represented by Avix. CARBONEXT is responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits. The Project Proponent is co-responsible for data archiving.

4.3.2 Monitoring of Leakage

a) Technical description of the monitoring tasks.

The sources of leakage identified as significant in the *ex-ante* assessment are subject to monitoring. Two sources of leakage are potentially subject to monitoring:

- Decrease in carbon stocks and increase in GHG emissions associated with leakage prevention activities;
- Decrease in carbon stocks and increase in GHG emissions in due to activity displacement leakage.

This Project Activity does not involve decrease in carbon stocks and increase in GHG emissions associated with leakage prevention activities. In this project, leakage prevention activities do not

involve any carbon stock reduction due to deforestation or additional emissions caused by increased grazing activities. In this case, only the decrease in carbon stocks and increase in GHG emissions in due to activity displacement leakage will be monitored.

b) Data to be collected.

Deforestation above the baseline in the leakage belt area will be considered activity displacement leakage.

The result of the ex-post estimations of carbon stock changes must be reported using the same table formats used in the ex-ante assessment of baseline carbon stock changes in the leakage belt.

Table 22.c.1. Ex post above-ground net carbon stock changes in the leakage belt.

Table 22.c.2. Ex post below-ground net carbon stock changes in the leakage belt.

Table 22.c.6. Ex post net carbon stock changes in the wood products in the leakage belt.

Where strong evidence can be collected that deforestation in the leakage belt is attributable to deforestation agents that are not linked to the Project Area, the detected deforestation will not be attributed to the Project Activity and considered leakage. The operational entity verifying the monitoring data shall determine whether the documentation provided by the project proponent represents sufficient evidence to consider the detected deforestation as not attributable to the Project Activity and therefore not leakage.

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 (table 23), except for the initial carbon stocks (Cab, Cdw) which shall be those of the initial forest classes burned in the leakage belt area.

Report the result of the estimations using the same table formats used in the ex-ante assessment of baseline GHG emissions from forest fires in the project area:

Table 23: Parameters used to calculate emissions from forest fires in the leakage belt area.

Table 24: Ex post estimated non-CO₂ emissions from forest fires in the leakage belt area.

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

Table 35. Total ex post estimated leakage.

c) Overview of data collection procedures.

The project area is located within a region that is subject to a national LU/LC monitoring program such as Mapbiomas and PRODES. The data generated by those programs are able to be used in this project. Both sources are applicable for use in this project, according to the criteria listed below (Methodology VM0015).

- i) monitoring occurs in the entire project area and leakage belt.
- ii) monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period.
- iii) monitors conversion of forest land to non-forest land.
- iv) monitoring occurred during the entire fixed baseline period.
- v) data accuracies are acceptable according to the methodology criteria.

d) Quality control and quality assurance procedures.

The validation of land-use data used for modeling of 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, accumulated deforestation and other (hydrography, not forest, clouds, roads, residues, unclassified objects, and others).

The validation will be performed by using the land use mapping PRODES Digital (2014). The satellite images used will be four scenes of satellite Landsat 8 TM (orbits 001/65, 001/66, 233/65, and 233/66) to the total geographic scope of the Project Area and Reference Region.

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 VM00015 1.1 methodology.

e) Data archiving.

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

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

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

All satellite imagery assessments will be performed by the third-party GIS company. CARBONEXT is responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits. The Project Proponent is co-responsible for data archiving.

4.3.3 Ex post calculation of net anthropogenic GHG emission reduction

a) Technical description of the monitoring tasks.

The calculation of ex post net anthropogenic GHG emission reductions is similar to the ex-ante calculation with the only difference that ex post estimated carbon stock changes and GHG emissions must be used in the case of the project scenario and leakage.

b) Data to be collected.

Report the ex post estimated net anthropogenic GHG emissions and calculation of Verified Carbon Units (VCUt, and VBCT) using the same table format used for the ex-ante assessment:

Table 36: Ex post estimated net anthropogenic GHG emission reductions and VCUs.

c) Overview of data collection procedures.

Data collection procedures are the same as described in previous steps. This step involves compilation of data from previous procedures to calculate ex post net anthropogenic GHG emission reduction.

d) Quality control and quality assurance procedures.

A map showing Cumulative Areas Credited within the project area shall be updated and presented to VCS verifiers at each verification event. The cumulative area cannot generate additional VCUs in future periods.

e) Data archiving.

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

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

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

All satellite imagery assessments will be performed by AVIX. CARBONEXT is responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits. The Project Proponent is co-responsible for data archiving.

4.3.4 community and biodiversity variables to be monitored

Communities

The indicators that will be monitored are described in the table below.

Table 10. Social parameters to be monitored

Activity	Scope	Indicator	Unit	Monitoring Frequency	Status
Training of Fire Brigade	Project Area	Attendance	Nº of attendees	Annual	A training was carried out in partnership with "Fortaleza do Ituxi REDD+ Project", and was held on March 2019 for 6 participants. The next trainings will be carried out after the validation and verification of the project.
Health and Security internal audits	Project Area	Occurrences	Nº of occurrences registered; Nº of corrective actions performed;	Semiannual	Will start after project validation and credit sale
Advice on nutritional aspects	Project Area	Attendance	Nº of attendees	Annual	
Gender equity	Project Area	Presence of men and women in trainings	% by gender	Annual	

Overview of data collection procedures:

The following forms will be applied after any of the trainings or the advice on nutritional aspects are completed:

- I. **Attendance List:** It contains the name of the participant, type of affiliation with the project and signature.
- II. **Reaction Assessment:** participants will be able to register their perceptions regarding the content presented, making it possible to evaluate the content and make suggestions for future training. This assessment can be done anonymously and is not mandatory.

In relation to the Health and Security audits, there is a checklist (named “Vistoria de Saúde e Segurança”) that will be applied. The checklist may be revised periodically as opportunities for improvement are noted.

Quality control and quality assurance procedures:

All communication with workers and families will be registered in minutes of meeting, which might be signed by all parties involved. Reports should be produced according to the monitoring frequency adopted. These reports should clearly inform the results of variables involved in monitoring, by means of photos, interviews, and documents.

Data archiving:

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

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

Organization and responsibilities of the parties involved in all the above:

The Project Proponent is responsible for financing, implementing, and monitoring social aspects within the Project Area. Carbonext is co-responsible for monitoring the realization of the trainings and keep the evidence in a data room.

Biodiversity

Technical description of the monitoring tasks:

The monitoring tasks aim to assess the level of awareness on conservation importance, as well as to keep mechanisms to avoid forest fires and illegal practices inside the Project Area.

Data to be collected:

This assessment will be monitored and reported according to the frequency adopted (Table 11).

A biomass and fauna inventory have been conducted in the neighbouring Fortaleza Ituxi REDD Project in July 2020, providing valuable primary data for the present project. Further inventories will be carried out to assess the maintenance of local biodiversity and biomass.

Table 11. Biodiversity parameters to be monitored

Activity	Scope	Indicator	Unit	Monitoring Frequency	Status
Biomass, fauna and flora inventory	Project Area	Carbon Stock	tCO ₂ per hectare	5 years	In July 2020, a biomass and fauna inventory were conducted in the Ituxi REDD+ project. The data was considered for the Unitor project because the properties are neighbors and have one owner in common.
		Endangered fauna species	Nº of endangered species		
		Total fauna species	Nº of species		
		Endangered flora species	Nº of endangered species		
		Total flora species	Nº of species		

Between the 11th and 24th of July 2020, the survey of vertebrate fauna conducted in the Fortaleza do Ituxi REDD+ project found 302 species of amphibians, reptiles, birds and mammals, taking into account only the direct records made using the sampling method of active search via transects and opportunistic sightings. For further information about the fauna inventory and, it is recommended to consult section “2.3 Environmental Impact” of the Project Description.

Overview of data collection procedures

Data collection and records will be carried out by the local administrator.

Quality control and quality assurance procedures

The quality control and quality assurance procedures will be determined by the local administrator and survey with attendees.

Data archiving

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

All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

Organization and responsibilities of the parties involved in all the above

The Project Proponent is responsible for all assessments in this Project Activity.

4.3.5 Revisiting the baseline projections for future fixed baseline period

According to VM0015, the baseline will be revisited every 10 years. Thus, the first revision of the baseline is scheduled for 2028. For this purpose, the following tasks will be carried out:

- Updating information on agents, drivers and underlying causes of deforestation, which involves the following sub-tasks:
 - Collecting information that is relevant to understand deforestation agents, drivers and underlying causes;
 - Redoing step 3 of the ex-ante methodology, as specified in the methodology;
 - Recalibrating the model for projection of future deforestation, using new “Factor Maps” for the subsequent fixed baseline period.
- Adjusting the land-use and land-cover change component of the baseline, which involves reassessing the following components of the baseline projections:
 - The annual areas of baseline deforestation.
 - The location of baseline deforestation.
 - Adjustment of the annual areas of baseline deforestation.
 - Adjustment of the location of the projected baseline deforestation.
- Adjusting, as needed, the carbon component of the baseline (this task will only be carried out if more accurate methods for carbon stocks estimates are available in the occasion of baseline revision).

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.2 Baseline Emissions

The accumulated baseline deforestation projected to occur within the Project Area over the 30-year project lifetime was estimated at 24,768.7 hectares. The estimated average annual rate of deforestation is 825.62 hectares for the Project Area.

Table 12. Annual areas of baseline deforestation in the Project Area (Table 9.b of VM0015)

Year	Project year	Total - PA	
		annual ABSLPA _t ha	cumulative ABSLPA ha
2018	0	1,041.18	1,041.2
2019	1	1,386.73	2,427.9
2020	2	1,700.25	4,128.2
2021	3	1,750.05	5,878.2
2022	4	1,736.86	7,615.1
2023	5	1,005.81	8,620.9
2024	6	838.90	9,459.8
2025	7	1,590.44	11,050.2
2026	8	848.95	11,899.2
2027	9	1,594.29	13,493.5
2028	10	952.36	14,445.8
2029	11	881.23	15,327.0
2030	12	881.23	16,208.3
2031	13	881.23	17,089.5
2032	14	881.23	17,970.7
2033	15	881.23	18,852.0
2034	16	420.81	19,272.8
2035	17	420.81	19,693.6
2036	18	420.81	20,114.4
2037	19	420.81	20,535.2
2038	20	420.81	20,956.0
2039	21	406.03	21,362.1
2040	22	406.03	21,768.1
2041	23	406.03	22,174.1
2042	24	406.03	22,580.1
2043	25	406.03	22,986.2

2044	26	412.83	23,399.0
2045	27	412.83	23,811.8
2046	28	412.83	24,224.7
2047	29	412.83	24,637.5
2048	30	131.20	24,768.7
TOTAL		24,768.7	

Table 13. Annual areas of baseline deforestation in the leakage belt (Table 9.c of VM0015)

Year	Project year	Total - LK	
		annual ABSLLK _t ha	cumulative ABSLLK ha
2018	0	4,149.6	4,149.6
2019	1	13,433.1	17,582.7
2020	2	12,253.8	29,836.6
2021	3	12,292.6	42,129.2
2022	4	10,778.3	52,907.5
2023	5	10,561.9	63,469.5
2024	6	10,344.6	73,814.1
2025	7	10,377.8	84,191.9
2026	8	9,798.3	93,990.2
2027	9	9,601.4	103,591.5
2028	10	9,403.6	112,995.1
2029	11	2,668.9	115,664.0
2030	12	2,668.9	118,332.9
2031	13	2,668.9	121,001.8
2032	14	2,668.9	123,670.7
2033	15	2,668.9	126,339.6
2034	16	2,021.9	128,361.5
2035	17	2,021.9	130,383.3
2036	18	2,021.9	132,405.2
2037	19	2,021.9	134,427.0
2038	20	2,021.9	136,448.9
2039	21	2,060.3	138,509.2
2040	22	2,060.3	140,569.6
2041	23	2,060.3	142,629.9
2042	24	2,060.3	144,690.2
2043	25	2,060.3	146,750.6
2044	26	2,104.0	148,854.5
2045	27	2,104.0	150,958.5
2046	28	2,104.0	153,062.5
2047	29	2,104.0	155,166.5
2048	30	668.7	155,835.1
TOTAL		155,835.1	

According to MMA data, the Project Area displays 64% of its forests classified as open ombrophylous forest (“As”), and 36% is submontane dense ombrophylous forest (“Ds”), however only open (“As”) is taken into account, for conservativeness reasons, as explained in this VCS PD. The data processing procedure in this step was the same as performed and explained in previous steps.

The following table shows the annual estimates of deforestation within the Project Area, obtained by means of modelling.

Table 14. Annual areas deforested per forest class icl within the project area in the baseline case (baseline activity data per forest class) (Table 11.b of VM0015)

Year	ID _{icl} >	1	Total baseline deforestation in the project area	
	Name >	Submontane open ombrophilous forest (As)		
	Project year <i>t</i>	ha	annual ABSLPA _{<i>t</i>} ha	cummulative ABSLPA ha
2018	0	1,041.2	1,041.2	1,041.2
2019	1	1,386.7	1,386.7	2,427.9
2020	2	1,700.3	1,700.3	4,128.2
2021	3	1,750.1	1,750.1	5,878.2
2022	4	1,736.9	1,736.9	7,615.1
2023	5	1,005.8	1,005.8	8,620.9
2024	6	838.9	838.9	9,459.8
2025	7	1,590.4	1,590.4	11,050.2
2026	8	849.0	849.0	11,899.2
2027	9	1,594.3	1,594.3	13,493.5
2028	10	952.4	952.4	14,445.8
2029	11	881.2	881.2	15,327.0
2030	12	881.2	881.2	16,208.3
2031	13	881.2	881.2	17,089.5
2032	14	881.2	881.2	17,970.7
2033	15	881.2	881.2	18,852.0
2034	16	420.8	420.8	19,272.8
2035	17	420.8	420.8	19,693.6
2036	18	420.8	420.8	20,114.4
2037	19	420.8	420.8	20,535.2
2038	20	420.8	420.8	20,956.0
2039	21	406.0	406.0	21,362.1
2040	22	406.0	406.0	21,768.1
2041	23	406.0	406.0	22,174.1
2042	24	406.0	406.0	22,580.1
2043	25	406.0	406.0	22,986.2
2044	26	412.8	412.8	23,399.0
2045	27	412.8	412.8	23,811.8

2046	28	412.8	412.8	24,224.7
2047	29	412.8	412.8	24,637.5
2048	30	131.2	131.2	24,768.7
TOTAL			24,768.7	

The following table shows the annual estimates of deforestation within the Leakage Belt, obtained by means of modelling.

Table 15. Annual areas deforested per forest class icl within the leakage belt area in the baseline case (baseline activity data per forest class) (Table 11.c of VM0015)

Area deforested per forest class icl within the leakage belt area			Total baseline deforestation in the leakage belt area	
Year	ID _{icl} > Name >	1 Submontane open ombrophylous forest (As)		
	Project year <i>t</i>	ha	ABSLLK _t annual ha	ABSLLK cumulative ha
2018	0	4,149.6	4,149.6	4,149.6
2019	1	13,433.1	13,433.1	17,582.7
2020	2	12,253.8	12,253.8	29,836.6
2021	3	12,292.6	12,292.6	42,129.2
2022	4	10,778.3	10,778.3	52,907.5
2023	5	10,561.9	10,561.9	63,469.5
2024	6	10,344.6	10,344.6	73,814.1
2025	7	10,377.8	10,377.8	84,191.9
2026	8	9,798.3	9,798.3	93,990.2
2027	9	9,601.4	9,601.4	103,591.5
2028	10	9,403.6	9,403.6	112,995.1
2029	11	2,668.9	2,668.9	2,668.9
2030	12	2,668.9	2,668.9	118,332.9
2031	13	2,668.9	2,668.9	121,001.8
2032	14	2,668.9	2,668.9	123,670.7
2033	15	2,668.9	2,668.9	126,339.6
2034	16	2,021.9	2,021.9	128,361.5
2035	17	2,021.9	2,021.9	130,383.3
2036	18	2,021.9	2,021.9	132,405.2
2037	19	2,021.9	2,021.9	134,427.0
2038	20	2,021.9	2,021.9	136,448.9
2039	21	2,060.3	2,060.3	138,509.2
2040	22	2,060.3	2,060.3	140,569.6
2041	23	2,060.3	2,060.3	142,629.9
2042	24	2,060.3	2,060.3	144,690.2
2043	25	2,060.3	2,060.3	146,750.6

2044	26	2,104.0	2,104.0	148,854.5
2045	27	2,104.0	2,104.0	150,958.5
2046	28	2,104.0	2,104.0	153,062.5
2047	29	2,104.0	2,104.0	155,166.5
2048	30	668.7	668.7	155,835.1
TOTAL			155,835.1	

To project the LU/LC classes that will replace forests in the baseline case, Method 1 “Historical LU/LC-change” was chosen, because historical LU/LC-changes are assumed to be representative of future trends. Hence, post-deforestation land-uses are allocated to the projected areas of annual deforestation in same proportions as those observed on lands deforested during the historical reference period in the Reference Region.

As mentioned in “1.13 Conditions Prior to Project Initiation” of this VCS-PD, pasture accounts for virtually all the deforested land occupation in the project region. An analysis of land-use cover in Lábrea Municipality over the historical reference period years¹⁶, show that, of the agricultural land uses, pastureland accounts for over 99% of the area in every year analysed. Corresponding evidence was duly presented at audit, under category “16 – Land use land cover maps”. Thus, the post deforestation class is considered exclusively as “pasture”.

The following table shows the annual estimates of deforestation within the Project Area, obtained by means of modelling.

Table 16. Annual areas deforested in each zone within the project area in the baseline case (baseline activity data zone) (Table 13.b of VM0015)

Year	ID _z >	1	Total baseline deforestation in the project area	
	Name >	Pasture		
	Project year _t	ha	annual ABSLPA _t ha	cummulative ABSLPA ha
2018	0	1,041.2	1,041.2	1,041.2
2019	1	1,386.7	1,386.7	2,427.9
2020	2	1,700.3	1,700.3	4,128.2
2021	3	1,750.1	1,750.1	5,878.2
2022	4	1,736.9	1,736.9	7,615.1
2023	5	1,005.8	1,005.8	8,620.9
2024	6	838.9	838.9	9,459.8
2025	7	1,590.4	1,590.4	11,050.2
2026	8	849.0	849.0	11,899.2
2027	9	1,594.3	1,594.3	13,493.5

¹⁶ Source, Mapbiomas, municipality Lábrea: <https://plataforma.brasil.mapbiomas.org>

2028	10	952.4	952.4	14,445.8
2029	11	881.2	881.2	15,327.0
2030	12	881.2	881.2	16,208.3
2031	13	881.2	881.2	17,089.5
2032	14	881.2	881.2	17,970.7
2033	15	881.2	881.2	18,852.0
2034	16	420.8	420.8	19,272.8
2035	17	420.8	420.8	19,693.6
2036	18	420.8	420.8	20,114.4
2037	19	420.8	420.8	20,535.2
2038	20	420.8	420.8	20,956.0
2039	21	406.0	406.0	21,362.1
2040	22	406.0	406.0	21,768.1
2041	23	406.0	406.0	22,174.1
2042	24	406.0	406.0	22,580.1
2043	25	406.0	406.0	22,986.2
2044	26	412.8	412.8	23,399.0
2045	27	412.8	412.8	23,811.8
2046	28	412.8	412.8	24,224.7
2047	29	412.8	412.8	24,637.5
2048	30	131.2	131.2	24,768.7
TOTAL			24,768.7	

The following table shows the annual estimates of deforestation within the Leakage Belt, obtained by means of modelling.

Table 17. Annual areas deforested in each zone within the Leakage Belt area in the baseline case (baseline activity data per zone) (Table 13.c of VM0015)

Year	ID _z >	1	Total baseline deforestation in the leakage belt	
	Name >	Pasture		
	Project year <i>t</i>	ha	annual ABSLLK _{<i>t</i>} ha	cummulative ABSLLK ha
2018	0	4,149.6	4,149.6	4,149.6
2019	1	13,433.1	13,433.1	17,582.7
2020	2	12,253.8	12,253.8	29,836.6
2021	3	12,292.6	12,292.6	42,129.2
2022	4	10,778.3	10,778.3	52,907.5
2023	5	10,561.9	10,561.9	63,469.5
2024	6	10,344.6	10,344.6	73,814.1
2025	7	10,377.8	10,377.8	84,191.9
2026	8	9,798.3	9,798.3	93,990.2
2027	9	9,601.4	9,601.4	103,591.5

2028	10	9,403.6	9,403.6	112,995.1
2029	11	2,668.9	2,668.9	2,668.9
2030	12	2,668.9	2,668.9	118,332.9
2031	13	2,668.9	2,668.9	121,001.8
2032	14	2,668.9	2,668.9	123,670.7
2033	15	2,668.9	2,668.9	126,339.6
2034	16	2,021.9	2,021.9	128,361.5
2035	17	2,021.9	2,021.9	130,383.3
2036	18	2,021.9	2,021.9	132,405.2
2037	19	2,021.9	2,021.9	134,427.0
2038	20	2,021.9	2,021.9	136,448.9
2039	21	2,060.3	2,060.3	138,509.2
2040	22	2,060.3	2,060.3	140,569.6
2041	23	2,060.3	2,060.3	142,629.9
2042	24	2,060.3	2,060.3	144,690.2
2043	25	2,060.3	2,060.3	146,750.6
2044	26	2,104.0	2,104.0	148,854.5
2045	27	2,104.0	2,104.0	150,958.5
2046	28	2,104.0	2,104.0	153,062.5
2047	29	2,104.0	2,104.0	155,166.5
2048	30	668.7	668.7	155,835.1
TOTAL			155,835.1	

The carbon stock change factors shown below were calculated based on VM0015 premises, using Method 2, as activity data are available for categories.

Table 18. Carbon stock change factors for land-use change categories (ct or ctz) (Method 2)
(Table 20.c of VM0015)

Year after deforestation		$\Delta C_{ab_{ctz,t}}$	$\Delta C_{bb_{ctz,t}}$	$\Delta C_{wp_{ctz,t}}$ long-lived
1	2018	-575.35	-14.91	0
2	2019	1.68	-14.91	0
3	2020	1.68	-14.91	0
4	2021	1.68	-14.91	0
5	2022	1.68	-14.91	0
6	2023	1.68	-14.91	0
7	2024	1.68	-14.91	0
8	2025	1.68	-14.91	0
9	2026	1.68	-14.91	0
10	2027	1.68	-14.91	0
11	2028	0	0.00	0
12	2029	0	0.00	0
13	2030	0	0.00	0
14	2031	0	0.00	0
15	2032	0	0.00	0
16	2033	0	0.00	0

17	2034	0	0.00	0
18	2035	0	0.00	0
19	2036	0	0.00	0
20	2037	0	0.00	0
21	2038	0	0.00	0
22	2039	0	0.00	0
23	2040	0	0.00	0
24	2041	0	0.00	0
25	2042	0	0.00	0
26	2043	0	0.00	0
27	2044	0	0.00	0
28	2045	0	0.00	0
29	2046	0	0.00	0
30	2047	0	0.00	0
31	2048	0	0.00	0

The following tables show the calculation of baseline carbon stock changes in above-ground biomass, below-ground biomass and wood products in the Project Area, using the carbon stock change factors presented in the Table 18 immediately above.

Table 19. Baseline carbon stock change in the above-ground biomass in the project area
(Table 22.b.1 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for above-ground biomass in the project area		Total baseline carbon stock change in the project area	
		Forest / Pasture		annual	cumulative
		ABSLPA _{ct,t}	ΔCab _{ct,t}	ΔCabBSLPA _t	ΔCabBSLPA
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	1,041.2	-575	-599,048	-599,048
2019	1	1,386.7	-328	-796,107	-1,395,155
2020	2	1,700.3	-236	-974,157	-2,369,311
2021	3	1,750.1	-170	-999,945	-3,369,256
2022	4	1,736.9	-130	-989,430	-4,358,687
2023	5	1,005.8	-66	-565,892	-4,924,578
2024	6	838.9	-49	-468,165	-5,392,743
2025	7	1,590.4	-81	-899,154	-6,291,897
2026	8	849.0	-39	-469,855	-6,761,752
2027	9	1,594.3	-66	-897,259	-7,659,011
2028	10	952.4	-39	-526,990	-8,186,001
2029	11	881.2	-38	-486,797	-8,672,798
2030	12	881.2	-40	-488,176	-9,160,974
2031	13	881.2	-44	-489,618	-9,650,592
2032	14	881.2	-47	-491,059	-10,141,650
2033	15	881.2	-48	-491,269	-10,632,919

2034	16	420.8	-23	-226,295	-10,859,214
2035	17	420.8	-26	-228,265	-11,087,478
2036	18	420.8	-28	-228,986	-11,316,465
2037	19	420.8	-33	-230,963	-11,547,427
2038	20	420.8	-36	-231,858	-11,779,286
2039	21	406.0	-37	-224,128	-12,003,413
2040	22	406.0	-40	-224,928	-12,228,342
2041	23	406.0	-44	-225,729	-12,454,070
2042	24	406.0	-49	-226,529	-12,680,600
2043	25	406.0	-55	-227,330	-12,907,929
2044	26	412.8	-56	-231,268	-13,139,198
2045	27	412.8	-56	-231,282	-13,370,479
2046	28	412.8	-56	-231,295	-13,601,774
2047	29	412.8	-56	-231,309	-13,833,083
2048	30	131.2	-18	-69,285	-13,902,368

Table 20. Baseline carbon stock change in the below-ground biomass in the project area (Table 22.b.2 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for below-ground biomass in the project area		Total baseline carbon stock change in the project area	
		Forest / Pasture		annual	cumulative
		BBSLPA _{ct,t}	ΔCbb _{ct,t}	ΔCbbBSLPA _t	ΔCbbBSLPA
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	1,041.2	-14.91	-15,524	-15,524
2019	1	1,386.7	-14.91	-36,200	-51,724
2020	2	1,700.3	-14.91	-61,550	-113,274
2021	3	1,750.1	-14.91	-87,643	-200,917
2022	4	1,736.9	-14.91	-113,540	-314,457
2023	5	1,005.8	-14.91	-128,536	-442,993
2024	6	838.9	-14.91	-141,044	-584,037
2025	7	1,590.4	-14.91	-164,757	-748,794
2026	8	849.0	-14.91	-177,415	-926,209
2027	9	1,594.3	-14.91	-201,186	-1,127,394
2028	10	952.4	-14.91	-199,861	-1,327,255
2029	11	881.2	-14.91	-192,324	-1,519,580
2030	12	881.2	-14.91	-180,113	-1,699,693
2031	13	881.2	-14.91	-167,159	-1,866,851
2032	14	881.2	-14.91	-154,401	-2,021,253
2033	15	881.2	-14.91	-152,544	-2,173,797
2034	16	420.8	-14.91	-146,310	-2,320,107
2035	17	420.8	-14.91	-128,871	-2,448,978
2036	18	420.8	-14.91	-122,488	-2,571,466
2037	19	420.8	-14.91	-104,991	-2,676,458

2038	20	420.8	-14.91	-97,066	-2,773,524
2039	21	406.0	-14.91	-89,981	-2,863,505
2040	22	406.0	-14.91	-82,896	-2,946,401
2041	23	406.0	-14.91	-75,811	-3,022,212
2042	24	406.0	-14.91	-68,725	-3,090,937
2043	25	406.0	-14.91	-61,640	-3,152,577
2044	26	412.8	-14.91	-61,521	-3,214,099
2045	27	412.8	-14.91	-61,402	-3,275,501
2046	28	412.8	-14.91	-61,283	-3,336,784
2047	29	412.8	-14.91	-61,164	-3,397,949
2048	30	131.2	-14.91	-56,846	-3,454,795

Table 21. Baseline carbon stock change in the wood products in the project area (Table 22.b.6 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for wood products biomass in the project area		Total baseline carbon stock change in the project area	
		Forest / Pasture		annual	cumulative
		WPSLPA _{ct,t}	ΔCwp _{ct,t}	ΔCwpBSLPA _t	ΔCwpBSLPA
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	1,041.2	0.00	0	0
2019	1	1,386.7	0.00	0	0
2020	2	1,700.3	0.00	0	0
2021	3	1,750.1	0.00	0	0
2022	4	1,736.9	0.00	0	0
2023	5	1,005.8	0.00	0	0
2024	6	838.9	0.00	0	0
2025	7	1,590.4	0.00	0	0
2026	8	849.0	0.00	0	0
2027	9	1,594.3	0.00	0	0
2028	10	952.4	0.00	0	0
2029	11	881.2	0.00	0	0
2030	12	881.2	0.00	0	0
2031	13	881.2	0.00	0	0
2032	14	881.2	0.00	0	0
2033	15	881.2	0.00	0	0
2034	16	420.8	0.00	0	0
2035	17	420.8	0.00	0	0
2036	18	420.8	0.00	0	0
2037	19	420.8	0.00	0	0
2038	20	420.8	0.00	0	0
2039	21	406.0	0.00	0	0
2040	22	406.0	0.00	0	0
2041	23	406.0	0.00	0	0

2042	24	406.0	0.00	0	0
2043	25	406.0	0.00	0	0
2044	26	412.8	0.00	0	0
2045	27	412.8	0.00	0	0
2046	28	412.8	0.00	0	0
2047	29	412.8	0.00	0	0
2048	30	131.2	0.00	0	0

The following tables show the calculation of baseline carbon stock changes in above-ground biomass, below-ground biomass and wood products in the Leakage Belt, using the carbon stock change factors presented in Table 18.

Table 22. Baseline carbon stock change in the above-ground biomass in the leakage belt area (Table 22.c.1 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for above-ground biomass in the leakage belt		Total baseline carbon stock change in the leakage belt	
		Forest / Pasture		annual	cumulative
		ABSLK _{ct,t}	ΔCab _{ct,t}	ΔCabBSLLK _t	ΔCabBSLLK
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	4,150	-575	-2,387,485	-2,387,485
2019	1	13,433	-439	-7,721,831	-10,109,316
2020	2	12,254	-235	-7,020,673	-17,129,989
2021	3	12,293	-167	-7,022,368	-24,152,357
2022	4	10,778	-116	-6,130,399	-30,282,756
2023	5	10,562	-94	-5,987,713	-36,270,469
2024	6	10,345	-79	-5,844,900	-42,115,370
2025	7	10,378	-69	-5,846,592	-47,961,962
2026	8	9,798	-58	-5,495,644	-53,457,606
2027	9	9,601	-52	-5,365,855	-58,823,461
2028	10	9,404	-48	-5,242,866	-64,066,328
2029	11	2,669	-14	-1,374,840	-65,441,168
2030	12	2,669	-16	-1,390,987	-66,832,155
2031	13	2,669	-18	-1,407,198	-68,239,353
2032	14	2,669	-20	-1,420,859	-69,660,212
2033	15	2,669	-23	-1,434,155	-71,094,367
2034	16	2,022	-20	-1,074,803	-72,169,170
2035	17	2,022	-24	-1,088,879	-73,258,048
2036	18	2,022	-29	-1,101,979	-74,360,027
2037	19	2,022	-36	-1,114,747	-75,474,774
2038	20	2,022	-48	-1,127,181	-76,601,955
2039	21	2,060	-50	-1,150,411	-77,752,366
2040	22	2,060	-52	-1,151,436	-78,903,802

2041	23	2,060	-53	-1,152,461	-80,056,263
2042	24	2,060	-55	-1,153,486	-81,209,749
2043	25	2,060	-57	-1,154,511	-82,364,261
2044	26	2,104	-58	-1,179,553	-83,543,814
2045	27	2,104	-57	-1,179,414	-84,723,228
2046	28	2,104	-57	-1,179,276	-85,902,504
2047	29	2,104	-57	-1,179,138	-87,081,641
2048	30	669	-18	-353,186	-87,434,827

Table 23. Baseline carbon stock change in the below-ground biomass in the leakage belt area (Table 22.c.2 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for below-ground biomass in the leakage belt		Total baseline carbon stock change in the leakage belt	
		Forest / Pasture		annual	cumulative
		BBSLLK _{ct,t}	$\Delta C_{bb,ct,t}$	$\Delta C_{bb}BBSLLK_t$	$\Delta C_{bb}BBSLLK$
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	4,150	-14.91	-61,870	-61,870
2019	1	13,433	-14.91	-262,156	-324,026
2020	2	12,254	-14.91	-444,859	-768,885
2021	3	12,293	-14.91	-628,140	-1,397,025
2022	4	10,778	-14.91	-788,844	-2,185,869
2023	5	10,562	-14.91	-946,320	-3,132,189
2024	6	10,345	-14.91	-1,100,557	-4,232,746
2025	7	10,378	-14.91	-1,255,289	-5,488,035
2026	8	9,798	-14.91	-1,401,379	-6,889,414
2027	9	9,601	-14.91	-1,544,534	-8,433,948
2028	10	9,404	-14.91	-1,622,870	-10,056,819
2029	11	2,669	-14.91	-1,462,377	-11,519,196
2030	12	2,669	-14.91	-1,319,467	-12,838,663
2031	13	2,669	-14.91	-1,175,979	-14,014,642
2032	14	2,669	-14.91	-1,055,068	-15,069,710
2033	15	2,669	-14.91	-937,385	-16,007,095
2034	16	2,022	-14.91	-813,294	-16,820,388
2035	17	2,022	-14.91	-688,707	-17,509,096
2036	18	2,022	-14.91	-572,762	-18,081,858
2037	19	2,022	-14.91	-459,753	-18,541,611
2038	20	2,022	-14.91	-349,693	-18,891,304
2039	21	2,060	-14.91	-340,619	-19,231,923
2040	22	2,060	-14.91	-331,546	-19,563,469
2041	23	2,060	-14.91	-322,472	-19,885,940
2042	24	2,060	-14.91	-313,398	-20,199,339
2043	25	2,060	-14.91	-304,325	-20,503,663
2044	26	2,104	-14.91	-305,549	-20,809,212

2045	27	2,104	-14.91	-306,773	-21,115,985
2046	28	2,104	-14.91	-307,998	-21,423,983
2047	29	2,104	-14.91	-309,222	-21,733,205
2048	30	669	-14.91	-289,046	-22,022,251

Table 24. Baseline carbon stock change in the wood products in the leakage belt area (Table 22.c.6 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for wood products biomass in the leakage belt area		Total baseline carbon stock change in the leakage belt area	
		Forest / Pasture		annual	cumulative
		WPSLLK _{ct,t}	$\Delta C_{wpct,t}$	$\Delta C_{wpBSLLK_t}$	$\Delta C_{wpBSLLK}$
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	4,149.6	0.00	0	0
2019	1	13,433.1	0.00	0	0
2020	2	12,253.8	0.00	0	0
2021	3	12,292.6	0.00	0	0
2022	4	10,778.3	0.00	0	0
2023	5	10,561.9	0.00	0	0
2024	6	10,344.6	0.00	0	0
2025	7	10,377.8	0.00	0	0
2026	8	9,798.3	0.00	0	0
2027	9	9,601.4	0.00	0	0
2028	10	9,403.6	0.00	0	0
2029	11	2,668.9	0.00	0	0
2030	12	2,668.9	0.00	0	0
2031	13	2,668.9	0.00	0	0
2032	14	2,668.9	0.00	0	0
2033	15	2,668.9	0.00	0	0
2034	16	2,021.9	0.00	0	0
2035	17	2,021.9	0.00	0	0
2036	18	2,021.9	0.00	0	0
2037	19	2,021.9	0.00	0	0
2038	20	2,021.9	0.00	0	0
2039	21	2,060.3	0.00	0	0
2040	22	2,060.3	0.00	0	0
2041	23	2,060.3	0.00	0	0
2042	24	2,060.3	0.00	0	0
2043	25	2,060.3	0.00	0	0
2044	26	2,104.0	0.00	0	0
2045	27	2,104.0	0.00	0	0
2046	28	2,104.0	0.00	0	0
2047	29	2,104.0	0.00	0	0
2048	30	668.7	0.00	0	0

Conversion of forest to non-forest involving fires is a source of emissions of non-CO₂ gases (CH₄ and N₂O). Sources report a steady increase in the number of fire alerts in Lábrea over the historical reference period. Furthermore, GIS analysis was conducted utilizing data on fire occurrence from the CPTEC/INPE database¹⁷ and Mapbiomas¹⁸.

To estimate non-CO₂ emissions from forest fires, the average percentage of the deforested area in which fire was used, the average proportion of mass burnt in each carbon pool (P_{burnt,p}), and the average combustion efficiency of each pool (CE_p) were estimated. These average percentage values were estimated for each forest class (*icl*) and are assumed to remain the same in the future.

In accordance with the VM0015 methodology, GHG emissions from biomass burning were estimated based on revised IPCC 1996 GL LULUCF guidance, as follows.

$$EBB_{tot_{icl,t}} = EBB_{N20_{icl,t}} + EBB_{CH4_{icl,t}}$$

Where:

$EBB_{tot_{icl,t}}$ Total GHG emission from biomass burning in forest class *icl* at year *t*; tCO₂-e ha⁻¹

$EBB_{N20_{icl,t}}$ Total GHG emission from biomass burning in forest class *icl* at year *t*; tCO₂-e ha⁻¹

$EBB_{CH4_{icl,t}}$ CH₄ emission from biomass burning in forest class *icl* at year *t*; tCO₂-e ha⁻¹

$$EBB_{N20_{icl,t}} = EBB_{CO2_{icl,t}} * 12/44 * NCR * ER_{N20} * 44/28 * GWP_{N20}$$

$$EBB_{CH4_{icl,t}} = EBB_{CO2_{icl,t}} * 12/44 * ER_{CH4} * 16/12 * GWP_{CH4}$$

Where:

$EBB_{CO2_{icl,t}}$ Per hectare CO₂ emission from biomass burning in slash and burn in forest class *icl* at year *t*; tCO₂-e ha⁻¹

$EBB_{N20_{icl,t}}$ Per hectare N₂O emission from biomass burning in slash and burn in forest class *icl* at year *t*; tCO₂-e ha⁻¹

¹⁷ Source (last visited on 04/07/2021): <http://queimadas.dgi.inpe.br/queimadas/bdqueimadas#exportar-dados>

¹⁸ Source . Projeto MapBiomas – Coleção 5.0 da Série Anual de Mapas de Uso e Cobertura da Terra do Brasil (last visited on 04/07/2021): https://mapbiomas.org/colecoes-mapbiomas-1?cama_set_language=pt-BR.

$EBBCH4_{icl,t}$	Per hectare CH ₄ emission from biomass burning in slash and burn in forest class <i>icl</i> at year <i>t</i> ; tCO ₂ -e ha ⁻¹
NCR	Nitrogen to carbon ratio (IPCC default value = 0.01); dimensionless
ER_{N2O}	Emission ratio for N ₂ O (IPCC default value = 0.007)
ER_{CH4}	Emission ratio for CH ₄ (IPCC default value = 0.012)
GWP_{N2O}	Global Warming Potential for N ₂ O (IPCC default value = 310 for the first commitment period)
GWP_{CH4}	Global Warming Potential for CH ₄ (IPCC default value = 21 for the first commitment period)

$$EBBCO2_{icl,t} = Fburnt_{icl} * \sum_{p=1}^p (C_{p,icl,t} * Pburnt_{p,icl} * CE_{p,icl})$$

$C_{p,icl,t}$	Average carbon stock per hectare in the carbon pool <i>p</i> burnt in the forest class <i>icl</i> at year <i>t</i> ; tCO ₂ -e ha ⁻¹
$Pburnt_{p,icl}$	Proportion of forest area burned during the historical reference period in the forest class <i>icl</i> ; %
$CE_{p,icl}$ dimensionless	Average combustion efficiency of the carbon pool <i>p</i> in the forest class <i>icl</i> ; dimensionless
<i>p</i>	Carbon pool that could burn (above-ground biomass, dead wood, litter)
<i>icl</i>	1, 2, 3 ... <i>lcl</i> (pre-deforestation) forest classes
<i>t</i>	1, 2, 3 ... <i>T</i> , a year of the proposed project crediting period; dimensionless

The IPCC default combustion efficiency of 0.5 was used. The Nitrogen to Carbon Ratio (NCR) of 0.01 was used.

Table 25. Parameters used to calculate non-CO2 emissions from forest fires (Table 23 of VM0015)

Initial Forest Class		Parameters				<i>ECO2-ab</i> tCO ₂ e ha ⁻¹	<i>EBBCO2-tot</i> tCO ₂ e ha ⁻¹	<i>EBBN2O_{icl}</i> tCO ₂ e ha ⁻¹	<i>EBBCH4_{icl}</i> tCO ₂ e ha ⁻¹	<i>EBBtot_{icl}</i> tCO ₂ e ha ⁻¹
<i>IDcl</i>	Name	<i>Fburnt_{icl}</i> N/A	<i>Cab</i> tCO ₂ e ha ⁻¹	<i>Pburnt_{ab,icl}</i> N/A	<i>CEab,icl</i> N/A					
1	Submontane open ombrophilous forest (As)	1.0	577	0.86	0.5	248	248	2.31	22.7	25.1

Table 26. Baseline non-CO2 emissions from forest fires in the project area (Table 24 of VM0015)

Year	Project year t	Emissions of non-CO2 gasses from baseline forest fires		Total baseline non-CO2 emissions from forest fires in the project area	
		<i>IDicl</i> = 1		annual	cumulative
		<i>ABSLPA_{icl,t}</i>	<i>EBBBSLtot_{icl}</i>	<i>EBBBSLPA_t</i>	<i>EBBBSLPA</i>
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	1,041.2	25.05	26,083	26,083
2019	1	1,386.7	25.05	34,739	60,822
2020	2	1,700.3	25.05	42,593	103,415
2021	3	1,750.1	25.05	43,841	147,256
2022	4	1,736.9	25.05	43,510	190,767
2023	5	1,005.8	25.05	25,197	215,964
2024	6	838.9	25.05	21,015	236,979
2025	7	1,590.4	25.05	39,842	276,822
2026	8	849.0	25.05	21,267	298,089
2027	9	1,594.3	25.05	39,939	338,028
2028	10	952.4	25.05	23,858	361,886
2029	11	881.2	25.05	22,076	383,961
2030	12	881.2	25.05	22,076	406,037
2031	13	881.2	25.05	22,076	428,113
2032	14	881.2	25.05	22,076	450,189
2033	15	881.2	25.05	22,076	472,265
2034	16	420.8	25.05	10,542	482,807
2035	17	420.8	25.05	10,542	493,349
2036	18	420.8	25.05	10,542	503,891

2037	19	420.8	25.05	10,542	514,432
2038	20	420.8	25.05	10,542	524,974
2039	21	406.0	25.05	10,172	535,146
2040	22	406.0	25.05	10,172	545,317
2041	23	406.0	25.05	10,172	555,489
2042	24	406.0	25.05	10,172	565,660
2043	25	406.0	25.05	10,172	575,832
2044	26	412.8	25.05	10,342	586,174
2045	27	412.8	25.05	10,342	596,516
2046	28	412.8	25.05	10,342	606,857
2047	29	412.8	25.05	10,342	617,199
2048	30	131.2	25.05	3,287	620,486

Ex-ante estimation of actual carbon stock changes

The ex-post carbon stock changes during the present monitoring period are due to the following:

- Planned activities forest management within the project area.
- Unplanned deforestation that cannot be avoided.

Carbon stock changes due to possible future catastrophic events cannot be predicted and were therefore excluded from the ex-ante assessment.

Certain discrete areas of forest within the project area will be subject to project activities that will change the carbon stocks of these areas compared to the baseline. In this Project Activity, such activities are related to planned timber logging.

According to the Sustainable Forest Management Plan, the annual area of sustainable logging is 3,931.62 hectares. Given that the total management area is of 43,247.79 hectares, it is assumed that logging activities will be carried out over 11 years, followed by 15 years of fallow period. The table below shows the yearly estimates of carbon stock decrease due to planned logging activities in the Project Area.

The increase following planned logging activities in the Project Area has also been estimated, using secondary data by West et al. (2014), which indicates an annual increase of 3.03 tCO₂ per hectare per year due to post-logging regeneration of vegetation.

Table 27. Ex ante estimated actual carbon stock decrease due to planned logging activities in the Project Area (Table 25.b of VM0015)

Year	Project year t	Areas of planned logging activities x Carbon stock change (decrease) in the project area	Total carbon stock decrease due to planned logging activities
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		IDcl = 1		annual	cumulative
		APLPA _{icl,t}	$\Delta C_{tot_{icl,t}}$	$\Delta CPLdPA_t$	$\Delta CPLdPA$
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	488.7	103.20	50,433	50,433
2019	1	2,893.9	103.20	298,637	349,069
2020	2	4,430.8	103.20	457,241	806,310
2021	3	3,297.3	103.20	340,270	1,146,580
2022	4	4,775.5	103.20	492,814	1,639,394
2023	5	4,786.1	103.20	493,910	2,133,304
2024	6	3,976.6	103.20	410,370	2,543,673
2025	7	3,980.1	103.20	410,728	2,954,401
2026	8	3,980.1	103.20	410,728	3,365,128
2027	9	3,971.7	103.20	409,867	3,774,995
2028	10	3,971.7	103.20	409,867	4,184,862
2029	11	2,694.3	103.20	278,041	4,462,903
2030	12	0.0	103.20	0	4,462,903
2031	13	0.0	103.20	0	4,462,903
2032	14	0.0	103.20	0	4,462,903
2033	15	0.0	103.20	0	4,462,903
2034	16	0.0	103.20	0	4,462,903
2035	17	0.0	103.20	0	4,462,903
2036	18	0.0	103.20	0	4,462,903
2037	19	0.0	103.20	0	4,462,903
2038	20	0.0	103.20	0	4,462,903
2039	21	0.0	103.20	0	4,462,903
2040	22	0.0	103.20	0	4,462,903
2041	23	0.0	103.20	0	4,462,903
2042	24	0.0	103.20	0	4,462,903
2043	25	0.0	103.20	0	4,462,903
2044	26	0.0	103.20	0	4,462,903
2045	27	3,430.1	103.20	353,972	4,816,875
2046	28	4,395.0	103.20	453,549	5,270,424
2047	29	3,286.6	103.20	339,165	5,609,590
2048	30	4,775.5	103.20	492,814	6,102,404

Table 28. Ex ante estimated carbon stock increase following planned logging activities in the project area (Table 26.b of VM0015)

Year	Project year t	Areas of planned logging activities x Carbon stock change (increase up to maximum long-term average)		Total carbon stock increase due to planned logging activities	
		<i>IDcl</i> = 1		annual	cumulative
		$APLPA_{icl,t}$	$\Delta C_{tot,icl,t}$	$\Delta CPLIPA_t$	$\Delta CPLIPA$
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	488.7	3.03	1,478	1,478
2019	1	2,893.9	3.03	10,232	11,711
2020	2	4,430.8	3.03	23,635	35,346
2021	3	3,297.3	3.03	33,610	68,956
2022	4	4,775.5	3.03	48,056	117,012
2023	5	4,786.1	3.03	62,534	179,545
2024	6	3,976.6	3.03	74,563	254,108
2025	7	3,980.1	3.03	86,603	340,711
2026	8	3,980.1	3.03	98,642	439,353
2027	9	3,971.7	3.03	110,657	550,010
2028	10	3,971.7	3.03	122,671	672,681
2029	11	2,694.3	3.03	130,821	803,502
2030	12	0.0	3.03	130,821	934,324
2031	13	0.0	3.03	130,821	1,065,145
2032	14	0.0	3.03	130,821	1,195,967
2033	15	0.0	3.03	130,821	1,326,788
2034	16	0.0	3.03	130,821	1,457,609
2035	17	0.0	3.03	130,821	1,588,431
2036	18	0.0	3.03	130,821	1,719,252
2037	19	0.0	3.03	130,821	1,850,074
2038	20	0.0	3.03	130,821	1,980,895
2039	21	0.0	3.03	130,821	2,111,716
2040	22	0.0	3.03	130,821	2,242,538
2041	23	0.0	3.03	130,821	2,373,359
2042	24	0.0	3.03	130,821	2,504,181
2043	25	0.0	3.03	130,821	2,635,002
2044	26	0.0	3.03	130,821	2,765,824
2045	27	3,430.1	2.99	139,719	2,905,543
2046	28	4,395.0	2.82	144,260	3,049,803
2047	29	3,286.6	2.59	140,799	3,190,602
2048	30	4,775.5	2.46	145,270	3,335,872

Some unplanned deforestation may happen in the project area despite the AUD project activity. The level at which deforestation will actually be reduced in the project case depends on the effectiveness of the proposed activities, which cannot be measured *ex ante*.

To allow ex ante projections to be made, the project proponent shall make a conservative assumption about the effectiveness of the proposed project activities and estimate an Effectiveness Index (EI) between 0 (no effectiveness) and 1 (maximum effectiveness). The estimated value of EI is used to multiply the baseline projections by the factor (1 - EI) and the result shall be considered the ex-ante estimated emissions from unplanned deforestation in the project case. The project design team conservatively considers that surveillance activities are able to attain 90% of effectiveness in avoiding unplanned deforestation inside the Project Area. According to studies comparing the incidence of fires in the Reference Region and the Project Area (for 2019 and 2020), it is evidenced the initial fire occurrences in PA are 74% lower than in the RR. Moreover, only three of these occurrences resulted in biomass loss, as demonstrated by satellite imagery. Evidence is available to auditors.

$$\Delta CUDdPA_t = \Delta CBSL_t * (1 - EI)$$

Where:

$\Delta CUDdPA_t$ Total ex ante actual carbon stock change due to unavoided unplanned deforestation at year t in the project area; tCO₂-e GHG emission from biomass burning in forest class *icl* at year t; tCO₂-e ha⁻¹

$\Delta CBSL_t$ Total baseline carbon stock change at year t in the project area; tCO₂-e

EI Ex ante estimated Effectiveness Index; %

t 1, 2, 3 ... T, a year of the proposed project crediting period; dimensionless

Table 29. Ex ante estimated net carbon stock change in the project area under the project scenario (Table 27 of VM0015)

Year	Project year t	Total carbon stock decrease due to planned logging activities		Total carbon stock increase due to planned logging activities		Total carbon stock decrease due to unavoided unplanned deforestation		Total carbon stock change in the project case	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		$\Delta CPLdPA_t$	$\Delta CPLdPA$	$\Delta CPLiPA_t$	$\Delta CPLiPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$
		tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e
2018	0	50,433	50,433	1,478	1,478	-61,457	-61,457	-110,412	-110,412
2019	1	298,637	349,069	10,232	11,711	-83,231	-144,688	-371,635	-482,047
2020	2	457,241	806,310	23,635	35,346	-103,571	-248,259	-537,176	-1,019,223
2021	3	340,270	1,146,580	33,610	68,956	-108,759	-357,017	-415,419	-1,434,641
2022	4	492,814	1,639,394	48,056	117,012	-110,297	-467,314	-555,055	-1,989,697
2023	5	493,910	2,133,304	62,534	179,545	-69,443	-536,757	-500,819	-2,490,516
2024	6	410,370	2,543,673	74,563	254,108	-60,921	-597,678	-396,728	-2,887,243

2025	7	410,728	2,954,401	86,603	340,711	-106,391	-704,069	-430,516	-3,317,759
2026	8	410,728	3,365,128	98,642	439,353	-64,727	-768,796	-376,812	-3,694,571
2027	9	409,867	3,774,995	110,657	550,010	-109,844	-878,641	-409,055	-4,103,626
2028	10	409,867	4,184,862	122,671	672,681	-72,685	-951,326	-359,881	-4,463,507
2029	11	278,041	4,462,903	130,821	803,502	-67,912	-1,019,238	-215,132	-4,678,639
2030	12	0	4,462,903	130,821	934,324	-66,829	-1,086,067	63,993	-4,614,646
2031	13	0	4,462,903	130,821	1,065,145	-65,678	-1,151,744	65,144	-4,549,502
2032	14	0	4,462,903	130,821	1,195,967	-64,546	-1,216,290	66,275	-4,483,227
2033	15	0	4,462,903	130,821	1,326,788	-64,381	-1,280,672	66,440	-4,416,787
2034	16	0	4,462,903	130,821	1,457,609	-37,260	-1,317,932	93,561	-4,323,226
2035	17	0	4,462,903	130,821	1,588,431	-35,714	-1,353,646	95,108	-4,228,118
2036	18	0	4,462,903	130,821	1,719,252	-35,147	-1,388,793	95,674	-4,132,444
2037	19	0	4,462,903	130,821	1,850,074	-33,595	-1,422,389	97,226	-4,035,218
2038	20	0	4,462,903	130,821	1,980,895	-32,892	-1,455,281	97,929	-3,937,289
2039	21	0	4,462,903	130,821	2,111,716	-31,411	-1,486,692	99,411	-3,837,879
2040	22	0	4,462,903	130,821	2,242,538	-30,782	-1,517,474	100,039	-3,737,840
2041	23	0	4,462,903	130,821	2,373,359	-30,154	-1,547,628	100,667	-3,637,172
2042	24	0	4,462,903	130,821	2,504,181	-29,525	-1,577,154	101,296	-3,535,876
2043	25	0	4,462,903	130,821	2,635,002	-28,897	-1,606,051	101,924	-3,433,952
2044	26	0	4,462,903	130,821	2,765,824	-29,279	-1,635,330	101,542	-3,332,409
2045	27	353,972	4,816,875	139,719	2,905,543	-29,268	-1,664,598	-243,521	-3,575,931
2046	28	453,549	5,270,424	144,260	3,049,803	-29,258	-1,693,856	-338,547	-3,914,477
2047	29	339,165	5,609,590	140,799	3,190,602	-29,247	-1,723,103	-227,614	-4,142,091
2048	30	492,814	6,102,404	145,270	3,335,872	-12,613	-1,735,716	-360,157	-4,502,248

Ex ante estimation of actual non-CO2 emissions from forest fires

Where forest fires have been included in the baseline scenario, non-CO₂ emissions from biomass burning must be included in the project scenario. This is done by multiplying the baseline emissions by the factor (1 – EI).

$$EBBPSPA_t = EBBBSPA_t * (1 - EI)$$

Where:

$EBBPSPA_t$ Total ex ante actual non-CO₂ emissions from forest fires due to unavoided unplanned deforestation at year t in the project area; tCO₂-e

$EBBBSPA_t$ Total non-CO₂ emissions from forest fires at year t in the project area; tCO₂-e

EI Ex ante estimated Effectiveness Index; %

t 1, 2, 3 ... T, a year of the proposed project crediting period; dimensionless

Table 30. Total ex ante estimated actual emissions of non-CO2 gases due to forest fires in the project area (Table 28 of VM0015)

Year	Project year t	Total ex ante estimated actual non-CO2 emissions from forest fires in the Project area	
		annual	cumulative
		EBBPSPA _t	EBBPSPA
		tCO ₂ -e	tCO ₂ -e
2018	0	2,608	2,608
2019	1	3,474	6,082
2020	2	4,259	10,342
2021	3	4,384	14,726
2022	4	4,351	19,077
2023	5	2,520	21,596
2024	6	2,102	23,698
2025	7	3,984	27,682
2026	8	2,127	29,809
2027	9	3,994	33,803
2028	10	2,386	36,189
2029	11	2,208	38,396
2030	12	2,208	40,604
2031	13	2,208	42,811
2032	14	2,208	45,019
2033	15	2,208	47,226
2034	16	1,054	48,281
2035	17	1,054	49,335
2036	18	1,054	50,389
2037	19	1,054	51,443
2038	20	1,054	52,497
2039	21	1,017	53,515
2040	22	1,017	54,532
2041	23	1,017	55,549
2042	24	1,017	56,566
2043	25	1,017	57,583
2044	26	1,034	58,617
2045	27	1,034	59,652
2046	28	1,034	60,686
2047	29	1,034	61,720
2048	30	329	62,049

Total ex ante estimations for the project area

Table 31. Total ex ante estimated actual net carbon stock changes and emissions of non-CO2 gases in the project area (Table 29 of VM0015)

Year	Project year t	Total ex ante carbon stock decrease due to planned activities		Total ex ante carbon stock increase due to planned activities		Total ex ante carbon stock decrease due to unavoided unplanned deforestation		Total ex ante net carbon stock change		Total ex ante estimated actual non-CO2 emissions from forest fires in the project area	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		ΔCPAdPA_t	ΔCPAdPA	ΔCPAiPA_t	ΔCPAiPA	ΔCUDdPA_t	ΔCUDdPA	ΔCPSPA_t	ΔCPSPA	EBBPSPA_t	EBBPSPA
		tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e
2018	0	50,433	50,433	1,478	1,478	-61,457	-61,457	-110,412	-110,412	2,608	2,608
2019	1	298,637	349,069	10,232	11,711	-83,231	-144,688	-371,635	-482,047	3,474	6,082
2020	2	457,241	806,310	23,635	35,346	-103,571	-248,259	-537,176	-1,019,223	4,259	10,342
2021	3	340,270	1,146,580	33,610	68,956	-108,759	-357,017	-415,419	-1,434,641	4,384	14,726
2022	4	492,814	1,639,394	48,056	117,012	-110,297	-467,314	-555,055	-1,989,697	4,351	19,077
2023	5	493,910	2,133,304	62,534	179,545	-69,443	-536,757	-500,819	-2,490,516	2,520	21,596
2024	6	410,370	2,543,673	74,563	254,108	-60,921	-597,678	-396,728	-2,887,243	2,102	23,698
2025	7	410,728	2,954,401	86,603	340,711	-106,391	-704,069	-430,516	-3,317,759	3,984	27,682
2026	8	410,728	3,365,128	98,642	439,353	-64,727	-768,796	-376,812	-3,694,571	2,127	29,809
2027	9	409,867	3,774,995	110,657	550,010	-109,844	-878,641	-409,055	-4,103,626	3,994	33,803
2028	10	409,867	4,184,862	122,671	672,681	-72,685	-951,326	-359,881	-4,463,507	2,386	36,189
2029	11	278,041	4,462,903	130,821	803,502	-67,912	-1,019,238	-215,132	-4,678,639	2,208	38,396
2030	12	0	4,462,903	130,821	934,324	-66,829	-1,086,067	63,993	-4,614,646	2,208	40,604
2031	13	0	4,462,903	130,821	1,065,145	-65,678	-1,151,744	65,144	-4,549,502	2,208	42,811
2032	14	0	4,462,903	130,821	1,195,967	-64,546	-1,216,290	66,275	-4,483,227	2,208	45,019
2033	15	0	4,462,903	130,821	1,326,788	-64,381	-1,280,672	66,440	-4,416,787	2,208	47,226
2034	16	0	4,462,903	130,821	1,457,609	-37,260	-1,317,932	93,561	-4,323,226	1,054	48,281
2035	17	0	4,462,903	130,821	1,588,431	-35,714	-1,353,646	95,108	-4,228,118	1,054	49,335
2036	18	0	4,462,903	130,821	1,719,252	-35,147	-1,388,793	95,674	-4,132,444	1,054	50,389
2037	19	0	4,462,903	130,821	1,850,074	-33,595	-1,422,389	97,226	-4,035,218	1,054	51,443
2038	20	0	4,462,903	130,821	1,980,895	-32,892	-1,455,281	97,929	-3,937,289	1,054	52,497
2039	21	0	4,462,903	130,821	2,111,716	-31,411	-1,486,692	99,411	-3,837,879	1,017	53,515
2040	22	0	4,462,903	130,821	2,242,538	-30,782	-1,517,474	100,039	-3,737,840	1,017	54,532
2041	23	0	4,462,903	130,821	2,373,359	-30,154	-1,547,628	100,667	-3,637,172	1,017	55,549
2042	24	0	4,462,903	130,821	2,504,181	-29,525	-1,577,154	101,296	-3,535,876	1,017	56,566
2043	25	0	4,462,903	130,821	2,635,002	-28,897	-1,606,051	101,924	-3,433,952	1,017	57,583
2044	26	0	4,462,903	130,821	2,765,824	-29,279	-1,635,330	101,542	-3,332,409	1,034	58,617
2045	27	353,972	4,816,875	139,719	2,905,543	-29,268	-1,664,598	-243,521	-3,575,931	1,034	59,652
2046	28	453,549	5,270,424	144,260	3,049,803	-29,258	-1,693,856	-338,547	-3,914,477	1,034	60,686
2047	29	339,165	5,609,590	140,799	3,190,602	-29,247	-1,723,103	-227,614	-4,142,091	1,034	61,720
2048	30	492,814	6,102,404	145,270	3,335,872	-12,613	-1,735,716	-360,157	-4,502,248	329	62,049

Leakage

Activities that will cause deforestation within the project area in the baseline case could be displaced outside the project boundary due to the implementation of the AUD project activity. If

carbon stocks in the leakage belt area will decrease more during project implementation than projected in the baseline case, this will be an indication that leakage due to displacement of baseline activities has occurred. Leakage due to activity displacement can thus be estimated by *ex post* monitoring of deforestation in the leakage belt and comparing *ex post* observed deforestation with *ex ante* projected baseline deforestation.

Ex ante activity displacement leakage can only be guessed based on the anticipated combined effectiveness of the proposed leakage prevention measures and project activities. This shall be done by multiplying the estimated baseline carbon stock changes for the project area by a “Displacement Leakage Factor” (DLF) representing the percent of deforestation expected to be displaced outside the project boundary.

If deforestation agents do not participate in leakage prevention activities and project activities, the Displacement Factor shall be 100%. Where leakage prevention activities are implemented, the factor shall be equal to the proportion of the baseline agents estimated to be given the opportunity to participate in leakage prevention activities and project activities.

It is expected that 100% of potential deforestation agents in the Reference Region will be given the opportunity to participate in leakage prevention activities. Thus, the “Displacement Leakage Factor” (DLF) is conservatively considered as 0.05.

If emissions from forest fires have been included in the baseline, the *ex-ante* emissions from forest fires due to activity displacement leakage will be calculated by multiplying baseline forest fire emissions in the project area by the same DLF used to estimate the decrease in carbon stocks.

Table 32. Ex ante estimated leakage due to activity displacement (Table 34 of VM0015)

Year	Project year t	Total ex ante estimated decrease in carbon stocks due to displaced deforestation		Total ex ante estimated increase in GHG emissions due to displaced forest fires	
		annual ΔCADLK_t tCO ₂ -e	cumulative ΔCADLK tCO ₂ -e	annual EADLK _t tCO ₂ -e	cumulative EADLK tCO ₂ -e
2018	0	-30,729	-30,729	1,304	1,304
2019	1	-41,615	-72,344	1,737	3,041
2020	2	-51,785	-124,129	2,130	5,171
2021	3	-54,379	-178,509	2,192	7,363
2022	4	-55,148	-233,657	2,176	9,538
2023	5	-34,721	-268,379	1,260	10,798
2024	6	-30,460	-298,839	1,051	11,849
2025	7	-53,196	-352,035	1,992	13,841
2026	8	-32,363	-384,398	1,063	14,904
2027	9	-54,922	-439,320	1,997	16,901
2028	10	-36,343	-475,663	1,193	18,094

2029	11	-33,956	-509,619	1,104	19,198
2030	12	-33,414	-543,033	1,104	20,302
2031	13	-32,839	-575,872	1,104	21,406
2032	14	-32,273	-608,145	1,104	22,509
2033	15	-32,191	-640,336	1,104	23,613
2034	16	-18,630	-658,966	527	24,140
2035	17	-17,857	-676,823	527	24,667
2036	18	-17,574	-694,397	527	25,195
2037	19	-16,798	-711,194	527	25,722
2038	20	-16,446	-727,640	527	26,249
2039	21	-15,705	-743,346	509	26,757
2040	22	-15,391	-758,737	509	27,266
2041	23	-15,077	-773,814	509	27,774
2042	24	-14,763	-788,577	509	28,283
2043	25	-14,449	-803,025	509	28,792
2044	26	-14,639	-817,665	517	29,309
2045	27	-14,634	-832,299	517	29,826
2046	28	-14,629	-846,928	517	30,343
2047	29	-14,624	-861,552	517	30,860
2048	30	-6,307	-867,858	164	31,024

Table 33. Ex-ante estimated total leakage (Table 35 of VM0015)

Year	Project year t	Total ex ante increase in GHG emissions due to displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
		annual EADLK _t tCO ₂ -e	cumulative EADLK tCO ₂ -e	annual Δ CADLK _t tCO ₂ -e	cumulative Δ CADLK tCO ₂ -e	annual Δ CLK _t tCO ₂ -e	cumulative Δ CLK tCO ₂ -e	annual ELK _t tCO ₂ -e	cumulative ELK tCO ₂ -e
2018	0	1,304	1,304	-30,729	-30,729	-30,729	-30,729	1,304	1,304
2019	1	1,737	3,041	-41,615	-72,344	-41,615	-72,344	1,737	3,041
2020	2	2,130	5,171	-51,785	-124,129	-51,785	-124,129	2,130	5,171
2021	3	2,192	7,363	-54,379	-178,509	-54,379	-178,509	2,192	7,363
2022	4	2,176	9,538	-55,148	-233,657	-55,148	-233,657	2,176	9,538
2023	5	1,260	10,798	-34,721	-268,379	-34,721	-268,379	1,260	10,798
2024	6	1,051	11,849	-30,460	-298,839	-30,460	-298,839	1,051	11,849
2025	7	1,992	13,841	-53,196	-352,035	-53,196	-352,035	1,992	13,841
2026	8	1,063	14,904	-32,363	-384,398	-32,363	-384,398	1,063	14,904
2027	9	1,997	16,901	-54,922	-439,320	-54,922	-439,320	1,997	16,901
2028	10	1,193	18,094	-36,343	-475,663	-36,343	-475,663	1,193	18,094
2029	11	1,104	19,198	-33,956	-509,619	-33,956	-509,619	1,104	19,198
2030	12	1,104	20,302	-33,414	-543,033	-33,414	-543,033	1,104	20,302
2031	13	1,104	21,406	-32,839	-575,872	-32,839	-575,872	1,104	21,406
2032	14	1,104	22,509	-32,273	-608,145	-32,273	-608,145	1,104	22,509
2033	15	1,104	23,613	-32,191	-640,336	-32,191	-640,336	1,104	23,613
2034	16	527	24,140	-18,630	-658,966	-18,630	-658,966	527	24,140
2035	17	527	24,667	-17,857	-676,823	-17,857	-676,823	527	24,667
2036	18	527	25,195	-17,574	-694,397	-17,574	-694,397	527	25,195
2037	19	527	25,722	-16,798	-711,194	-16,798	-711,194	527	25,722
2038	20	527	26,249	-16,446	-727,640	-16,446	-727,640	527	26,249
2039	21	509	26,757	-15,705	-743,346	-15,705	-743,346	509	26,757
2040	22	509	27,266	-15,391	-758,737	-15,391	-758,737	509	27,266
2041	23	509	27,774	-15,077	-773,814	-15,077	-773,814	509	27,774
2042	24	509	28,283	-14,763	-788,577	-14,763	-788,577	509	28,283
2043	25	509	28,792	-14,449	-803,025	-14,449	-803,025	509	28,792
2044	26	517	29,309	-14,639	-817,665	-14,639	-817,665	517	29,309
2045	27	517	29,826	-14,634	-832,299	-14,634	-832,299	517	29,826
2046	28	517	30,343	-14,629	-846,928	-14,629	-846,928	517	30,343
2047	29	517	30,860	-14,624	-861,552	-14,624	-861,552	517	30,860
2048	30	164	31,024	-6,307	-867,858	-6,307	-867,858	164	31,024

Net GHG Emission Reductions and Removals

The determination of which GHG emissions by sources, decreases in carbon pools, and leakage emissions are significant for this Project Activity has been carried out using the “Tool for testing significance of GHG emissions in A/R CDM project activities (Version 01)”. According to the tool,

the GHG emissions by sources, decreases in carbon pools and leakage emissions are all considered significant, as their sums represent more than 5% of net emission reductions.

Calculation of ex-ante estimation of total net GHG emissions reductions

The net anthropogenic GHG emission reduction of the proposed AUD project activity is calculated as follows:

$$\Delta REDD_t = (\Delta CBSLPA_t + EBBBSLPA_t) - (\Delta CPSPA_t + EBBPSPA_t) - (\Delta CLK_t + \Delta ELK_t)$$

Where:

$\Delta REDD_t$ Ex ante estimated net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t; tCO₂e

$\Delta CBSLPA_t$ Sum of baseline carbon stock changes in the project area at year t; tCO₂e

Note: The absolute values of $\Delta CBSLPA_t$ shall be used in the equation above

$EBBBSLPA_t$ Sum of baseline emissions from biomass burning in the project area at year t; tCO₂e

$\Delta CPSPA_t$ Sum of ex ante estimated actual carbon stock changes in the project area at year t; tCO₂e of baseline emissions from biomass burning in the project area at year t; tCO₂e

Note: If $\Delta CPSPA_t$ represents a net increase in carbon stocks, a negative sign before the absolute value of $\Delta CPSPA_t$ shall be used. If $\Delta CPSPA_t$ represents a net decrease, the positive sign shall be used.

$EBBPSPA_t$ Sum of (ex ante estimated) actual emissions from biomass burning in the project area at year t; tCO₂e

ΔCLK_t Sum of ex ante estimated leakage net carbon stock changes at year t; tCO₂e

Note: If the cumulative sum of ΔCLK_t within a fixed baseline period is > 0, ΔCLK_t shall be set to zero.

ΔELK_t Sum of ex ante estimated leakage emissions at year t; tCO₂e

t 1, 2, 3 ... T, a year of the proposed project crediting period; dimensionless

Calculation of ex-ante estimation of total net GHG emissions reductions

The number of Verified Carbon Units (VCUs) to be generated through the proposed AUD project activity at year t is calculated as follows:

$$VCU_t = REDD_t - VBC_t$$

$$VBC_t = (CBSLPA_t - CPSPA_t) * RF_t$$

Where:

VCU_t	Number of Verified Carbon Units that can be traded at time t ; tCO ₂ -e
$REDD_t$	<i>Ex-ante</i> estimated net anthropogenic greenhouse gas emission reductions attributable to the AUD project activity at year t ; tCO ₂ -e ha ⁻¹
VBC_t	Number of Buffer Credits deposited in the VCS Buffer at time t ; tCO ₂ -e
$CBSLPA_t$	Sum of baseline carbon stock changes in the project area at year t ; tCO ₂ e
$CPSPA_t$	Sum of ex ante estimated actual carbon stock changes in the project area at year t ; tCO ₂ -e ha ⁻¹
RF_t	Risk factor used to calculate VCS buffer credits; %
Note: RF_t is a risk factor to be determined using the latest version of the VCS-approved AFOLU Non-Permanence Risk Tool.	
t	1, 2, 3 ... T, a year of the proposed project crediting period; dimensionless

Table 34. Ex-ante estimated net anthropogenic GHG emission reductions ($\Delta REDD_t$) and Voluntary Carbon Units (VCU_t) (Table 36 of VM0015)¹⁹

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
2018	640,654	113,020	32,033	495,602
2019	867,046	375,109	43,352	448,585
2020	1,078,300	541,435	53,915	482,950
2021	1,131,429	419,803	56,571	655,055

¹⁹ Note: for remaining columns of this table, see Appendix 1 of the VCS PD: Calculation of Total VCUs

2022	1,146,480	559,406	57,324	529,750
2023	719,624	503,339	35,981	180,304
2024	630,224	398,829	31,511	199,884
2025	1,103,753	434,500	55,188	614,065
2026	668,537	378,939	33,427	256,171
2027	1,138,384	413,049	56,919	668,416
2028	750,709	362,267	37,535	350,907
2029	701,197	217,339	35,060	448,798
2030	690,365	-61,785	34,518	717,632
2031	678,852	-62,936	33,943	707,846
2032	667,536	-64,068	33,377	698,227
2033	665,889	-64,233	33,294	696,827
2034	383,147	-92,507	19,157	456,496
2035	367,678	-94,054	18,384	443,348
2036	362,016	-94,620	18,101	438,535
2037	346,496	-96,172	17,325	425,343
2038	339,466	-96,875	16,973	419,368
2039	324,280	-98,393	16,214	406,460
2040	317,996	-99,022	15,900	401,118
2041	311,711	-99,650	15,586	395,776
2042	305,426	-100,279	15,271	390,434
2043	299,142	-100,907	14,957	385,092
2044	303,131	-100,508	15,157	388,483
2045	303,026	244,556	15,151	43,319
2046	302,920	339,581	15,146	-51,807
2047	302,815	228,648	15,141	59,026
2048	129,418	360,485	6,471	-237,538
Total	17,977,649	4,564,296	898,882	12,514,470

5.3 Project Emissions

The use of carbon stock estimates in similar ecosystems derived from local studies, literature and IPCC defaults is permitted, provided the accuracy and conservativeness of the estimates are demonstrated. Data presented in the next table have been calculated from this scientific publication, as well as superior and inferior limits of the 90% Confidence Intervals.

Table 35 Ex post carbon stock per hectare of initial forest classes icl existing in the project area and leakage belt (Table 15a of VM0015)

Year	Project year t	Initial forest class <i>icl</i>										Ctot <i>icl</i>	
		Name: Submontane open ombrophilous forest (As)											
		ID <i>icl</i> 1											
		Average carbon stock per hectare ± 90% CI											
		Cab <i>icl</i>		Cbb <i>icl</i>		Cwp <i>icl</i>							
						short lived		medium lived		long lived			
C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI		
t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹		
2018	0	577	559	176	170	0	0	0	0	30	25	723	704
2019	1												
2020	2												
2021	3												
			596		182		0		0		35		742

The 90% Confidence Intervals were used to define if the most suitable choice would be the average or the inferior limit of intervals, to mitigate uncertainties in estimates, as shown in the table below. In the present case, the averages of above and below-ground biomass have been utilized for calculation; while the superior limit of the interval has been taken for the calculations related to the wood products carbon pool, for conservativeness purposes and mitigation of uncertainties.

Table 36. Ex post carbon stock per hectare of initial forest classes icl existing in the project area and leakage belt (the selection of carbon pools is subject to the latest VCS requirements) (Table 15b of VM0015)

Year	Project year t	Initial forest class <i>icl</i> Name: Submontane open ombrophilous forest (As) ID <i>icl</i> 1 Average carbon stock per hectare ± 90% CI													
		Cab <i>icl</i>		Cbb <i>icl</i>		Cwp <i>icl</i>								Ctot <i>icl</i>	
						short lived		medium lived		long lived					
		C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change			C stock	C stock change
		t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹			t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹
2018	0														
2019	1	577	0	176	0	0	0	0	0	35	5	718	-5		
2020	2														
2021	3														

In the case of baseline deforestation, the same reasoning is applicable to post-deforestation classes, for which the upper limit of the interval was taken in the case of above-ground biomass, while the average was utilized for below-ground biomass, for conservativeness purposes and mitigation of uncertainties. However, in the case of project emissions, the lower confidence intervals were utilized for above- and below-ground biomass, for conservativeness purposes.

Table 37. Ex post carbon stock per hectare of final classes fcl existing in the project area and leakage belt (Table 16 of VM0015)

Year	Project year t	Post deforestation class fcl											
		Name: Pasture											
		ID fcl 1											
		Average carbon stock per hectare ± 90% CI											
		Cab fcl		Cbb fcl		short lived		Cwp fcl medium lived		long lived		Ctot fcl	
average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% CI	average stock	± 90% CI		
		t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	t CO ₂ e ha ⁻¹	
2018	0												
2019	1												
2020	2	11,37	5,9	18,15	9,4	0	0	0	0	0	0	29,52	15,3
2021	3		16,8		26,9		0		0		0		43,7
Average		11,37		18,15		0		0		0		29,52	
Average to be used in calculations		16,8		26,9		0		0		0		43,7	

Certain discrete areas of forest within the project area will have been subject to project activities that changed the carbon stocks of these areas compared to the baseline. In this Project Activity, such activities are related to planned timber logging.

The table below shows the yearly carbon stock decrease due to planned logging activities in the Project Area. During the months of November and December 2018, there was no logging in the properties.

Table 38: Ex-ante and Ex-post planned logging activities in the Project Area

		M3 logged per property/Year	Sta Catarina (m3)	Sta Maria (m3)	Presidente Prudente (m3)	Recanto (m3)	São Manoel (m3)	Três Barras (m3)	Total
Ex-ante predicted	2018		6,989.52	4934.927	0.00	0.00	0.00	0.00	11,924.45
	2019		20,968.56	11843.83	0.00	0.00	0.00	37,798.04	70,610.42
	2020		13,979.04	6,908.90	10,192.86	0.00	13,351.31	63,679.12	108,111.23
	2021		19,180.35	11,848.64	10,192.86	0.00	13,351.31	25,881.08	80,454.24
	Total		61,117.47	35,536.29	20,385.71	0.00	26,702.63	127,358.24	271,100.34
Ex-post actual	2018		4,923.99	0.00	0.00	0.00	0.00	0.00	4,923.99
	2019		14,771.98	0.00	0.00	0.00	0.00	64,082.04	78,854.02
	2020		0.00	0.00	18,547.93	0.00	16,366.02	51,868.63	86,782.58
	2021		0.00	0.00	0.00	0.00	3,323.34	3,337.85	6,661.19
	Total		19,695.97	0.00	18,547.93	0.00	19,689.36	119,288.53	177,221.79

The differences between ex-ante predicted and ex-post actual logging are presented in the table above. The reasons for these discrepancies include: delay on behalf of the environmental organ responsible for issuing SFMP licenses; and unpredictable efforts to carry out as much harvesting as possible, within the legal and licensed limits, while licensing and climatic conditions are favorable.

Table 39. Ex post carbon stock decrease due to planned logging activities the Project Area (Table 25.b of VM0015)

Year	Project year t	Areas of planned logging activities x Carbon stock change (decrease) in the project area		Total carbon stock decrease due to planned logging activities	
		IDcl = 1		annual	cumulative
		APLPA _{icl,t}	ΔC _{toticl,t}	ΔCPLdPA _t	ΔCPLdPA
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	198.0	105.20	20,825	20,825
2019	1	3,170.3	105.20	333,502	354,327
2020	2	3,489.1	105.20	367,034	721,361
2021	3	267.8	105.20	28,173	749,534

The increase following planned logging activities in the Project Area has also been estimated, using secondary data by West et al. (2014), which indicates an annual increase of 3.03 tCO₂ per hectare per year due to post-logging regeneration of vegetation. For 2021, the coefficient was adjusted in accordance with the length of the monitoring period.

Table 40: Ex post estimated carbon stock increase following planned logging activities in the Project Area (Table 26.b of VM0015)

Year	Project year t	Areas of planned logging activities x Carbon stock change (increase up to maximum long-term average)		Total carbon stock increase due to planned logging activities	
		IDcl = 1		annual	cumulative
		APLPA _{icl,t}	ΔC _{toticl,t}	ΔCPLiPA _t	ΔCPLiPA
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	198.0	3.03	599	599
2019	1	3,170.3	3.03	10,189	10,788
2020	2	3,489.1	3.03	20,743	31,531
2021	3	267.8	1.76	12,519	44,050

According to land use classification up to July 2021, there was 1027.5 ha of unplanned deforestation within the Project Area over the 2018 – 2021 period, as demonstrated in the table and figure below. Although project fire brigade training had taken place on 9 March 2019, these measures and actions were ineffectual in mitigating fires within the project on this occasion. This failure is due to the recent implementation of fire brigade measures as well as the aggressive nature of the invasion, evidenced by the police report made available at audit, meaning that entry of project staff to the area was not possible. Furthermore, frequent remote monitoring of the area was not available at the time, as this is on track for implementation in 2022.

For this reason, the 1027.5 ha corresponding to project emissions are taken into account in the calculation of non-CO₂ gases due to forest fires in the Project Area (Table 28 of VM0015).

Table 41. Ex post carbon stock decrease due unplanned deforestation in the Project Area (Table 25.a of VM0015)

Year	Project year t	Areas of planned logging activities x Carbon stock change (decrease) in the project area		Total carbon stock decrease due to planned logging activities	
		$IDcl = 1$		annual	cumulative
		AUDPA _{icl,t}	$\Delta C_{tot,icl,t}$	$\Delta CUDdPA_t$	$\Delta CUDdPA$
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	48.1	707.80	34,033	34,033
2019	1	149.4	707.80	105,746	139,778
2020	2	454.4	707.80	321,625	461,404
2021	3	375.6	707.80	265,851	727,254

The imagery classification was performed utilizing July 2021 Landsat 8 images, for which a 91% accuracy result (Kappa Index) was calculated for the whole reference region, leakage belt and project area. All data, products and accuracy assessment were made available as evidence at audit.

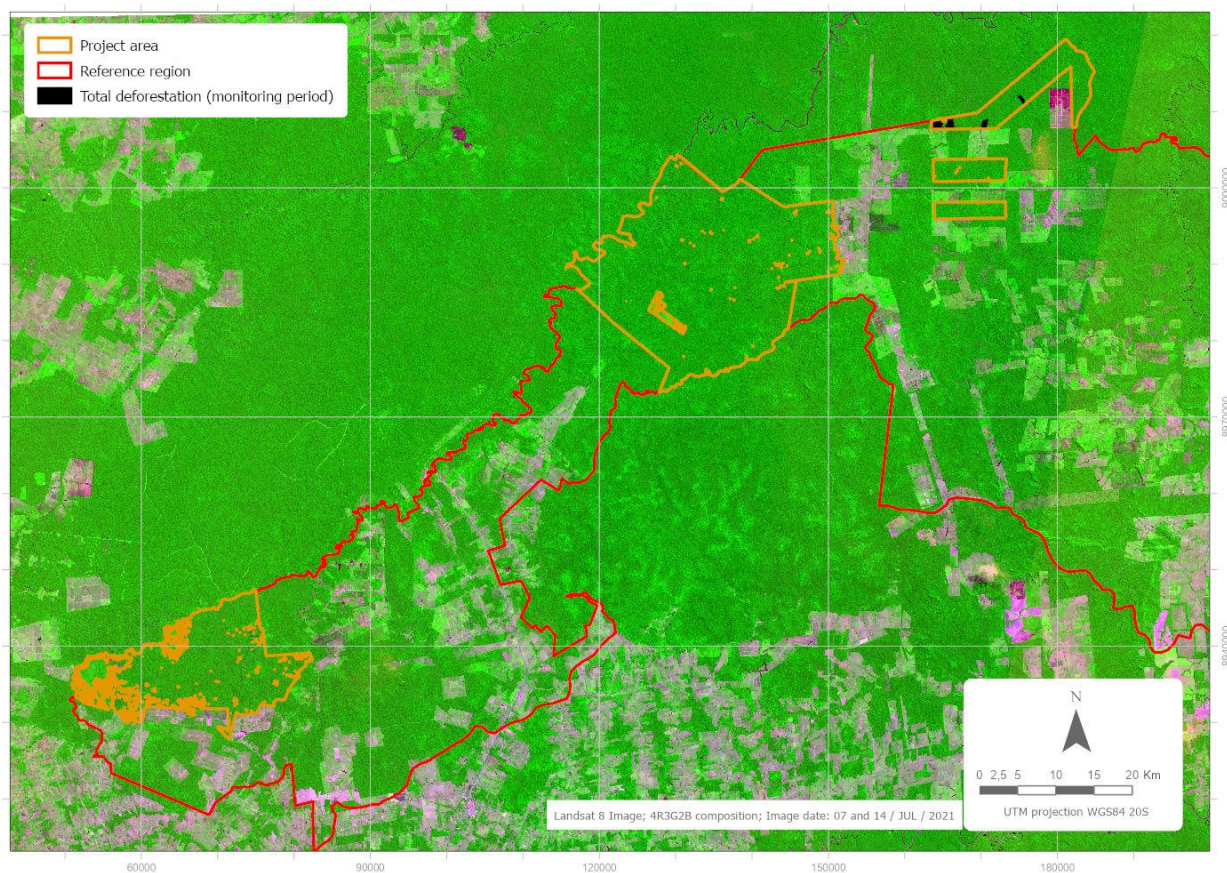


Figure 11. Project area deforestation for the monitoring period.

The ex-post total net carbon stock change within the Project Area is expressed in the table below.

Table 42. Ex post total net carbon stock change in the Project Area (Table 27 of VM0015)

Year	Project year t	Total carbon stock decrease due to planned logging activities		Total carbon stock increase due to planned logging activities		Total carbon stock decrease due to unavoided unplanned deforestation		Total carbon stock change in the project case	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		ΔCPLdPA_t	ΔCPLdPA	ΔCPLiP_{A_t}	ΔCPLiPA	ΔCUDdP_{A_t}	ΔCUDdPA	ΔCPSPA_t	ΔCPSPA
		tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e
2018	0	20,825	20,825	599	599	34,033	34,033	54,259	54,259
2019	1	333,502	354,327	10,189	10,788	105,746	139,778	429,058	483,318
2020	2	367,034	721,361	20,743	31,531	321,625	461,404	667,916	1,151,234
2021	3	28,173	749,534	12,519	44,050	265,851	727,254	281,504	1,432,738

The ex-post non-CO2 emissions from forest fires in the Project Area are shown in the table below.

Table 43. Total ex-post estimated actual emissions of non-CO2 gases due to forest fires in the project area (Table 28 of VM0015)

Year	Project year t	Total ex post estimated actual non-CO2 emissions from forest fires in the Project area	
		annual	cumulative
		EBBPSPA _t	EBBPSPA
		tCO ₂ -e	tCO ₂ -e
2018	0	1,205	1,205
2019	1	3,743	4,947
2020	2	11,383	16,330
2021	3	9,409	25,740

The ex-post actual net changes in carbon stocks and emissions in the Project Area are shown in table below.

Table 44. Total ex post estimated actual net changes in carbon stocks and emissions of GHG gases in the project area (Table 29 of VM0015)

Year	Project year t	Total ex-post carbon stock decrease due to planned activities		Total ex-post carbon stock increase due to planned activities		Total ex-post carbon stock decrease due to unavoided unplanned deforestation		Total ex-post net carbon stock change		Total ex-post estimated actual non-CO2 emissions from forest fires in the project area	
		annual ΔCPA_{dP} A _t	cumulative ΔCPA_{dP} A	annual ΔCPA_{iP} A _t	cumulative ΔCPA_{iP} A	annual ΔCUD_{dP} A _t	cumulative ΔCUD_{dP} A	annual $\Delta CPSP$ A _t	cumulative $\Delta CPSPA$	annual EBBPSP A _t	cumulative EBBPSP A
		tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e
		tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e
2018	0	20,825	20,825	599	599	34,033	34,033	54,259	54,259	1,205	1,205
2019	1	333,502	354,327	10,189	10,788	105,746	139,778	429,058	483,318	3,743	4,947
2020	2	367,034	721,361	20,743	31,531	321,625	461,404	667,916	1,151,234	11,383	16,330
2021	3	28,173	749,534	12,519	44,050	265,851	727,254	281,504	1,432,738	9,409	25,740

5.4 Leakage

The results of all ex-post estimates of leakage are summarized below, along with the ex-ante leakage projection.

Table 45. Annual ex-ante estimated, ex post measured of deforestation in the Leakage Belt and percentage difference (Table 9.c of VM0015)

Year	Project year t	Total LK -Ex ante		Total LK -Ex post	
		annual ABSLLKt ha	cumulative ABSLLKt ha	annual ABSLLKt ha	cumulative ABSLLKt ha
2018	0	4,149.6	4,149.6	2,864.0	2,864.0
2019	1	13,433.1	17,582.7	20,132.7	22,996.7
2020	2	12,253.8	29,836.6	23,450.9	46,447.6
2021	3	7,139.8	36,976.4	35,390.2	81,837.8
Total		36,976.4	N/A	81,837.8	N/A

The table above shows that in gross terms the ex-post measured leakage is higher than the ex-ante estimated leakage in all years except 2018. However, not all the increase in deforestation can be attributed to the project activity, given that the entire region underwent a highly significant boom of deforestation over the monitoring period, which is quantified by the difference between ex-ante and ex-post values of deforestation in the Reference Region (δ), shown in Table 45 below.

The main factors for this boom in deforestation as of 2020 are as follows:

Trends in Brazilian legislation: there are several indications of slackening of environmental legislation in recent years, mainly in the Bolsonaro government framework, with emphasis on the following subfactors:

Greater ease of obtaining “forest clearing authorizations”: An example of this can be observed in the state of Goiás, which reported a 1,100% increase in the number of permits for deforestation in 2020²⁰. The new environmental licensing in Goiás, plus technologies that facilitate the inspection work of the Secretariat of Environment and Sustainable Development (Semad), in addition to effort in the analysis of applications, are responsible for increasing the numbers of deforestation permits in the State. According to data from Semad's Environmental Licensing Superintendency, there was a 673% increase of area deforested: 6.5 km² in 2019, to 43.8 km² in 2020. Thus, as occurred in the State of Goiás, the facilitation of the issuance of authorization for the removal of native vegetation can occur at any time in the Amazon Biome. Indeed, attempts at further facilitation have been sought recently (in 2020), as indicated in the next topic.

²⁰ <https://www.meioambiente.go.gov.br/noticias/2089-emiss%C3%A3o-de-licen%C3%A7as-para-supress%C3%A3o-de-vegeta%C3%A7%C3%A3o-tem-aumento-de-1-100-in-a-year-in-goi%C3%A1s.html>

Granting of tacit (or automatic) environmental licensing, in case of delay of the environmental agency: The controversial automatic release of environmental permits and permits by completion of term, that is, after a period stipulated for the government agency to respond (120 days), was voted for on 29/04/2020, by a virtual plenary. Provisional Measure 915 originally referred to the so-called "Economic Freedom Law" edited by the government, but ended up bringing, within the texts, changes that directly affect the rite of environmental licensing throughout the country. The change could lead to the automatic authorization of forest suppression in the Amazon and Atlantic Forest enforced by delay, and without analysis of the environmental agency. This means that, once the 120-day period is expired, the request would be automatically granted with a "tacit license"²¹. Fortunately, environmentalists have revised the Provisional Measure 915, to prevent deforestation licensing from being subject to expiration of term²².

Loosening legislation for timber exports: As reported by Reuters, over 2019 Brazil exported "thousands of cargoes of wood from an Amazonian port without authorization from the federal environmental agency, increasing the risk that they have been extracted from illegally deforested land". The rule change, which scraps IBAMA's authorization for most timber exports, came after five cargoes of wood arrived in US and European ports without these mandatory documents. Foreign authorities contacted Brazil to ask about the missing authorizations, with the head of Ibama in Pará then retroactively granting the authorizations. The problem, however, is much more widespread than just these five shipments. In Pará state, more than half of the roughly 3,000 officially registered shipments in the past year, containing an estimated 54,000 m³ of wood that left one port, was not officially authorized. Companies had requested authorizations from IBAMA for those shipments but exported them before the agency had time to respond. Furthermore, many shipments were exported without seeking IBAMA's approval. Shipments went to the US, the Netherlands, France, Germany, Belgium, and possibly other countries. Before the rules changed, IBAMA was required to authorize all wood exports before they leave port. Even so, most shipments continued to require the proper paperwork to be given the green light, however only a few would be randomly selected for physical inspection²³. Arbitrarily, the president of IBAMA ensured that all future unauthorized exports of wood, previously classified as illegal, became legal: he took advantage of the lack of attention of the press to the topic during Carnival, at the end of February 2020, to quietly revoke a 2011 IBAMA policy that required an authorization from the agency before forest products could receive export licenses. From that date on, such permits would be required only for endangered tree species or in other special circumstances. Given the repeal, the floodgates were opened for large shipments of illegal timber from the Brazilian Amazon to go abroad²⁴. It was also revealed that in February 2020, loggers from Pará asked IBAMA to effect that rule change: the companies wanted to sell wood abroad presenting only the Document of Forest Origin (DFO, "DOF – Documento de Origem Florestal" in Portuguese), made

²¹ <https://www.correiobraziliense.com.br/app/noticia/brasil/2020/04/29/interna-brasil,849652/camara-pode-aprovar-hoje-licenciamento-ambiental-automatico.shtml>

²² <https://epbr.com.br/ambientalistas-alteram-mp-915-para-prevent-licensing-environmental-by-course-of-time/>

²³ <https://www.businesslive.co.za/bd/world/americas/2020-03-04-brazil-may-be-exporting-illegally-deforested-wood/>

²⁴ <https://brasil.mongabay.com/2020/04/ao-afrouxar-leis-de-exportacao-brasil-permite-saida-de-madeira-ilegal-da-amazonia/>

by the companies themselves and that originally only served to allow the transport of the goods to the port. This change was immediately accepted by the president of Ibama²⁵.

Legislation favoring landgrabbers. An analysis conducted by IPAM (Environmental Research Institute of the Amazon) showed that 35% of deforestation in the Amazon between August 2018 and July 2019 was recorded in non-designated areas without information. Regarding land regularization, environmental NGOs warn about two ongoing projects. While Bill 510/21 was being presented in the Senate, the vote on Bill 2633/20²⁶ was being considered in the House of Representatives. Both derive from the original text of Provisional Measure 910, known as "*MP da Grilagem*" (Landgrabbers' Provisional Measure), which proposes to change the law to favor large occupants of recently invaded public lands. Bill 510/21 once again changes the deadline for public land invasions to be legalized (from 2011 to 2014) and allows large areas (up to 2500 hectares) to be processed without the need for inspection. Indeed, given that land-grabs of undesignated public lands are responsible for more than 1/3 of the deforestation in the country, it is to be expected that amnesty for landgrabbers and illegal deforesters would be an incentive to intensify this practice in the coming years. Bill 2633/20 has a loophole that would allow legalization, via bidding, of public areas invaded after the deadline for occupation provided for by law (i.e., 2014). Of the 49.8 million hectares of forests under state and federal responsibility, but not yet allocated to any category of use, 11.6 million hectares, or 23%, were irregularly declared as rural properties for private use, under the National System of Rural Environmental Registration (CAR). If the entire area registered to date as private property were legalized, 2.2 to 5.5 million hectares could be deforested in the coming years, according to the deforestation limits defined by the Forest Code and taking into account that deforestation is often beyond permitted limits. In recent years, grabbing of uncategorized public forests has increased: in 2019, this was the land category displaying the most forest felled in the Amazon, according to data from the deforestation alert system of INPE (National Institute of Space Research), Deter. The trend continued in 2020. The following are some of the conditions defined by Provisional Measure 910, for appropriation of public lands by individuals: i) the area must be registered in the Rural Environmental Registry (CAR, "*Cadastro Ambiental Rural*"): as it is known, any information can be inputted into the "CAR" system up until the present moment without any veracity checking, and ii) the claimant must be carrying out agricultural activities in the area (i.e., should preferably have deforested the area)²⁷. The Provisional Measure defines that, for areas meeting the requirements above and having up to 15 fiscal modules (i.e. up to 1,650 hectares), the title is to be granted without the need for inspection. Before the Provisional Measure, the exemption from inspection was granted to areas with up to four fiscal modules (i.e. with a maximum of 440 hectares). The exemption from inspection may allow large illegally deforested areas to be taken over by individuals. This is because the Provisional Measure prohibits the regularization only of

²⁵ <https://g1.globo.com/natureza/noticia/2020/11/17/documentos-mostram-que-ibama-facilitou-exportacao-de-madeira-extraida-ilegalmente.ghtml>

²⁶ <https://ipam.org.br/35-do-desmatamento-na-amazonia-e-grilagem-indica-analise-do-ipam/>

²⁷ <https://ipam.org.br/cientistas-mapeiam-grilagem-em-florestas-publicas-na-amazonia/#:~:text=O%20impacto%20da%20grilagem%20se,main%20g%C3%A1s%20effect%20estufa>

areas that have been subject to fines or environmental embargoes, and not all environmental violations are known and fined by the government²⁸. Given that Boa Fe farm is surrounded by public lands and that cases of land-grabbing have been proven in the Reference Region, an abnormal increase in deforestation in that region is expected in the coming years. This is primarily because Brazilian legislation increasingly gives every indication that it is highly welcoming to acts of land-grabbing, by granting amnesty to landgrabbers and agents of illegal deforestation.

Increased demand for beef in the international market: China's demand for beef is still a reflection of swine flu, which has decimated between 40% and 60% of the country's pig stock (about one third of the world's pork production). In addition to this conjuncture, China also contributed to the growth of imports, since it was the only major world economy to record economic growth in 2020, even amid the coronavirus pandemic, and a more long-term factor, which is the gradual increase in income of the Chinese population, which results in progressively higher consumption of more expensive protein sources, such as beef. Analysts estimate that the price of beef should remain under pressure for the next few years, due to the livestock cycle: the low supply of oxen is not something that can quickly be solved, because cattle production is a multi-year cycle, given that production beginning today will deliver animals in two, three, or four years²⁹. In 2020, Brazil broke its beef export record, with more than 2 million tons sold (8% more than in 2019). For 2021, the projection indicates an increase of 5% on the 2020 values³⁰, indicating a strong increasing export trend for the coming years. Beef exports have continued to increase, growing by almost 7% in 2020 and close to 8% in 2021, increasing by more than 15% in the 2020/2021³¹ period. Chinese importers increased their purchases of Brazilian beef by more than 150% in 2020³².

Table 46. Ex-ante estimated, ex-post measured deforestation for the period in the Reference Region, and percentage difference

Year	Project year	Ex-ante		Ex-post		percentage difference (δ)
		annual ABSLRR _t ha	cumulative ABSLRR ha	annual ABSLRR _t ha	cumulative ABSLRR ha	
2018	0	9,969.7	9,969.7	9,447.5	9,447.5	-6%
2019	1	15,387.3	25,357.1	24,350.2	33,797.7	37%
2020	2	14,004.4	39,361.4	27,937.2	61,734.9	50%
2021	3	8,141.2	47,502.6	42,563.8	104,298.7	81%

²⁸ <https://amazonia.org.br/como-a-mp-da-grilagem-pode-mudar-o-mapa-de-regioes-da-amazonia/>

²⁹ <https://www.bbc.com/portuguese/brasil-55664305>

³⁰ <https://revistagloborural.globo.com/Noticias/Criacao/Boi/noticia/2021/01/apos-recorde-brasil-projeta-alta-de-5-nas-exportacoes-de-carne-bovina-em-2021.html#:~:text=Segundo%20Abrafrigo%2C%20pa%C3%ADs%20alcan%C3%A7ou%20marca,em%20rela%C3%A7%C3%A3o%20ao%20ano%20anterior&text=As%20exports%C3%A7%C3%B5es%20de%20carne%20bovine,by%20fortes%20shipments%20%C3%A0%20China>

³¹ <https://www.avisite.com.br/index.php?page=noticias&id=21284>

³² <https://www2.safras.com.br/eng/2020/09/23/meat-exports-in-brazil-will-be-an-important-differential-in-2021/>

TOTAL	47,502.6	N/A	104,298.7	N/A	N/A
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The adjusted value for ex-post deforestation in the Leakage Belt was obtained by multiplying *Total LK - Ex Post* by δ (The *ex-ante* – *ex-post* relationship in the RR shown above). This process was carried out for years 2019 – 2021, however 2018 is exempt because the *ex-post* observed was already below *ex-ante* estimates, by multiplying Observed LK -

Table 47: Annual ex-post adjusted areas of deforestation in the Leakage Belt (Table 9.c of VM0015)

Year	Project year t	Total LK -Ex ante		Total LK - Ex Post	Adjusted annual ex post deforestation in the LB		(δ) Percentage difference observed in the RR
		annual	cumulative	annual	annual	cumulative	
		ABSLLKt ha	ABSLLKt ha	ABSLLKt ha	ABSLLKt ha	ABSLLKt ha	
2018	0	4,149.59	4,149.59	2,864.0	0.0	0.00	N/A
2019	1	13,433.15	17,582.74	20,132.7	12,722.2	12,722.2	37%
2020	2	12,253.82	29,836.56	23,450.9	11,755.5	24,477.7	50%
2021	3	7,139.84	36,976.40	35,390.2	6,769.1	31,246.8	81%
Total		36,976.40	N/A	81,837.8	31,246.8	N/A	N/A

As shown in Table 47 above, the resulting adjusted annual ex-post deforestation in the leakage belt is consistently below the estimated Total Leakage *Ex-ante*. Therefore, the leakage due to project activities was considered to be 0 for each year as shown below. This in turn resulted in 0 values for ex-post above and below-ground net carbon stock changes in the leakage belt, as well as in wood products, as shown in the following tables.

Table 48. Annual ex-post adjusted proportional areas of deforestation in the leakage belt (Table 9.c of VM0015)

Year	Project year t	Total - LK	
		annual	cumulative
		ABSLLKt ha	ABSLLKt ha
2018	0	0	0
2019	1	0	0

2020	2	0	0
2021	3	0	0

Table 49. Ex post above-ground net carbon stock changes in the leakage belt (Table 22.c.1 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for above-ground biomass in the leakage belt		Total baseline carbon stock change in the leakage belt	
		Forest / Pasture		annual	cumulative
		ABSLLK _{ct,t}	$\Delta C_{abct,t}$	$\Delta C_{abBSLLK_t}$	$\Delta C_{abBSLLK}$
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	0	0	0	0
2019	1	0	0	0	0
2020	2	0	0	0	0
2021	3	0	0	0	0

Table 50. Ex post below-ground net carbon stock changes in the leakage belt (Table 22.c.2 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for below-ground biomass in the leakage belt		Total baseline carbon stock change in the leakage belt	
		Forest / Pasture		annual	cumulative
		BBSLLK _{ct,t}	$\Delta C_{bbct,t}$	$\Delta C_{bbBSLLK_t}$	$\Delta C_{bbBSLLK}$
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	0	0	0	0
2019	1	0	0	0	0
2020	2	0	0	0	0
2021	3	0	0	0	0

Table 51. Ex-post net carbon stock changes in wood products in the leakage belt (Table 22.c.6 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for wood products biomass in the leakage belt area		Total baseline carbon stock change in the leakage belt area	
		Forest / Pasture		annual	cumulative
		WPSLLK _{ct,t}	$\Delta C_{wp_{ct,t}}$	$\Delta C_{wpBSLLK_t}$	$\Delta C_{wpBSLLK}$
		ha	tCO ₂ -e ha ⁻¹	tCO ₂ -e	tCO ₂ -e
2018	0	0.0	0.00	0	0
2019	1	0.0	0.00	0	0
2020	2	0.0	0.00	0	0
2021	3	0.0	0.00	0	0

Table 52. Parameters used to calculate emissions from forest fires in the leakage belt area (Table 23 in VM0015)

Initial Forest Class		Parameters								
IDcl	Name	<i>F_{burnt,icl}</i>	<i>C_{ab}</i>	<i>P_{burnt_{ab,icl}}</i>	<i>CE_{ab,icl}</i>	<i>ECO_{2-ab}</i>	<i>EBBCO_{2-tot}</i>	<i>EBBN_{2O}_{icl}</i>	<i>EBBCH_{4,icl}</i>	<i>EBBtot_{icl}</i>
		N/A	tCO ₂ e ha ⁻¹	N/A	N/A	tCO ₂ e ha ⁻¹	tCO ₂ e ha ⁻¹	tCO ₂ e ha ⁻¹	tCO ₂ e ha ⁻¹	tCO ₂ e ha ⁻¹
1	Submontane open ombrophilous forest (As)	1.0	577	0.86	0.5	248	248	2.31	22.7	25.1

Table 53. Ex post estimated non-CO2 emissions from forest fires in the leakage belt

Year	Project year t	Total ex ante estimated increase in GHG emissions due to displaced forest fires	
		annual	cumulative
		EADLK _t tCO ₂ -e	EADLK tCO ₂ -e
2018	0	0	0
2019	1	0	0
2020	2	0	0
2021	3	0	0

Table 54. Ex post estimated leakage due to activity displacement (Table 34 of VM0015)

Year	Project year t	Total ex post measured decrease in carbon stocks due to displaced deforestation		Total ex ante estimated increase in GHG emissions due to displaced forest fires	
		annual	cumulative	annual	cumulative
		ΔCADLK_t tCO ₂ -e	ΔCADLK tCO ₂ -e	EADLK _t tCO ₂ -e	EADLK tCO ₂ -e
2018	0	0	0	0	0
2019	1	0	0	0	0
2020	2	0	0	0	0
2021	3	0	0	0	0

Table 55. Total ex post estimated leakage (Table 35 of VM0015)

Year	Project year t	Total ex-ante increase in GHG emissions due to displaced forest fires		Total ex post measured decrease in carbon stocks due to displaced deforestation		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
		annual EADLK _t	cumulative EADLK	annual Δ CADLK _t	cumulative Δ CADLK	annual Δ CLK _t	cumulative Δ CLK	annual ELK _t	cumulative ELK
		tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e	tCO ₂ -e
2018	0	0	0	0	0	0	0	0	0
2019	1	0	0	0	0	0	0	0	0
2020	2	0	0	0	0	0	0	0	0
2021	3	0	0	0	0	0	0	0	0

5.5 Net GHG Emission Reductions and Removals

The table below expresses the quantification of the net change in carbon stocks. As determined in the AFOLU non-permanence risk report (available in the VCS-PD), this project activity has 10% non-permanence risk rating.

Table 56. Ex-post estimated net anthropogenic GHG emission reductions and VCUs (Table 36 of VM0015)

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)	Buffer pool allocation	VCUs eligible for issuance
2018	640,654	-53,055	0	693,709	66,883	626,826
2019	867,046	432,801	0	434,245	40,325	393,921
2020	1,078,300	679,300	0	399,000	36,779	362,221
2021	680,044	290,914	0	389,131	37,308	351,823
Total	3,266,045	1,349,960	0	1,916,086	181,295	1,734,791

APPENDIX

APPENDIX 1: BIBLIOGRAPHY

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