2017 MONITORING REPORT FOR CIKEL BRAZILIAN AMAZON REDD APD PROJECT

Document Prepared by CARBONEXT

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CONTENTS

List of Acronyms

AGB	Aboveground biomass
AUTEF	Authorization of Forest Exploitation
BCEF	Biomass Conversion and Expansion Factor
BGB	Belowground Biomass
CBNS	CBNS NEGÓCIOS FLORESTAIS S/A (former "CKBV Florestal Ltda"). It could be referred to as CBNS or "the company" throughout the text.
Cikel REDD Project	CIKEL BRAZILIAN AMAZON REDD APD PROJECT - AVOIDING PLANNED DEFORESTATION (also referred CIKEL BRAZILIAN AMAZON REDD APD)
EMBRAPA	Brazilian Agricultural Research Corporation
FMA	Forest Management Area
FMU	Forest Management Unit
FOD	Dense Ombrophylous Forest
FS	Secondary Forest
FSC	Forest Stewardship Council® Certification
FUNAI	National Indigenous Foundation (*Fundação Nacional do Índio*)
GPOM	CBNS Monitoring Operational Procedures Guide
HCV	High Conservation Values
INCRA	National Institute of Colonization and Agrarian Reform
IFT	Tropical Forest Institute (*Instituto Floresta Tropical*)
LB	Leakage Belt
LPF	Forest Products Laboratory
LDF	Logging Damage Factor
PA	Project Area
PGRS	Solid Waste Management Plan
PMFS	Sustainable Forest Management Plan
PPA	Permanent Preservation Area
PPRA	Environmental Risk Prevention Program
PRAT	Work Accident Reduction Program
PROSP01	Conflict Management Procedures

PROSP02	Compensation of Possible Losses and Damages Procedures
PRORS03	Community Relations in Forest Management Area Procedures
PTW	Permit to Work
RCC	Rio Capim Complex
SEMA	Secretariat for the Environment and Sustainability
SFB	Brazilian Forest Service
SFMLIL	Sustainable Forest Management with Low Impact Logging
SFMP	Sustainable Forest Management Practices
TRA	Task Risk Assessment
UFPA	Federal University of Pará
UFRA	Federal Rural University of the Amazon

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project is located at the Rio Capim Complex (RCC), Paragominas municipality, in Para State, in the Eastern Amazon. The RCC property includes five forest areas: Rio Capim, Poty, Cauaxi, Sumal and Caculé, totaling 209,130.54 ha. The project area is a subset of the RCC property and covers an area of 27,434.7 ha of native forest.

The objective of the project CIKEL BRAZILIAN AMAZON REDD APD PROJECT - AVOIDING PLANNED DEFORESTATION (referred in this report as “Cikel REDD project” or “CIKEL BRAZILIAN AMAZON REDD APD”), is to avoid emissions from planned deforestation on a property in Pará State, Brazil. The project proponent is CBNS NEGÓCIOS FLORESTAIS S/A (the former project proponent was “CKBV Florestal Ltda” and referred in this report as “CBNS”), a Brazilian private family-owned company, whose core business is the management and commercialization of native wood.

Due to difficulties in its tropical wood products business in 2005 and 2006, which had a negative financial impact on the company, in 2006 CBNS decided to diversify its business beyond wood products. The diversification alternative chosen was livestock, and to pursue this new business activity CBNS had initiated plans to legally convert (suppress) 20% of its forest property in the Rio Capim Complex to pasture. However, they chose not to proceed with the suppression plan and to conserve the forest through a REDD project based on avoided emissions from planned deforestation.

The main events relevant to the period of this monitoring report are described below. More information and a complete list of relevant activities and events are described in section 3.1.

- Limited forest management activities in the area under Forest Stewardship Council® Certification (FSC®) with Low Impact Logging (SFMLIL) practices carried out within 2010 and 2017 (Table 10);
- Annual FSC® certification audits were carried out by a third-party certification body between 2010 and 2017 (Table 11) and the forest company has kept the certification status throughout the monitoring period, being in conformity with all FSC® Principles and Criteria;
- Parallelly to the timber management activities, the company guaranteed governance within the PA, as well as ensured presence in the areas to inhibit invasions.

The total net GHG emission reductions generated in this monitoring period are estimated at 5,186,724tCO_2e while the verified volume of VCUs eligible for issuance is 4,364,505 VCUs.

1.2 Sectoral Scope and Project Type

Project Scope 14: Agriculture, Forest and other Land Use (AFOLU)

Project Category: Reduction Emission from Deforestation and Degradation (REDD)

Type of Activity: Avoided Planned Deforestation (APD)

This is not a grouped project.

1.3 Project Proponent

Organization name	CBNS NEGÓCIOS FLORESTAIS S/A (former "CKBV Florestal Ltda", there was a change in the company name)
Contact person	Francisco de Assis Silva Matos
Title	Director of Operations
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1.4 Other Entities Involved in the Project

Organization name	Carbonext Consultoria Ltda.
Role in the project	Monitoring Report Developer
Contact person	Janaína Dallan & Luiz Fernando de Moura
Title	Monitoring Report Developer
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1.5 Project Start Date

The project start date is July 19, 2007, which is the date of issuance of the Authorization of Forest Exploitation (AUTEF) in the project area.

1.6 Project Crediting Period

The project has a crediting period of 20 years. The start date of the crediting period is July 19, 2007, and the end date of the crediting period is July 18, 2027.

1.7 Project Location

The project is located in the Rio Capim Complex (RCC), Paragominas municipality, Pará State, Eastern Amazon, Brazil, as shown if Figure 1.

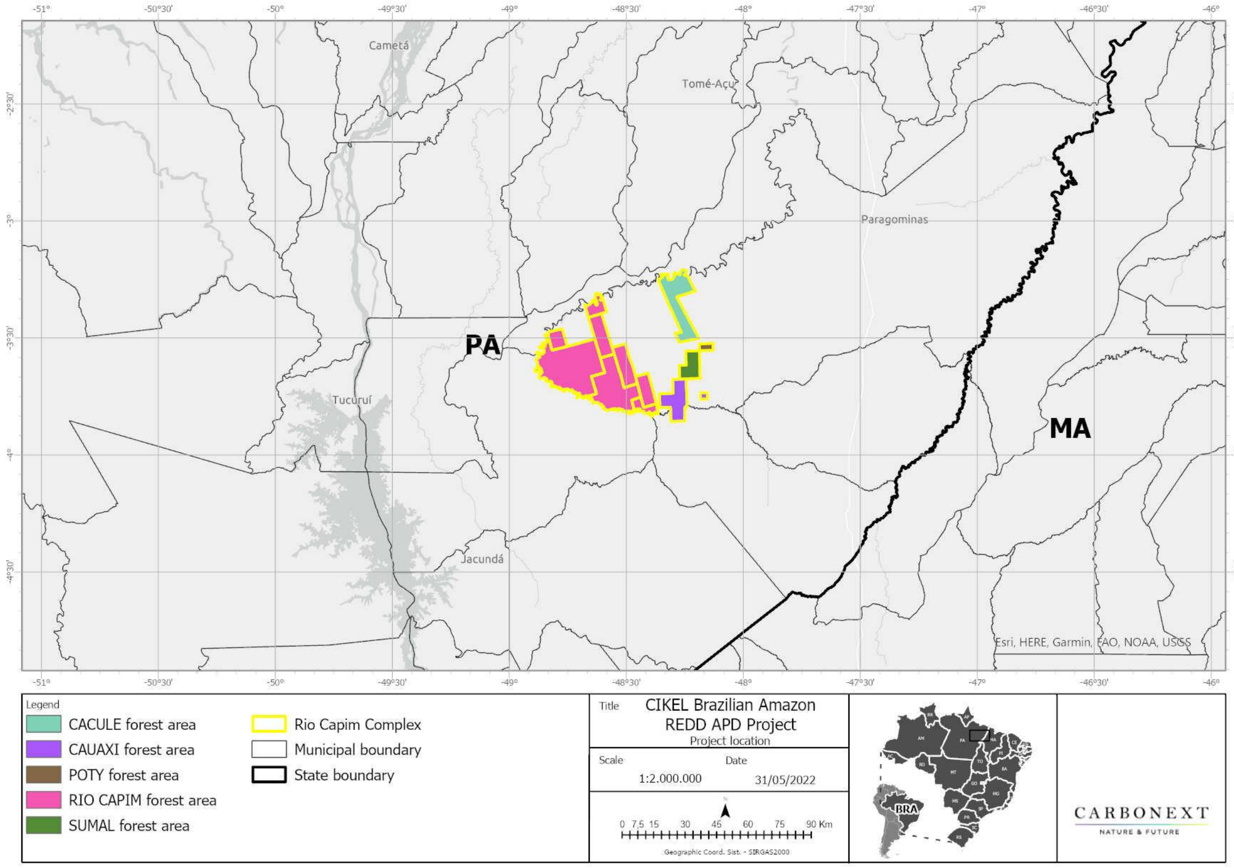

Figure 1: Rio Capim Complex location

The project area corresponds to a portion of the RCC property. It is specifically located in fraction of the following forest areas, all of them administered by CBNS: Rio Capim, Cauaxi, Sumal and Caculé. The geographical coordinates (coordinate system: South American Datum) of the project area within the RCC are shown in the Table 1 and the polygons in the Figure 2 below:

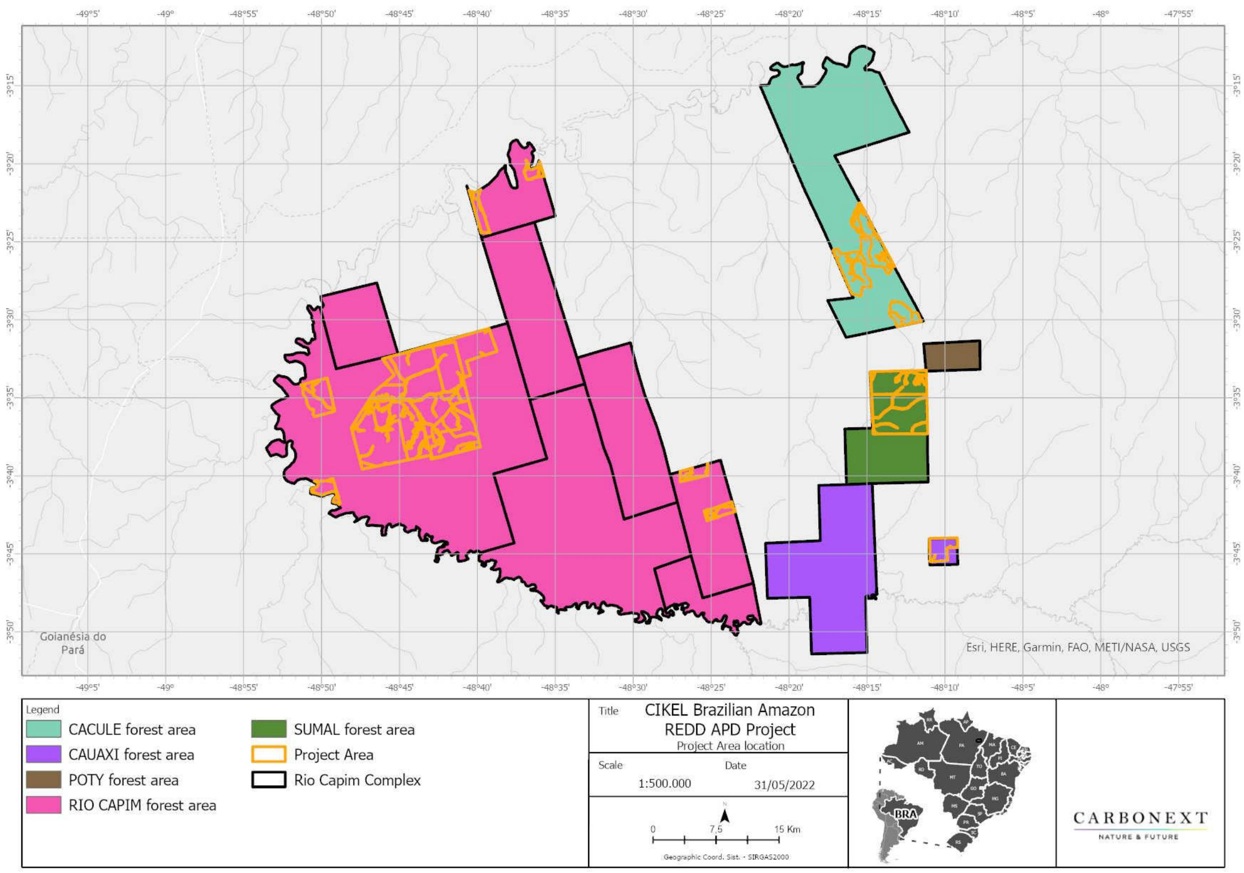

Figure 2: Map of the polygons of the project area

Table 1. The GPS coordinates of the polygons of the project area

Points	Areas	Year	Latitude	Longitude
1	Rio Capim	1	3° 35' 55,07" S	48° 46' 39,16" W
2	Rio Capim	1	3° 36' 26,81" S	48° 44' 59,92" W
3	Rio Capim	1	3° 39' 35,02" S	48° 47' 22,64" W
4	Rio Capim	1	3° 37' 5,27" S	48° 48' 2,13" W
5	Rio Capim	2	3° 38' 53,93" S	48° 43' 59,73" W
6	Rio Capim	2	3° 38' 59,43" S	48° 44' 26,89" W
7	Rio Capim	2	3° 35' 55,07" S	48° 46' 39,16" W
8	Rio Capim	2	3° 36' 55,69" S	48° 48' 4,78" W
9	Rio Capim	2	3° 34' 11,30" S	48° 46' 3,94" W
10	Rio Capim	2	3° 35' 10,98" S	48° 44' 51,32" W
11	Rio Capim	3	3° 35' 9,90" S	48° 44' 49,52" W
12	Rio Capim	3	3° 32' 31,19" S	48° 46' 5,08" W
13	Rio Capim	3	3° 34' 11,09" S	48° 44' 37,94" W
14	Rio Capim	4	3° 32' 2,28" S	48° 38' 43,78" W
15	Rio Capim	4	3° 32' 39,93" S	48° 40' 41,12" W

Points	Areas	Year	Latitude	Longitude
16	Rio Capim	4	3° 33' 33,94" S	48° 40' 25,10" W
17	Rio Capim	4	3° 31' 36,50" S	48° 42' 53,01" W
18	Rio Capim	4	3° 30' 33,59" S	48° 39' 13,78" W
72	Rio Capim	4	3° 34' 37,66" S	48° 42' 8,53" W
19	Rio Capim	5	3° 36' 30,49" S	48° 40' 12,27" W
20	Rio Capim	5	3° 35' 10,23" S	48° 44' 24,15" W
21	Rio Capim	5	3° 34' 10,22" S	48° 40' 48,33" W
22	Rio Capim	5	3° 34' 15,48" S	48° 51' 22,72" W
23	Rio Capim	5	3° 35' 50,50" S	48° 49' 11,38" W
24	Rio Capim	5	3° 33' 47,99" S	48° 49' 40,20" W
25	Rio Capim	6	3° 38' 9,88" S	48° 39' 47,58" W
26	Rio Capim	6	3° 38' 55,96" S	48° 42' 57,40" W
27	Rio Capim	6	3° 38' 52,99" S	48° 43' 55,10" W
28	Rio Capim	6	3° 37' 0,78" S	48° 41' 8,02" W
29	Rio Capim	6	3° 35' 38,85" S	48° 41' 28,32" W
30	Rio Capim	6	3° 36' 36,26" S	48° 40' 10,93" W
31	Rio Capim	6	3° 35' 55,53" S	48° 49' 10,44" W
32	Rio Capim	6	3° 36' 16,87" S	48° 50' 29,76" W
33	Rio Capim	6	3° 34' 16,91" S	48° 51' 24,12" W
34	São Romualdo/Caculé	7	3° 25' 37,99" S	48° 15' 33,64" W
35	São Romualdo/Caculé	7	3° 27' 53,91" S	48° 14' 44,08" W
36	São Romualdo/Caculé	7	3° 28' 20,77" S	48° 15' 57,53" W
37	São Romualdo/Caculé	7	3° 25' 33,99" S	48° 17' 10,75" W
38	São Romualdo/Caculé	7	3° 24' 39,40" S	48° 15' 25,80" W
39	São Romualdo/Caculé	7	3° 23' 45,34" S	48° 16' 0,99" W
40	São Romualdo/Caculé	7	3° 22' 31,98" S	48° 15' 24,13" W
41	São Romualdo/Caculé	7	3° 26' 28,39" S	48° 13' 16,97" W
42	São Romualdo/Caculé	7	3° 27' 4,07" S	48° 13' 38,31" W
43	Cauaxi	8	3° 44' 35,72" S	48° 9' 11,05" W
44	Cauaxi	8	3° 44' 38,99" S	48° 9' 52,27" W
45	Cauaxi	8	3° 45' 24,89" S	48° 9' 50,01" W
46	Cauaxi	8	3° 45' 30,20" S	48° 10' 56,72" W
47	Cauaxi	8	3° 44' 0,68" S	48° 10' 58,95" W
48	Cauaxi	8	3° 43' 58,36" S	48° 9' 12,26" W
49	Rio Capim	8	3° 42' 55,01" S	48° 25' 15,40" W

Points	Areas	Year	Latitude	Longitude
50	Rio Capim	8	3° 42' 17,86" S	48° 25' 26,58" W
51	Rio Capim	8	3° 42' 8,75" S	48° 23' 29,82" W
52	Rio Capim	8	3° 42' 19,94" S	48° 23' 26,81" W
53	Rio Capim	8	3° 41' 42,38" S	48° 23' 40,02" W
54	Rio Capim	8	3° 41' 52,61" S	48° 48' 51,08" W
55	Rio Capim	8	3° 41' 7,63" S	48° 50' 37,63" W
56	Rio Capim	8	3° 40' 21,65" S	48° 50' 26,99" W
57	Rio Capim	8	3° 40' 12,46" S	48° 49' 15,31" W
58	Rio Capim	8	3° 39' 58,41" S	48° 25' 12,76" W
59	Rio Capim	8	3° 40' 23,10" S	48° 26' 58,96" W
60	Rio Capim	8	3° 39' 45,25" S	48° 26' 59,55" W
61	Rio Capim	8	3° 39' 14,28" S	48° 25' 12,49" W
62	Rio Capim	8	3° 24' 30,04" S	48° 39' 45,56" W
63	Rio Capim	8	3° 21' 42,40" S	48° 39' 46,69" W
64	Rio Capim	8	3° 24' 27,25" S	48° 39' 10,00" W
65	Rio Capim	8	3° 21' 30,69" S	48° 40' 36,54" W
66	Rio Capim	8	3° 20' 49,29" S	48° 35' 43,51" W
67	Rio Capim	8	3° 19' 58,15" S	48° 35' 58,41" W
68	Rio Capim	8	3° 20' 58,45" S	48° 36' 50,54" W
69	Rio Capim	8	3° 19' 45,42" S	48° 36' 52,02" W
70	Sumal	9	3° 37' 18,85" S	48° 14' 36,88" W
71	Sumal	9	3° 37' 18,20" S	48° 11' 6,60" W
73	Sumal	10	3° 34' 47,20" S	48° 14' 42,85" W
74	Sumal	10	3° 33' 19,69" S	48° 14' 46,86" W
75	Sumal	10	3° 34' 46,55" S	48° 11' 9,75" W
76	Sumal	10	3° 33' 14,41" S	48° 11' 11,43" W
77	São Romualdo/Caculé	10	3° 29' 34,33" S	48° 11' 47,23" W
78	São Romualdo/Caculé	10	3° 30' 6,05" S	48° 11' 32,46" W
79	São Romualdo/Caculé	10	3° 28' 52,56" S	48° 12' 45,34" W
80	São Romualdo/Caculé	10	3° 30' 25,59" S	48° 13' 4,75" W
81	São Romualdo/Caculé	10	3° 29' 29,74" S	48° 13' 34,30" W
82	São Romualdo/Caculé	10	3° 28' 52,96" S	48° 13' 23,19" W

The total size of the project area is 27,434.7 ha, distributed in each farm as presented in Table 2. The total area is a private land owned by CBNS and the entire Project Area is under the control of the project proponent at the time of verification.

Table 2. Portions of the project area in each RCC farm

Farms	Areas (ha)
Rio Capim	*18,684.3*
Cacule	*3,389.0*
Cauaxi	*688.2*
Sumal	*4,673.2*
Total	*27,434.7*

According to the rural property documentation and project design, it is demonstrated that the project will not encroach uninvited on private property, community property, or government property. It is also demonstrated that project activities do not lead to involuntary removal or relocation of Property Rights Holders from their lands or territories and does not force them to relocate activities important to their culture or livelihood. No restitution or compensation is owed to any parties, given that no other lands have been or will be affected by this project in terms of land tenure and property rights and, no property rights are affected by this project activity.

1.8 Title and Reference of Methodology

VM0007 REDD Methodology Module, REDD Methodology Framework (REDD-MF), version 1.0

Carbon pool modules:

CP-AB “VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools”, version 1.0

CP-W “VMD0005 Estimation of carbon stocks in the long-term wood products pool”, version 1.0

Baseline module:

BL-PL “VMD0006 Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation”, version 1.0

Leakage modules:

LK-ASP “VMD0009 Estimation of emissions from activity shifting for avoided planned deforestation”, version 1.0

LK-ME “VMD0011 Estimation of emissions from market-effects”, version 1.0

Monitoring module:

M-MON “VMD0015 Methods for monitoring of greenhouse gas emissions and removals”, v2.0

Other modules:

X -STR “VMD0016 Methods for stratification of the project area”, version 1.0

X-UNC "VMD0017 Estimation of uncertainty for REDD project activities", version 1.0

Tools:

T-ADD "VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities", version 3.0.

Tool for testing significance of GHG emissions in A/R CDM project activities, version 1.0

AFOLU Non-permanence Risk Tool, version 4.0

1.9 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 yet. The project has not been registered, nor is seeking registration under any other GHG programs.

1.10 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.

1.11 Sustainable Development Contributions

The CIKEL REDD+ Project has the objective to promote sustainable development in the region, in which the CBNS group is considered a facilitating and encouraging agent. CBNS group aims to apply in its activities a sustainable approach. For instance, CBNS was one of the first companies to start developing low-impact logging management in the Amazon Region, in a period where intense logging was the most common practice. During a difficult financial time, the company looked for alternative solutions that could help it and continuously keep the forest preserved, which led it to be the first one to develop a REDD+ project for avoided planned deforestation in Brazil.

The CNBS group is located in the municipality of Paragominas, Pará state, the leading state in deforestation rate in the legal Amazon in the past decade, as shown in Figure 3[1]. In this complex

[1] http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/increments

degradation context, the presence of a conservation project where forest ecosystems are properly valued is of great relevance not only for climate change issues, but also for biodiversity preservation. In addition to the carbon project and the sustainable business, the CNBS groups aims to develop and maintain a healthy relationship with the local communities and stakeholders.

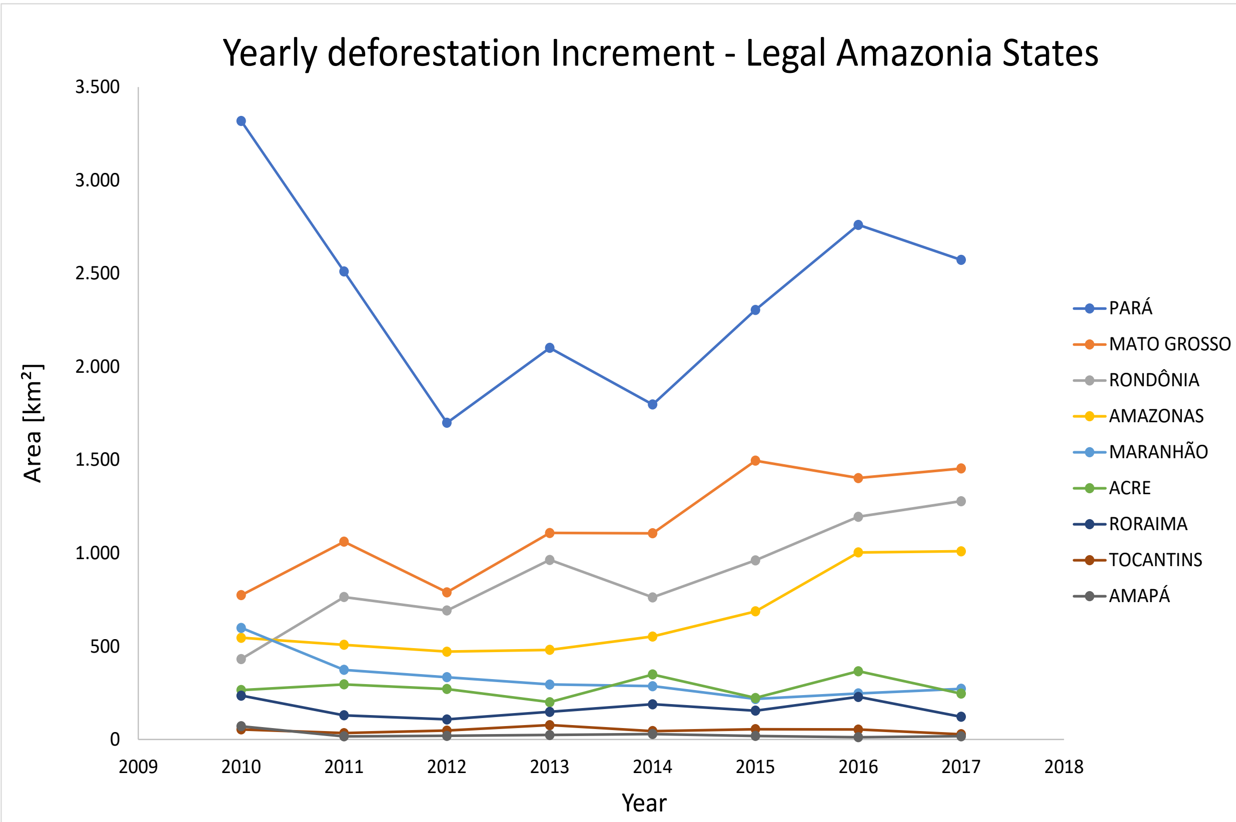

Figure 3: Deforestation rates in Legal Amazon States

The UN Sustainable Development Goals (SDGs) are a campaign of the United Nations Organization to promote positive changes in the world by conserving natural resources, combating climate change, and adopting more sustainable production and consumption practices. The SDGs are central to Brazil's 2030 Agenda and private initiatives have an important role to accomplish these goals. In this context, the Cikel REDD+ Project represents a significant potential to assist the government administrations to attain these goals.

The SDGs described in the table below also contribute to achieving the national priorities. Those SDGs are relevant to the National Policy on Climate Change (Law nº 12.187/2009) which sets Brazil's commitment to reduce the projected emissions of greenhouse gases and provides for the conservation and recovery of national biomes. In addition, they contribute to the National Biodiversity Strategy and Action Plan to promote the conservation of biodiversity.

Due to the increase in deforestation across 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 in 2004, starting ongoing actions to mitigate and to reduce deforestation. Therefore, the Cikel REDD + Project continues to be highly relevant in the context of PPCDAm premises.

The CIKEL APD project allowed to maintain 27,434.7 ha of forest, which has a direct positive impact on water ecosystem and biodiversity. Overall, during this second monitoring period, the project contributes to the following SDGs aligned with the national sustainable development priorities:

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime	How the goals are being monitored
1	6.6	Protect water-related ecosystems, (river)	Implemented activities to increase	Monitored yearly from 2011 to 2017 by satellite the HCV area 2, which is associated with floodplain lakes and marginal environments of the Rio Capim, and it is within the Cikel REDD project area. Through monitoring, it was found that there was no degradation or deforestation in the HCV area.	It is expected that there will be no degradation or deforestation in the HCV area throughout the life of the project, keeping the unique attributes of these areas preserved.	The monitoring of these areas is through satellite imagery covering and carrying out the surveillance of the property, including ground and fluvial monitoring.
2	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	By conserving 27,434.7 ha of tropical rainforest, CIKEL BRAZILIAN AMAZON REDD APD Project has prevented the release of 5,186,724tonnes of carbon into the atmosphere during the monitoring period.	Prevented the release of 5,186,724 tonnes of carbon into the atmosphere during this monitoring period.	Forest cover change is monitored through satellite imagery covering and carrying out the surveillance of the property, including ground and fluvial monitoring.
3	15.1	Ensure the conservation and sustainable use of forest and inland freshwater ecosystems and their services	Implemented activities to increase	By conserving 27,434.7 ha of tropical rainforest, CIKEL BRAZILIAN AMAZON REDD APD PROJECT has ensured conservation and sustainable use of the forest and the Rio Capim inland freshwater ecosystem and its services.	Conserved 27,434.7 ha of tropical rainforest and inland freshwater from Rio Capim since the beginning of the project to the end of this monitoring period, ensuring it sustainable use and conservation.	Forest cover change is monitored through satellite imagery covering and carrying out the surveillance of the property, including ground and fluvial monitoring.
4	15.2	Promote the implementation of sustainable management of all types of forests and halt deforestation	Implemented activities to increase	Promoted in this monitoring period the sustainable management of the forest through FSC certificate.	Since the start of the CIKEL BRAZILIAN AMAZON REDD APD PROJECT (2007), the proponents promoted sustainable management of the forest through FSC certificate.	Monitored parameters are and will be sourced from annual post-harvest assessment reports prepared for SEMA.

5	15.5	Reduce the degradation of natural habitats and halt the loss of biodiversity	Implemented activities to decrease	By conserving 27,434.7 ha of tropical rainforest, CIKEL BRAZILIAN AMAZON REDD APD PROJECT has reduced degradation and prevented habitat and biodiversity loss.	Preserved 27,434.7 ha of tropical rainforest from the beginning of the project to the end of this monitoring period, preventing significant area of habitat loss, consequently preventing biodiversity loss as well.	Forest cover change is monitored through satellite imagery covering and carrying out the surveillance of the property, including ground and fluvial monitoring.
	15.5	Take action to protect and prevent the extinction of threatened species	Implemented activities to increase protection	Between 2010 and 2014, records of fauna sightings were made in the Rio Capim Complex. Not all animals seen had the species properly identified, but 12 genera of birds, 20 genera of mammals and 2 genera of reptiles were recorded. Of the species observed, 15 are threatened (NT, VU, EN and CR) according to the Red Lists of the IUCN[2] and ICMBIO[3]. Were sighted four species of apes classified as EN (endangered) and CR (critically endangered), endemic of this region: *Cebus kaapori, Chiropotes satanas, Alouatta ululata* and *Ateles marginatus*. By monitoring and conserving 27,434.7 ha of tropical rainforest, CIKEL BRAZILIAN AMAZON REDD APD PROJECT has preserved several threatened species and prevented habitat loss.	Preserved 27,434.7 ha of tropical rainforest from the beginning of the project to the end of this monitoring period, preventing significant area of habitat loss and conserving threatened and endangered species.	CBNS supports a partnership with Pará Federal University, which has been doing research in their forest to improve the local biodiversity and the preservation of high conservation areas and species. In addition, forest cover change is monitored through satellite imagery covering and carrying out the surveillance of the property.

[2] https://www.iucnredlist.org/. Accessed July 20, 2022

[3] ICMBIO, 2018. Livro Vermelho. Accessed July 20, 2022

During the years 2015 to 2017, the company did not carry out fauna monitoring activities due to budget difficulties, which forced the company to carry out cost containment plans temporarily. However, they maintained remote sensing monitoring of HCV areas to identify possible deforestation, in addition to maintaining the terrestrial monitoring plan, in order to guarantee forest integrity, preventing illegal deforestation, invasions and forest fires.

But since 2019, the company has resumed monitoring biodiversity through a research partnership with the Federal University of Pará, through the Laboratory of Vertebrate Ecology and Zoology, for the monitoring and development of research with terrestrial mammals in the area of Rio Capim Complex. In a survey using camera traps, 25 species of terrestrial mammals have already been photographed on the Rio Capim Complex, which are described in the "Photographic Guide to Mammals of the Rio Capim Farm – 2021"[4]. More results from these studies will be discussed in the next MR.

Figure 4. Record of a camera trap of a *Panthera onca* in the Rio Capim Complex

Source: Dr. Ana Cristina, November 2020.

[4] Available in the PDF "Fauna_Guia fotográfico Rio Capim"

2 SAFEGUARDS

2.1 No Net Harm

The CBNS Group is a pioneer in supporting research and development of techniques that cooperate with the continuous improvement of forest management and the responsible use of natural resources. Since 1995, the company has provided area and support to the *Instituto Floresta Tropical* (IFT; Tropical Forest Institute), which is the school for low-impact management in native forests. These techniques, conceived and tested at the Rio Capim Complex (RCC), are used nationally and recognized by environmental agencies as the only ones suitable for harvesting native species in the Amazon. As a result of this partnership, CBNS was a pioneer in the implementation of a Sustainable Forest Management Plan (PMFS; *Plano de Manejo Florestal Sustentável*) in the Amazon, providing for a 35-year cutting cycle, the correct selection of trees for cutting, as well as the implementation of operational techniques that minimize the impact intervention in the forest, guaranteeing the continuity of the forestry business. Also, this work led the company to obtain the FSC® forest certification, in 2001, which attests that the economic, social, and environmental benefits are obtained in equality and balance. Since then, CBNS seeks to continuously improve its processes, as well as contribute to the evolution of forest management in Brazil. Since 2000, the company has partnered with EMBRAPA and the Federal Rural University of the Amazon (UFRA; *Universidade Federal Rural da Amazônia*), for the development of studies and research aimed at getting to know the forest and subsidizing, through the results obtained, new work practices, expanding the productive capacity of the enterprise, in addition to allowing adjustments to the PMFS. Over the years, a series of research has been carried out, generating dissertations, theses and more than 30 articles with an emphasis on the ecology, dynamics, silviculture, and biogeochemistry of tropical forests, allowing a better understanding of the dynamics of managed and unmanaged native forests, in addition to measuring the possible impacts of forest management activities over time.

Some examples of these works developed in partnership are:

- **Recovery plan of areas of *Euxylophora paraensis* Huber (Pau-amarelo):** Experiment conducted in partnership with EMBRAPA that aims to know the dynamics and growth of seedlings of Pau-amarelo. 987 seedlings from 20 matrices were selected and planted in 8 clearings in 2016.
- **National Forest Inventory:** The Brazilian Forest Service (SFB, in Portuguese) conducted a National Forest Inventory, which is a planning instrument that aims to provide information on the floristic potential throughout the national territory. The work methodology, sampling process in the systematic distribution of sampling points (clusters), led the RCC area to compose this body's

data collection. The data obtained in this inventory will be public and can be used by CBNS for decisions regarding its forestry practices.

- **Species Phenology**. The dynamics of the forest combined with the dynamics of the market, demand that forestry enterprises seek to insert new species into the criteria of commercial species. For this, knowing the phenology of the species found in the forest makes it possible to improve the selection of cut, aiming at the use of these woods in the industry associated with obtaining yields and economic results. In this way, EMBRAPA, based on samples collected in RCC areas, is developing research called "Phenology of Commercial Forest Species". The main objective is to identify the species with commercial potential, verify the flowering/fruiting period throughout the year and the dispersion process. Allied with the monitoring over the years of the regeneration process of these species within the management areas, it will be possible to identify whether it is necessary to reduce the exploitation of any species or define some differentiated selection criterion.
- **Quantification of forest residues and the relationship between forest residues and charcoal:** In order to quantify forest residues from forest management and obtain the relationship between these residues and the charcoal generated in the ovens, UFRA, at the request of CBNS, conducted a detailed yield study in 2015.
- **Monitoring of forest residue removal areas:** Aiming at quantifying the damage to natural regeneration, to the soil and to the remaining trees during the exploitation of forest residues and to support CBNS in making decisions about the definition of equipment, elaboration, and application of methodologies compatible with reduced impact, EMBRAPA prepared a project to be applied in areas where residue was exploited at RCC. This project includes, in addition to the aspects already mentioned, the possible benefits to natural regeneration such as the visible ingress of seedlings in the explored areas. In addition, it intends to go further, researching the nutrient cycling in these areas compared to areas of natural forest without exploitation in order to verify if the rates of woody material left in the soil are sufficient to maintain the environment in perfect functioning, or if there is a need to leave a little more of this material to go into decomposition. This research will allow making the decision for the management plan on the need to increase or not the minimum diameter to be collected so that sufficient material remains to maintain the nutrient cycling in amounts that are favorable for the maintenance of the forest.
- **Use of volume equations for analysis and elaboration of regional equation:** In 2010, CBNS collected data to assemble the volume equation for its management plan. 1,100 trees were measured involving all the extracted species and the equation was set up using the Smalian method. In 2016, the data collected for the CBNS equation was passed on to EMBRAPA so that they can be used in a project of an equation for the Amazon in progress at the institution. In this

project, EMBRAPA intends to analyze data from the most varied regions of the Amazon, and to assemble an equation capable of estimating the volume of any tree in any forest in the Amazon.

It is known that the fauna has relevance in the maintenance of the forest ecosystem and interacts directly in the dynamics of low impact forest management. In this way, CBNS since 2001 has supported and/or developed research and monitoring aimed at identifying existing fauna and impacts of the management operation on the animal population in forest areas. Among the main actions, we can highlight:

Fauna identification and protection actions in forest management operations: Administrative rule nº 1 of 04/24/2007[5] provides for the identification of nest trees or areas of special value to the fauna, in order to exclude them in the cutting selections and keep them in the forest, guaranteeing the permanence of the identified species. The integration and training stage for operations highlights the importance of preserving the fauna in the forest area to employees, which are: instruction for the maintenance of nest trees; guidance on not cutting down trees when there is a concentration of animals at the time of the felling, and on the prohibition of hunting and fishing within the RCC.

Wildlife Monitoring by Sighting: In partnership with the Federal University of Pará (UFPA) – Biology Center, the company developed a methodology for monitoring fauna by sighting. In the period between 2002 and 2012[6][7], data were collected that demonstrate the characteristics of the local fauna in the period before the management operation, soon after the forest management intervention and years after the extraction of logs and residues.

Identification and monitoring of areas of High Conservation Value (HCV): The concept of HCF was first proposed by the FSC as a way of providing extra protection to critically important forests, as well as encompassing exceptional or critical ecological attributes, ecosystem services and social functions. In 2010, the technical team of CBNS indicated two areas of High Conservation Value within its complex of Forest Management Area. After a technical visit by a team of contracted biologists, another area considered of High Conservation Value was suggested within Rio Capim Complex, in addition to the two areas previously indicated. Of these areas, only HCV 2 is within the Cikel project area (Figure 15: HCV Areas identified in the Rio Capim Complex). These are floodplain lakes and associated habitats located on the

[5] https://www.legisweb.com.br/legislacao/?id=91545

[6] Documented in “2011_Relatório de Fauna_UFPA”

[7] Documented in “2013_Guia de Instalacao_Censo de Fauna”

right bank of the Capim River on the Caculé property[8]. Between 2013 and 2017[9], CBNS monitored these areas through satellite images and found that there was no degradation or deforestation in the area, which remained intact and preserved.

In 2008, CBNS started an Environmental Diagnosis Study at the Rio Capim Complex to identify the environmental problems that the unit has, such as its polluting sources, waste destination and even compliance with environmental legislation. Through this diagnosis, they were able to assess the environmental quality of the unit's facilities and activities and issue suggestions for remediation and prevention. Over the years, CBNS has conducted several complementary actions, such as:

- **Implementation of the Solid Waste Management Plan ("PGRS"):** The PGRS[10] was established in 2013 and its purpose was to propose the correct management of solid waste generated in the Rio Capim Complex, in order to establish procedures and strategies for the proper management of such waste, in accordance with the guidelines established by environmental legislation. The plan describes the most appropriate management system to obtain the correct collection, transport, storage, packaging, final disposal, or treatment/recycling of the waste in question. The residues generated in forest management activities (the only activity that occurs within the Cikel REDD project area), are described in Table 3, the classification of each waste according to NBR 10.004[11] is also described, in which the classification criterion was established according to its nature: Hazardous (class I) and Non-Hazardous (class II) ± Non-Inert (class II A) and Inert (Class II B). The residues are also stored according to their classification, and later they are collected and transported by a third company that will give the correct destination.

Table 3. Waste generated in forest management areas.

Waste Type	Classification	Storage	Final Disposal
Paper	Class II A Non-Hazardous Waste	Waste shelter	Reuse or recycling
Plastic (disposable cups)	Class II A Non-Hazardous Waste	Waste shelter	Reuse or recycling
Organic waste	Class II A Non-Hazardous Waste	Does not apply	Compost
Aluminum food containers	Class II A Non-Hazardous Waste	Waste shelter	Recycling

[8] Documented in "2011_ Validation Report of HCV Areas"

[9] Documented in "2014_2018.Relatório de Monitoramento"

[10] Documented in "2013_PGRS"

[11] ABNT NBR 10004 2004 Edition

Lubricating oil containers	Class I Hazardous Waste	Waste shelter	Incineration or Co-processing
Materials contaminated with oil from equipment	Class I Hazardous Waste	Metallic collector	Incineration or Co-processing

Infrastructure inspections: It is the responsibility of the company to offer conditions of comfort and hygiene in the places intended for employees for common use, such as accommodation, bathrooms, cafeterias etc. Thus, over the years, the company carried out several inspections of the infrastructures and identified the need for improvements and reforms (Table 4).

Table 4. Inspections and renovations carried out on CBNS's infrastructures

Period/Date	Description
May 2011	A report was conducted on the conditions of CBNS's infrastructure, in particular the areas most used by employees, such as accommodation, cafeterias, and bathrooms. At the end of the report, opportunities for improvement and needs for reforms were pointed out to guarantee the health, safety and well-being of employees and third parties.
28/April/2015	An inspection was carried out in the accommodation aiming at safety, health, and well-being issues of the employees, in addition to identifying repairs and improvements in infrastructure.
06/May/2015	An occupational health and safety inspection report was carried out at the entrances to the Rio Capim Complex.
13/May/2015	An inspection was conducted in the accommodation aiming at safety, health, and well-being issues of the employees, in addition to identifying repairs and improvements in infrastructure.
19/May/2015	Renovations were carried out in the accommodations, including painting in the internal and external areas; general electrical and hydraulic maintenance; and repairs to the roofs, bathrooms, and bedrooms.
March 2016	An occupational health and safety inspection report was conducted at the entrances to the Rio Capim Complex.
13/April/2016	An inspection was carried out in the accommodation aiming at safety, health, and well-being issues of the employees, in addition to identifying repairs and improvements in infrastructure.

CBNS over time has been improving the health and safety issues of workers in their activities. In 2010, 26 of the 31 occurrences of accidents at work, corresponding to 83.6%, occurred due to behavioral issues. To change behavior, the causes must be identified and corrected. Thus, in 2011, the "Safe

Behavior" program[12] was created at CBNS based on the Task Risk Assessment (TRA) tool. The main purpose of the program is to reduce indicators related to occupational accidents. This transformation is directly linked to the feedback given to the observed after the observation of the task, and how to increase the understanding of the observed regarding the concepts of safety, health, and the environment. Due to the low level of education of forest workers, it was necessary to modify the Safe Behavior tool, which is linked to the science that studies adult learning, andragogy. Through this modification, training and observations were reformulated and made more dynamic, more reflective and, as a consequence, bringing a greater level of worker awareness. Without any form of punishment, the tool is based on the observation of the task in order to alert workers to avoid the occurrence of risky behaviors.

In 2012, the Work Accident Reduction Program[13] (PRAT; *Programa de Redução de Acidentes de Trabalho*) was implemented, which also aims to reduce work accidents by targeting employee behavior but has a different methodology from the "Safe Behavior" program. PRAT aims to implement the following tools:

a. **Integration:** Integration is the first contact of a person who is starting in the company, where diverse topics are presented, going through a presentation of the company, notions of the environment precautions and ending with a greater emphasis on safety at CBNS. It is the employee's first contact with the aspects and safety standards adopted by the company.

b. **Speak Easy (Fale Fácil):** It is a form to report deviations or anomalies identified on a daily basis during inspections and audits and other work hygiene and safety checks in the areas, being a reactive and preventive tool, as it constitutes a reaction to a certain situation out of default, which turns out to be a prevention against possible repetitions of this situation. It is a tool available to all employees, and everyone is responsible for recording deviations and looking for the person in charge of the area to solve the problem.

c. **Permit to Work (PTW):** It is a tool whose objective is to establish criteria for the application of a methodology for the release of a service, being a preventive instrument, where the risk involved is analyzed first, becoming aware of this risk so that the work can be carried out safely. The PTW is intended for leaders, who are responsible for authorizing the performance of a service upon release.

d. **Signaling:** This is a tool used to raise worker awareness through visual stimuli, where at all times the employee is reminded, through warning signs, of the safety standards in force at that particular location.

[12] Documented in "2011_Programa Comportamento Seguro"

[13] Documented in "2012_PRAT"

e. **DSS:** The hygiene, safety, environment dialogues are small meetings that take place in each area of the organization, once a week, normally at the beginning of the day, where various texts and situations related to the topics mentioned above are discussed, and each week a person in the area is responsible for leading this discussion. In these small meetings, routine situations experienced by a given person are discussed, and may also have as a source newspaper, magazine or any other situation that serves as a reference for those people who participate in the dialogue. In this way, through common and casual situations, we seek a greater awareness of employees about events that can be repeated in their work routine, helping to prevent a situation already seen from happening again and causing damage to someone, especially the work accident situations.

CBNS has operational procedures for all its forest management activities, certifying that operations are conducted following a quality standard in order to reduce environmental impacts, avoid safety risks and increase the efficiency of operations. There is a monitoring team that follows the methodology described in the document "GPOM *Guia de Procedimentos Operacionais de Monitoramento*" (CBNS Monitoring Operational Procedures Guide), where operational activities are observed without the interference of CBNS technicians, who at the end of each activity talks with the operational teams to present the strengths and opportunities for improvement in the activity, with a view to providing guidance on the correct standard procedures. Indicators are evaluated to verify the correct application of cutting techniques and safety procedures, as well as damage caused by falling trees. The team also evaluates the roads, bridges and culverts built during the operations, to certify that they follow the standards established by the company.

In 2011, CBNS developed the "Plan for Preventing and Combating Forest Fires"[14]. The prevention and combat of forest fires are silvicultural procedures that aim to protect the forest against the destructive action of fire. The plan brings several concepts applied to forest fires, in addition to fire fighting and prevention techniques.

Over the years, CBNS has conducted various training courses for its employees and for companies that carry out forestry operations in their management areas. The concepts covered were health and safety, good practices, and best techniques in forestry operations, first aid, leadership, and fire brigade (Table 5).

[14] Documented in "2011_Plano_Incendios RC"

Table 5. Training carried out by CBNS.

Period/Date	Description
16/May/2011 to 20/May/2011	A training of forest fire brigade was carried out for CBNS employees.
18/April/2013	Training on leadership in the work environment was conducted, with 9 employees participating.
04/September/2014	Training in forest management techniques and occupational safety was conducted for the employees of the JP company, which carries out forestry operations in the CBNS area. 47 employees attended the training.
09/July/2015	First aid training was carried out with the employees of SOMA and JP companies, which conduct forestry operations in the CBNS area. The training covered basic concepts of first aid for burns, injuries, respiratory arrest, among others. Altogether, 81 employees participated.
11/July/2015 to 14/July/2015	Training was conducted in special techniques for logging and safety in forest management, aiming at greater use of the logs, greater safety at work and minimizing impacts and damages during the logging operation. The course was given by Instituto Floresta Tropical (IFT) for employees of SOMA, which conduct forestry operations in CBNS's areas. Altogether, 10 employees participated.
17/August/2015 to 19/August/2015	Training was conducted in techniques for planning and building decks, roads, and infrastructure in forest management, aiming at greater efficiency and less forest damage, in addition to avoiding accidents in operations. The course was given by Instituto Floresta Tropical (IFT) for employees of J.P. Souza Madeiras, Terra Brasil, and Montana Madeiras, which carry out forestry operations in CBNS's areas. Altogether, 11 employees participated.
18/August/2015 to 20/August/2015	Training was carried out in special techniques for logging and safety in forest management, aiming at greater use of the logs, greater safety at work and minimizing impacts and damages during the logging operation. The course was given by Instituto Floresta Tropical (IFT) for employees of J.P. Souza Madeiras, Terra Brasil, and Montana Madeiras, which carry out forestry operations in CBNS's areas. Altogether, 33 employees participated.

The process of evaluating potential environmental and social impacts on the forest management unit caused by the forestry operations of the company CBNS it is an important process for the maintenance of the environmental quality of the managed forest and for the harmonious coexistence between the company, employees, and its neighbors.

From September 2014 to May 2015, the company's team of representatives held meetings with the communities surrounding the properties of the Rio Capim Complex, with the communities called Ararandeua, Surubiju and Barreirinha, indigenous people of the Amanayé ethnicity; the community of the access road to the Rio Capim Complex, in the Rouxinol locality, and also met with the charcoal workers, adopting the assessment standard established in the "PRORS 03 – *Relações Comunitárias em AMF*" procedure (PRORS 03 – Community Relations in FMA, Forest Management Area). In the process of assessing social and environmental impacts, participatory mapping was also carried out with these communities that live in the border of the CBNS management area (Ararandeua, Surubiju and Barreirinha), in order to identify the places where these communities carry out exploration activities (hunting, fishing, collection of forest products) within the area of the Rio Capim Complex. This process also included field validation of these locations, which are further described in section 2.2. The goals of this mapping were:

- Identify and map in the field the places within CBNS that are used by the surrounding communities for their subsistence and which products are used by these communities;
- Enable CBNS to include these locations in its Management Plan in order to improve its land use planning, in order to minimize the impact of management on these areas and, consequently, minimize the impact on communities;
- To promote rapprochement between the company and the community, aiming to strengthen relationship ties, fostering partnership and support for the development of these communities.

Continuing with this work of mapping the areas used by communities, between May 2015 and April 2016, CBNS carried out further consultations with community members to identify and map potential environmental and social risks according to community perceptions. During the meeting, the community members were able to express their feelings, perceptions, doubts, and criticisms about the company. During the interaction with the communities, several issues were exposed, all of them were noted, with a division between what they indicated as positive and/or negative in relation to the presence and performance of the company in the region. The positive points mentioned by the community were recorded (Table 6), while the negative points generated an action plan to mitigate the social and environmental impacts identified by the evaluation process (Table 7).

Table 6. Positive aspects mentioned by the community about CBNS.

Community	Positive Impacts/Perceptions
Indigenous Ararandeua	The company helps by maintaining the access road from the community to the city;
	Carpools are provided for community members to travel to the city and especially in cases of emergencies;
	Positive economic impact occurs through the CBNS food service provider who purchases fish and flour from the community; and also sells food to the community;
	When they request support for equipment repair, the company assists them.

Indigenous Barreirinha	Forest management activities do not interfere with the way of life of the community
Indigenous Surubiju	They indicated that the regeneration of skid trails, clearings and decks favors an increase in hunting in the forest and also brings animals closer to the community;
	The extraction of residues makes the environment easier to walk and reach the açai collection points, still, they believe that this helps in the return of the hunts
	The technique used by forest management preserves the wellspring of rivers and their surroundings (preservation of riparian forest)
	The presence of CBNS as a neighbor gives more security in the sense of keeping the forest preserved
Rouxinol	They claim that 90% of the traffic conditions on the access road to the city are promoted by CBNS due to the periodic maintenance carried about by the company, which contributes positively to the community.

It is important to emphasize that the Cikel Brazilian Amazon REDD APD Project itself does not have negative impacts on the community, given that it is a forest conservation project, which favors the preservation of natural resources that are exploited by the community, especially by the Indigenous communities Barreirinha, Surubiju and Ararandeua. The aspects mentioned in Table 7 are associated with sustainable forest management operations that take place not only in the project area, but in the entire Rio Capim Complex. Some aspects of the charcoal plants that are located within the Rio Capim Complex are also mentioned, but there are no charcoal plants within the REDD project area. This information was presented in order to show transparency and demonstrate that there are dialogues between CBNS and the community, and that actions are taken to mitigate any impacts mentioned by them.

Table 7. Mitigation Plan of Social and Environmental Impacts

Community	Problem	Impact	Justification	Step of SFMP	Mitigation Action Proposed	Mitigation Action Executed (2015/2016)
Indigenous Ararandeua	Potential risk of accidents in the harbor as it is very close to the bridge	Security	Due to the current of the river, boats are pulled to the side of the bridge, and accidents could occur, although there are no previous records of this kind of accident	Access to SFMP and transport	Initially, it was proposed to improve the lighting of the place where the boats dock, to reduce the risk of accidents at night. Since there are no records of accidents and because the location of the harbor is strategic in terms of surveillance to CBNS (it is close to the guardhouse), the harbor location will not be changed.	In 2015, an improvement was carried out in the lighting of this berthing point. In 2016, in conversation with community leaders, they said that the problem was solved, that it was good to dock, and the lighting greatly minimized the risk of accidents.
Indigenous Ararandeua	Smoke from the charcoal plant: it is not constant, with the highest incidence during the summer and when it occurs, it is during the morning.	Health	Inhaling smoke can cause respiratory problems for community members.	Carbonization and Chain of Custody	Monitoring the occurrences through the employees located at the bridge's entrance to take pictures at different times of the day and take measurements of the smoke concentration at those determined times. In case of identifying prominent levels of CO2/CO, carry out weekly surveys in the community to verify if the smoke is directly affecting and to what extent the lives of the communities on the banks of the Ararandeua River. Based on these monitoring, prepare monthly reports on the established indicators for further analysis and proposal of corrective actions.	In 2015, this proposal to monitor smoke through equipment was changed. Monitoring began to be carried out qualitatively, through conversations with community residents. During the meetings with the community, it was reported that the smoke was at tolerable levels. In addition, the company has been seeking innovative technologies for its production matrix, in this way, the company celebrated a partnership with the "Universidade Federal Rural da Amazônia" (UFRA) to carry out several research to seek opportunities for improvement in its processes and ovens (APPENDIX II - Research carried out in partnership with UFRA).

Indigenous Ararandeua	During the forest management operation, the hunting moves away.	Subsistence	They indicate that due to the movement of teams and machinery, the animals flee to other places.	Harvest and Transportation	It was explained that this is a natural process of management and that at the end of activities, hunting returns. The community even stated that more hunting is returning and that after the extraction of residues it is much better to walk in the forest. Thus, it is defined that to mediate the impact, the company will always communicate the locations where the operation is taking place, at least 7 days in advance of the start of forestry operations.	In June 2015, community leaders were informed about the start of activities and the locations where they were taking place. In 2016, they stated that in the winter period the presence of hunting increased in the managed areas of UPA 15 and surroundings, near the Surubiju River, because at the end of the management, the sprouting of seedlings and seeds increases, which makes the incidence of animals increase (manly tapir, wild pig, and deer)
Indigenous Barreirinha	CBNS's representation in the community is weak.	Personal Satisfaction and Institutional Image	They claim that the company stays a long time without showing up and that they changed the representatives without warning	No operation step	CBNS indicated who would be responsible for the contact with communities.	In 2015, the monitoring team was in the process of structuring, and the person hired to carry out the social monitoring in the field started its activities in September 2015. In April 2016, the field mapping of areas used by communities was carried out with community leaders. This field mapping was important for the rapprochement between the company and the community and aimed to identify the areas of use by communities in CBNS's areas and their productive potential, allied to an objective of identifying possibilities of partnership/support for the development of productive chains of non-timber forest products to be possibly developed by the communities, as well as to reestablish the trust of the community with the company. This field mapping was completed in April 2016, and was discussed with the community leader, Mr. Ezídio, about the areas identified and the potential of each area, and some ideas emerged about the possibility of partnerships, mainly focused on the management of Açai (for food/market) and Guarumã (for handicrafts). He was satisfied and decided to meet with all the residents of the community, about how the company CBNS could contribute (partnership or support) to the development of some production chains of non-timber forest products.
Indigenous Barreirinha	Create and frustrate expectations.	Personal Satisfaction and Institutional Image	They indicated that many plans were made, and nothing materialized.	Implementation of new projects.	Evaluate exactly how CBNS can work with them and be transparent in this relationship. One possibility would be to support and participate in the actions promoted by Imaflora.	

Indigenous Surubiju	Difficulty getting a ride in company cars	Economic and Quality of life	Without a ride, they have to pay for transportation and run out of money to buy food, for example.	Access to SFMP and transport	Reinforce CBNS drivers of light vehicles to give rides to Indigenous people.	The drivers were oriented and whenever possible they have given rides to the Indigenous people.
Indigenous Surubiju	During forest management, jaguars flee to the side of the community	Security	They said forest management scares the jaguars away and increases the risk to the community side.	Harvest and Transportation	Communicate whenever there will be operations in the vicinity of the community, so that they redouble their attention. Thus, it is defined that to mediate the impact, the company will always communicate the locations where the operation is taking place, at least 7 days in advance of the start of forestry operations.	Community leaders were informed about the start of activities and the locations where they were taking place.
Indigenous Surubiju	The company takes a long time to return contacts (Annual meetings)	Personal Satisfaction	They do not receive information, nor do they pass on what they know. They think more frequent meetings would be better.	No operation step	Establish a work agenda in the communities to improve communication.	In 2015, the monitoring team was in the process of structuring, and the person hired to carry out the social monitoring in the field started its activities in September 2015. In April 2016, the field mapping of areas used by communities was carried out with community leaders. This field mapping was important for the rapprochement between the company and the community and aimed to identify the areas of use by communities in CBNS's areas and their productive potential, allied to an objective of identifying possibilities of partnership/support for the development of productive chains of non-timber forest products to be possibly developed by the communities, as well as to reestablish the trust of the community with the company. Mr. Bilu from the Surubiju community accompanied the CBNS team in the mapping. Some ideas emerged about possibilities for partnerships, mainly focused on the management of Açai (for food/market). He was satisfied and decided to meet with the community leaders and with all the residents of the community, about how the company could contribute to the development of this potential productive chain of Açai.

Rouxinol	Dust caused by the speed of trucks	Quality of Life/Health	Dust can cause breathing problems	Transport	Conduct an awareness lecture for CBNS drivers, partners and third parties.	The awareness was carried out only by drivers of light vehicles (Figure 5);
Rouxinol		Security	Risks of road accidents		Placement of 30 awareness, speed, attention signs on the 500-meter stretches before and after all roadside communities by August 10, 2015.	Maintenance was carried out on the access road that connects the property's entrance and the PA-150 highway. The signs were installed in the stretches where maintenance was carried out.
					Placement of speed bumps on roads that pass-through communities, aiming at obligatory speed reduction as well as avoiding accidents in places close to communities.	Speed bumps were placed on the roads close to the Rouxinol and Vila Preguiça communities. The placement of the speed bumps was previously agreed with the residents, where they signed an agreement on their installation. The speed bumps were placed as well as correctly signposted. In conversation with residents, an improvement was identified in terms of the speed of vehicles that travel there, as well as a reduction in the risk of accidents.
Rouxinol	They are unaware of the company's job vacancies	Economic	They say they do not see the company posting open positions to the community.	No operation step	Placement of advertisements about job vacancies in the community	HR made vacancies available in the communities, where six employees from the surrounding communities were hired, four for the residues extraction sector and two for the charcoal industry. In addition to these, the service provider company (Uthil Group) hired an employee from the Ararandeua community, and the JP company hired two employees from the communities surrounding CBNS for the 2015 harvest.

Figure 5. Defensive driving training carried out for CBNS employees and third parties

Source: CBNS Archive

2.2 Local Stakeholder Consultation

Consultation carried out with stakeholders during the monitoring period

During all the years at the Rio Capim Complex, the CBNS group has always made a significant effort to keep a strong a close engagement with the local stakeholders. This group includes the communities' groups presented before on item 2.1. Local stakeholders were presented to the CBNS REDD Project as well given them opportunity to express their feedback about it.

Regarding the Community Public Consultation, as stated in the methodology, individuals, neighbors, and communities were mapped (Figure 6) if they live within:

- the project area (but there are no communities and residents within the project area); and
- within a 20 km radius of the project area.

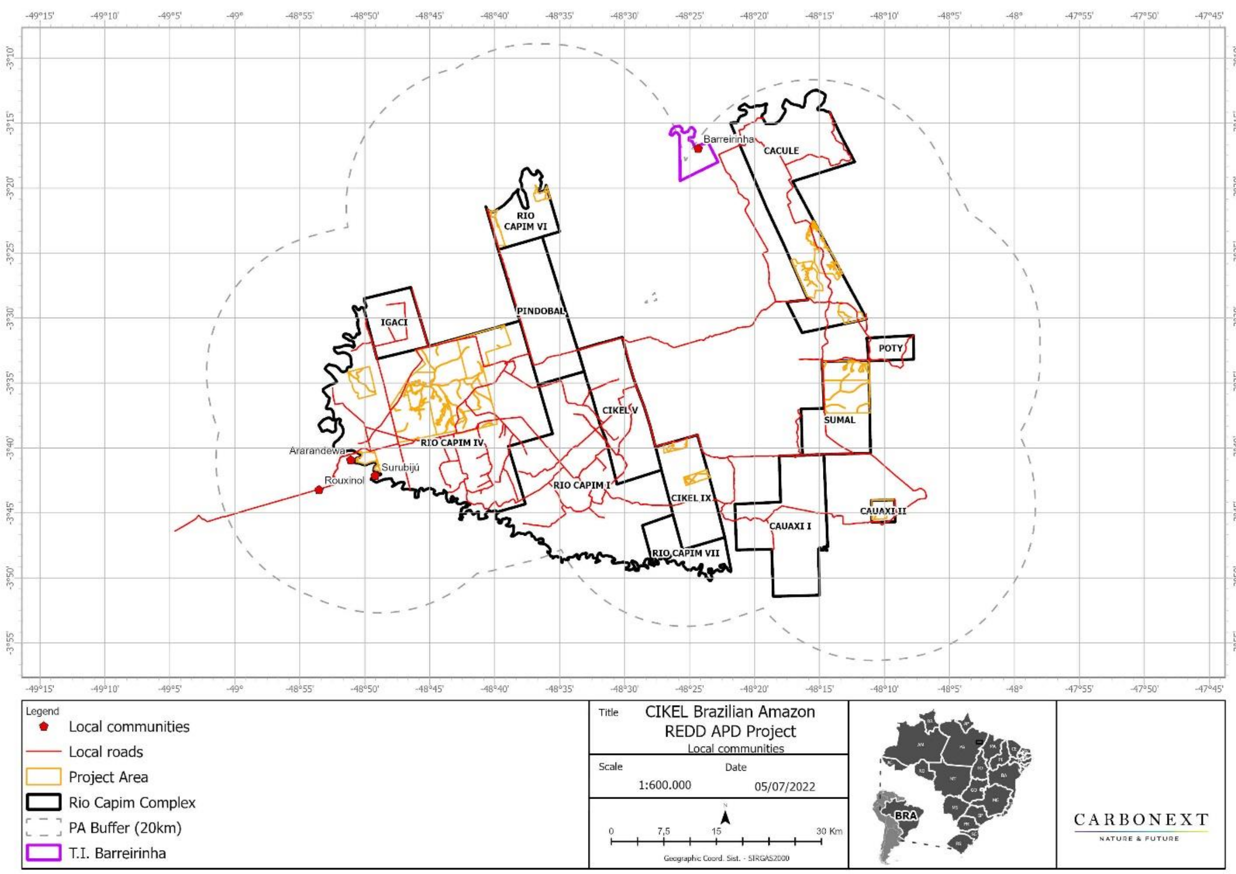

Figure 6: Location of communities around the Rio Capim Complex

CBNS group has developed its own standards and procedures to establish guidelines to deal with the multiple aspects of interaction with the local communities, it is called Social Responsibility Guidelines

(*Procedimento de Responsabilidade Social,* in Portuguese) or PRORS 03. They also have procedures to deal with and avoid possible conflicts, to compensate possible losses or damages caused by the company activities, to provide support and donations for the communities among other guidelines. CBNS group has Social Responsibility and Property Security departments, which are the ones responsible for maintaining contact with the locals and to assure that the social protocols are being correctly implemented. The main pilar for PRORS 03 guidelines for communication with the local communities are described in the following steps:

I. Identification of local communities
II. Meeting between the company and each community
    i. Better understanding of local community and introduction of the CBNS group
    ii. It is established and presented a consultation channel to the community
III. Define a periodicity for contact
IV. If necessary, meetings can be requested as needed by the community or CBNS
V. All meetings, actions and projects may be registered

All these procedures' goals are to ensure that the local stakeholders actively take part in pointing out any issue they face regarding company activities and, if needed, on the development of a mitigation plan. This process consists of community meetings, individual interviews, and participatory mapping. The meetings are an opportunity not only to clearly present to the community the company activities and their possible impacts, but also to get their feedback on how positive or negative these impacts they are observing. The goal is to evaluate together the impacts observed and prioritize them, so a mitigation plan can be as efficient as possible.

Accessible language and appropriate communication is a pilar found in all CBNS Group communities' affairs protocols. In this way, it's foreseen in the procedure PRORS 03 that the professionals making the communications have the necessary language skills to be understood by the public in question. The mentioned guideline also foresees that the customs, way of life and history of occupation of the community members be identified, in addition to involving at least one representative of each family during the participatory mapping process. This process allows any community member to participate in the social diagnosis, regardless of gender, race, or age.

Considering that CBNS Group acts on different commercial fronts since before the beginning of the REDD+ project, it already had a great effort to maintain a positive relationship with the local community. Regarding REDD+ consultations specifically, the dates of meetings in which the project was presented to the communities are presented below.

Throughout the monitoring period (2010-2017), all sustainable logging that happened in the area has been yearly audited by FSC certification. During each FSC audit, interviews were carried out with leaders and residents of local communities existing in the vicinity of the forest management area. The audits mainly intended to evaluate the maintenance of traditional use rights of resources, the relationship with CBNS Group and the socio-environmental impacts arising from forestry activity.

During the meetings with the local Indigenous communities, it was observed that communities do not have conflicts over land use rights or natural resources over management areas. The relationship between the CBNS Group and the communities is good and ends up generating mutual benefits, such as surveillance of the areas by the communities against the entry of strangers and the CBNS permission to locals to use forest resources for subsistence, such as fishing and hunting.

The communication channel was always open to discuss all activities that were being held on the farm, carbon project included. The Social Impact Assessments and Communities Relationship in FMA are examples of this openness and effort to a positive communication. Some of the meetings and developments involving the communities, to demonstrate the company on-going communication policy, are listed below:

- 28 March 2011 – Meeting with Rouxinol community to present and discuss the REDD+ project.
- 30 March 2011 – Meeting with Barreirinha community to present and discuss the REDD+ project.
- August 2011 – PROR03 – *Social Impact Assessment* (PROR03).
- 20 January 2012 – Meeting with Ararandeua community to present and discuss the REDD+ project.
- 28 May 2013 – Meeting requested by Ararandeua community to discuss the interaction between the company and the locals.
- September 2014 to May 2015 – *Communities Relationship in FMA* (PROR03).
- 05 April 2015 – Meeting with Ararandeua community to assess Social Impact aiming to develop a mitigation plan.
- April 2016 –Social Impacts Mitigation Plan Report Publication.

During this time, the company carried out the activities foreseen in the company social responsibility guidelines in three Indigenous communities (Ararandeua, Surubiju e Barreirinha), a local community (Rouxinol), and with the company's workers. From these interviews, the following achievements can be mentioned:

I. Validation report of the areas used by the communities surrounding the management area of the Rio Capim complex;

II. Assessment of social and environmental impacts forest logging area of Rio Capim Complex;

III. Follow-up report on the social and environmental impacts mitigation plan and in the forest logging area.

Between September 2014 and May 2015, CBNS group carried out the activities foreseen in “PROR03 - Community Relations in FMA” in three Indigenous communities, a local community, and the company's workers. During this period, teams held meetings with the communities surrounding the property and its employees. This assessment generated an action plan to mitigate the social and environmental impacts identified during the interviewing stages. While evaluating social and environmental impacts, participatory mapping was also carried out with the communities in order to identify the places these communities use within the CBNS area. In addition to that, during the interviews the locals were asked what their main use for these areas was. The assessment showed that the communities utilize their vicinity areas inside CBNS only for subsistence and the activities they reported are hunting, fishing and non-wood forest products collect. There was no recorded extraction of wood products inside CBNS by the locals.

The participatory mapping allowed us to find the principal areas inside CBNS property where the communities consider important for them. Over all the communities, the main uses of CBNS lands for subsistence activities were fishing, hunting, and wild açai and other fruits harvesting. Furthermore, there is an area of high cultural value, holding an ancient indigenous cemetery: this area is preserved, and local communities have easy access to it. After the participatory mapping, CBNS employees and locals together went to each location considered important to properly map them. Thereof, CBNS could have better information to include in its land use plans, so they can avoid and minimize any possible impacts for the communities. Moreover, CBNS developed this mapping to try to identify potential productivity areas to support local community’s development.

Figure 7: Participatory mapping with Surubiju community

Source: CBNS collection, from March 31, 2016

Although there is no community living inside CBNS areas, during each PRORO 03 campaign, interviews have been carried out with company's employees to assess their working conditions and give them opportunity to express themselves regarding the company activities. These procedures demonstrate the effort of CBNS to keep an effective communication not only with the local communities but also with the staff.

As stated before, the communication channel between CBNS group and the local communities existed before the carbon project, and it is still active. None of the questions and issues discussed in the meetings presented above were directly related to the REDD+ project, since the avoided planned deforestation project has little or no direct impact on the communities, especially if compared with other company's activities. However, all these meetings and activities definitely showed how there is a well-developed and open relationship between the group and the locals, where doubts or problems related to the carbon project could be discussed.

Institutional stakeholders are also part of the CNBS communication procedures: during 2011 and 2012, they were contacted and the REDD+ project presented to them. Local City Halls from the municipality of Paragominas e Goianésia do Pará, EMBRAPA, National Indigenous Foundation (FUNAI; *Fundação Nacional* *do Índio*), IDEFLOR-Bio and Federal University of Pará were all informed of the APD REDD+ projects through the meetings presented below, and all of these groups formally demonstrated their support to the project development (supporting letter were made available to audit team). During the monitoring period, CNBS Group maintained good and close communication with the stakeholders.

On February 2nd, 2012, a meeting was carried out in Belem (PA) aiming to present and consult institutional stakeholders about the REDD+ Project at CBNS. The project was presented to six people from different institutes at this event, and they answered a questionnaire where they could give their opinion and suggestion about the REDD+ project. Overall, they demonstrated positive about the project and considered it a useful tool to encourage a responsible environmental conscience. They did not state any negative aspects from the project.

During the monitoring years, CBNS maintained a positive relationship with institutional stakeholders. EMBRAPA has been developing research in the area, with a focus on reduced impact logging and carbon storage, therefore contributing to CBNS sustainable management. CBNS also supports a partnership with Pará Federal University, which has been doing research in their forest to apprise the local biodiversity and the preservation of high conservation areas and species. CBNS Group pursuit to maintain positive communication with the local towns administration, as well as Pará State environmental agencies.

Table 8. Meetings held with community members and CBNS staff about the Cikel REDD project

Date	Stakeholder Group	Meeting	Men	Women	Men (%)	Women (%)
28/03/2011	Rouxinol	Meeting with Rouxinol community to present and discuss the REDD+ project.	36	14	72%	28%
30/03/2011	Barreirinha	Meeting with Barreirinha community to present and discuss the REDD+ project.	28	14	67%	33%
20/01/2012	Ararandewa	Meeting with Ararandewa community to present and discuss the REDD+ project.	11	2	85%	15%
28/05/2013	Ararandewa	Meeting requested by Ararandeua community to discuss the interaction between the company and the locals.	4	2	67%	33%
04/05/2014	Ararandewa	Participatory mapping	11	2	85%	15%
05/05/2014	Barreirinha	Participatory mapping	7	4	64%	36%
06/05/2015	Rouxinol	Participatory mapping	21	15	58%	42%
06/05/2015	Surubiju	Participatory mapping	3	4	43%	57%

Communication about the monitoring report and audit process

According to VCS Standard v4.4, stakeholders need to be informed in advance about the audit process, thus, administrative employees and leaders of CBNS operational teams, surrounding communities and representatives of institutions were previously informed about this process.

The community members were first communicated through the WhatsApp messaging application or phone call and a date for a face-to-face visit was arranged to present the project and explain the audit process. The on-site visits were carried out by representatives of Cikel and Carbonext and took place during the periods detailed in the table below:

Table 9. Meetings held to inform community members and staff about the audit process

Date	Group	Local	Nº of participants*	Men (%)	Women (%)
21/06/2022	CBNS administrative staff and operational team leaders	CNBS	14	64%	36%
22/06/2022	Chief (*Cacique*) of the Ararandewa Indigenous Land and his son	CNBS	2	100%	0%
22/06/2022	Residents of the rural neighborhood "Rouxinol"	School "E.M.E.I.F Raimunda Clementina de Almeida" located in the Rouxinol neighborhood	12	50%	50%
23/06/2022	Residents and chiefs of the Ararandewa and Surubiju Indigenous Lands	Ararandewa Indigenous Land	11	55%	45%
26/06/2022	Residents and chiefs of the Barreirinha Indigenous Land	Barreirinha Indigenous Land	12	42%	58%

* Carbonext and CBNS employees who participated in meetings with community members were not included in the total number of participants, despite being on the attendance list

During the meetings, the project areas, the objectives of a REDD project, the concept of carbon credit and the functioning of the project verification process were presented. Community members were able to express their perceptions and ask questions to clarify any doubts. Community members have not expressed any concern or perceived negative impact from the Cikel REDD project and recognize the benefits of conserving the forest. The only negative point was mentioned by the community members of Ararandewa about the smoke from the charcoal plants, which during the summer causes respiratory discomfort. The charcoal activity is not related to the project as it has been going on since before the implementation of the Cikel REDD project and is outside the project area. But as mentioned in Table 7 this impact has already been mapped previously by CBNS, which has been looking for alternatives to improve the process and performance of its ovens: to this end, the company celebrated a partnership with the "Universidade Federal Rural da Amazônia" (UFRA) to carry out several research to seek opportunities for improvement in its processes (APPENDIX II - Research carried out in partnership with UFRA).

Figure 8. First figure on the left: presentation to the CBNS team. Second figure on the right: first meeting with the chief of Ararandewa and his son

Source: CBNS collection, from June 2022

Figure 9. Top row figures: Meeting with community members from Ararandewa and Surubiju. Figures in the bottom row: Meeting with community members from Barreirinha

Figure 10. Meeting with community members from the neighborhood "Rouxinol"

Community members were invited to participate in the verification process, and interviews with the VVB auditor were scheduled according to their availability.

During the meetings with the community, a folder with a summary in Portuguese of the Cikel REDD project was also distributed (Figure 11).

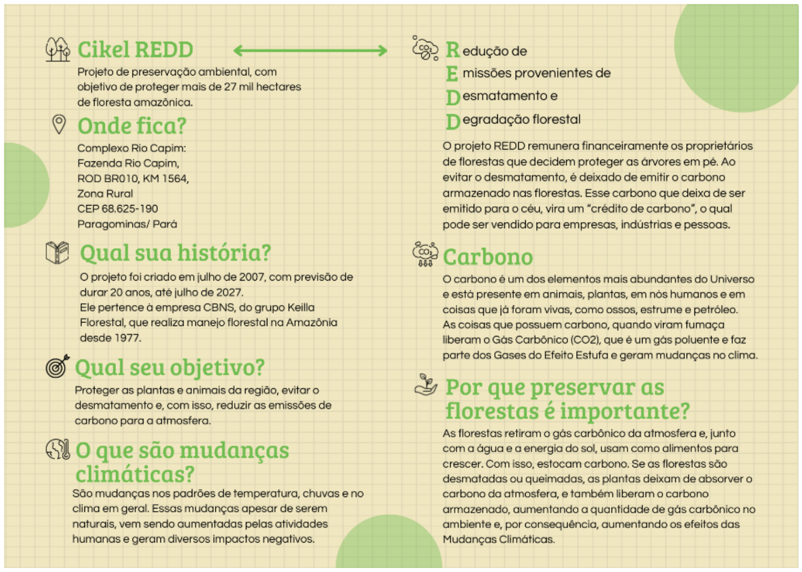

Figure 11. Folder distributed with a summary of the Cikel REDD project (material in Portuguese)

Representatives of the following institutions were also informed about the verification process and participated in the audit process (interviewed by the VVB auditor):

Institution - Portuguese	Institution - English	Nº of participants in the audit
Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA)	Brazilian Agricultural Research Corporation	1
Secretaria de Estado de Meio Ambiente e Sustentabilidade (SEMAS)	Secretary of State for Environment and Sustainability	1
Universidade Federal Rural da Amazônia (UFRA)	Federal Rural University of the Amazon	1
Universidade Federal do Pará (UFPA)	Federal University of Pará	1

The attendance lists of meetings held with community members were made available during the audit.

2.3 AFOLU-Specific Safeguards

As detailed in section "2.1 No Net Harm", the implementation of the project did not bring negative impacts to the community members, as stated by them during the meetings and participatory mapping carried out with community members.

In addition, as mentioned in Table 6, the community members recognize the positive aspects of the REDD project, such as the preservation of the forest. The impacts mentioned in Table 7 refer to sustainable forest management, which is the company's core business and occurs throughout the Rio Capim Complex, not being exclusive to the REDD project. All the impacts mentioned by the communities related to SFMP resulted in action plans and resolutions, which were validated and approved by the community members.

There is an employee from the Social and Environmental Management area of CBNS responsible for maintaining contact and good relationships with the community. Communications are made by email and WhatsApp to schedule visits in loco in advance, according to the availability of the community.

CBNS has a conflict management procedure (*01_PROSP Administração de Conflitos*; 01_PROSP Conflict Management), which includes the following steps:

Contact: Whenever possible, and preferably every month, stay connected with local communities and neighbors. When a possibility or situation of conflicts is identified, the case must be registered immediately with the Property Security area, so that the prevention and/or resolution of the identified situation can proceed. This work will be carried out jointly by the Social Responsibility and Property Security teams, and it can be reconciled with community meetings, social surveys, impact assessments and monitoring rounds.

Identification: When the possibility or existence of a conflict is confirmed, the Property Security area must identify the type of conflict (dispute over land, frustration with generated expectations, prohibition of hunting, fishing or activities in the area, impacts caused by forest activities, illegal logging in the SMFP, attempted invasion, theft of materials, threats to forest workers, etc.) and collect information about it, in addition to reinforcing security at the site and keeping alert.

Conciliation: In the event of an identified conflict, Property Security shall mediate with the agent(s), seeking resolution through conversations and awareness of the agent(s) about the possible implications. The property security team, from the knowledge of the case, will define a period for an attempt of peaceful resolution, not being able to exceed 20 days, or forward it to the Forestry, Legal and Social sectors for the adoption of other appropriate measures, either in legal or with environmental and government agencies.

Other Alternatives: If the situation is not resolved, the Social Responsibility sector must analyze the situation to identify the type of conflict and call an external intermediary, which could be the public agency related to the conflict (examples: Unions, City Hall, Incra, Funai, etc.) which will seek a consensus with the community and the company about a resolution model. For all cases of illegal logging, a report must be issued to the Forestry Sector, which will map the impact to the SFMP and provide appropriate referrals to environmental agencies. In cases of dispute over land, in areas that are leased by Grupo CBNS, registrations will take place and the search for a peaceful resolution will also take place, if there is no agreement, the landowner will be notified so that they can take steps to resolve the case.

Records: Activities, incident reports and court records must be registered in the Qualyteam software by the Social Responsibility and Property Security team.

In 2022, the company implemented a complaints and requests management system through the Qualyteam software. When a request or complaint is received, it is registered in this system, and will be analyzed by the person responsible for the Social and Environmental Management area. The Social and Environmental Management area team is responsible for planning and executing the action plan and evaluating, together with the requester, the effectiveness of the resolution. However, is worth mentioning that during the period of this monitoring report there were operational problems with employees' notebooks and a hacker attack that caused the loss of relevant documents and evidence of the company making it impossible to obtain a complete history of the actions implemented and their effectiveness. As described in section 4.3, after these events, the company adopted the use of a cloud server called Ktree, minimizing the risk of data and evidence loss. The hacker attack did not impact the data relevant to the calculations of emissions and carbon sequestration: for example, the original spreadsheets used for the PD and MR1 are still available, as well as the forest inventory data to determine biomass. The main losses are due exclusively to records of activities carried out in the past (e.g., employee training and activities with community members), such as photos, videos, and attendance lists.

Apart from it, there were no changes in the ownership and right to use the project area, given that Rio Capim Complex belongs to the CBNS group and there are no community members living on the property. Through the mapping of customary uses carried out between 2015 and 2016[15], areas within CBNS that were used by community members to obtain resources were identified, such as areas of açai collection, subsistence hunting and fishing. In this way, the community did not lose access to these areas that are important for the maintenance of their traditions and way of living.

Code of Conduct

CBNS has a Code of Conduct publicly available on the website www.grupokeilla.com.br[16]. The code contemplates ethical and conduct principles, being applied to all employees, service providers, partners, suppliers, as well as all relationships established inside and outside the company. The document can be consulted in full on the website, but in short, the main points covered are:

a. The company does not use or support the use of forced labor and/or similar to slavery in its operations, as well as repudiates and acts against child labor practices (page 9 of Code of Conduct, section 3.2.1);

[15] Documented in "2015_2016_Validacao Areas de Uso_Comunidades"

[16] Code of Conduct available at https://www.grupokeilla.com.br/wp-content/uploads/2022/03/Codigo-de-Conduta-Grupo-Keilla.pdf. Accessed 09 January, 2023.

b. The company does not tolerate abuse of power and attitudes that characterize moral or sexual harassment at work. If such behavior is evidenced, the appropriate penalties will be applied (page 9 of Code of Conduct, section 3.2.3). The project proponent nor any other entity involved in project design or implementation are not involved in any form of discrimination or sexual harassment;

c. It is up to all employees, in the exercise of their attributions, to be committed to preserving the environment, through special respect and express compliance with all rules of procedures, guidelines and laws (page 13 of Code of Conduct, section 7).

The communication channels for reporting concerns regarding conduct, questions or suggestions are:

E-mail: canal.denuncia@grupokeilla.com.br **Phone:** +55 41 2169-8224

Website: https://denuncia.iauditcloud.com.br/grupokeilla

During the monitoring period, CBNS did not receive any denunciation or notification from the communities and workers that would violate the code of ethics and conduct, as reinforced by the statement signed by the company's operations director and made available to the VVB. If any report or complaint is received, it will be handled according to the operational procedure PRO GA 001 "Management of Communication, Conflicts and Treatment of Non-conformities".

In addition, during the monitoring period, the company maintained FSC certification, so external audits occurred annually to validate that they were in accordance with the standard, which also establishes the implementation of mechanisms for resolving conflicts and disputes, and the existence of communication channels with stakeholders, as requested in Principle 2 (Tenure and Rights of Use and Responsibilities) and Principle 4 (Community Relationships and Workers' Rights)[17] of the Forest Stewardship Council standard.

Carbonext also has its own Code of Ethics and Conduct, as well as the Anti-Corruption Policy. Both documents can be accessed in their entirety on the website www.carbonext.com.br/corporate-governance[19].

[17] FSC https://br.fsc.org/br-pt/tipos-de-certificacao/manejo-florestal

[18] https://static.carbonext.com.br/files/codigo-etica-conduta_pt-br.pdf; https://static.carbonext.com.br/files/politica-combate-corrupcao_pt-br.pdf

[19] https://static.carbonext.com.br/files/codigo-etica-conduta_pt-br.pdf; https://static.carbonext.com.br/files/politica-combate-corrupcao_pt-br.pdf

Communication with stakeholders

CBNS has as one of its commitments to establish and maintain a channel for dialogue and conflict management with interested and affected parties, to ensure ethno-cultural and socio-environmental commitment in the efficiency of communication and to achieve conciliation in possible conflicts.

The company has the operational procedure PRO GA 001 "Management of Communication, Conflicts and Treatment of Non-conformities", which determines the guidelines on how communications with stakeholders should take place and the management of conflicts that may occur.

Regarding communication management the PRO GA 001 states that:

a) The person responsible for managing communication with stakeholders and affected parties is responsible for registering all communications received from communities/villages, unions, and public agencies via official letter, telephone/WhatsApp, and/or e-mail;

b) The realization of visits and meetings in communities/villages, unions and public agencies, must be conducted by a prepared professional who has linguistic skills that are aligned to the level of understanding of the public in question (culturally appropriate);

c) All demands received will be registered in the Qualyteam system and directed to the responsible areas. More information about the Qualyteam system is described in section 4.3 item “Management of non-conformities”;

d) The areas will have a maximum deadline of 30 days to resolve the requests, recording all evidence of resolution in the Qualyteam system. The Communication Management Officer will receive the resolution and inform the interested and affected parties.

In the procedure, CBNS also reinforces gender equality, respecting the full and effective participation of women in all meetings and activities carried out by the company. As evidenced in Table 8 and Table 9, women had participation and quorum in the meetings and participatory mappings conducted by the company during this monitoring period.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

Sustainable Forest Management - FSC Certified

Since 1999, CBNS adapted its practices and techniques according to the principles set out in the FSC® Certification: Compliance with all applicable laws and international treaties; Demonstrated and uncontested, clearly defined, long–term land tenure and use rights; Recognition and respect of indigenous peoples' rights; Maintenance or enhancement of long-term social and economic well-being of forest workers and local communities and respect of worker's rights in compliance with International Labour Organization (ILO) conventions; Equitable use and sharing of benefits derived from the forest; reduction of environmental impact of logging activities and maintenance of the ecological functions and integrity of the forest; Appropriate and continuously updated management plan; Appropriate monitoring and assessment activities to assess the condition of the forest, management activities and their social and environmental impacts; Maintenance of High Conservation Value Forests (HCVFs) defined as environmental and social values that are considered to be of outstanding significance or critical importance.

Limited sustainable, FSC-certified, forest management activities have been conducted, with low impact logging taking place on 9,145 ha between 2010 and 2017 (Table 10). During the monitoring period, audits were carried out annually by a third-party accredited certification body. The certification audit dates are described in the Table 11.

Table 10. Forest management areas within the PA during the monitoring period.

Year of SMFP	Property	FMU	AUTEF	AUMP	FMU Area within the PA (ha)	Volume explored
2010	Caculé	13	1450/2010	1450/2010	1,130	33,693
2011	Rio Capim IV	14	2349/2012	140/2013	1,564	25,967
2011	Caculé	14	2044/2011	105/2013	1,141	33,302
2012	Rio Capim IV	15	2299/2012	162/2014	2,80	80,91
2012	Sumal	15	2396/2013	-	2,724	80,369
2013	Rio Capim IV	16	2524/2013	20152/2014	1,193	33,137
2015	Sumal	16	2970/2014	3173/2016	633,89	15,683
2014	Rio Capim IV	17	3013/2015	3182/2016	217,73	3,937
2017	Cauaxi II	20	273133/2017	AU 4070/2019	538,03	14,575
Total					**9,145**	**240,744**

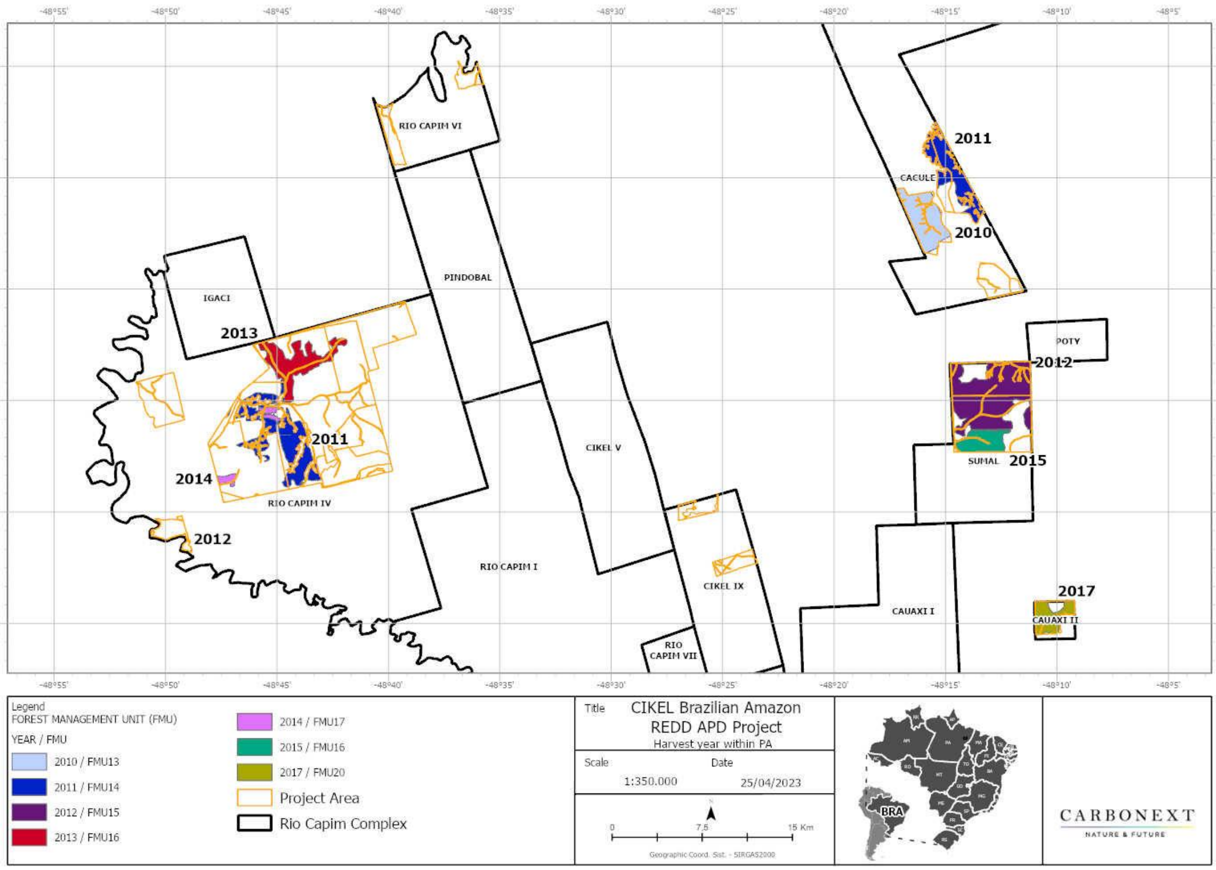

Figure 12: Year of operation of forest management units within the Cikel REDD Project

Table 11. Period of FSC audits and certification validity.

Period	Scope	N° Certificate	Issue date	Expiration date	On-site visit date	Report date
2010	Rio Capim, Sumal, Poty, Caculé, Cauaxi (199.168,26 ha)	SW-FM/COC-005147	01/09/2006	31/08/2011	November 29 to December 03 of 2010	07/02/2011
2011	Rio Capim, Sumal, Poty, Caculé, Cauaxi (199.168,83 ha)	SW-FM/COC-005147	01/09/2006	31/08/2011	July 04 to 08 of 2011	26/08/2011
2012	Rio Capim, Sumal, Poty, Caculé, Cauaxi (199.168,83 ha)	SW-FM/COC-005147	01/09/2011	31/08/2016	October 08 to 13 of 2012	26/02/2013
2013	Rio Capim, Sumal, Poty, Caculé, Cauaxi (199.168,83 ha)	SW-FM/COC-005147	01/09/2011	31/08/2016	July 29 to August 02 of 2014	20/02/2014

2014	Rio Capim, Sumal, Poty, Caculé, Cauaxi (199.168,83 ha)	RA-FM/COC-005147	01/09/2011	31/08/2016	September 01 to 05 of 2014	23/02/2015
2015	Rio Capim, Sumal, Poty, Caculé, Cauaxi (199.168,83 ha)	SW-FM/COC-005147	01/09/2011	31/08/2016	September 28 to October 02 of 2015	22/02/2015
2016	Rio Capim, Sumal, Poty, Caculé, Cauaxi (197.168,826 ha)	RA-FM/COC-005147	01/09/2016	31/08/2021	May 16 to 20 of 2016	19/07/2016
2017	Rio Capim, Sumal, Poty, Caculé, Cauaxi (199.168,83 ha)	SW-FM/COC-005147	01/09/2016	31/08/2021	September 18 to 22 of 2017	25/02/2018

Surveillance and Property Security

To prevent encroachment by outside actors, the company hired the services of third-party companies to carry out the monitoring and surveillance of the property, including ground and fluvial monitoring. The third-party companies had the obligation to keep guards at the monitoring stations and farm entrances (Figure 13) for 24 hours, every day of the week, including holidays. Motorized patrols were also carried out on the farm's properties, and these took place from Monday to Friday. In April 2013, CBNS hired the services of the company NOSERG, which kept three armed guards at the monitoring posts, but this service only occurred during the night (from 7 pm to 7 am) and every day of the week. The main responsibilities of the third-party team are:

- To inhibit the criminal action practiced by third parties against the farms of the Rio Capim complex;
- Prevent the intrusion of strangers into the RCC;
- Prevent the exit and entry of material without authorization;
- Immediately report to CBNS' management when a change or disturbances are detected in the vicinity of its areas of operation or within the area;
- Provide protection to employees.

These actions are important to prevent the invasion of external agents and the occurrence of illegal practices, such as wood extraction, illegal hunting, forest fires, among others.

Along with the third-party team, there is a CBNS supervisor, who monitors the activities of the third-party company and ensures the integrity of services and good practices in accordance with the CBNS' standard procedures. In the event of any occurrence, the supervisor is responsible for generating reports and recording the events.

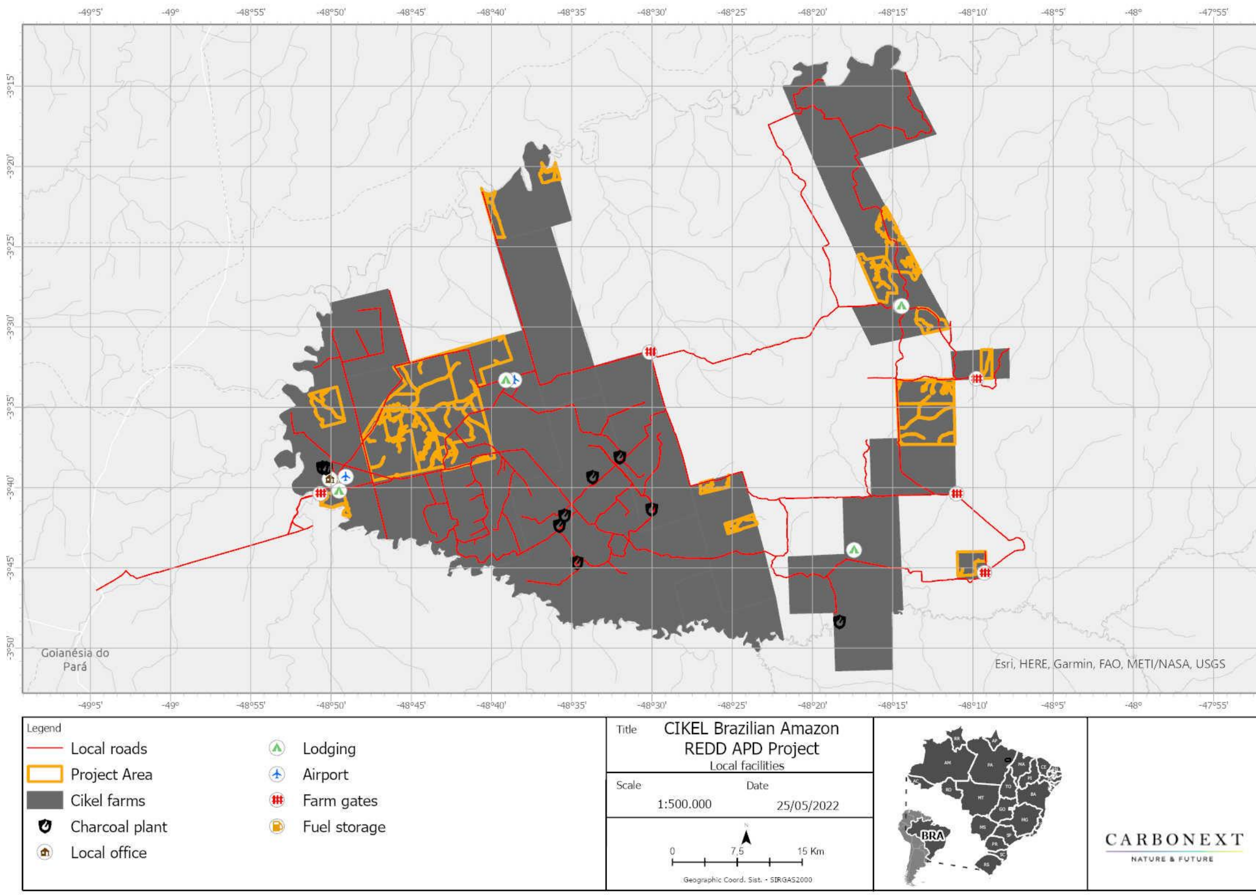

Figure 13: Infrastructure in the Rio Capim Complex

CBNS also continues to implement its fire management/prevention plan on the project area, involving an equipped fire brigade on-site that has conducted annual trainings, forest fire prevention signs visible along roads, safety meetings with employees and third parties and meeting with neighbors for covering fire risk and prevention.

Figure 14: Fire brigade team

Source: CBNS archive, from September 17, 2015

Minimizing leakage

In this avoiding planned deforestation project, the baseline agent of deforestation is the same as the project proponent and generally, leakage mitigation activities are directed to the baseline agents to minimize risk of displacement of activities. During the project monitoring period (July/2010 – July/2017), CBNS had difficulties in selling the credits generated in the first monitoring report (July/2008 – July 2010), due to the low demand for credits and the low price practiced in the market. Buyers tend to value newer offsets over older offsets, and there are many offsets available for sale that were issued before 2016, and thus those suppliers may have been more competitive and offered lower prices to attract buyers, so before 2016 many offsets were sold at a lower average price of $2.9/tCO_2$[20]. However, even with this unfavorable scenario, the company maintained monitoring activities inside the area of the REDD project, so that the area remained conserved. It also only carried out low-impact and FSC-certified forest management.

HCV Areas

In 2010, in response to the demand for forest certification under the precepts of the FSC, the technical team of CBNS indicated three areas of High Conservation Value within its complex of Forest Management

[20] Forest Trends, 2017. https://www.forest-trends.org/publications/unlocking-potential/

Area, totalizing 4,114 hectares. However, only de HCV 2 is within the REDD project area and has an area of 1,767 hectares (Figure 15).

HCV 2 and HCV 3 share the same characteristics, as both are located on the banks of the Capim River, where some points of the topography and soil favor the emergence of marginal lakes, connected to the river, apparently even in the dry season. These environments have great importance in nutrient cycling with high primary productivity. For fish, the marginal lakes have special importance, since these areas are colonized, from the contact with the rivers, by fish eggs and larvae. Thus, the recruitment of fish populations is strongly associated with the flooding cycle of these areas. Migratory species strongly depend on marginal lakes to complete their reproductive cycle, highlighting these areas as natural breeding grounds, due to their habitat diversity, providing a large amount of food and shelter from predators for several species of fish. The marginal lakes of the Capim river basin are surrounded by palm groves, with a predominance of species of hydromorphic soils such as the Jauari (*Astrocaryum jauari*), and the fruits of this palm are important in the diet of several species of fish (Figure 16).

CBNS monitored these areas through the evaluation of satellite images and on-site visits, certifying that during the monitoring period (July/2010 – July/2017), there was no deforestation or degradation in these areas of high conservation value. During this period, the following reports were produced:

- February 2011: The identification and validation report of the 3 areas of high conservation value of the Rio Capim Complex was published.
- 2013: The HCV monitoring plan was prepared, establishing the methodology and parameters to be analyzed.
- October 2014: The HCV area monitoring report was prepared for the period 2011, 2012, 2013 and 2014, in which satellite images were used to analyze whether there was deforestation or degradation in the areas, but they remained intact in this period.
- 2016: The monitoring report for the period of 2015 and 2016 was prepared, and there was also no degradation or deforestation in the HCV areas in this period.
- 2018: The monitoring report for the period 2017 and 2018 was prepared. Through NDVI analysis, they found that between 2017 and 2018, the increase in vegetation in the HCV 2 area was 0.3. This result demonstrates that there is no deforestation or degradation in the HCV 2 area, showing that it has been conserved, as the NDVI index behaved in an increasing way over the years evaluated.

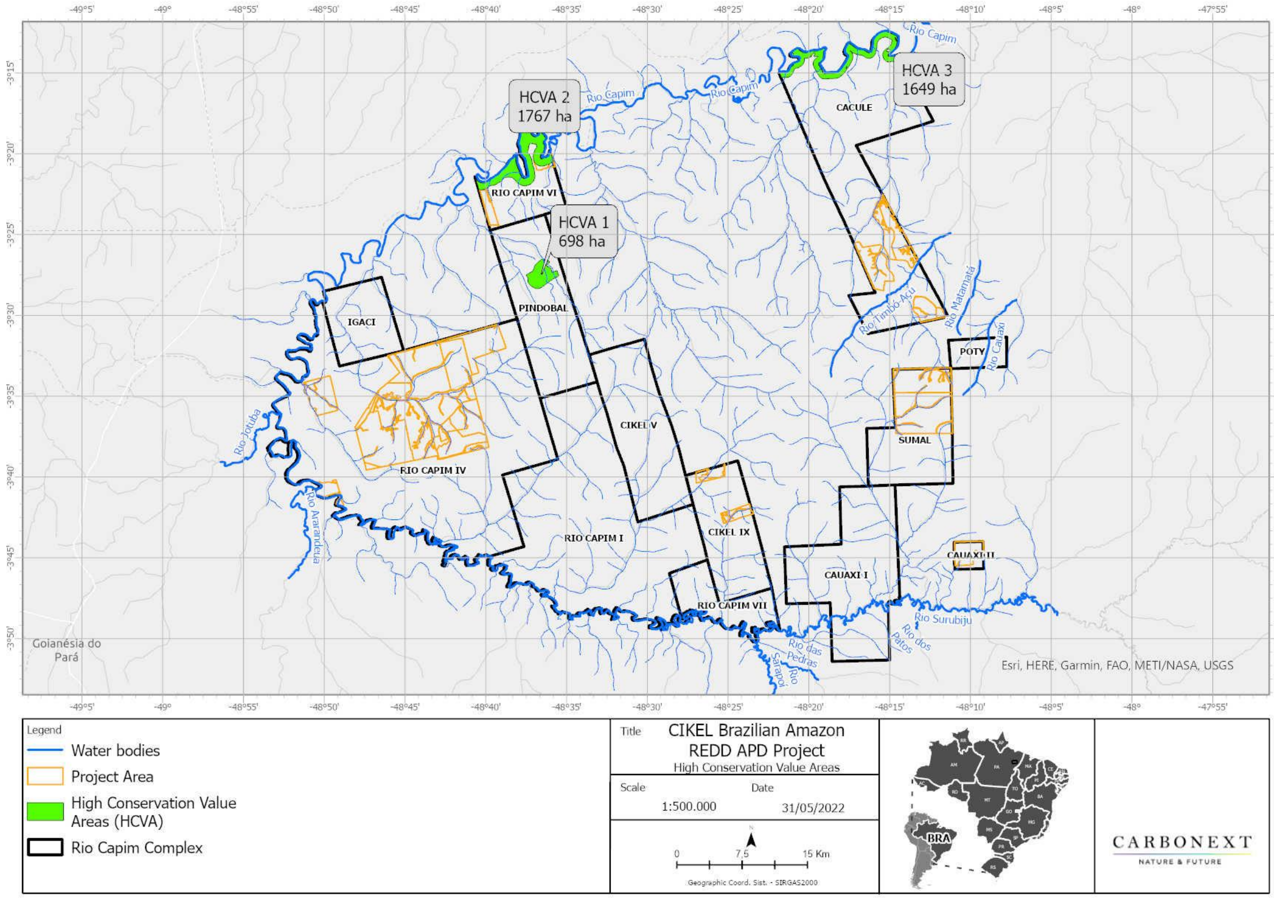

Figure 15: HCV Areas identified in the Rio Capim Complex

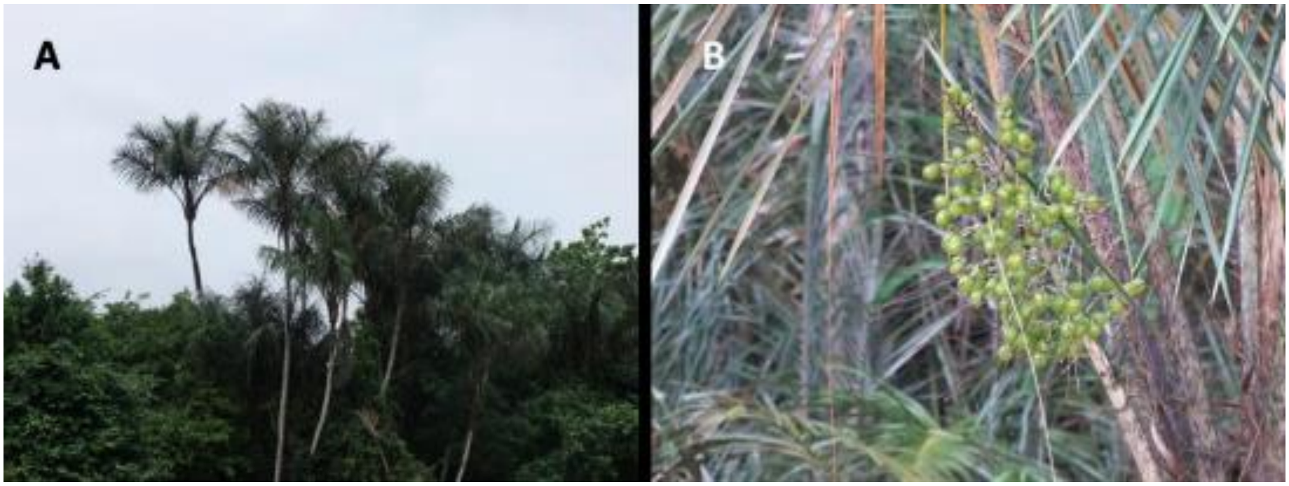

Figure 16: A – Jauari (*Astrocaryum jauari*), dominant palm species in the area of the marginal lakes of the Capim River; B –Jauari fruit

Source: CBNS collection, from January 2011

Table 12. Activities and actions that took place in the Cikel REDD project during the monitoring period of this report.

Year	Date/Period	Description
Disclosure		
2011		Cikel published the Sustainability Report for the year 2010.
FSC		
2010	October 19 to 23	FSC Audit
2011	July 4 to 8	FSC Audit
2012	October 8 to 13	FSC Audit
2013	June 18 to 23	An internal audit was carried out by the Cikel team to assess the development of activities, as well as the engagement of stakeholders with the operational processes and FSC and Chain of Custody certification, and also identify opportunities for improvements and adjustments for full compliance with the legal and certification standards inherent to the company's activities.
2013	July 29 to August 2	FSC Audit
2014	June 03 to 13	An internal audit was carried out by the Cikel team to assess the development of activities, as well as the engagement of stakeholders with the operational processes and FSC and Chain of Custody certification, and also identify opportunities for improvements and adjustments for full compliance with the legal and certification standards inherent to the company's activities.
2014	September 1 to 5	FSC Audit
2015	September 28 to October 2	FSC Audit
2016	May 16 to 20	FSC Audit

2017	September 18 to 22	FSC Audit
Institucional Stakeholder		
2011	January 31	A meeting was held with EMBRAPA to present the REDD project and possible research partnerships in the area of biodiversity. In total, 16 people participated.
2011	March 29	The Cikel team presented the REDD project at the event "Seminar to Celebrate the Impact on Combating and Controlling Deforestation and Environmental Regularization", held in the municipality of Goianésia, State of Pará. Altogether, 467 people from different institutions participated, such as government agencies, non-governmental institutions, unions, and associations.
2011	April 1	A meeting was held about the project at the city hall of Paragominas. Altogether, 27 people participated.
2011	May 21	A meeting was held with CBNS customers and entrepreneurs about the project. Altogether, 14 people participated.
2012	January 02	Cikel invited representatives from different institutions, such as SEMA, IFT, IMAZON, EMBRAPA, Municipalities of Paragominas and Goianésia do Pará, AIMEX, FIEPA and entrepreneurs from the surroundings of the Rio Capim Complex to a presentation about the project. Altogether, 16 representatives participated, who were positive and interested in the project, in addition to claiming that it would be a pioneering project for the region.
Community		
2011	March	Development of Procedure relating to the Compensation of Possible Losses and Damages (PROSP02)
2011	March, 28	A meeting was held with the residents of Vila Rouxinol about the REDD Cikel project and climate change. Altogether, 50 community members participated.
2011	March 30 to 31	A meeting was held with residents of the Barreirinha community about the REDD Cikel project. Altogether, 42 community members participated.
2011	May	Communities in Cikel's forest management area were identified and described through participatory work.
2011	May 18 to 19	Social diagnoses were carried out with surrounding communities to assess the social impacts caused in communities by the company's operations and analysis of their priorities. 12 community members from the Barreirinha community and 11 from the Ararandeua community participated. Also, 70 Cikel employees were consulted about the perception of the company's impacts.
2011	August 9	A meeting was held with the residents of the rural road near Rio Capim to include them in the report about the social impacts caused by the company's activities and determine mitigation plans. Altogether, 6 residents participated.
2011	September	Development of Procedure relating to Conflict Management (PROSP01)
2012	January 20	A meeting was held with residents of the Ararandeua community about the REDD Cikel project. Altogether, 13 community members participated.

2013	May 28	Three representatives of the Ararandeua Indigenous community requested a visit from Cikel representatives to monitor the progress of the REDD project. In addition, they raised concerns about hunters and fishers who were entering the area to exploit resources without the consent of the community, so they were seeking reinforcements from FUNAI to avoid conflicts.
2015	May 04 to 05	The Monitoring Report of the Social and Environmental Impact in the CBNS Forest Management Area was carried out, presenting the results of mitigation actions for the period between September 2014 and May 2015. To prepare the report, 13 residents of the Ararandeua community, 48 employees of the charcoal plant, 11 of the Barreirinha community and 36 of the Rouxinol community were consulted, totaling 108 participants.
2016	April	The Monitoring Report of the Social and Environmental Impact in the CBNS Forest Management Area was carried out, presenting the results of mitigation actions for the period between May 2015 and April 2016.
Biodiversity		
2011	March	A technical report was carried out by Dr Ana Cristina Mendes de Oliveira from the Federal University of Pará on the importance of forests in the Capim River complex for the conservation of fauna and fauna in the Guamá/Capim watershed.
2012	September 12 to 14	Training was carried out for Cikel employees to update the collection methodologies and for preliminary data analysis of data collected in fauna monitoring. The course was carried out by the Ecology and Zoology group at the Federal University of Pará.
Areas of High Conservation Value (HCV)		
2011	February	A “Validation Report of HCV Areas” was produced, and three (3) High Conservation Areas were identified within the Rio Capim Complex, but just the HCV 2 is in the PA (Figure 15).
2013		A monitoring plan was prepared for the areas of high conservation value in the Rio Capim Complex, establishing the monitoring methodology and schedule.
2014	October	A monitoring report was carried out on areas of high conservation value, and through the analysis of satellite images from the years 2011, 2012, 2013 and 2014, it was found that there were no external influences on the environment (fire, deforestation, or environmental degradation), so that the HCV remained intact in this period.
2016		A “Monitoring Report of HCVA Conservation Status” was carried out for the period of 2011 to 2016. Analyzes of annual satellite images of the mentioned period were carried out, and no changes in land use were identified in the HCV areas.
Health, Safety and Environment (HSE)		
2011	May	A report was carried out on the conditions of Cikel's infrastructure, in particular the areas most used by employees, such as accommodation, cafeterias and bathrooms. At the end of the report, opportunities for improvement and need for reforms were pointed out principles to guarantee the health, safety and well-being of employees and third parties

2011		The "Safe Behavior Program" (Programa de Comportamento Seguro) was implemented based on the Task Risk Assessment (Observação de Risco na Tarefa - ORT), which aims to reduce behaviors associated with unsafe conditions found in the company's employees' tasks.
2012		The "Work Accident Reduction Program" (PRAT) program was implemented, which is focused on excellence in health, safety, and the environment. It comprises the following tools: training; form called "Fale-Fácil" to report daily deviations or anomalies during inspections and hygiene and safety audits; permit to work (PTW) to ensure that only authorized employees carry out potentially hazardous activities; and signage in the area. The program is complementary to the "Safe Behavior Program".
2012	August 24	A vaccination campaign was carried out for CBNS employees, with the application of tetanus, yellow fever, hepatitis B and influenza vaccines.
2013		Implementation of the "Solid Waste Management Plan" (PGRS, in Portuguese), with the aim of proposing the correct management of solid waste generated at the Rio Capim Complex, in order to establish procedures and strategies for the adequate management of these residues, in accordance with the guidelines established by the environmental legislation.
2013	May 01	The "Environmental Risk Prevention Program" (PPRA, in Portuguese) was implemented with the purpose of establishing a methodology that guarantees the preservation of the health of workers against the risks of the work environment. In addition to complying with legal requirements, the program also aims to eliminate or reduce the risk of accidents at work, concentration of harmful agents and avoid exposure or permanence of workers in environments susceptible to risks.
2015	April 28	An inspection was carried out in the accommodation aiming at safety, health, and well-being issues of the employees, in addition to identifying repairs and improvements in infrastructure.
2015	May 06	An occupational health and safety inspection report was carried out at the entrances to the Rio Capim Complex
2015	May 13	An inspection was carried out in the accommodation aiming at safety, health, and well-being issues of the employees, in addition to identifying repairs and improvements in infrastructure.
2015	May 19	Renovations were carried out in the accommodations, including painting in the internal and external areas; general electrical and hydraulic maintenance; and repairs to the roofs, bathrooms, and bedrooms.
2015	August 24	A lecture on sexually transmitted diseases was held (STD), with the aim of raising awareness about prevention and treatment. Altogether, 29 employees participated.
2016	March	An occupational health and safety inspection report was carried out at the entrances to the Rio Capim Complex
2016	April 13	An inspection was carried out in the accommodation aiming at safety, health, and well-being issues of the employees, in addition to identifying repairs and improvements in infrastructure.

2016	August 18	A lecture was given to CBNS employees on sexually transmitted diseases, in addition to HIV, syphilis and hepatitis C tests.
2017	July 05	Eye exams were offered to employees and at the end of the exam, a lecture on eye care was held.
Training		
2011	May 16 to 20	A training of forest fire brigade was carried out for 21 CBNS's employees.
2013	April 18	Training on leadership in the work environment was carried out, with 9 employees participating.
2014	September 04	Training in forest management techniques and occupational safety was carried out for the employees of the JP company, which carries out forestry operations in the CBNS area. The training was attended by 47 employees.
2014	December 19	The "Training of work instructions and socio-environmental responsibility" was carried out for the employees of the SOMA company, which carries out forest management in the area of CBNS. The goal was to present the procedures that must be followed by employees who work in the areas of forest management at CBNS, focusing on reduced impact forest management techniques, work safety and care for the environment. Overall, 28 employees participated.
2015	July 09	First aid training was carried out with the employees of SOMA and JP companies, which carry out forestry operations in the CBNS area. The training covered basic concepts of first aid for burns, injuries, respiratory arrest, among others. Altogether, 81 employees participated.
2015	July 11 to14	Training was carried out in special techniques for logging and safety in forest management, aiming at greater use of the logs, greater safety at work and minimizing impacts and damages during the logging operation. The course was given by Instituto Floresta Tropical (IFT) for employees of SOMA, which carry out forestry operations in Cikel's areas. Altogether, 10 employees participated.
2015	August 17 to 19	Training was carried out in techniques for planning and building decks, roads, and infrastructure in forest management, aiming at greater efficiency and less forest damage, in addition to avoiding accidents in operations. The course was given by Instituto Floresta Tropical (IFT) for employees of J.P. Souza Madeiras, Terra Brasil, and Montana Madeiras, which carry out forestry operations in Cikel's areas. Altogether, 11 employees participated.
2015	August 18 to 20	Training was carried out in special techniques for logging and safety in forest management, aiming at greater use of the logs, greater safety at work and minimizing impacts and damages during the logging operation. The course was given by Instituto Floresta Tropical (IFT) for employees of J.P. Souza Madeiras, Terra Brasil, and Montana Madeiras, which carry out forestry operations in CBNS's areas. Altogether, 33 employees participated.

2015	November 25 to 26	Training in hearing protection was carried out with the aim of providing guidance on the care and safety equipment needed to reduce the risk of hearing loss caused by noise. In all, 18 employees participated.

Table 13. Impact of project activities on GHG emissions

Activity	GHG Emissions Removal/Reduction
Fire Brigade Training	Positive impact on the reduction of GHG emissions, because with more efficient teams for fire control and prevention, there is a tendency to reduce the number of fire outbreaks and, in the event of an incident, it is dealt with more quickly and efficiently.
Training in Sustainable Forest Management Techniques	Positive impact on the reduction of GHG emissions, because with the improvement of forest management techniques, there are less impacts during operations, resulting in greater use of the trees harvested, reduction in mortality during the fall and better planning of infrastructures
Preservation of Areas of High Conservation Value (HCV)	The maintenance of high conservation value areas contributes positively to the reduction of GHG emissions by preventing deforestation and degradation of these environments.
Maintenance of FSC Certification	Maintaining the FSC forest management certification contributes positively to the reduction of GHG, given that it is necessary to comply with strict criteria for low-impact forest management.
Biodiversity research	Experimental analyzes have shown that changes in the abundance of animals can cause major changes in the capacity of ecosystems to store or exchange carbon. In some cases, these changes, in the same ecosystem, cause this environment to change its status. Instead of being a carbon source for the atmosphere when the animal population is not abundant, it becomes a carbon-fixing region when animals are plentiful. In tropical forests, such as the Atlantic Forest or the Amazon Forest, the conservation of large mammals maintains the environmental services of these ecosystems vigorously, including the dispersal of seeds by fruit-bearing animals and the support of plant production by herbivores, which favors the fixation of carbon. One of the studies[21] showed that a 3.5-fold increase in mammal species in a region caused carbon retention to increase by up to 400% in the same region. In this way, it can be assumed that conducting research, monitoring biodiversity in the project area and preserving their habitat contribute positively to the local carbon cycle.

[21] C Bello. "Defaunation affects carbon storage in tropical forests", 2018. Available: https://www.science.org/doi/pdf/10.1126/sciadv.1501105 Accessed July 25,2022.

Social activities	The mapping of important forest areas (through participatory mapping) for community members are environmental awareness activities and contributes positively to the reduction of GHG emissions, as community members understand the need to conserve natural resources for the maintenance and perpetuation of their traditions and way of life. Through the strengthening of this man-nature relationship, there is a reduction in activities that cause the loss of vegetation cover, such as forest degradation. This is evidenced, for example, by the community members' statement that they do not harvest wood for charcoal, preferring to buy charcoal or cooking gas.

3.2 Deviations

3.2.1 Methodology Deviations

According to Section 3.19 of the VCS Standard (v4.4) definition of methodology deviations, there were no methodology deviations on this MR, only project description deviations described in the next section.

3.2.2 Project Description Deviations

The VCS Standard v4.4 states in the item 3.20.2 that: "The procedures for documenting a project description deviation depend on whether the deviation impacts the applicability of the methodology, additionality, or the appropriateness of the baseline scenario. Interpretation of whether the deviation impacts any of these shall be determined consistent with the *CDM Guidelines on assessment of different types of changes from the project activity as described in the registered PDD*[22], mutatis mutandis." Considering these guidelines, the deviations mentioned below did not result in changes in the PD, because they did not impact the applicability of the methodology, additionality, or the appropriateness of the baseline scenario. The explanations of each deviation are in the topics below (from 3.2.2.1 to 3.2.2.8). All the project description deviations were applied during the monitoring period analyzed in this report, that is, from July 19, 2010 to July 18, 2017.

Besides the deviations mentioned below, an updated PD was submitted, in which the following changes were made:

[22] Annex 67. CDM. Available at https://cdm.unfccc.int/EB/048/eb48_repan67.pdf

I. Inclusion of the "Tool for testing significance of GHG emissions in A/R CDM project activities, version 1.0" in the section 2.1 of the PD. This tool was not used in the PD, however it was used in this monitoring report, so the inclusion in the PD was to maintain consistency.

II. Updating of the AFOLU Non-Permanence Risk Tool version from 3.1 to 4.0 in section 2.1 of the PD. This update was necessary, because as mentioned in section 1. Introduction and Scope of the AFOLU Non-Permanence Risk Tool v4.0: "*This document shall be updated from time-to-time and readers should ensure that they are using the most current version of the document*."

3.2.2.1 Carbon Stocks and Forest Inventory

In the PD, it was planned that the first remeasurement of the forest inventory would be in 2015. However, because of the low price of carbon credits in the past and the difficulty of selling the credits from the first monitoring period, the project proponent could not afford the proposed remeasurement for 2015. The non-execution of an activity planned by the project represents a deviation from the PD but has no impact in the applicability of the methodology, additionality, or the appropriateness of the baseline scenario, as explained below. Furthermore, there is no deviation regarding the requirements of VMD0001 v1.0, which states in section "5 Procedures" (subitem "Frequency of measurement for baseline above- and belowground biomass stocks"), that "above- and belowground biomass stock estimates are valid in the baseline (i.e. treated as constant) for 10 years, after which they must be re-estimated from new field measurements". In this context, the methodology endorses using the inventory biomass data until 2017, as applied in this Monitoring Report.

The carbon stocks values previously used for this project (PD and MR1) were maintained for the MR2. Those values come from field measurements of multiple forest inventories done from 2003 to 2011 (±4 years of the project start date) and an average biomass of these years was obtained to estimate the biomass of the year 2007 (start date of the project), which is in accordance with what is established by VMD0001 v1.0 that states that "Measurements of initial stocks employed in the baseline must take place within ±5 years of the project start date". Methodology and results of the forest inventories follows all requirements pointed out in VM0007 v1.0 modules (VMD0001 v1.0 and VMD0015 v2.0) and counted with CBNS and other entities to produce this data. A QA/QC procedure was also adopted to guarantee the data integrity. All records about this robust carbon stock estimation can be assessed on PD's Annex 5 ("Forest Biomass Inventory Results for the Rio Capim property, CBNS, REDD project areas, Paragominas, Para, Brazil").

The main parameter related to forest inventory and field measurements in VMD0015 (M-MON, v2.0) is $C_{AB,tree,i}$, defined as "Carbon stock in aboveground biomass in trees in the project case in stratum i". This parameter originates from VMD0001 (CP-AB, v1.0) where monitoring frequency must occur at least every ten years for baseline renewal or at least every five years where carbon stock enhancement is included. The project start date was July 19, 2007, then the first baseline is valid until July 18,2017. Because no carbon stock enhancement was considered to this MR, the $C_{AB,tree,I}$ can be treated as a constant for 10 years. Since this MR covers a crediting period until July 18, 2017, there is no need for another remeasurement for $C_{AB,tree,i}$ parameter, according to VM0007 v1.0 modules (VMD0001 v1.0 and VMD0015 v2.0).

The uncertainty of this inventory is mentioned in the section 5.1.8 Uncertainty, but as described in the "Forest Biomass Inventory Results for the Rio Capim propriety" report, the total sample size for the forest inventory was 152 plots, which was the sample size required to achieve the target accuracy of +/- 15% with a mean of 95% confidence, in compliance with the VMD0001 v1.0 request of confidence interval of 90%.

PD also points out that: "Post 2015, forest carbon stock estimates will be updated for any strata where deforestation or natural disturbance is detected." During this monitoring period, 29.32 hectares of deforestation were detected in the project area, therefore leading to insignificant emissions from deforestation, given that it represents less than 5% of the total project emissions, according to the "Tool for testing significance of GHG emissions in A/R CDM project activities, version 1.0". So, there would be no need of remeasuring carbon stock.

Besides that, carbon stocks changes related to deforestation and forest degradation (associated with low impact logging activities) are already being discounted throughout project emissions (5.2.2.2). Thus, it can be understood that re-measurement is not necessary to assess carbon loss once it is already being calculated. It is also important to state that no illegal logging (for charcoal for example) was detected on the PA.

Also, the secondary forest (FS) stratum within the project area is expected to increase its carbon stock due to forest growth. So, using the previous $C_{AB,tree,i}$ value can be understood as conservative, because it does not contemplate this increase in stock.

According to Section 3.20.2 of the VCS Standard (v4.4), this deviation fits as a Project Description Deviation once it differs from original measurement and monitoring plan, but not from methodology requirements. The deviation doesn't affect the applicability of the methodology, additionality or the appropriateness of the baseline scenario, because the $C_{AB,tree,I}$ value that is being considered in this monitoring is the same that was validated in the PD.

3.2.2.2 Adjustment due to removal of the Permanent Preservation Areas

During the validation process, 0.2 ha of Permanent Preservation Areas (PPA) were considered part of the Project Area and these constitute a part of the planned deforestation areas. However, according to Brazilian legislation, forest suppression is not allowed in PPAs. Therefore, in order to be consistent with the law, PPA areas were removed from the current monitoring report, as shown in Table 14. However, as it is a very small area, this adjustment is not significant and does not impact the project's GHG calculations: when the PA is updated from 27,434.9 to 27,434.7 hectares there is no change in the net REDD benefits for the monitoring period and in the total VCUs, maintaining the values of 5,186,724 tCO2e and 4,364,505tCO2e respectively, in both cases.

Table 14. Adjustment of PA strata.

Strata	Previous Area (ha)	Adjusted Area (ha)
FOD	19,687.4	19,687.4
FS	7,747.3	7,747.3
PPA	0.2	0.0
Total	**27,434.9**	**27,434.7**

According to Section 3.20.2 of the VCS Standard (v4.4), this deviation fits as a Project Description Deviation once it excludes an area in a conservative manner. The deviation doesn't affect the applicability of the methodology, additionality or the appropriateness of the baseline scenario, since it only excludes an insignificant area of the PA, in order to fit legislative requirements.

This update was applied for the period of this monitoring report (19/July/2010 to 18/July/2017).

3.2.2.3 Compensation/reforestation accounting

In the present MR, the calculation of carbon removal from the offset planting that was considered in the validated PD was adjusted, causing a reduction in the predicted carbon sequestration for the period from 2008 to 2017, reducing its value from 1,491,269 to 441,594 tCO_2. The reason for this deviation is clarified below.

As explained in page 61 of the PD, this offset planting would only occur if the suppression plan was executed, so this activity would be a consequence of the baseline scenario and do not change the core of baseline activities. Therefore, this project deviation does not have impact in the appropriateness of the baseline scenario, because it remains the same, which is the execution of the suppression plan followed by implementation of livestock activities.

According to Section 3.20.2 of the VCS Standard (v4.4), this deviation constitutes a Project Description Deviation, as it updates miscalculated values. The deviation doesn't affect the applicability of the methodology, additionality or the appropriateness of the baseline scenario, since it only changes the carbon removal of the offset planting based on more reliable data as described in Table 20. Although the Table 18 and Table 19 show values from 2008 to 2017, this update applies only for the period of this monitoring report (19/July/2010 to 18/July/2017). The previous years were shown only to demonstrate the dynamics of carbon sequestration over the 10 years originally planned.

The compensation/reforestation activity, as pointed out in the PD, is not claimed to be an ARR activity. Instead, this is a mandatory activity according to local legislation (Law no. 12.651, of May 25, 2012[23]) if the planned deforestation had occurred in the baseline. So, the compensation/reforestation is being discounted from the carbon credits as a removal that would have hypothetically occurred in the baseline scenario.

Since this activity is not being claimed to generate carbon credits from ARR project type, the mandatory issue doesn't affect project additionality, being instead only a baseline carbon pool accounted for. Additionality would have been compromised only if the project had claimed carbon credits from this reforestation activity, given that the PP is obliged by the government to do so (but this was not the case and because PP didn't deforest, no reforestation occurred in the first place).

The change in the rate of carbon removal by the offset planting occurred because we realized that the PD applied a calculation rationale that led to an overestimation of carbon sequestered by the plantation.

In the PD, they considered the following parameters to calculate carbon sequestration:

Table 15. Parameters applied in the PD to calculate the carbon sequestration by the offset planting

Parameter	Value/Equation	Source
BCEFs	4	Derived from Table 4.5 in IPCC 2006 GL Chapter 4 Forest Lands
CF	0.47	Table 4.3 in IPCC 2006 GL Chapter 4 Forest Lands. Default value.
C to CO_2e	3.67	44/12 Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}
Area-Weighted Average Growth Rate (m^3/ha/yr)	4.2	Calculated as area-weighted growth rate among the three species proposed for reforestation (*Carapa guianensis*, *Tabebuia avellanedae* and *Hymenaea courbaril*)[24].

[23] Law no. 12.651, of May 25, 2012.

[24] TONINI, H; ARCO-VERDE, M.F.; SA, S.P. Dendrometria de espécies nativas em plantios homogêneos no estado de Roraima: andiroba (Carapa guianensis Aubl), castanha-do-Brasil (Bertholletia excelsa Bonpl.), ipê-roxo (Tabebuia avellanedae Lorentz ex Griseb) e jatobá (Hymenaea courbaril L.). Available at: https://doi.org/10.1590/S0044-59672005000300008

R (ratio of below-ground biomass to above-ground biomass)	EXP (-1.085 + 0.9256 LN(aboveground biomass density)	Cairns et al 1997 equation. Table 4.A4: All Forests ABD. IPCC Good Practice Guidance for LULUCF[25]
Hectare to reforest per year	930	Area to be reforested to comply with the legislation.

To calculate the carbon sequestration, the rationale detailed below was applied in the PD. It is important to note that in the previous PD and MR, the equations and rationale mentioned below were not clearly described. They were included in the current MR to make clear and transparent which rationale was developed previously.

$$(1)\ Aboveground_{biomass} = G_f * \mathrm{BEFCs} * \mathrm{CF} * \left(\frac{44}{12}\right)$$

$$(2)\ Belowground_{biomass} = \mathrm{EXP}\ (-1.085 + 0.9256\ \mathrm{LN(Aboveground_{biomass}})$$

$$(3)\ Total\ ABG_{biomass} = \mathrm{Belowground_{biomass}} + \mathrm{Aboveground_{biomass}})$$

Where:

Total $ABG_{biomass}$: sum of above-ground and below-ground carbon stock, tCO_2/ha

G_f: annual change in growth rate at time t_i, m^3/ha

BEFCs: expansion of merchantable growing stock volume to above-ground biomass, tonnes/m^3

CF: carbon fraction of dry matter, tonne C

44/12: Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}

The annual increment in growth should be calculated using the following equation:

$$G_f = \frac{(G_{t2} - G_{t1})}{t_2 - t_1}$$

Where:

G_f: annual change in growth rate between at two points in time, m^3/ha

[25] IPCC Good Practice. <https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp4/Chp4_4_Annexes.pdf>

G_{t2}: growth rate at time t_2, m^3/ha

G_{t1}: growth rate at time t_1, m^3/ha

However, instead of applying the above rationale to obtain the annual change in growth (G_f), they used the cumulative growth, because of that, the G_f parameter was overestimated. The results obtained in the PD are shown in the table below. The column "Total ABG tCO2/ha" shows that the above-ground and below-ground carbon stock was unrealistic. For example, the ABG of the forest types present in the Cikel REDD project area, FOD (Dense Ombrophylous Forest,) and FS (secondary forest), are 642 tCO_2/ha and 388 tCO_2/ha, respectively. Both forest types present in the project area were more than 10 years old at the start date, as a methodology requirement, so it is inconsistent for a 7-years-old planted forest to have a higher ABG stock, which, according to the calculation applied in the PD, would have 752 tCO_2/ha (Table 16). Due to this factor, an overestimated carbon sequestration of 1,491,269 tCO_2 was calculated in the PD over a period of 10 years.

Table 16. Total carbon stock (ABG) calculated in the PD for the offset planting.

Planting Year		Aboveground (tCO_2/ha)	Belowground (tCO_2/ha)	Total ABG (tCO_2/ha)	Offset Planting (ha/yr)	Total Removal (tCO_2)
2008	**1**	0.0	0.0	**0**	**930**	**0**
2009	**2**	29.0	7.6	**36.6**	**930**	**34,003**
2010	**3**	86.9	22.1	**108.9**	**930**	**101,297**
2011	**4**	173.7	43.1	**216.8**	**930**	**201,639**
2012	**5**	289.5	70.6	**360.1**	**930**	**334,875**
2013	**6**	434.3	104.4	**538.7**	**930**	**500,894**
2014	**7**	608.0	144.4	**752.4**	**930**	**699,610**
2015	**8**	810.7	190.5	**1,001.2**	**930**	**930,950**
2016	**9**	1,042.3	242.7	**1,285.0**	**930**	**1,194,853**
2017	**10**	1,302.8	300.9	**1,603.8**	**930**	**1,491,269**

Therefore, it was necessary to adjust this carbon sequestration calculation.

Gardon *et al* (2020)[26], conducted a systematic and integrative review to search for biomass or carbon evaluations conducted in Brazilian Passive Restoration (PR) and Active Restoration (AR) sites. PRs refer to restoration techniques with no action taken except to cease environmental stressors such as agriculture or grazing (e.g. natural regeneration). ARs, in turn, refer to implementation techniques such as planting

[26] Gardon, F. R., dos Santos, R. F., & Rodrigues, R. R. (2020). Brazil's forest restoration, biomass and carbon stocks: A critical review of the knowledge gaps. *Forest Ecology and Management*, *462*. https://doi.org/10.1016/j.foreco.2020.117972

seeds or seedlings (as would be done for the hypothetical baseline compensation planting to comply with the local legislation). The authors found out that almost 70% of the studied restoration sites are in the Amazon range, but only one study of AGB in ARs was found in this biome.

The study carried out by Freitas *et al* (2019)[27] evaluated ARs sites up to 10 years old located in Amazon biomes in the Mato Grosso State, Brazil. The studied region considered a mixture of native trees and annual and sub-perennial green manure legumes. The study obtained an annual net carbon absorption of 2.46 Mg C ha^{-1} $year^{-1}$, similar to the absorption rate of secondary wet forests ranging in age from 5 to 15 years (2.35 Mg C ha^{-1} $year^{-1}$; Rozendaal et al., 2017[28]) and of neotropical forests after 20 years of regeneration since the last farming activity (3.05 Mg C ha^{-1} $year^{-1}$; Poorter et al., 2016[29]).

Holl *et al* (2020)[30] reviewed results from a 15-year study, replicated at 15 sites in tropical forest from southern Costa Rica, that compared different strategies of ARs. They found out annual above-ground biomass accumulation ranging from 2.35 to 4.98 t ha^{-1} yr^{-1} (equivalent to 1.1 to 2.3 tC[31] ha^{-1} yr^{-1}, respectively). This range is far below that mentioned by Freitas et al (2019), as cited above.

Le *et al* (2014)[32] reviewed reforestation projects in Philippines and found a mean annual increment for aboveground biomass to mixed native species plantations of 6.9 Mg[32] ha^{-1} 1 $year^{-1}$ or 3.2 tC[31] ha^{-1} $year^{-1}$. These studies show that there is a variation between 1.1 to 3.2 tC ha^{-1} $year^{-1}$ in the rate of carbon sequestration by restored forests, and that it is influenced by the location of the study, age of planting, restoration technique, and others. Given this context, it was opted to use, for this current MR, the annual net carbon absorption data obtained by Freitas *el al* (2019) study of 2.46 tC $^{-1}$ $year^{-1}$, because it reflects more similar conditions to the project, such as being in the same country and biome, evaluating native species and implementing an AR practice.

The parameters considered to adjust the offset planting calculation for the current monitoring report are described in the table below.

[27] Freitas, Marina Guimarães; *et al*, (2019). *Evaluating the success of direct seeding for tropical forest restoration over ten years. Forest Ecology and Management, 438(), 224–232.* doi:10.1016/j.foreco.2019.02.024

[28] Rozendaal, D.M.A., *et al*, 2017. *Demographic drivers of aboveground biomass dynamics during secondary succession in neotropical dry and wet forests*. Ecosystems 20, 340–353. https://doi.org/10.1007/s10021-016-0029-4.

[29] Poorter, L., *et al*, 2016. *Biomass resilience of Neotropical secondary forests*. Nature 530, 211–214. https://doi.org/10.1038/nature16512.

[30] Holl, Karen D., et al. "Applied nucleation facilitates tropical forest recovery: Lessons learned from a 15-year study." Journal of Applied Ecology 57.12 (2020): 2316-2328. https://doi.org/10.1111/1365-2664.13684

[31] Considering a carbon fraction (CF) of 0.47 to convert

[32] Le, Hai Dinh, Carl Smith, and John Herbohn. "What drives the success of reforestation projects in tropical developing countries? The case of the Philippines." *Global Environmental Change* 24 (2014): 334-348. < https://rainforestation.ph/wp-content/uploads/2022/04/Le_et_al_2013.pdf>

Table 17. Parameters applied in the current MR to calculate the carbon sequestration

Parameter	Definition	Value/Equation	Source
Annual net carbon absorption (tC/ha/yr)	Annual carbon absorption in aboveground biomass	2.46	Freitas, Marina Guimaraes, et al. "Evaluating the success of direct seeding for tropical forest restoration over ten years." Forest ecology and management 438 (2019): 224-232[27].
C to CO_2e	Conversion to molecular mass of carbon dioxide	3.67	44/12
R	Root-to-shoot	0.17	Table 4.4 from IPCC 2019 GL Chapter 4 Forests
Hectare to reforest per year		930	Area to be reforested to comply with the legislation

The rationale to calculate the average annual carbon stock growth above and below-ground was an adaptation of the equation 2.10[33] from IPCC 2006, which is applied to calculate the average annual biomass growth above and below-ground in tonnes d.m.ha^{-1} yr^{-1}:

$$Equation\ 2.10\ (\text{IPCC 2006}):\ G_{total} = G_w * (1 + R)$$

Where:

G_{TOTAL} = average annual biomass growth above and below-ground, tonnes d. m. ha^{-1} yr^{-1}

G_W = average annual above-ground biomass growth for a specific woody vegetation type, tonnes d.m.ha^{-1} yr^{-1}

R = ratio of below-ground biomass to above-ground biomass for a specific vegetation type, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$

$$Equation\ Adapted:\ CG_{total=}\ Annual\ C_a * (1 + R) * (\frac{44}{12})$$

Where:

[33] Volume 4. IPCC 2006. <https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_14_An2_SumEqua.pdf>]

CG_{total}: Annual carbon stock growth above-ground and below-ground, tCO_2/ha/yr

Annual C_a: annual net carbon absorption by aboveground biomass, tC/ha/yr

R: ratio of below-ground biomass to above-ground biomass, in tonne d.m.

(44/12): Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}

This adaptation was made because the annual biomass growth is already converted to carbon. Thus, the annual stock growth of above-ground and below-ground stock is 10.55 tCO_2/ha/yr (Table 18).

Table 18. Annual stock growth of ABG (tCO_2/ha/yr)

Planting year (t)	Year	Aboveground carbon stock increment (tCO_2/ha/yr)	Belowground carbon stock increment (tCO_2/ha/yr)	CG_{total} ABG increment (tCO_2/ha/yr)
1	2008	0	0	0
2	2009	9.02	1.53	10.55
3	2010	9.02	1.53	10.55
4	2011	9.02	1.53	10.55
5	2012	9.02	1.53	10.55
6	2013	9.02	1.53	10.55
7	2014	9.02	1.53	10.55
8	2015	9.02	1.53	10.55
9	2016	9.02	1.53	10.55
10	2017	9.02	1.53	10.55

Applying the CG_{total} described above (10.55 tCO_2/ha/yr), the following carbon sequestration was calculated for each planting year:

Table 19. tCO_2 removal by the offset planting between 2008 to 2017

Planting Rate (ha/yr)	930	930	930	930	930	930	930	930	930	930		
Planting year / **Monitoring Period**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total removals (tCO_2^e)**	**Total removals MR2 (tCO_2^e)**
2008	0	0	0	0	0	0	0	0	0	0	**0**	**0**
2009	-9,813	0	0	0	0	0	0	0	0	0	**-9,813**	**0**
2010	-9,813	-9,813	0	0	0	0	0	0	0	0	**-19,626**	**-8,980**
2011	-9,813	-9,813	-9,813	0	0	0	0	0	0	0	**-29,440**	**-29,440**
2012	-9,813	-9,813	-9,813	-9,813	0	0	0	0	0	0	**-39,253**	**-39,253**
2013	-9,813	-9,813	-9,813	-9,813	-9,813	0	0	0	0	0	**-49,066**	**-49,066**
2014	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	0	0	0	0	**-58,879**	**-58,879**
2015	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	0	0	0	**-68,692**	**-68,692**

2016	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	0	0	**-78,506**	**-78,506**
2017	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	0	**-88,319**	**-47,910**
Total	**-88,319**	**-78,506**	**-68,692**	**-58,879**	**-49,066**	**-39,253**	**-29,440**	**-19,626**	**-9,813**	**0**	**-441,594**	**-380,725**

The values above are shown in negative to indicate that they will be discounted from the baseline emissions

According to the PD, over 10 years 930 hectares per year would be planted. Given that the sequestration rate is 10.55tCO_2/ha, the total sequestered per year for each planting area would be 9.813 tCO_2 (rounded up values), which would result in a total of 441,594tCO_2 sequestered over 10 years. For the current monitoring period, the proportional sequestration rate was calculated for the years 2010 and 2017, because in the current MR it only considers one semester of those years. Thus, for the current monitoring report, the carbon stock sequestered by the hypothetical offset planting is 380,725tCO_2e, which is subtracted from the ΔCBSL,planned (Net greenhouse gas emissions in the baseline from planned deforestation), reducing the ΔCBSL (Net greenhouse gas emissions in the baseline). In the section 5.1.10, Table 39 this discount calculation is shown.

Table 20. Impacts of the deviation 3.2.2.3

Impacts	Justification
Applicability of the methodology	There is no impact, because no calculations were made in deviation from the rules of the methodology.
Additionality	There is no impact because this parameter is not related to additionality.
Appropriateness of the baseline scenario	As explained in the beginning of section 3.2.2.3, the offset planting would be mandatory if the suppression plan was carried out. In other words, a *consequence activity* of the baseline scenario. There is no change in the baseline scenario (suppression plan followed by livestock activities), so there is no impact on the appropriateness of the baseline scenario. The BL-PL v1.0 determines the net greenhouse gas emissions in the baseline from planned deforestation (ΔCBSL,planned) through equation 1, which does not have a specific parameter for removals. Therefore, the rationale for the ΔCBSL,planned calculation remained the same for the PD and the present monitoring report, with

	no changes in the *baseline emissions* from planned deforestation.
Previous MR	This calculation has no effective impact on the VCUs claimed in the first MR, because if this adjustment had been made in the previous MR, it would have generated more VCUs (Figure 18). However, these changes will not be applied to MR1, because there has not been an overestimation of VCU issuance.
PD	In the PD, the calculation for the offset planting considered that forest sequestered more carbon during growth, so the baseline was lower in the PD due to the larger discount (that it, it was more conservative). However, as explained in this section, this correction was applied in this current monitoring period to correctly represent the dynamics of forest growth. As shown in Figure 17, if this adjustment of the sequestration rate had been applied in the PD, emissions or removals from the baseline would have been 8% higher than validated.

In the figure below (Figure 17) there are two scenarios:

- **Scenario 1**: Original results from the PD that was validated.
- **Scenario 2**: Applying the sequestration rate adjustment in the PD to analyze the impact on VCUs.

If this adjustment of the sequestration rate had been applied in the PD, emissions or removals from the baseline would have been 8% higher than validated and the net VCUs to be issue would be 8.7% higher, which is equivalent to 1,110,544 VCUs.

1. Original PD validated

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	1,815,232	0	354,183	1,815,232	281,361
2009	1,700,492	0	353,252	1,700,492	263,576
2010	1,707,561	116,917	367,230	1,590,643	246,550
2011	1,716,590	984,349	283,122	732,241	113,497
2012	900,252	0	353,407	900,252	139,539
2013	821,758	0	324,016	821,758	127,372
2014	1,537,097	0	338,687	1,537,097	238,250
2015	814,410	0	290,685	814,410	126,234
2016	1,613,270	0	366,269	1,613,270	250,057
2017	1,236,940	0	299,184	1,236,940	191,726
Total	**13,863,600**	**1,101,266**	**3,330,034**	**12,762,334**	**1,978,162**

2. Scenario applying the correction of CO2 sequestration rate by offset planting in the PD

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	1,815,232	0	354,183	1,815,232	226,463
2009	1,734,495	0	353,252	1,734,495	214,093
2010	1,765,875	116,917	367,230	1,648,958	216,790
2011	1,787,492	984,349	283,122	803,143	233,177
2012	994,235	0	353,407	994,235	99,328
2013	938,711	0	324,016	938,711	95,278
2014	1,676,933	0	338,687	1,676,933	207,428
2015	977,058	0	290,685	977,058	106,388
2016	1,798,668	0	366,269	1,798,668	222,022
2017	1,485,446	0	299,184	1,485,446	183,871
Total	**14,974,144**	**1,101,266**	**3,330,034**	**13,872,878**	**1,804,837**

3. Difference between Scenario 2 and Scenario 1

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	0	0	0	0	-54,898
2009	34,003	0	0	34,003	-49,484
2010	58,314	0	0	58,314	-29,760
2011	70,902	0	0	70,902	119,680
2012	93,983	0	0	93,983	-40,211
2013	116,953	0	0	116,953	-32,095
2014	139,836	0	0	139,836	-30,822
2015	162,647	0	0	162,647	-19,846
2016	185,398	0	0	185,398	-28,035
2017	248,506	0	0	248,506	-7,855
Total	**1,110,544**	**0**	**0**	**1,110,544**	**-173,325**

Figure 17. Comparison between scenarios

In the figure below there are two scenarios:

- Scenario 1: Original results from the previous MR that was verified.
- Scenario 2: Applying the sequestration rate adjustment in the previous MR to analyze the impact on VCUs.

If this adjustment of the sequestration rate had been applied in the previous MR, emissions from the baseline would have been 1.5% higher than verified, which would issue more 80,837 VCUs.

1. Original MR1 verified

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	1,815,232	0	378,514	1,436,718	281,361
2009	1,700,492	0	360,556	1,339,936	263,576
18/July/2010	1,707,561	0	389,753	1,317,808	264,672
Total	**5,223,284**	**0**	**1,128,822**	**4,094,462**	**809,609**

2. Scenario applying the correction of CO2 sequestration rate by offset planting in MR1

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	1,815,232	0	378,514	1,436,718	281,361
2009	1,724,681	0	360,556	1,364,126	267,326
18/July/2010	1,764,208	0	389,753	1,374,455	273,452
Total	**5,304,121**	**0**	**1,128,822**	**4,175,299**	**822,139**

3. Difference between Scenario 2 and Scenario 1

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	0	0	0	0	0
2009	24,190	0	0	24,190	3,749
18/July/2010	56,648	0	0	56,648	8,780
Total	**80,837**	**0**	**0**	**80,837**	**12,530**

Figure 18. Comparison between scenarios

In summary, we can conclude that it is not necessary to update this deviation in the PD because:

1. The baseline scenario is the same in PD and current monitoring period (planned deforestation followed by livestock activities) because offset planting would be a mandatory activity by law if the suppression plan was executed.
2. The rationale to calculate *ΔCBSL,planned* (baseline emissions) remains the same in the PD, previous MR and current MR.
3. The removals of the offset planting are *more conservative* in the PD and in the previous MR and did not cause an overestimated VCU issuance.
4. The removal remains lower than baseline emissions, so the project scenario continues to reduce emissions.

3.2.2.4 Change of Project Proponent Name

At this monitoring report, the new Project Proponent is "CBNS Negócios Florestais S/A" (formerly the Project Proponent was "CKBV Florestal Ltda."). The alteration of company name is due to administrative changes. The seven farms were leased among the Economy Group companies and until be further leased to CBNS (a Cikel Economic Group Member). These processes mostly happened in an administrative level only, as the direct management of the farm and the Project Area did not suffer any implications due to these changes, since the staff was not altered because of name alteration. Therefore, forest management and other project activities did not suffer any implication due to the proponent change of name. Many of the employees and partners involved in the beginning and early years of the project are still working directly with it (as can be seen in staff documentation). The relationship between the company, local community and stakeholder did not change.

Table 21. Demonstration of ownership and possession rights of the Project Area

Propriety	Number and location of the legal registry	Current Landowner	Possessor of the Land and former Cikel REDD Project Owner between 2010 and 2017	Current Possessor of the Land and new Cikel REDD Project Proponent
RIO CAPIM VI	4594 (Paragominas).	MADEIREIRA MATINHA S/A	CKBV FLORESTAL LTDA. |CNPJ 03.501.232/0001-11	CBNS NEGÓCIOS FLORESTAIS S.A.| CNPJ nº 03.496.757/0002-97
RIO CAPIM IV	4828 (Paragominas).	MADEIREIRA MATINHA S/A	CKBV FLORESTAL LTDA. |CNPJ 03.501.232/0001-11	CBNS NEGÓCIOS FLORESTAIS S.A.| CNPJ nº 03.496.757/0002-97
CIKEL IX	8709 (Paragominas).	CKBV FLORESTAL LTDA.	CKBV FLORESTAL LTDA. |CNPJ 03.501.232/0001-11	CBNS NEGÓCIOS FLORESTAIS S.A.| CNPJ nº 03.496.757/0002-97
SUMAL	2501 (Paragominas).	RONDON IMÓVEIS LTDA.	CKBV FLORESTAL LTDA. |CNPJ 03.501.232/0001-11	CBNS NEGÓCIOS FLORESTAIS S.A.| CNPJ nº 03.496.757/0002-97
CACULÉ	8824 (Paragominas).	RONDON IMÓVEIS LTDA.	CKBV FLORESTAL LTDA. |CNPJ 03.501.232/0001-11	CBNS NEGÓCIOS FLORESTAIS S.A.| CNPJ nº 03.496.757/0002-97
CAUAXI II	15394(Paragominas).	RONDON IMÓVEIS LTDA., as per Public Deed of Asset Purchase and Sale.	CKBV FLORESTAL LTDA. |CNPJ 03.501.232/0001-11	CBNS NEGÓCIOS FLORESTAIS S.A.| CNPJ nº 03.496.757/0002-97

According to Section 3.20.2 of the VCS Standard (v4.4), this deviation fits as a Project Description Deviation once it changes project proponent's name. The deviation doesn't affect the applicability of the methodology, additionality or the appropriateness of the baseline scenario.

3.2.2.5 Change on the Other Entities Involved in the Project

During the past years between the validation and the current verification, the Project Proponent changed its technical support, which assists in the development of the carbon project. This support was presented in the project description as "Other Entities Involved in the Project" and, they were provided by 33 Forest Capital and TerraCarbon LLC. Nowadays, these companies do not have any relation to the project.

Currently, the project proponent is advised by Carbonext Consultoria Ltda for technical carbon support, therefore the company is now presented as “Other Entities Involved in the Project”.

According to Section 3.20.2 of the VCS Standard (v4.4), this deviation fits as a Project Description Deviation, once it changes the citation of other entities involved. The deviation doesn’t affect the applicability of the methodology, additionality or the appropriateness of the baseline scenario.

3.2.2.6 Correction in the application of formula 10 of VMD0015 v2.0

An adjustment was made to the calculation rationale for the following formula in VMD0015 v2.0:

(10)

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

Where:

$C_{LG,i,t}$ Actual net project emissions arising in the logging gap, in stratum i in year t; t CO_2-e

$C_{EXT,z,i,t}$ Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t; t CO_2-e

$LDF_{z,i}$ Logging damage factor for logging stratum z, in stratum i; t C m^{-3}

$V_{EXT,z,i,t}$ Volume extracted from logging stratum z, in stratum i in year t; m^3

Z 1, 2, 3, … …Z logging strata

i 1, 2, 3, … M strata

t 1, 2, 3, … t years elapsed since the start of the project activity

In the PD, the volumes of logs and residues were summed as V_{ext} and were considered in the calculation of emissions from logging gaps. However, during the elaboration of this monitoring report, it was found that V_{ext} should consider only the commercial volume exploited, since forest residue emissions are already included in the LDF parameter, as described in VMD0015 v2.0:

> *“The logging damage factor (LDF) is a representation of the quantity of emissions that will ultimately arise per unit of extracted timber (m^3). These emissions arise from the noncommercial portion of the felled trees (the branched and stump) and trees incidentally killed during felling”.*

That is, considering the volume of residue in the V_{ext} would be a double counting of emissions, as residues emissions are already included in the LDF factor.

This change caused a difference in the ex-ante versus ex-post predicted values for ΔCP,SelLog (Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case). Further details of this calculation are described in section 5.2 and summarized in Table 63.

According to Section 3.20.2 of the VCS Standard (v4.4), this deviation fits as a Project Description Deviation, the possible impacts and justifications are in the table below:

Table 22. Impacts of deviation 3.2.2.6

Impacts	Justification
Applicability of the methodology	There is no impact, as it is an adjustment to correctly apply the equation 10 from VMD0015 v2.0.
Additionality	There is no impact because this parameter is not related to additionality.
Appropriateness of the baseline scenario	There is no impact because this parameter is not applied in the baseline scenario, just in emissions arising due to project activities (forest management).
Previous MR	This calculation has no impact on the VCUs claimed in the first MR, because in the final version of MR1, the forest management schedule to take place in 2010 was not considered, therefore, this management was quantified only in this MR. CLG,i,t only applies when there is management activity, because it quantifies emissions arising from logging gaps.
PD	Regarding the impact in the PD, the larger the volume of Vext considered, the larger will be the logging gap emission. As in the PD a larger volume of Vext was considered (log + residue), the project emissions are higher, therefore, there is less generation of VCUs. Therefore, if this calculation were corrected in the PD, a larger volume of VCUs (677,385 $tCO_{2e)}$ would be expected to be generated (Figure 19).

The deviation doesn't affect the applicability of the methodology, additionality or the appropriateness of the baseline scenario, as it is a necessary adjustment to avoid double counting of emissions. This update was applied for the period of this monitoring report (19/July/2010 to 18/July/2017).

In order to analyze the possible impact of this deviation in the PD, simulations were done, which are described below:

- **Scenario 1**: Original results from the PD that was validated.
- **Scenario 2**: Adjustment of equation 10 of the VMD0015 v2.0 in the PD to analyze the impact on VCUs.

If this adjustment of the formula 10 was applied in the PD, emissions from the project activities (forest management) would have been 61,5% lower than validated, which is equivalent to 677,385 tCO_{2e}, which would consequently generate 5,3% more VCUs because the project's emissions discount would be lower.

1. Original PD validated

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	1,815,232	0	354,183	1,815,232	281,361
2009	1,700,492	0	353,252	1,700,492	263,576
2010	1,707,561	116,917	367,230	1,590,643	246,550
2011	1,716,590	984,349	283,122	732,241	113,497
2012	900,252	0	353,407	900,252	139,539
2013	821,758	0	324,016	821,758	127,372
2014	1,537,097	0	338,687	1,537,097	238,250
2015	814,410	0	290,685	814,410	126,234
2016	1,613,270	0	366,269	1,613,270	250,057
2017	1,236,940	0	299,184	1,236,940	191,726
Total	**13,863,600**	**1,101,266**	**3,330,034**	**12,762,334**	**1,978,162**

2. Scenario applying the correction in the formula 10 of the VMD0015 V2.0

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	1,815,232	0	354,183	1,815,232	226,463
2009	1,700,492	0	353,252	1,700,492	263,576
2010	1,707,561	116,917	367,230	1,590,643	246,550
2011	1,716,590	306,964	283,122	1,409,625	218,492
2012	900,252	0	353,407	900,252	139,539
2013	821,758	0	324,016	821,758	127,372
2014	1,537,097	0	338,687	1,537,097	238,250
2015	814,410	0	290,685	814,410	126,234
2016	1,613,270	0	366,269	1,613,270	250,057
2017	1,236,940	0	299,184	1,236,940	191,726
Total	**13,863,600**	**423,882**	**3,330,034**	**13,439,719**	**2,028,258**

3. Difference between Scenario 2 and Scenario 1

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	0	0	0	0	-54,898
2009	0	0	0	0	0
2010	0	0	0	0	0
2011	0	-677,385	0	677,385	104,995
2012	0	0	0	0	0
2013	0	0	0	0	0
2014	0	0	0	0	0
2015	0	0	0	0	0
2016	0	0	0	0	0
2017	0	0	0	0	0
Total	**0**	**-677,385**	**0**	**677,385**	**50,096**

Figure 19. Comparison between scenarios

In summary, we can conclude that it is not necessary to update this deviation in the PD because:

- There is no impact the applicability of the methodology, additionality, or the appropriateness of the baseline scenario (Table 22)
- The Equation 10 is just applicable when there are forest management activities, which just occurred after 2010, being contemplated in the current monitoring report

3.2.2.7 Market Leakage

During the development of the PD and the previous MR, CBNS had sawmills in which it processed the harvested wood, adding more value to the final product, and sold to the international market. Since according to the VMD0011 LK ME v1.0, international market leakage is not considered, in the PD, the parameter $LK_{MarketEffects,timber}$ was considered zero (0), and only the emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into national markets ($LK_{MarketEffects,FW/C}$) was considered.

However, since 2011 the sales began to be mostly to the domestic market, because the company stopped processing wood and started selling only logs, which has less value because it is not a processed product. Due to this market change, emissions due to market- effects leakage through decreased timber harvest ($LK_{MarketEffects,timber}$) were included in the current monitoring period.

Section 3.20.2 of the VCS Standard v4.4, Item 2, gives the following example of deviation that does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario: "changes in the procedures for measurement and monitoring, or project design changes". This deviation fits as a Project Description Deviation because a new parameter was included ($LK_{MarketEffects,timber}$) and is being monitored as described in Section 5.3.2.

As described in the VMD0011 LK-ME v1.0, to calculate the $LK_{MarketEffects,timber}$, the formula 2 is applied:

$$(2)\quad LK_{MarketEffects,Timber} = \sum_{i=1}^{M}\left(LF_{Me} * AL_{T,i}\right)$$

The definitions of LF_{ME} parameter for $LK_{MarketEffects,timber}$ are different from the definitions of LF_{me} validated for $LK_{MarketEffects,FW/C}$. Following the VMD0011 LK-ME v1.0 criteria, the leakage factor (LF_{ME}) for $LK_{MarketEffects,timber}$ was adopted as 0.2, given that the mean merchantable biomass as a proportion of total aboveground tree biomass (PML) for dense forest in Amazon Biome is 27% greater than merchantable biomass as a proportion of total aboveground tree biomass inside the project boundaries (PMP), as demonstrated on Section 5.3.2.

In summary, this MR2 considered the following values for LF_{ME}:

- LF_{ME} Fuelwood and Charcoal: 0.4 (as validated in PD).
- LF_{ME} Timber: 0.2 (as demonstrated on Section 5.3.2.).

Table 23. Impacts of deviation 3.2.2.7

Impacts	Justification
Applicability of the methodology	There is no impact, as it is an adjustment to correctly apply the module VMD0011 LK-ME v1.0 due to changes in the wood consumer market (international to national).
Additionality	There is no impact on additionality, as the project remains additional. The current commercial situation (selling only logs for the domestic market) corroborates that the project is financially additional, and that the additionality analysis presented in the PD is highly conservative. This is concluded because the wood was traded for a higher value when it was destined for the international market, as it was a processed product. However, even with a higher value, the NPV of the baseline scenario (suppression plan/livestock activities) was approximately 35 times higher than the forest management scenario (Table 2.11 of the PD). By reducing the revenue from forest management due to the change to the national market, the NPV of the suppression scenario becomes even more financially attractive. Therefore, the project remains additional, and this deviation does not impact the additionality.
Appropriateness of the baseline scenario	There is no impact because this parameter is not applied in the baseline scenario.
Previously MR	This calculation has no impact on the VCUs claimed in the first MR, because until the first monitoring period, the sale of timber was carried out only for the international market, and the $LK_{MarketEffects,timber}$ parameter was not applicable.
PD	Between the years 2007 and 2010, the main market was international, but forest management was not expected to occur in the project area. The market only becomes national after 2011 and this change is already being incorporated in the current monitoring report, so there is no need to make retroactive adjustments in the PD.

The comparison between PD and MR scenarios are demonstrated in Table 24, Table 25 and Table 26. The calculations are detailed in Section 5.3.

As presented in Table 24, the PD deviation doesn't impact the leakage market effects calculations of Fuel Wood and Charcoal ($LK_{MarketEffects,FW/C}$). The difference between ex ante and ex post was due to the monitoring of the sustainable forest management parameters.

Table 24. Comparison of the $LK_{MarketEffects,FW/C}$ calculated in the PD versus in the current MR[34]

Year	Ex-ante (PD)		Ex-post (MR2)		Difference
	$C_{BSL,XBFWC}$	$LK_{MarketEffects,FW/C}$	$C_{BSL,XBFWC}$	$LK_{MarketEffects,FW/C}$	$LK_{MarketEffects,FW/C}$
	tCO2	tCO2	tCO2	tCO2	tCO2
2011	707,806	283,122	796,342	318,537	35,414
2012	883,517	353,407	883,381	353,352	-54
2013	810,039	324,016	754,360	301,744	-22,272
2014	846,717	338,687	840,434	336,174	-2,513
2015	726,713	290,685	724,282	289,713	-972
2016	915,672	366,269	915,672	366,269	0
2017	747,960	299,184	730,112	292,045	-7,139
TOTAL	5,638,424	2,255,369	5,644,582	2,257,833	2,463

The Leakage Market Effects – Timber Harvest ($LK_{MarketEffects,\ timber}$) values for the current monitoring report (MR2) are higher than the validated numbers of PD, since this factor was not foreseen in the validation. This difference is shown in Table 25.

Table 25. Comparison of the calculated $LK_{MarketEffects,}$ in the PD versus the MR2[34]

Year	Ex-ante (PD)		Ex-post (MR2)		Difference
	$C_{BSL,XBT,i,t}$	$LK_{MarketEffects,\ timber}$	$C_{BSL,XBT,i,t}$	$LK_{MarketEffects,\ timber}$	$LK_{MarketEffects,\ timber}$
	tCO2	tCO2	tCO2	tCO2	tCO2
2011	0	0	374,205	74,841	74,841
2012	0	0	263,861	52,772	52,772
2013	0	0	409,557	81,911	81,911
2014	0	0	554,800	110,960	110,960
2015	0	0	425,392	85,078	85,078
2016	0	0	617,551	123,510	123,510
2017	0	0	444,294	88,859	88,859
TOTAL	0	0	3,089,660	617,932	617,932

As presented in Table 26, the Leakage Market Effects ($\Delta C_{LK\text{-}ME}$) in the current monitoring period was 620,395 tCO_2 higher than the estimated in Project Description, being more conservative and reducing the VCUs generation.

[34] Positive values in column "Difference" mean that Ex-post (MR2) numbers are greater than Ex-ante (PD). Negative values in column "Difference" mean that Ex-post (MR2) numbers are less than Ex-ante (PD).

Table 26. Comparison of the calculated Total Leakage Market Effects (ΔC_{LK-ME}) in the PD versus the updated calculation[34]

Year	Ex-ante (PD) ΔC_{LK-ME} tCO_2	Ex-post (MR2) ΔC_{LK-ME} tCO_2	Difference ΔC_{LK-ME} tCO_2
2011	283,122	393,378	110,255
2012	353,407	406,125	52,718
2013	324,016	383,655	59,640
2014	338,687	447,134	108,447
2015	290,685	374,791	84,106
2016	366,269	489,779	123,510
2017	299,184	380,903	81,719
TOTAL	2,255,369	2,875,765	620,395

To evaluate the possible impact of this deviation on the PD in the generation of VCUs, two scenarios were evaluated, as shown in Figure 20:

- **Scenario 1**: Original results from the PD that was validated.
- **Scenario 2**: Including Market-Effects Leakage Through Decreased Timber Harvest in the PD to analyze the impact on VCUs.

1. Original PD validated

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	1,815,232	0	354,183	1,461,049	281,361
2009	1,700,492	0	353,252	1,347,240	263,576
2010	1,707,561	116,917	367,230	1,223,413	246,550
2011	1,716,590	984,349	283,122	449,118	113,497
2012	900,252	0	353,407	546,845	139,539
2013	821,758	0	324,016	497,742	127,372
2014	1,537,097	0	338,687	1,198,410	238,250
2015	814,410	0	290,685	523,725	126,234
2016	1,613,270	0	366,269	1,247,001	250,057
2017	1,236,940	0	299,184	937,756	191,726
Total	**13,863,600**	**1,101,266**	**3,330,034**	**9,432,299**	**1,978,162**

2. Scenario including Market-Effects Leakage Through Decreased Timber Harvest in the PD

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	1,815,232	0	354,183	1,461,049	281,361
2009	1,700,492	0	353,252	1,347,240	263,576
2010	1,707,561	116,917	367,230	1,223,413	246,550
2011	1,716,590	984,349	365,000	367,241	113,497
2012	900,252	0	472,580	427,672	139,539
2013	821,758	0	433,278	388,480	127,372
2014	1,537,097	0	452,896	1,084,201	238,250
2015	814,410	0	388,708	425,703	126,234
2016	1,613,270	0	489,779	1,123,491	250,057
2017	1,236,940	0	400,072	836,868	191,726
Total	**13,863,600**	**1,101,266**	**4,076,977**	**8,685,357**	**1,978,162**

3. Difference between Scenario 2 and Scenario 1

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation
2008	0	0	0	0	0
2009	0	0	0	0	0
2010	0	0	0	0	0
2011	0	0	81,877	-81,877	0
2012	0	0	119,173	-119,173	0
2013	0	0	109,262	-109,262	0
2014	0	0	114,209	-114,209	0
2015	0	0	98,022	-98,022	0
2016	0	0	123,510	-123,510	0
2017	0	0	100,888	-100,888	0
Total	**0**	**0**	**746,942**	**-746,942**	**0**

Figure 20. Comparison between scenarios

Applying this PD deviation from the year 2011 when the sale of wood shifted to the national market, leakage emissions would have been 22.4% higher than validated, which is equivalent to 746,942 VCUs. So, adopting this PD deviation is conservative and reduces the VCUs issuance for the current monitoring period.

This calculation has no impact on the VCUs claimed in the first MR, because until the first monitoring period, the sale of timber was carried out only for the international market, and the $LK_{MarketEffects,timber}$ parameter was not applicable.

In summary, we can conclude that it is not necessary to update the PD due to this deviation because:

1. Between the years 2007 and 2010, the main market was international, so $LK_{MarketEffects,timber}$ is not applicable.
2. The market only becomes national after 2011, so this change is already being incorporated in the current monitoring report, so there is no need to make retroactive adjustments.
3. This deviation is conservative because reduces the VCU issuance
4. The project remains additional.

3.2.2.8 Post-Deforestation Carbon Stock

The Project Description did not include the post-deforestation carbon stock in the baseline (pasture) because, as explained in the Table 2.3 Carbon Pools of the PD, non-tree woody biomass is lower in the baseline than in the project scenario (forest), thus, it was conservatively excluded.

Furthermore, as explained in Section 2.2 Post-Deforestation Carbon Stocks of the VMD0006 1.0: "*Carbon pools excluded from the project can be accounted as zero. Herbaceous non-tree vegetation is considered to be de minimis in all instances.*" According to the suppression plan, after the deforestation predicted in the baseline, pastures would be implemented with species of the genus *Brachiaria*, which are herbaceous grasses, falling under this *minimis* rule.

No equation in the entire methodology and its modules foresees the inclusion of herbaceous carbon pool, as it is not comprised in the "non-tree" carbon pool (CAB_nontree). According to CP-AB v. 1.0 "*Non-tree woody aboveground biomass pool includes trees smaller than the minimum tree size measured in the tree biomass pool, all shrubs, and all other* ***non-herbaceous*** *live vegetation*".

However, for conservatism reasons, we chose to include the pasture stock in the baseline for the *current* monitoring period only. The calculations are described in section 5.1.5.

This deviation does not impact the first monitoring report. Applying the tool T-SIG "Determination of the significance of emissions sources and changes in carbon stocks in REDD project activities", the inclusion of the post-deforestation stock (pasture) in the first monitoring report is insignificant, because it represents 4.4% of the total ERRs, therefore, there was no over-issuance of VCUs. To evaluate the possible impact of this deviation on the first monitoring report, two scenarios were evaluated, as shown in Figure 21.

- **Scenario 1**: Original results from the first monitoring report that was verified.
- **Scenario 2**: Including the post-deforestation stock in the baseline (pasture)

1. Original MR1 verified

Year	Baseline emissions or removals (tCO2e)	Project emissions or removals (tCO2e)	Leakage emissions (tCO2e)	Net GHG emission reductions or removals (tCO2e)	Buffer pool allocation
2008	1,815,232	0	378,514	1,436,718	281,361
2009	1,700,492	0	360,556	1,339,936	263,576
18/July/2010	1,707,561	0	389,753	1,317,808	264,672
Total	**5,223,284**	**0**	**1,128,822**	**4,094,462**	**809,609**

2. Scenario including post-deforestation stock (pasture) in the baseline

Year	Baseline emissions or removals (tCO2e)	Project emissions or removals (tCO2e)	Leakage emissions (tCO2e)	Net GHG emission reductions or removals (tCO2e)	Buffer pool allocation
2008	1,755,764	0	378,514	1,377,250	213,474
2009	1,641,180	0	360,556	1,280,624	198,497
18/July/2010	1,645,902	0	389,753	1,256,149	194,703
Total	**5,042,845**	**0**	**1,128,822**	**3,914,023**	**606,674**

3. Difference between Scenario 2 and Scenario 1

Year	Baseline emissions or removals (tCO2e)	Project emissions or removals (tCO2e)	Leakage emissions (tCO2e)	Net GHG emission reductions or removals (tCO2e)	Buffer pool allocation
2008	59,468	0	0	59,468	67,887
2009	59,312	0	0	59,312	65,079
18/July/2010	61,659	0	0	61,659	69,969
Total	**180,439**	**0**	**0**	**180,439**	**202,935**

Figure 21. Comparison between scenarios (Previous monitoring report – MR1)

The same simulation mentioned above was conducted for the current monitoring period (MR2). When applying the T-SIG tool, the post-deforestation stock of the pasture becomes significant, representing 7% of the total ERRs, equivalent to 392.763 VCUs. The Figure 22 below shows the results of this simulation.

1. Previous version of the MR2

Year	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Net GHG emission reductions or removals (tCO2e)	Buffer pool allocation
2010	-8,980	150,729	0	-159,709	0
2011	1,783,408	323,366	393,378	1,066,664	146,004
2012	990,024	372,336	406,125	211,563	61,769
2013	934,866	156,078	383,655	395,133	77,879
2014	1,673,188	20,483	447,134	1,205,572	165,271
2015	973,600	75,632	374,791	523,176	89,797
2016	1,794,617	0	489,779	1,304,839	179,462
2017	1,482,137	68,984	380,903	1,032,250	141,315
Total	**9,622,861**	**1,167,608**	**2,875,765**	**5,579,488**	**861,496**

2. Scenario including post-deforestation stock (pasture) in the baseline

Year	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Net GHG emission reductions or removals (tCO2e)	Buffer pool allocation
2010	-8,980	150,729	0	-159,709	0
2011	1,721,787	323,366	393,378	1,005,043	139,842
2012	930,686	372,336	406,125	152,226	55,835
2013	880,463	156,078	383,655	340,730	72,439
2014	1,616,322	20,483	447,134	1,148,705	159,584
2015	924,796	75,632	374,791	474,373	84,916
2016	1,733,120	0	489,779	1,243,341	173,312
2017	1,431,904	68,984	380,903	982,016	136,292
Total	**9,230,098**	**1,167,608**	**2,875,765**	**5,186,724**	**822,220**

3. Difference between Scenario 2 and Scenario 1

Year	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Net GHG emission reductions or removals (tCO2e)	Buffer pool allocation
2010	0	0	0	0	0
2011	-61,622	0	0	-61,622	-6,162
2012	-59,338	0	0	-59,338	-5,934
2013	-54,403	0	0	-54,403	-5,440
2014	-56,866	0	0	-56,866	-5,687
2015	-48,803	0	0	-48,803	-4,880
2016	-61,497	0	0	-61,497	-6,150
2017	-50,234	0	0	-50,234	-5,023
Total	**-392,763**	**0**	**0**	**-392,763**	**-39,276**

Figure 22. Comparison between scenarios (Current monitoring period – MR2)

Table 27. Summary of the impact of this deviation on the CREDD

Year	CREDD (tCO2e)						
	ORIGINAL		CBSL POST INCLUDED			Difference (tCO2e)	
	MR1	MR2	PD	MR1	MR2	MR1	MR2
2008	1,436,718		1,401,581	1,377,250		59,468	0
2009	1,339,936		1,287,928	1,280,624		59,312	0
2010	1,317,808	-159,709	1,161,754	1,256,149	-159,709	61,659	0
2011		1,066,664	387,496	0	1,005,043	0	61,622
2012		211,563	487,507	0	152,226	0	59,338
2013		395,133	443,339	0	340,730	0	54,403
2014		1,205,572	1,141,544	0	1,148,705	0	56,866
2015		523,176	474,922	0	474,373	0	48,803
2016		1,304,839	1,185,503	0	1,243,341	0	61,497
2017		1,032,250	887,523	0	982,016	0	50,234
Total	**4,094,462**	**5,579,488**	**8,859,097**	**3,914,023**	**5,186,724**	**180,439**	**392,763**
						4.4%	**7.0%**

Table 28. Impacts of deviation 3.2.2.8

Impacts	Justification
Applicability of the methodology	There is no impact since the inclusion of this carbon pool is done following the recommendations of equation 5 of VMD0006 v1.0.
Additionality	There is no impact on additionality because this parameter is not associated with the additionality.
Appropriateness of the baseline scenario	There is no change in the baseline scenario (suppression plan followed by livestock activities), so there is no impact on the appropriateness of the baseline scenario. Therefore, the rationale for the ΔCBSL,planned calculation (section 5.1.10) remained the same for the PD and the present monitoring report, with no changes in the baseline emissions from planned deforestation.
Previous MR	This calculation has no impact on the VCUs claimed in the first MR. According to the tool T-SIG, the inclusion of post-deforestation stock in the first monitoring report would be insignificant, representing only 4.4% of the total ERR.
Current MR	In several sections, the methodology VM0007 v1.0 refers to post-deforestation herbaceous carbon pools as insignificant (i.e., *de minimis*). According to VMD0006, v. 1.0, page 9: "*Carbon pools excluded from the project can be accounted as zero. Herbaceous non-tree vegetation is considered to be de minimis in all instances*". Also, in tables in page 12, the same module states: "*Herbaceous vegetation considered de minimis in all instances*". Similarly, VMD0015, Version 2.0, page 10, corroborates that "Carbon pools excluded from

	the project can be accounted as zero. Herbaceous non-tree vegetation is considered to be de minimis in all instances". Complementarily, the "Guidance Document for the Use of Avoided Deforestation Partners VCS REDD Modular Methodology"[35] clearly states, in pages 21 and 22, that "*Aboveground biomass shall always be included. However, where biomass is herbaceous such as grasses or non-woody crops no assessment is required*". Indeed, no equation in the entire methodology and its modules foresees the inclusion of herbaceous carbon pool, even if considering "non-tree" carbon pools (definition of "non-tree" carbon pool excludes herbaceous vegetation, in CP-AB v. 1.0: "*Non-tree woody aboveground biomass pool includes trees smaller than the minimum tree size measured in the tree biomass pool, all shrubs, and all other non-herbaceous live vegetation*".). This rationale is still prevailing after several methodology reviews, as it can be evidenced in Verra's website. Under this context, the project proponent had designed all the ERR calculation based on the "*de minimis*" pasture carbon pool premise, given that pasture vegetation (i.e., post-deforestation vegetation) is classified as "*herbaceous*". Even though, for this monitoring period, the tool T-SIG was applied, and the post-deforestation stock was conservatively considered significant, representing 7% of the total ERR. Therefore, this monitoring report included this carbon pool, emphasizing conservatism.
PD (ex-ante)	As explained above, the PD had designed all the ERR calculation based on the "*the minimis*" pasture carbon pool premise, because, as explained in the Table 2.3 Carbon Pools of the PD, non-tree woody biomass are lower in the baseline than in the project scenario (forest). Thus, it was conservatively excluded during the project conception. Since the PD was designed following the methodological premises, there is no need to change the PD.

3.3 Grouped Projects

Not applicable. This is not a grouped project.

[35] https://verra.org/wp-content/uploads/ADP_Modules_Guidance.pdf, visited in 18/07/2023.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Emissions due to FSC-certified selective logging

Data / Parameter	LDF
Data unit	t C m^{-3}
Description	Logging damage factor for logging stratum z, in stratum i
Source of data	VMD0015 v2.0
Value applied	0.53
Justification of choice of data or description of measurement methods and procedures applied	Default value for broadleaf and mixed forests. There is a discrepancy between the value presented in the text (0.67) and in the graph (0.53) of annex 1 of VMD0015 v2.0 (page 52). Considering that the value of 0.53 is also presented in VMD0011 v1.0, this was considered the correct one.
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions
Comments	N/A.

Data / Parameter	CF
Data unit	t C t^{-1} d.m
Description	Carbon fraction biomass
Source of data	Default value from IPCC 2006 GL (e.g., IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3)
Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	Global default.
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	D_j
Data unit	t d m.m^{-3}
Description	Basic wood density of species j
Source of data	Sourced from Forest Products Laboratory (LPF) of the Brazilian Forest Service database https://lpf.florestal.gov.br/pt-br/madeiras-brasileiras
Value applied	0.67
Justification of choice of data or description of measurement methods and procedures applied	The Forest Products Laboratory (LPF) of the Brazilian Forest Service database is an acknowledged authoritative source for regional species-specific wood density data.
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions
Comments	This value represents de average density of the commercial species according to the suppression plan that was elaborated prior to the Cikel REDD project

Data / Parameter	WW_S
Data unit	Dimensionless
Description	Wood waste. The fraction immediately emitted through mill inefficiency by class of wood products
Source of data	VMD0015 v2.0
Value applied	0.24
Justification of choice of data or description of measurement methods and procedures applied	Derived by Winjum et al. 1998, according to VMD0015 v2.0
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions
Comments	N/A.

Data / Parameter	SLF_S
Data unit	Dimensionless
Description	Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood products
Source of data	VMD0015 v2.0
Value applied	0.2
Justification of choice of data or description of measurement methods and procedures applied	Derived by Winjum et al. 1998, according to VMD0015 v2.0. Reference for sawnwood product class.
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions
Comments	N/A.

Data / Parameter	Of_S
Data unit	Dimensionless
Description	Fraction of wood products that will be emitted to the atmosphere between 5 and 10 years of timber harvest by class of wood products
Source of data	The source of data is the published paper of Winjum et al. 1998[36]
Value applied	0.84
Justification of choice of data or description of measurement methods and procedures applied	Value referenced in the module VMD0005 v1.0 for the sawnwood class in tropical forests.
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions
Comments	N/A.

[36] Winjum, J.K., Brown, S. and Schlamadinger, B. 1998. Forest harvests and wood products: sources and sinks of atmospheric carbon dioxide. Forest Science 44: 272-284

Activity shifting leakage

Data / Parameter	$NewR_{i,t}$
Data unit	ha
Description	New calculated forest clearance in stratum i at time t by the baseline agent of the planned deforestation where no leakage is occurring
Source of data	Derived from Section 3 of PD
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	Fixed for the first baseline period, derived and justified in Section 3 of PD
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of leakage
Comments	N/A.

Market leakage - Fuelwood and Charcoal

Data / Parameter	$FG_{BSL,t}$
Data unit	$m^3 yr^{-1}$
Description	Average projected annual volume of fuelwood to be gathered in the project area in the baseline scenario in stratum i at time t
Source of data	Derived from Section 3 of PD
Value applied	Set at start of baseline period
Justification of choice of data or description of measurement methods and procedures applied	Fixed for the first baseline period, derived and justified in Section 3 of PD
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of leakage
Comments	N/A.

Data / Parameter	DM_{mn}
Data unit	t.d.m.m-^{3}
Description	Mean wood density of commercially harvested species
Source of data	Average basic wood density of the Forest Products Laboratory (LPF) of the Brazilian Forest Service database http://www.ibama.gov.br/lpf/madeira/pesquisa.php?idioma=portugues
Value applied	0.65
Justification of choice of data or description of measurement methods and procedures applied	Parameter Dmn is set as 0.65 metric tons per cubic meter, which represents the average basic wood density of the Forest Products Laboratory (LPF) of the Brazilian Forest Service database http://www.ibama.gov.br/lpf/madeira/pesquisa.php?idioma=portugues This is conservative, because the majority of tree species exploited for fuelwood/charcoal are successional/non-commercial species with relatively low wood densities.
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions
Comments	N/A.

Data / Parameter	CF
Data unit	t C t $^{-1}$ d.m
Description	Carbon fraction of biomass for commercially harvested species
Source of data	IPCC 2006GL
Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	Global default
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	LF_{ME}
Data unit	Dimensionless
Description	Leakage factor for market effects calculations
Source of data	VMD0011 v1.0
Value applied	0.4
Justification of choice of data or description of measurement methods and procedures applied	Default for fuelwood/charcoal in all circumstances; VMD0011 v1.0
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	Validated value applied for fuelwood/charcoal.

Market leakage - Timber Harvest

Data / Parameter	DM_{mn}
Data unit	t.d.m.m-^{3}
Description	Mean wood density of commercially harvested species
Source of data	Average basic wood density of the Forest Products Laboratory (LPF) of the Brazilian Forest Service database http://www.ibama.gov.br/lpf/madeira/pesquisa.php?idioma=portugues
Value applied	0.65
Justification of choice of data or description of measurement methods and procedures applied	Parameter Dmn is set as 0.65 metric tons per cubic meter, which represents the average basic wood density of the Forest Products Laboratory (LPF) of the Brazilian Forest Service database http://www.ibama.gov.br/lpf/madeira/pesquisa.php?idioma=portugues This is conservative, because the majority of tree species exploited for fuelwood/charcoal are successional/non-commercial species with relatively low wood densities.
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions
Comments	N/A.

Data / Parameter	CF
Data unit	t C t -1 d.m
Description	Carbon fraction of biomass for commercially harvested species
Source of data	IPCC 2006GL
Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	Global default
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

Data / Parameter	LDF
Data unit	t C m^{-3}
Description	Factor for calculating the biomass of dead wood created during logging operations per cubic meter extracted (i.e., Logging Damage Factor)
Source of data	VMD0011 LK-ME v1.0
Value applied	0.53
Justification of choice of data or description of measurement methods and procedures applied	It is the default value for broadleaf and mixed forests, according to module VMD0011 LK-ME v1.0. Default value for broadleaf and mixed forests of 0.53 t C m-3 from 774 logging gaps measured by Winrock International in Bolivia, Belize, the Republic of Congo, Brazil, and Indonesia may be used for tropical broadleaf forests
Purpose of Data	Calculation of leakage emissions Calculation of project emissions
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

Data / Parameter	LIF
Data unit	$t\ C\ m^{-3}$
Description	Factor for calculating the emissions arising from the creation of logging infrastructure (roads, skid trails and decks) during logging operations per cubic meter extracted
Source of data	VMD0011 LK-ME v1.0, pg. 8
Value applied	0.29
Justification of choice of data or description of measurement methods and procedures applied	Conservative default value of 0.29 t CO_2-e m^{-3} calculated from 1,839 hectares of logging concessions analyzed by Winrock International in the Republic of Congo and Brazil, may be used for tropical broadleaf forests.
Purpose of Data	Calculation of leakage emissions Calculation of project emissions
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

Data / Parameter	PML_{FT}
Data unit	%
Description	Mean merchantable biomass as a proportion of total aboveground tree biomass for each forest type
Source of data	Calculated from the study “Brown, Sandra & Lugo, Ariel. (1992). Aboveground biomass estimates for tropical moist forest of the Brazilian amazon. Interciencia. 17. 8-18.”, where VEF for dense forest in the Legal Amazon is 1.25
Value applied	0.80
Justification of choice of data or description of measurement methods and procedures applied	Value deducted from the VEF (Volume Expansion Factor) parameter for dense forest in the Legal Amazon that relates the volume of trees with a diameter greater than 30 cm to the volume of total biomass. $PML_{FT} = 1/VEF$. $PML_{FT} = 1/1.25$ $PML_{FT} = 0.80$
Purpose of Data	• Calculation of LF_{ME}
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

4.2 Data and Parameters Monitored

Details on data and parameters monitored are provided below. Note that:

- "Monitoring equipment" is left blank to provide flexibility in measurement and monitoring approach, essential for any long-term MRV plan;
- Where a parameter is calculated from a methodology equation (i.e., not raw data), the methodology module and equation number are specified and "Description of measurement methods and procedures to be applied" and "QA/QC procedures to be applied" are appropriately left blank;
- To avoid repetition in the tables below, "Description of measurement methods and procedures to be applied" and "QA/QC procedures to be applied" for monitored (not calculated) parameters are described in the monitoring plan in the section 4.3.

Emissions due to deforestation and natural disturbance

Data / Parameter	$\Delta C_{P,Def,i,t}$
Data unit	t CO_2-e
Description	Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t
Source of data	Calculated
Description of measurement methods and procedures to be applied	1. If secondary data such as MapBiomas or PRODES are available for the monitoring period, they can be used to measure deforestation as these sources aim to provide data about land use change; 2. Produce a supervised classification of optical or SAR images such as Landsat or Sentinel sensors. With both procedures, a year-by-year mapping of deforestation is carried out and the area is accounted for in a GIS environment. Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	

Purpose of the data	Calculation of project emissions
Calculation method	Equation 3, VMD0015 2.0
Comments	During the period of this monitoring, 29.32 hectares of deforestation with no known causes have been identified within the project area, but apparently due to edge effect of previously opened area and natural events, as they are in isolated places and with difficult access. It is possible to assess in more recent satellite images that these areas are regenerating. Applying the "Tool for testing significance of GHG emissions in A/R CDM project activities, version 1.0", this deforestation is considered insignificant, as it represents less than 5% of the project's emissions, thus, the emissions from these areas were considered zero.

Data / Parameter	$\Delta C_{P,DistPA,i,t}$
Data unit	t CO_2-e
Description	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum i at time t
Source of data	Calculated
Description of measurement methods and procedures to be applied	1. If secondary data such as MapBiomas or PRODES are available for the monitoring period, they can be used to measure deforestation as these sources aim to provide data about land use change; 2. Produce a supervised classification of optical or SAR images such as Landsat or Sentinel sensors. With both procedures, a year-by-year mapping of deforestation is carried out and the area is accounted for in a GIS environment. Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 20, VMD0015 2.0

Comments	As mentioned in the parameter $\Delta C_{P,Def,i,t}$, 29.32 hectares of deforestation with no known causes have been identified within the project area, but apparently due to edge effect of previously opened area and natural events, as they are in isolated places and with difficult access. Applying the "Tool for testing significance of GHG emissions in A/R CDM project activities, version 1.0", this deforestation is considered insignificant, as it represents less than 5% of the project's emissions, thus, the emissions from these areas were considered zero.

Data / Parameter	$A_{Def\ PA,u,i,t}$
Data unit	ha
Description	Area of recorded deforestation in the project area stratum i converted to land use u at time t
Source of data	Monitored at each monitoring/verification event through analysis of classified satellite imagery
Description of measurement methods and procedures to be applied	1. If secondary data such as MapBiomas or PRODES are available for the monitoring period, they can be used to measure deforestation as these sources aim to provide data about land use change; 2. Produce a supervised classification of optical or SAR images such as Landsat or Sentinel sensors. With both procedures, a year-by-year mapping of deforestation is carried out and the area is accounted for in a GIS environment. Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	As mentioned in the parameters $\Delta C_{P,Def,i,t}$ and $\Delta C_{P,DistPA,i,t}$, 29.32 hectares of deforestation were detected in the project area, but it was considered insignificant through "Tool for testing significance of GHG

	emissions in A/R CDM project activities, version 1.0", thus, these areas were considered as zero.

Data / Parameter	$A_{Dist\ PA,q,i,t}$
Data unit	*ha*
Description	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i, at time t
Source of data	Monitored at each monitoring/verification event through analysis of classified satellite imagery
Description of measurement methods and procedures to be applied	1. If secondary data such as MapBiomas or PRODES are available for the monitoring period, they can be used to measure deforestation as these sources aim to provide data about land use change; 2. Produce a supervised classification of optical or SAR images such as Landsat or Sentinel sensors. With both procedures, a year-by-year mapping of deforestation is carried out and the area is accounted for in a GIS environment. Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	

Data / Parameter	$C_{BSL,i}$
Data unit	t CO_2-e ha^{-1}
Description	Carbon stock in all pools in the baseline case in stratum i
Source of data	Estimated from forest carbon inventory
Description of measurement methods	Detailed procedures provided below under monitoring plan description

and procedures to be applied	
Frequency of monitoring/recording	Every < 10 years.
Value monitored	-
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	Parameter not monitored in this Monitoring Period. For more information, see Section 3.2.2.

Emissions due to illegal degradation

Data / Parameter	$A_{DegW,i,t}$
Data unit	*ha*
Description	Area potentially impacted by degradation processes in stratum i
Source of data	Delineated based on survey results indicating general area of project potentially accessed and typical depth of penetration of illegal harvest activities from points of access
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Repeated each time the PRA indicates a potential for degradation. PRA conducted every < 2 years
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description
Purpose of the data	Calculation of project emissions
Calculation method	

Comments	No degradation identified in this monitoring period as detailed in the section 5.3

Data / Parameter	$C_{DegW,i,t}$
Data unit	t CO_2-e
Description	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i at time t
Source of data	Estimated from diameter measurements of cut stumps in sample plots
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every < 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	No degradation identified in this monitoring period as detailed in section 5.3

Data / Parameter	AP_i
Data unit	ha
Description	Total area of degradation sample plots in stratum i
Source of data	Calculated as 3% of $A_{DegW,i,t}$
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every < 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area

Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	No degradation identified in this monitoring period.

Data / Parameter	$\Delta C_{DegW,i,t}$
Data unit	t CO_2-e
Description	Net carbon stock changes as a result of degradation in stratum i in the project area at time t
Source of data	Calculated
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every < 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 8, VMD0015 2.0
Comments	No degradation identified in this monitoring period.

Emissions due to FSC-certified selective logging

Data / Parameter	$C_{LG,i,t}$
Data unit	t CO_2-e
Description	Actual net project emissions arising in the logging gap, in stratum i at time

Source of data	Calculated
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every < 5 years
Value monitored	(see table below)
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 10, VMD0015 2.0
Comments	

Year	tCO_2 CLG
July/2010	104,611
2011	184,019
2012	249,780
2013	102,885
2014	12,222
2015	48,692
2016	0
July/2017	45,252
Total	**747,461**

Data / Parameter	$V_{EXT\ z,i,t}$
Data unit	m^3
Description	Volume extracted from logging stratum z, in stratum i at time t
Source of data	Annual harvest reports
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every < 5 years
Value monitored	(see table below)

Year	Vext (m^3)
July/2010	33,693
2011	59,269

	2012	80,450
	2013	33,137
	2014	3,937
	2015	15,683
	2016	0
	2017	14,575
	TOTAL	240,744
Monitoring equipment		
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description	
Purpose of the data	Calculation of project emissions	
Calculation method		
Comments		

Data / Parameter	$C_{EXT\ z,i,t}$
Data unit	$t\ CO_2$-e
Description	Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i at time t
Source of data	Calculated from $V_{EXT\ z,i,t}$
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every < 5 years
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	

Value monitored:

Year	tCO2
	CEXT
2010	39,133
2011	68,839
2012	93,440
2013	38,488
2014	4,572
2015	18,215
2016	0
2017	16,928
	279,615

Purpose of the data	Calculation of project emissions
Calculation method	Equation 11, VMD0015 2.0
Comments	

Data / Parameter	$C_{LR\ i,t}$
Data unit	$t\ CO_2\text{-}e$
Description	Actual net project emissions arising from logging infrastructure in stratum i at time t
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every < 5 years
Value monitored	<table><tr><th rowspan="2">Year</th><th>tCO2</th></tr><tr><th>CLR</th></tr><tr><td>2010</td><td>49,925</td></tr><tr><td>2011</td><td>146,044</td></tr><tr><td>2012</td><td>131,646</td></tr><tr><td>2013</td><td>56,937</td></tr><tr><td>2014</td><td>8,705</td></tr><tr><td>2015</td><td>28,713</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>2017</td><td>25,379</td></tr><tr><td></td><td>**447,349**</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 12, VMD0015 2.0
Comments	

Data / Parameter	$\Delta C_{SKID,i,t}$
Data unit	$t\ CO_2\text{-}e$

Description	Change in carbon stock resulting from skid trail creation in stratum i at time t
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every < 5 years
Value monitored	(see table below)
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 13, VMD0015 2.0
Comments	

Year	tCO2
	∆CSKID
2010	33,355
2011	75,419
2012	67,502
2013	30,496
2014	5,564
2015	16,199
2016	0
2017	13,750
	242,286

Data / Parameter	$L_{SKID,i,t}$
Data unit	m
Description	Length of skid trails
Source of data	Annual harvest reports
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording	*Every < 5 years*

Value monitored	<table><tr><th rowspan="2">Year</th><th>m</th></tr><tr><th>LSKID</th></tr><tr><td>2010</td><td>132,176</td></tr><tr><td>2011</td><td>321,933</td></tr><tr><td>2012</td><td>295,845</td></tr><tr><td>2013</td><td>129,526</td></tr><tr><td>2014</td><td>23,633</td></tr><tr><td>2015</td><td>68,803</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>2017</td><td>58,398</td></tr><tr><td></td><td>**1,030,313**</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description.
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	

Data / Parameter	*SK*
Data unit	tCO_2/m
Description	Skid trails emission factor
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every < 5 years
Value monitored	<table><tr><th rowspan="2">Year</th><th>tCO2/m</th></tr><tr><th>SK</th></tr><tr><td>2010</td><td>0.25</td></tr><tr><td>2011</td><td>0.23</td></tr><tr><td>2012</td><td>0.23</td></tr><tr><td>2013</td><td>0.24</td></tr><tr><td>2014</td><td>0.24</td></tr><tr><td>2015</td><td>0.24</td></tr><tr><td>2016</td><td>0.00</td></tr><tr><td>2017</td><td>0.24</td></tr></table>

Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 14, VMD0015 2.0
Comments	As explained in the section 2.3 Carbon pools in the PD, the carbon pool from soil organic carbon was excluded in the baseline because significant changes in this pool are not expected to occur in the baseline – note that the IPCC default stock change factor for permanent grassland is 1.0, which signifies no change from original stocks (managed forest), which is also 1.0 (IPCC 2006GL Vol 4 AFOLU Chapter 6 Grassland Table 6.2 and IPCC 2006GL, Chapter 5 Cropland, Table 5.10). Because of that, the parameter $\Delta CSOC\_sk$ was considered 0 (zero) in the Equation 14 of the VMD0015 v2.0.

Data / Parameter	W_{SKID}
Data unit	*m*
Description	Mean width of skid trails
Source of data	Annual harvest reports
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording	Every < 5 years
Value monitored	see table below
Monitoring equipment	

Year	W_{SKID} (m)
July/2010	3.9
2011	3.6
2012	3.6
2013	3.7
2014	3.7
2015	3.7
2016	0
July/2017	3.7

QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description.
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	

Data / Parameter	*Cdest, i*
Data unit	t CO2-e ha-1
Description	Mean live carbon stock of trees and non-tree biomass assumed to be killed per unit area in creation of skid trail in stratum i
Source of data	Sourced from strata-level mean forest carbon stock estimates from forest carbon inventory of project area; conservatively assume that all stocks are emitted from within skid trails
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Re-measured every < 10 years
Value monitored	-
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	Parameter not monitored in this Monitoring Period. For more information, see Section 3.2.2. Equivalent to C_{BSL}.

Data / Parameter	$\Delta C_{ROAD,i,t}$
Data unit	*t CO2-e*
Description	Change in carbon stock resulting from logging road creation in stratum i at time t
Source of data	Calculated
Description of measurement methods	

and procedures to be applied	
Frequency of monitoring/recording	Every < 5 years
Value monitored	<table><tr><th rowspan="2">Year</th><th>ΔC_{ROAD}</th></tr><tr><th>tCO_2</th></tr><tr><td>July/2010</td><td>11,666</td></tr><tr><td>2011</td><td>51,815</td></tr><tr><td>2012</td><td>46,547</td></tr><tr><td>2013</td><td>19,188</td></tr><tr><td>2014</td><td>2,279</td></tr><tr><td>2015</td><td>9,081</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>July/2017</td><td>8,439</td></tr><tr><td></td><td>**149,016**</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 17, VMD0015 2.0
Comments	

Data / Parameter	A_{ROAD}
Data unit	*ha*
Description	Area of roads in stratum i at time t
Source of data	Annual harvest reports
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording	Every < 5 years
Value monitored	<table><tr><th rowspan="2">Year</th><th>A_{ROAD}</th></tr><tr><th>ha</th></tr><tr><td>July/2010</td><td>18</td></tr><tr><td>2011</td><td>81</td></tr><tr><td>2012</td><td>72</td></tr></table>

	<table><tr><td>2013</td><td>30</td></tr><tr><td>2014</td><td>4</td></tr><tr><td>2015</td><td>14</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>July/2017</td><td>13</td></tr><tr><td></td><td>232</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description.
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	

Data / Parameter	$C_{BSL,i}$
Data unit	*t CO2-e ha-1*
Description	Carbon stock in all pools in the baseline case in stratum i
Source of data	Sourced from strata-level mean forest carbon stock estimates from forest carbon inventory of project area; equivalent to Cdest, i
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording	Re-measured every < 10 years
Value monitored	-
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description.
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	Parameter not monitored in this Monitoring Period. For more information, see Section 3.2.2.

Data / Parameter	$\Delta C_{DECKS,i,t}$
Data unit	*t CO2-e*

Description	Change in carbon stock resulting from logging deck creation in stratum i at time t
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every < 5 years
Value monitored	<table><tr><th rowspan="2">Year</th><th>ΔC_{DECKS}</th></tr><tr><th>tCO_2</th></tr><tr><td>July/2010</td><td>4,904</td></tr><tr><td>2011</td><td>18,811</td></tr><tr><td>2012</td><td>17,596</td></tr><tr><td>2013</td><td>7,253</td></tr><tr><td>2014</td><td>862</td></tr><tr><td>2015</td><td>3,433</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>July/2017</td><td>3,190</td></tr><tr><td></td><td>56,047</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 18, VMD0015 2.0
Comments	

Data / Parameter	A_{DECKS}
Data unit	*ha*
Description	Area of logging decks in stratum i at time t
Source of data	Annual harvest reports
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording	Every < 5 years

Value monitored	<table><tr><th rowspan="2">Year</th><th>A_{DECKS}</th></tr><tr><th>ha</th></tr><tr><td>July/2010</td><td>8</td></tr><tr><td>2011</td><td>29</td></tr><tr><td>2012</td><td>27</td></tr><tr><td>2013</td><td>11</td></tr><tr><td>2014</td><td>1</td></tr><tr><td>2015</td><td>5</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>July/2017</td><td>5</td></tr><tr><td></td><td>87</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description.
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	

Data / Parameter	$C_{WP\ i,t}$
Data unit	*t CO2-e*
Description	Carbon stock in wood products pool from stratum i, at time t
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every < 5 years
Value monitored	<table><tr><th rowspan="2">Year</th><th>tCO_2</th></tr><tr><th>CWP</th></tr><tr><td>July/2010</td><td>3,807</td></tr><tr><td>2011</td><td>6,697</td></tr><tr><td>2012</td><td>9,090</td></tr><tr><td>2013</td><td>3,744</td></tr><tr><td>2014</td><td>445</td></tr><tr><td>2015</td><td>1,772</td></tr><tr><td>2016</td><td>0</td></tr></table>

	<table><tr><td>2017</td><td>1,647</td></tr><tr><td>TOTAL</td><td>27,201</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of project emissions
Calculation method	Equation 2, VMD0005 1.0
Comments	

Data / Parameter	$V_{EXT,s,i,t,}$
Data unit	*m3*
Description	Volume wood product class "s" (sawnwood) extracted from stratum i at time t
Source of data	Annual harvest reports;
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording	Every < 5 years
Value monitored	<table><tr><th>Year</th><th>Vext</th></tr><tr><td>July/2010</td><td>33,693</td></tr><tr><td>2011</td><td>59,269</td></tr><tr><td>2012</td><td>80,450</td></tr><tr><td>2013</td><td>33,137</td></tr><tr><td>2014</td><td>3,937</td></tr><tr><td>2015</td><td>15,683</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>2017</td><td>14,575</td></tr><tr><td>TOTAL</td><td>240,744</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description
Purpose of the data	Calculation of project emissions
Calculation method	
Comments	

Activity shifting leakage

Data / Parameter	$\Delta C_{LK\text{-}AS,planned}$
Data unit	*t CO2-e*
Description	*Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation*
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	*Every < 5 years*
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	• Calculation of leakage
Calculation method	Equation 1, VMD0009 1.0
Comments	As detailed in the section 5.4, no shifting leakage was considered during this monitoring report

Data / Parameter	$A_{defLK,i,t}$
Data unit	*ha*
Description	*The total area of deforestation by the baseline agent of the planned deforestation in stratum* i *at time,* t
Source of data	Monitored through assessment of aerial/satellite imagery
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording	Every < 5 years
Value monitored	0
Monitoring equipment	

QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description.
Purpose of the data	Calculation of baseline emissions
Calculation method	
Comments	As detailed in the section 5.4, no shifting leakage was considered during this monitoring report

Data / Parameter	$LKA_{planned,i,t}$
Data unit	ha
Description	The area of activity shifting leakage in stratum i at time t
Source of data	Calculated as NewRi,t - AdefLK,i,t
Description of measurement methods and procedures to be applied	Remote sensing data
Frequency of monitoring/recording	Every < 5 years
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	Calculation of leakage
Calculation method	Equation 5, VMD0009 1.0
Comments	As detailed in the section 5.4, no shifting leakage was considered during this monitoring report

Data / Parameter	$\Delta C_{BSL,i}$
Data unit	$t\ CO_{2-e}\ ha^{-1}$
Description	Net carbon stock changes in all pools in baseline stratum i
Source of data	Sourced from mean forest carbon stock estimates from forest carbon inventory of project area for equivalent strata in area of activity shifting leakage
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description.

Frequency of monitoring/recording	Stock estimates updated every ≤ 10 years
Value monitored	-
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description.
Purpose of the data	• Calculation of baseline emissions
Calculation method	
Comments	Parameter not monitored in this Monitoring Period. For more information, see Section 3.2.2.

Market leakage - Fuelwood and Charcoal

Data / Parameter	$FG_{LP,t}$
Data unit	m^3 yr-1
Description	Volume of fuelwood gathered in the project area
Source of data	Annual harvest reports
Description of measurement methods and procedures to be applied	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	See table below
Monitoring equipment	
QA/QC procedures to be applied	Detailed procedures provided below under monitoring plan description.

Year	FGLP,t
2011	108,181
2012	121
2013	49,706
2014	5,609
2015	2,170
2016	0
2017	15,934
TOTAL	**181,722**

Purpose of the data	• Calculation of project emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	$C_{BSL,XBFWC,t}$
Data unit	$t\ CO_2$
Description	Carbon emission due to displaced fuelwood/charcoal harvests in stratum i in the baseline scenario at time t
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	(see table below)

Year	CBSL,XBFWC,i1	CBSL,XBFWC,i2	CBSL,XBFWC,
2011	571,463	224,879	796,342
2012	633,922	249,458	883,381
2013	541,336	213,024	754,360
2014	603,103	237,331	840,434
2015	519,751	204,530	724,282
2016	657,095	258,577	915,672
2017	523,935	206,177	730,112
Total	4,050,605	1,593,977	5,644,582

Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	• Calculation of leakage
Calculation method	Equation 7, VMD0011 v1.0
Comments	

Data / Parameter	$AL_{FW/C,i}$
Data unit	$t\ CO_2$-e
Description	Summed emissions from fuelwood/charcoal harvests in stratum i in the baseline case potentially displaced through implementation of carbon project

Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	<table><tr><th rowspan="2">Year</th><th>ALFW/C</th></tr><tr><th>tCO2e</th></tr><tr><td>2011</td><td>796,342</td></tr><tr><td>2012</td><td>883,381</td></tr><tr><td>2013</td><td>754,360</td></tr><tr><td>2014</td><td>840,434</td></tr><tr><td>2015</td><td>724,282</td></tr><tr><td>2016</td><td>915,672</td></tr><tr><td>2017</td><td>730,112</td></tr><tr><td>Total</td><td>5,644,582</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	• Calculation of leakage
Calculation method	Equation 6, VMD0011 v1.0
Comments	

Data / Parameter	$LK_{MarketEffects,FW/C}$
Data unit	$t\ CO_2$
Description	Total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	<table><tr><th>Year</th><th>LKMarketEffects,FW/C</th></tr></table>

	<table><tr><th></th><th>tCO_2e</th></tr><tr><td>2011</td><td>318,537</td></tr><tr><td>2012</td><td>353,352</td></tr><tr><td>2013</td><td>301,744</td></tr><tr><td>2014</td><td>336,174</td></tr><tr><td>2015</td><td>289,713</td></tr><tr><td>2016</td><td>366,269</td></tr><tr><td>2017</td><td>292,045</td></tr><tr><td>TOTAL</td><td>2,257,833</td></tr></table>
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	• Calculation of leakage
Calculation method	Equation 5, VMD0011 v1.0
Comments	

Market leakage - Timber Harvest

Data / Parameter	$C_{BSL,XBT}$
Data unit	$t\ CO_2$
Description	Carbon emission due to displaced timber harvests in the baseline scenario in stratum i in time t; t CO2-e
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	<table><tr><th>Year</th><th>CBSL,XBT,i,t tCO2</th></tr><tr><td>2011</td><td>**374,205**</td></tr><tr><td>2012</td><td>**263,861**</td></tr><tr><td>2013</td><td>**409,557**</td></tr><tr><td>2014</td><td>**554,800**</td></tr><tr><td>2015</td><td>**425,392**</td></tr><tr><td>2016</td><td>**617,551**</td></tr><tr><td>2017</td><td>**444,294**</td></tr><tr><td>**Total**</td><td>**3,089,660**</td></tr></table>

Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	• Calculation of leakage
Calculation method	Equation 4, VMD0011 v1.0
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

Data / Parameter	$AL_{T,i}$
Data unit	t CO_2-e
Description	Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO2-e
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	(see table below)
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	• Calculation of leakage
Calculation method	Equation 3, VMD0011 v1.0
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

Value monitored:

Year	AL_{ti} tCO2
2011	**374,205**
2012	**263,861**
2013	**409,557**
2014	**554,800**
2015	**425,392**
2016	**617,551**
2017	**444,294**
Total	**3,089,660**

Data / Parameter	$LK_{MarketEffects,timber}$
Data unit	$t\ CO_2$
Description	Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO2-e
Source of data	Calculated
Description of measurement methods and procedures to be applied	
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	see table below
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	• Calculation of leakage
Calculation method	Equation 2, VMD0011 v1.0
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

Year	LKMarketEffects,timber
	tCO2
2011	74,841
2012	52,772
2013	81,911
2014	110,960
2015	85,078
2016	123,510
2017	88,859
TOTAL	617,932

Data / Parameter	PMP_i
Data unit	%
Description	Merchantable biomass as a proportion of total aboveground tree biomass for stratum i within the project boundaries
Source of data	Own measurements
Description of measurement methods	Biomass data were measured on the forest inventory. Within each stratum the summed merchantable biomass (DBH > 30cm) was divided by the summed total aboveground tree biomass. The

and procedures to be applied	weighted average of the two strata was calculated to obtain the parameter.
Frequency of monitoring/recording	Every ≤ 5 years
Value monitored	0.63
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of the data	• Calculation of leakage
Calculation method	N/A
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

Data / Parameter	LF_{ME}
Data unit	Dimensionless
Description	Leakage factor for market effects (Timber Harvest) calculations
Source of data	VMD0011 v1.0
Value applied	0.2
Justification of choice of data or description of measurement methods and procedures applied	Parameter deducted according to page 3 of VMD0011 v1.0 LK-ME, considering the relationship between the parameters PML_{FT} and PMP_i. PML_{FT} is > 15% greater than PMP_i.
Purpose of Data	• Calculation of leakage
Comments	Parameter included in this Monitoring Report. For more information, see Section 3.2.2.

4.3 Monitoring Plan

Revision of the Baseline

The baseline as outlined on the Project Description is valid for 10 years, through July 2017. The baseline will be revised every 10 years from the project start date. Because the entire project area is deforested in the first 10-year baseline period, deforestation rate and emissions in the baseline for all subsequent baseline periods will be equal to zero.

Monitoring of actual carbon stock changes and greenhouse gas emissions

The project area comprises a combination of mature forest and secondary forest, the latter having regenerated since 1992, the year of acquisition of the property by CBNS. Although the secondary forests are accumulating biomass over the project crediting period, for accounting purposes the project conservatively assumes stable stocks and no biomass monitoring is conducted in areas undergoing carbon stock enhancement, as permitted in the methodology monitoring module VMD0015 v2.0, hence ∆CP,Enh,i,t is set to 0.

Monitoring of actual emissions in the project area focuses on:

- Emissions due to deforestation and natural disturbance
- Emissions due to illegal degradation
- Emissions due to FSC-certified selective logging

Procedures and responsibilities for monitoring each of the above sources of emissions are detailed below.

Emissions due to deforestation and natural disturbance

Forest cover change due to deforestation and natural disturbance is monitored through periodic assessment of classified satellite imagery covering the project area. Emissions ($\Delta C_{P,Def,i,t}$ and $\Delta C_{P,DistPA,i,t}$ for deforestation and natural disturbance, respectively) are estimated by multiplying area of forest loss detected ($A_{DefPA,u,i,t}$ and $A_{DistPA,q,i,t}$, for deforestation and natural disturbance, respectively) by average forest carbon stock per unit area (conservatively assuming $\Delta C_{P,Dist,q,i,t}$ and $\Delta C_{pools,Def,u,i,t} = C_{BSL,i}$). Stock estimates from the initial field inventory completed in 2011 (using measurements from 2005 to 2011), are valid for 10 years (per VM0007 v1.0). Since detected deforestation was considered insignificant (according to T-SIG), updating carbon stocks is not needed in the present MR02.

Monitoring changes in forest cover

The project boundary, as set out in the PD, will serve as the initial “forest cover benchmark map” against which changes in forest cover will be assessed over the first monitoring period; the entire project area has been demonstrated to meet the forest definition at the beginning of the crediting period. For subsequent monitoring periods, changes in forest cover are assessed against the preceding classified forest cover map marking the beginning of the monitoring interval.

Data collection and analysis to determine forest cover change at each monitoring event will follow the procedures detailed below. The resulting classified image is compared with the preceding classified image (forest cover benchmark map marking the start of the monitoring interval) to detect forest cover change over the monitoring period, and subsequently becomes the updated forest cover benchmark map for the next monitoring interval. Thus, the forest benchmark map is updated at each monitoring event. All changes in forest cover detected for the monitoring interval will be annualized (to produce estimates of ha for each year) by dividing the area by the number of years in the period.

Monitoring of land-use and land-cover change within the Project Area and Leakage Belt were carried out through analysis of MapBiomas[37] Land Cover Data for the whole Reference Region, over the entire monitoring period. The MapBiomas project was launched in July 2015, aiming to contribute with the understanding of LU/LC dynamics in Brazil. The LU/LC annual maps produced in this project were based on the Landsat archive available in the Google Earth Engine platform, encompassing the years from 1985 through the present.

The imagery dataset used in the MapBiomas project, across Collections 1 to 6, was obtained by the Landsat sensors Thematic Mapper (TM), Enhanced Thematic Mapper Plus (ETM+) and the Operational Land Imager and Thermal Infrared Sensor (OLI-TIRS), onboard of Landsat 5, Landsat 7, and Landsat 8, respectively. In Collection 6, new Landsat mosaics were processed using surface reflectance (SR) data.

The application of MapBiomas land-use and land-cover data maintains the consistency of the Minimum Mapping Unit (MMU) parameter of 0.81 ha, corresponding to a 3x3 pixel window (90m by 90m) considering that the orbital sensor image generator is the same, Landsat.

The main steps of methodological[38] process are:

1. Pre-processing

The first step is to generate an annual mosaic of Landsat images comprising a specific time window to optimize spectral contrast, remove clouds and shadows and better discriminate usage classes. Cloud and shadow removal utilizes the Quality Assessment (QA) band and Google Earth Engine's Medium Reducer, identifying which pixels may be affected by artifacts such as cloud contamination or shadows. With this, the mechanism identifies high brightness (clouds) or very dark (shadow) pixels, discarding them and calculating the pixel median of each band over the period. Thus, a temporal mosaic of Landsat is constructed for each year, including about ninety other variables (in addition to the traditional sensor bands) such as texture information, fraction images, indexes, maximizing the spectral contrast to better distinguish each theme.

[37] Available at: https://mapbiomas.org/en

[38] Available at: https://mapbiomas-br-site.s3.amazonaws.com/downloads/Colecction%206/Cod_Class_legenda_Col6_MapBiomas_BR.pdf

2. **Interpretation and classification**

To reduce waste, the process evaluates and selects the best images to enter the classification stage. The classification is made through the Random Forest algorithm. Samples for training the Random Forest classifier are extracted from classes that do not change over the years in past collections, complemented with samples collected in the field, in the most traditional way. The Random Forest process requires the definition of some parameters such as the number of trees, list of variables and training samples, which varies from biome to biome.

3. **Post-processing**

Because the classification method is pixel-based (pixel-by-pixel), a series of procedures are applied to filter classifier interpretation residues and spatial and temporal inconsistencies: (i) gap fill filter is used to fill no-data pixels; (ii) spatial filter removes isolated pixels, without connection with any other of the same value; (iii) temporal filter analyzes and corrects improper securities transactions for a series of three to five years; (iv) frequency filter reduces the temporal oscillation associated with a class of natural use; (v) incident filter removes pixels that change value every year from the time series; (vi) and finally, the rules for integrating themes are applied according to a hierarchy established for each biome.

4. **Accuracy Map**

The validation strategy initially occurs through comparative analysis with reference maps from the biome, region, and date, according to availability. In addition, accuracy analysis is based on statistical techniques of independent samples (points) with visual interpretation. Three independent interpreters inspect each sample. In case of doubts, a senior interpreter decides the final class of the pixel. Interpreters have access to Landsat, MODIS, and Google Earth images. The accuracy analysis is performed according to Stehman et al. 2014 and Stehman & Fody, 2019, using the population error matrix and the global user and producer accuracies. The accuracy for the Amazon biome, classification Level 1, 2 and 3 (Collection 6) is, respectively, 97%, 96.6% and 96.6%.

5. **Data acquisition and pre-processing**

Available on the MapBiomas platform, the annual organized data were obtained in raster format (.tif) for the entire reference region and all leakage areas (CBNS, ABC Florestas, Jataituba and Deus é Bom I e II). MapBiomas collection of land use and land cover classes is extensive and detailed. To adapt to the methodology, the classes were grouped into Forest, Other natural formations (non-forest), hydrography and anthropic land use areas, as show in the table below.

MapBiomas ID	Project ID	Land use description
3	1	Forest (Forest area)
4	2	Other natural formations
5	2	Other natural formations
49	2	Other natural formations
10	2	Other natural formations
11	2	Other natural formations
12	2	Other natural formations
32	2	Other natural formations
29	2	Other natural formations
13	2	Other natural formations
14	4	Non-Forest land (Anthropic LU)
15	4	Non-Forest land (Anthropic LU)
18	4	Non-Forest land (Anthropic LU)
19	4	Non-Forest land (Anthropic LU)
39	4	Non-Forest land (Anthropic LU)
20	4	Non-Forest land (Anthropic LU)
40	4	Non-Forest land (Anthropic LU)
41	4	Non-Forest land (Anthropic LU)
36	4	Non-Forest land (Anthropic LU)
46	4	Non-Forest land (Anthropic LU)
47	4	Non-Forest land (Anthropic LU)
48	4	Non-Forest land (Anthropic LU)
9	4	Non-Forest land (Anthropic LU)
21	4	Non-Forest land (Anthropic LU)
22	4	Non-Forest land (Anthropic LU)
23	2	Other natural formations
24	4	Non-Forest land (Anthropic LU)
30	4	Non-Forest land (Anthropic LU)
25	4	Non-Forest land (Anthropic LU)
26	3	Hydrography
33	3	Hydrography
31	4	Non-Forest land (Anthropic LU)
27	5	Not observed

6. Change detection

Maps were organized by class with a single code (4 - anthropic), year by year, and overlayed in a GIS environment, thus enabling the quantification of annual hectares of land use change inside the PA and in the whole LB for the monitoring period.

Data Archiving

All data sources and processing, classification and change detection procedures will be documented and stored in a dedicated long-term electronic archive maintained by CBNS at its head office in Paragominas, PA.

Information related to monitoring deforestation maintained in the archive will include:

- All cartographic data used on this MR (boundaries, base data, auxiliary imagery)
- Base (raw) MapBiomas data used (land use / land cover raster data – raster format);
- Union of all annual land cover maps used to quantify land change

Data archived will be maintained through at least two years beyond the end of the project crediting period, through July 2029. Given the extended time frame and the pace of production of updated versions of software and new hardware for storing data, electronic files will be updated periodically or converted to a format accessible to future software applications, as needed.

Updating forest carbon stock estimation

Forest carbon stock estimation used to calculate emissions from deforestation and natural disturbance will use estimated values derived from field measurements less than or equal to 10 years old. In the occasional case, where any significant deforestation may be observed in the project area (as per "Tool for testing significance of GHG emissions in A/R CDM project activities v1.0"), forest carbon stock estimation older than 10 years will be updated for any strata where deforestation is detected.

Where necessary (per above), forest carbon stocks will be re-estimated from new field measurements. Fifteen sample plots will be randomly located in areas within the Rio Capim Complex representative of the stratum(a) where significant deforestation may have been detected, then they will be measured following field procedures outlined in Silva et al (2005[39]) and maintaining conformance with field procedures used in the collection of data for the "Forest Biomass Inventory Results for the Rio Capim" document (2011). Biomass will be estimated applying the allometric equations of Higuchi et al (1998[40]) and otherwise maintain consistency with analytical procedures applied in the original inventory ("Forest Biomass Inventory Results for the Rio Capim", 2011).

For each stratum, where the re-measured estimate of forest biomass carbon (live above- and belowground biomass) is within the 90% confidence interval of the 2011 estimate, the 2011 stock estimate will be used. If the re-measured estimate is outside (i.e., greater than or less than) the 90% confidence interval

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[39] SILVA, J. N. M.;LOPES, J. do C. A. L.; OLIVEIRA, L. C. de; SILVA, S. M. A. da; CARVALHO, J. O. P. de; COSTA, D. H. M.; MELO, M. S.; TAVARES, M. J. M. 2005. Diretrizes para a instalação e medição de parcelas permanentes em florestas naturais da Amazônia Brasileira. Belém, PA: Embrapa Amazônia Oriental, p. 68.

[40] HIGUCHI, N., SANTOS, J., RIBEIRO, R.J., MINETTE L. & BIOT, Y. 1998. Biomassa da parte aérea da vegetação da floresta tropical úmida de terra-firme da Amazônia brasileira. Acta Amazonica 28(2):153-166.

of the 2011 estimate, then the new stock estimate from the supplemental fifteen sample plots will be used.

Quality Assurance /Quality Control and Data Archiving Procedures

The following steps will be taken to control for errors in field sampling and data analysis:

1. Professional field crews with extensive prior training in forest inventory will carry out all field data collection and adhere to field measurement protocols outlined in Silva et al (2005). Field crews will have attended periodic update training courses at IFT (Tropical Forest Institute) and/or Embrapa. Pilot sample plots shall be measured before the initiation of formal measurements to appraise field crews and identify and correct any errors in field measurements. Field crew leaders will be responsible for ensuring that field protocols are followed to ensure accurate and consistent measurement. To ensure accurate measurements, the height of diameter at breast height (1.3 m) will be periodically re-assessed by personnel during the course of the inventory; note that in re-measurements, diameter at breast height will be carried out in places marked previously in old measurements. Field crews will have fine scale forest strata maps for use in the field to precisely interpret strata/forest boundaries and identify potential areas of plot overlap.
2. An opportunistic sample of plots will be re-measured to identify and correct any field measurement issues which arise during implementation of the monitoring plan and to assess measurement errors. Re-measurement for this purpose will be done by a different field crew. Measurement error will be assessed as 1/2 of the mean (absolute) percent difference between re-measured plot level biomass estimates (a valid assumption where teams are equally experienced and there are no systematic errors in measurement, which will also be appraised from the re-measurement results). Target measurement error is < 3-5%.
3. Field measurement data will be recorded on standard field data sheets "FICHA DE CAMPO PARA PARCELA PERMANENTE – ARVORE" and entered to the forest inventory software MFT – Monitoramento de Florestas Tropicais for data management and quality control; MFT identifies and reports potential errors in data entry (anomalous values) which are then verified, or corrected consulting the original data sheets or personnel involved in measurement. Original data sheets will be permanently archived at the CBNS office on-site at Rio Capim, and the electronic MFT database of all field measurements will be stored in the dedicated long-term electronic archive maintained by CBNS at its head office. The electronic database will also archive GIS coverages detailing forest and strata boundaries and plot locations. Note that the 152 original data sheets that are part of this project are distinguished by a label from the others, indicating the plot identification to standardize the nomenclature with maps, spreadsheets, and any information regarding the inventory for the carbon stock. Furthermore, in addition to the sheets' information, it includes the geographical coordinates of the plots.

Emissions due to illegal degradation

Emissions due to illegal logging are and will be tracked by conducting surveys in the surrounding areas. Locations surveyed will include:

- Ararandeua Community: located in the municipality of Goianésia do Pará, in the neighboring area of RCC on the bank of the Ararandeua river, an area still known as an Indigenous Land.
- Barreirinha: Indigenous community of Amanayé ethnic group, located near RCC and has an area of 2,374 hectares on the banks of the Capim river, area known as Indigenous Land.
- Surubiju: Indigenous community of Amanayé ethnic group

As described in the section 2.2, between 2014/2015 a participatory mapping was carried out with the community members to understand which resources they explored within the Rio Capim Complex. No community reported exploiting wood or firewood within the Rio Capim Complex.

In the event that any potential of illegal logging occurring in the project area is detected from the surveys (i.e., ≥ 10% of those interviewed/surveyed believe that degradation may be occurring within the project boundary), temporary sample plots will be allocated and measured in the area of the project indicated by the surveys as a potential source area for illegally harvested wood. The potential degradation area within the project area ($A_{DegW,i}$) will be delineated based on survey results, incorporating general area information and maximum depth of penetration. Rectangular plots 10 meters by 1 kilometer (1 ha area) will be randomly or systematically allocated in the area, sufficient to produce a 1% sample of the area, and any recently cut stumps or other indications of illegal harvest will be noted and recorded. Diameter at breast height, or diameter at height of cut, whichever is lower, of cut stumps will be measured.

In the event that the sample plot assessment indicated that illegal logging is occurring in the area, supplemental plots will be allocated to achieve a 3% sample of the area. Biomass will be estimated from measured diameters (conservatively assuming that diameters of stumps cut below breast height are equivalent to diameter at breast height) applying the allometric equations of Higuchi et al (1998) and otherwise maintain consistency with analytical procedures applied in the original inventory ("Forest Biomass Inventory Results for the Rio Capim", 2011). Emissions due to illegal logging ($\Delta C_{P,DegW,i,t}$) are estimated by multiplying area ($A_{DegW,i}$) by average biomass carbon of trees cut and removed per unit area ($C_{DegW,i,t}$ / AP_i).

The more intensive 3% sample will be carried out once every 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area to produce an estimate of emissions resulting from illegal logging ($\Delta C_{P,DegW,i}$). Estimates of emissions will be annualized (to produce estimates in t CO_2-e per year) by dividing the emission for the monitoring interval by the number of years in the interval.

The same quality assurance/quality control and archiving procedures as detailed above for updating estimates of forest carbon stocks will be adhered to in the field surveys of potential degradation areas.

Emissions due to FSC-certified selective logging

Project emissions due to FSC-certified selective logging ($\Delta C_{P,SelLog,i,t}$) will be estimated applying module VMD0015 v2.0, covering emissions from the following sources/sinks:

- Emissions from the felling gap ($C_{LG,i,t}$)
- Emissions from construction of infrastructure, including roads, skid trails and logging decks ($C_{LR,i,t}$)
- Removals from storage in long term wood products generated ($C_{WP\ i,t}$)

Monitored parameters will be sourced from annual post-harvest assessment reports prepared for SEMA.

Volume wood removed by product class (logs and residues)

The procedures are described below:

The volume of wood removed is measured when the logs arrive in the CBNS sawmills. Workers use tape measures to perform the length and diameter measurement to calculate the volume of the logs discounting bark, rotten and hollows (if necessary). Measurements and information about logs entry and output are recorded.

The top of the logs measured will be painted and information regarding the number of the tree and species code is added to the log. Monthly a log inventory is performed, and if any distinction from the initial volume inventoried is found an investigation is conducted.

Regarding residues, these shall be stacked on carts that are already sized for determined amount (steres) or be measured in the moment of its discharge.

Monitored parameters will supply the calculations of with-project emissions from FSC-certified selective logging (ΔCP,SelLog,i,t).

Monitoring of leakage carbon stock changes and greenhouse gas emissions

Two sources of leakage will be monitored: activity shifting leakage and market leakage.

Activity-shifting leakage

Activity-shifting leakage will be monitored by tracking forest cover change across all lands outside of the project area owned or under the management of CBNS ($A_{defLK,i,t}$). This will be accomplished using remotely sensed imagery that covers the properties at the needed monitoring intervals. Imagery that is freely available and accessible using Google Earth will be used preferentially when it is available. When it is unavailable, other remotely sensed imagery will be acquired for analysis. CBNS property boundaries will be overlaid on remotely sensed imagery to assess if forest cover changes have occurred. If deforestation is noted, further confirmation will be made that the deforestation resulted from authorized deforestation activities by CBNS. If annual forest cover change data is unavailable, all changes in forest cover (due to planned deforestation) detected for the monitoring interval will be annualized (to produce estimates of ha for each year) by dividing the area by the number of years in the period.

The CBNS administers the Rio Capim Complex performing the Sustainable Forest Management all over the forest area. Part of the Rio Capim Complex is CBNS property, and another part is administered and managed in accordance with a lease agreement of forest land held with the owners of other forest areas: Madeireira Matinha S.A. and Rondon Imóveis Ltda

Thus, the CBNS has the Sustainable Forest Management Plan, as well as all environmental permits to develop forestry activities within the Rio Capim Complex.

The CBNS also managed and developed the Sustainable Forest Management in other forests owned by companies that do not belong to Pereira Dias´s family members and are located in the Portel municipality, Pará state. These forests are:

1. Jataituba forest area owned by Martins Agropecuária S/A: CBNS began the administration of the forest and forest management through the Lease Agreement entered into force on June 18, 2002, and terminated in 2011.
2. ABC forest area owned by ABC Agropecuária Brasil Norte S/A – Produção e Exportação: CBNS started the administration of the forest and forest management by the Lease Agreement concluded in 1997. The contractual relationship has been renewed over the years and lasted until 2014.

In summary:

Forest Area	Landowner	Status
Rio Capim Complex	CBNS and other family companies	CBNS Forest Management
Deus é Bom I	Rondon Imóveis (Family company)	No Forestry Activity during the monitoring period

Deus é Bom II	Rondon Imóveis (Family company)	No Forestry Activity during the monitoring period
Jataituba	Martins Agropecuária	Management by CBNS ended in 2011
ABC	ABC Agropecuária	Management by CBNS ended in 2014

Option 1.2 from methodology module VMD0009 LK-ASP v1.0 will be used to calculate activity shifting deforestation.

Market leakage

In this monitoring period, leakage due to market effects considered decreased timber harvest and decreased harvest of fuelwood and charcoal sold into regional and/or national market.

For estimation of market leakage, the main parameter monitored is annual volume of timber and fuelwood harvested from the project area, which will be derived from annual harvest reports with harvested volumes estimated as per procedures above.

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

Estimates of GHG credits eligible for issuance as VCU's will be calculated entering the following data into the calculation spreadsheet, where:

Estimated GHG emission reduction credits =

Baseline emissions, fixed for 10 years at validation *minus*

Project emissions *minus*

Leakage *minus*

Non-permanence Risk Buffer withholding (calculated as a percent of net change in carbon stocks prior to deduction of leakage)

Organization and Responsibilities

For all aspects of project monitoring, CBNS will ensure that data collection, processing, analysis, management, and archiving are conducted in accordance with the monitoring plan.

It is important to report that between 2011 and 2017, there were operational problems with employees' notebooks and a hacker attack that caused the loss of relevant documents and evidence of the company, including evidence related to the Cikel REDD project, such as training certificates, fire brigade reports, photos, among others. The hacker attack did not impact the data relevant to the calculations of emissions and carbon sequestration, for example, the original spreadsheets used for the PD and MR1 are still available, as well as the forest inventory data to determine biomass. The main losses are due exclusively to records of activities carried out in the past (e.g., employee training and activities with community members), such as photos, videos and attendance lists.

In view of this, the company adopted the following measures to avoid new operational problems[41]:

- Cloud email contracting where messages are stored on Ktree company servers, with daily backup and seven-day retention
- Creation of an exclusive folder for the group's units, where all information will be stored inside the file server, with daily backup and 7-day retention, located at the headquarters in Curitiba (State of Paraná)
- Adoption of Virtual Private Network (VPN) infrastructure for secure and exclusive access to the group's file server
- Acquisition of space in the cloud, for contingency of the information contained in the file server

Management of non-conformities

Internal audits will be carried out by the CBNS technical team during scheduled inspections and identified non-conformities will be recorded in the Qualyteam System, which is a quality management system that meets ISO 9001 requirements, and was implemented at CBNS from January 2022.

The operational procedure “PRO GA 001 - Management of Communication, Conflicts and Handling of Non-Conformities” (PRO GA 001 “Gestão de Comunicação, Conflitos e Tratativa de Não-Conformidades”) determines that non-conformities identified during the internal and external audits of the Cikel REDD project will be recorded in the Qualyteam System, as well as the action plans and evidence of the closure of the non-conformity.

[41] Detailed at “Prevenção Contra Perdas de Documentos” document

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As described in section 3.1 of the validated PD, due to financial difficulties in 2005 and 2006, CBNS began the process to obtain authorization to legally deforest the project area and convert to pasture to diversify its business and raise revenues. However, the company opted to give up the suppression plan and implement a REDD project.

Thus, baseline emissions were calculated applying module VMD0006 BL-PL v. 1.0.

5.1.1 Area of deforestation $A_{planned,i}$

Area in hectares deforested per year follows the approved suppression plan, that is, the annual deforestation rate ($D\%_{planned,i,t}$) is known because it follows the company's business plan, so the rate is the actual area planned ($A_{planned,i}$) in the suppression plan described below.

Table 29. Area in hectares deforested per year in the project area in the baseline and the volume of sawnwood and residues that would be produced.

Year	Forest area	$D\%_{planned,i,t}$ * $A_{planned,i,t}$ ha	Sawnwood (m^3)	Residues (bolts and firewood) (m^3)
2010	Caculé	0[1]	0[1]	0[1]
2011	Rio Capim	2,949.4	149,945	819,095
2012	Rio Capim	2,840.0	144,388	788,737
2013	Rio Capim	2,603.9	132,380	723,142
2014	Caculé	2,721.8	138,374	755,885
2015	Cauaxi	2,336.0	118,762	648,754
2016	Sumal	2,943.4	149,643	817,442
2017	Caculé, Sumal	2,404.3	122,235	667,722
TOTAL		**18,799**	**955,726**	**5,220,777**

[1] All planned deforestation for 2010 was already considered in MR1.

5.1.2 Likelihood of deforestation L-Di

As per BL-PL v1.0 section 1.4:

"For all other planned deforestation areas (i.e., areas not both under government control and zoned for deforestation), $L\text{-}D_i$ shall be equal to 100%". The likelihood of deforestation ($L\text{-}D_i$) is set as 1.

5.1.3 Baseline carbon stocks

As described in the VMD0006 v1.0, the net carbon stock changes in the baseline are equal to:

(3) $$\Delta C_{BSL,i} = C_{BSL,i} - C_{BSL,post,i} - C_{BSL,wp,i}$$

Where:

$\Delta C_{BSL,i}$ Net carbon stock changes in all pools in the baseline in stratum i; t CO_2-e ha^{-1}

$C_{BSL,i}$ Carbon stock in all pools in the baseline in stratum i; t CO_2-e ha^{-1}

$C_{BSL,post,i}$ Carbon stock in all pools in the baseline post-deforestation in stratum i; t CO_2-e ha^{-1}

$C_{BSL,WP,i}$ Carbon stock sequestered in wood products in the baseline in stratum i; t CO_2-e ha^{-1}

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

5.1.4 Forest carbon stocks

The forest carbon stock is calculated using the formula 4 of the VMD0006 v1.0:

(4) $$C_{BSL,i} = C_{AB\_tree,i} + C_{BB\_tree,i} + C_{AB\_non-tree,i} + C_{BB\_non-tree,i} + C_{DW,i} + C_{LI,i} + C_{SOC,i}$$

Where:

$C_{BSL,i}$ Carbon stock in all pools in the baseline in stratum *i*; t CO_2-e ha^{-1}

$C_{AB\_tree,i}$ Carbon stock in aboveground biomass in the baseline in stratum *i*; t CO_2-e ha^{-1}

$C_{BB\_tree,i}$ Carbon stock in belowground biomass in the baseline in stratum *i*; t CO_2-e ha^{-1}

$C_{AB\_non-tree,i}$ Carbon stock in aboveground non-tree vegetation in stratum *i*; t CO_2-e ha^{-1}

$C_{BB\_non-tree,i}$ Carbon stock in belowground non-tree vegetation in stratum *i*; t CO_2-e ha^{-1}

$C_{DW,i}$ Carbon stock in dead wood in the baseline in stratum *i*; t CO_2-e ha^{-1}

$C_{LI,i}$ Carbon stock in litter in the baseline in stratum *i*; t CO_2-e ha^{-1}

$C_{SOC,i}$ Carbon stock in soil organic carbon in the baseline in stratum *i*; t CO_2-e ha^{-1}

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

Estimation of forest biomass stocks was made from direct inventory of the Rio Capim property area, including the project area, and is detailed in Annex 4 of the Project Document "Forest Biomass Inventory Results for the Rio Capim property, CBNS, REDD project areas, Paragominas, Para, Brazil". Results are summarized by forest type/strata in the table below (Table 31).

As described in section 2.3 of the PD, carbon stocks from litter, dead wood, soil organic carbon and non-trees were excluded, as indicated below.

Table 30. Carbon pools excluded

Carbon pools excluded	Value
$C_{AB\_non\text{-}tree,i}$	0
$C_{BB\_non\text{-}tree,i}$	0
$C_{DW,i}$	0
$C_{LI,i}$	0
$C_{SOC,i}$	0

Therefore, the carbon stock in the baseline (*CBSL,i*) is the sum of the carbon stock in the aboveground (*CAB_tree,i*) and belowground biomass (*CBB_tree,i*), as indicated in the table below (Table 31).

Table 31. Aboveground biomass ($C_{AB\_tree,i}$), Belowground biomass ($C_{BB\_tree,i}$) and Total Biomass ($C_{BSL,i}$) by Forest Type in live trees > 5 cm dbh. (FOD = Dense Ombrophylous Forest, FS = Secondary Forest)

Forest type	Total Aplanned,i (ha)	$C_{AB\_tree,i}$	$C_{BB\_tree,i}$	$C_{BSL,i}$
		(tCO_2e/ha)	(tCO_2e/ha)	(tCO_2e/ha)
FOD	19,687.40	520	122	642
FS	7,747.30	294	72	366
TOTAL	**27,434.70**			

5.1.5 Post-deforestation carbon stocks

The post-deforestation carbon stocks (CBSL,post,i) are calculated according to equation 5 of the VMD0006 v1.0:

$$C_{BSL,post,i} = C_{AB\_tree,i} + C_{BB\_tree,i} + C_{AB\_non-tree,i} + C_{BB\_non-tree,i} + C_{DW,i} + C_{LI,i} + C_{SOC,PD-BSL,i} \quad (5)$$

As described in sections 2.3 and 3.1 of the validated PD, post deforestation carbon stocks in pasture in included pools (aboveground and belowground live aboveground trees = *CAB_tree,i* and *CBB_tree,i*) was considered zero (*CBSL,post,i* = 0), as the suppression plan involves clearcut timber harvest and no trees are retained on-site following conversion to pasture. In item "c- Carbon Pools" of the VM0007 v1.0 (page 11), it is stated that "The project *shall* account for any significant *decreases* in carbon stock in the project scenario and any significant increases in carbon stock in the baseline scenario and *may* account for *decreases* in the baseline scenario and increases in the project scenario." Non-tree woody biomass is lower in the baseline (pasture) than in the project case (forest), so *CAB_non-tree,l and CBB_non-tree,l* were considered zero (0) in the PD and in the first monitoring report. .

As explained in Section 2.2 Post-Deforestation Carbon Stocks of the VMD0006 1.0: "Carbon pools excluded from the project can be accounted as zero. Herbaceous non-tree vegetation is considered to be *de minimis* in all instances." According to the suppression plan, after the deforestation of the baseline, pastures would be implemented with species of the genus Brachiaria, which are herbaceous grasses, falling under this minimis rule.

Indeed, no equation in the entire methodology and its modules foresees the inclusion of herbaceous carbon pool, even if considering the "non-tree" carbon pool (CAB_nontree). According to CP-AB v. 1.0 "*Non-tree woody aboveground biomass pool includes trees smaller than the minimum tree size measured in the tree biomass pool, all shrubs, and all other* ***non-herbaceous*** *live vegetation*". That is, the parameter CAB_nontree does not consider herbaceous non-tree, as it is considered the minimis in all instances by the methodology.

However, to be more conservative, we applied the T-SIG tool (Tool for testing significance of GHG emissions in A/R CDM project activities) to analyze whether the post-deforestation stock would be significant for the previous and current monitoring period.

Three studies were considered to obtain the pasture's aboveground and belowground stock. One of them was carried out by Fearnside (1996)[42], who evaluated the total biomass (t/ha) of productive and degraded pastures in the Amazon, obtaining, respectively, the values of 10.7 t/ha and 8 t/ha, and an average of 9.4 t/ha (equivalent of 4.39 tC/ha). Two studies conducted by SANQUETTA *et al.* were also considered. Both studies assessed the carbon stocks of cultivated pastures located in Rondônia, southwestern Brazilian Amazon. The predominant grass species in both studies is *Urochloa brizantha*, synonymy of *Brachiaria brizantha,* same species that would be used in the baseline scenario. In the 2019[43] study, the carbon stock obtained had an average of 7.53 tC/ha, while in the 2022[44] study the average stock was 5.17 tC/ha. These two studies were chosen instead of the IPCC (2006) default because they are the most up-to-date data from the Amazon biome and include the same species that would be used in the baseline scenario. Thus, for the present simulation, the average of these three studies (4.39 tC/ha, 7.53 tC/ha and 5.17 tC/ha) was considered, obtaining a value of 5.70 tC/ha for the post-deforestation stock.

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[42] Philip M. Fearnside (1996). *Amazonian deforestation and global warming: carbon stocks in vegetation replacing Brazil's Amazon forest. , 80(1-3), 0–34.* doi:10.1016/0378-1127(95)03647-4

[43] Sanquetta, Carlos Roberto, et al. "Estoque de biomassa e carbono em pastagens cultivadas no norte de rondônia." BIOFIX Scientific Journal 5.1 (2019): 102-107. Available at http://dx.doi.org/10.5380/biofix.v5i1.67756

[44] Sanquetta, Carlos R., et al. "Assessing the carbon stock of cultivated pastures in Rondônia, southwestern Brazilian Amazon." Anais da Academia Brasileira de Ciências 94 (2022). Available at https://doi.org/10.1590/0001-3765202220210262.

A simulation was done considering the pasture stock value (CBSL,post,) of 5.70 tC/ha for the previous MR (MR1) and for the current MR (MR2), to demonstrate that this carbon pool was insignificant in the MR1, but significant in the current MR. As shown in the table below (Table 32), considering the pasture stock (*CBSL,post* = 5.70 tC/ha), the difference in the total ERRs from the previous MR and the current MR would be, respectively, 180,439 tCO_2e, and 392,763 tCO_2e lower, which is equivalent, respectively, to 4.4% and 7.0% reduction in CREDD. According to T-SIG, carbon pools may be neglected when they represent less than 5% of the total emissions. Therefore, the stock of pasture after deforestation can be excluded from the first monitoring period but was included in the current monitoring period.

Table 32. Simulation considering the CBSL,post,i in the baseline

Baseline emissions or removals (tCO2e)						
Year	ORIGINAL SCENARIO		CBSL POST INCLUDED		Difference (tCO2e)	
	MR1	MR2	MR1	MR2	MR1	MR2
2008	1,436,718		1,377,250		59,468	0
2009	1,339,936		1,280,624		59,312	0
2010	1,317,808	-159,709	1,256,149	-159,709	61,659	0
2011		1,066,664	0	1,005,043	0	61,622
2012		211,563	0	152,226	0	59,338
2013		395,133	0	340,730	0	54,403
2014		1,205,572	0	1,148,705	0	56,866
2015		523,176	0	474,373	0	48,803
2016		1,304,839	0	1,243,341	0	61,497
2017		1,032,250	0	982,016	0	50,234
Total	4,094,462	5,579,488	3,914,023	5,186,724	180,439	392,763
					4.4%	7.0%

Thus, for the current monitoring report, it was considered *CBSL,post* = 5.70 tC/ha.

Table 33. $CBSL_{,post}$ for the current monitoring period

Year	Planned Deforestation (ha/yr)	*CBSL,post* tCO_2/yr
2010	0.00	0.00
2011	2,949	61,622
2012	2,840	59,338
2013	2,604	54,403
2014	2,722	56,866
2015	2,336	48,803
2016	2,943	61,497
2017	2,404	50,234
Total	18,799	392,763

5.1.6 Greenhouse gas emissions

GHG emissions ($GHG_{BSL,E}$) in the baseline are conservatively assumed to be zero (0). No nitrogen fertilizer application takes place in the project area in the baseline ($N2O_{direct\text{-}N,I}$, = 0). Biomass burning is conservatively excluded from accounting in the baseline ($E_{BiomassBurn,i,t}$ = 0). While some fossil fuel emissions occur from vehicles and machinery used in the forest conversion process, they are conservatively excluded from the baseline ($E_{FC,i,t}$ = 0).

5.1.7 Ex ante estimation of carbon stocks in the wood products pool in the baseline

Carbon sequestered in long-lived wood products is calculated using module CP-W v1.0 Option 1, Direct Volume Extraction Estimation, because an approved harvest plan for the project is available. One wood product class (sawnwood, “s”) is extracted in the baseline. All other wood extracted would be in the form of residues for fuelwood/charcoal production use, and thus involve no long-term sequestration in wood products and are not treated here. All parameters employed in calculations are summarized in the table below (Table 34).

Parameters A and $V_{ex,ty,j}$ are in accordance with the suppression plan for planned extraction of sawnwood. For this monitoring period, only the area that would be deforested between 2011 and 2017 was considered, because the area that would be deforested in 2010 was already quantified in the previous MR. For the same reason, only the volume of sawnwood generated in this same period was considered. These values are described in the Table 34 below.

Wood density applied, D_j, represents a volume-weighted wood density across all species for the project area, referencing species-specific wood densities from the Forest Products Laboratory (LPF) of the Brazilian Forest Service database (accessed at https://lpf.florestal.gov.br/pt-br/madeiras-brasileiras)[45] and permitted species-specific volumes of sawnwood from the suppression plan. This represents the volume-weighted average density for commercial species to be extracted as sawlog in the baseline in the project area.

A default carbon fraction of biomass of 0.47 is applied for parameter *CF* (IPCC 2006GL).

[45] Where species were unidentified or no species-specific wood density data was available, 0.65 metric tons per cubic meter was applied, which represents the average basic wood density of the Forest Products Laboratory (LPF) of the Brazilian Forest Service database.

Table 34. Assumptions used in calculations of the wood products pool in the baseline.

Coefficients	Value	Unit
A	18,799	hectare
$V_{ex,ty,j}$	955,726	m^3
D_j	0.67	g/cm3
CF_j	0.47	dimensionless
WW_S	0.24	dimensionless
SLF_S	0.2	dimensionless
OF_{ty}	0.84	dimensionless
Log extracted	50.84	m^3/ha
Residues/fuelwood extracted	277.72	m^3/ha
LDF	0.53	tC/m^3

Step 1: Identify the wood product class (ty) that are the anticipated end use of the extracted carbon: *Sawnwood*

Step 2: Calculate the biomass carbon of the volume extracted by wood product type ty from within the project boundary:

(01)

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

Where:

$C_{XB,ty,i}$: Mean stock of extracted biomass carbon by class of wood product ty from stratum i; t CO_2-e ha^{-1}

A_i: Total area of stratum i; ha

$V_{ex,ty,j}$: Volume of timber extracted from within stratum i (does not include slash left onsite) by species j and wood product class ty; m^3

D*j:* Mean wood density of species j; t d.m.m^{-3}

CF*j:* Carbon fraction of biomass for tree species j; t C t^{-1} d.m.

J: 1, 2, 3, … S tree species

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

44/12: Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}

The tCO_2/ha sequestered in gross volume of sawnwood extracted (CXB), is calculated as 59.0 tCO_2/ha using equation 1 of VMD0005 CP-W v1.0. Reinforcing that the emissions from deforestation planned for the year 2010 were already considered in the previous MR, which covered up to July 18, 2010, that is, the first semester of the year. Therefore, the calculation tables referring to the baseline emissions are not considering the year 2010. For more information about the emissions of 2010, refer to section 4.1 Baseline Emissions of the PD[46].

Table 35. C_{XB} calculated for the baseline according to formula 01 from VMD0005 v1.0

Year	Aplanned,i,t (ha)	Vext Sawnwood (m^3)	D_j	CF	44/12	C_{XB} tCO_2/ha	C_{XB} tCO_2
2011	2,949	149,945	0.67	0.47	3.67	59	174,156
2012	2,840	144,388	0.67	0.47	3.67	59	167,701
2013	2,604	132,380	0.67	0.47	3.67	59	153,754
2014	2,722	138,374	0.67	0.47	3.67	59	160,716
2015	2,336	118,762	0.67	0.47	3.67	59	137,938
2016	2,943	149,643	0.67	0.47	3.67	59	173,805
2017	2,404	122,235	0.67	0.47	3.67	59	141,971
TOTAL	**18,799**	**955,726**					**1,110,041**

Step 3: Calculate the proportion of biomass carbon extracted that remains sequestered in long-term wood products after 100 years.

(2)
$$C_{WP,i} = \sum_{ty=s,w,oir,p,o} C_{XB,ty,i} * (1 - WW_{ty}) * (1 - SLF_{ty}) * (1 - OF_{ty})$$

Where:

$C_{WP,i}$: Carbon stock in wood products pool (stock remaining in wood products after 100 years) from stratum i; t CO_2-e ha^{-1}

$C_{XB,ty,i}$: Mean stock of extracted biomass carbon by class of wood product ty from stratum i; t CO_2-e ha^{-1}

[46] Project 832: https://registry.verra.org/app/projectDetail/VCS/832

WW_{ty}: Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product ty; dimensionless

SLF_{ty}: Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product ty; dimensionless

OF_{ty}: Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product ty; dimensionless

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

i 1, 2, 3, … M strata

Applying the formula above and considering the emission factors WWs, SLFs and OFs (Table 34), the proportion retained in long-lived wood products after 100 years (CWP) obtained was 5.7 tCO_2/ha.

Table 36. Carbon sequestered in long-lived wood products in the baseline

Year	CXB tCO_2	$(1-WW_{ty})$	$(1-SLF_{ty})$	$(1-Of_{ty})$	CWP tCO_2	CWP tCO_2/ha
2011	174,156	0.76	0.8	0.16	16,942	5.7
2012	167,701	0.76	0.8	0.16	16,314	5.7
2013	153,754	0.76	0.8	0.16	14,957	5.7
2014	160,716	0.76	0.8	0.16	15,634	5.7
2015	137,938	0.76	0.8	0.16	13,419	5.7
2016	173,805	0.76	0.8	0.16	16,908	5.7
2017	141,971	0.76	0.8	0.16	13,811	5.7
TOTAL	**1,110,041**				**107,985**	

5.1 8 Uncertainty

Total uncertainty in carbon stocks (parameter $Uncertainty_{BSL,SS}$) is equal to combined uncertainty of forest carbon stock estimates across strata/forest types, calculated using propagation of errors (equation 3 of VM0007 v1.0 module X-UNC v1.0). Parameter $Uncertainty_{BSL,SS}$ is, thus, calculated to be 10.2% at the 95% confidence level. Total uncertainty in the baseline scenario ($Uncertainty_{BSL}$) is then 10.2%, applying equation 4 of VM0007 v1.0 module X-UNC v1.0, because uncertainty in the baseline rate ($Uncertainty_{BSL,RATE}$) is assumed to be zero where the planned deforestation rate is based on actual plans.

According to the VMD0001 v.1.0:

"Above- and belowground biomass stock estimates are valid in the baseline (i.e. treated as constant) for 10 years, after which they must be re-estimated from new field measurements. For each stratum, where the re-measured estimate is within the 90% confidence interval of the t=0 estimate, the t=0 stock estimate takes precedence and is re-employed, and where the re-measured estimate is outside (i.e. greater than

or less than) the 90% confidence interval of the t=0 estimate, the new stock estimate takes precedence and is used for the subsequent period."

Because no carbon stock enhancement was considered to this MR, the monitoring frequency should be after 10 years, on July 19, 2017. However, this MR covers a crediting period until July 18, 2017 so there is no need for another remeasurement for CAB,tree,i parameter, according to VM0007 v1.0 modules (VMD0001 v1.0 and VMD0015 v2.0).

Besides that, the PD's Annex 4 ("Forest Biomass Inventory Results for the Rio Capim property, CBNS, REDD project areas, Paragominas, Para, Brazil") was made available to the VVB during this verification. This document is a report made in 2011 by entities involved (Terra Carbon LLC and Embrapa) in the forest inventory process. The biomass assessment was based on direct field measurements from 2005 to 2011 aiming to determine forest carbon stock in 2007 (project start date). Therefore, field measurements were made prior to this verification event. Moreover, plots selection, strata representativeness, field measurement and data processing were made based on best practices guidelines and QA/QC procedures, which can be consulted on the report. As described in the report, the total sample size for the forest inventory was 152 plots, which was the sample size required to achieve the target accuracy of +/- 15% with a mean of 95% confidence, in compliance with is the VMD0001 v1.0 request of confidence interval of 90%.

5.1.9 Offset planting

The legal permit to conduct the suppression activity requires that CBNS compensates for the loss of forest by replanting an existing unforested area. Although technically the reforestation activity would be outside the accounting boundary of the project in the baseline because non-forest areas are not eligible project areas, for completeness in project accounting, sequestration resulting from this activity is included in the project baseline, as the planned deforestation could not have legally occurred without it.

Sequestration occurring in the baseline due to the mandatory reforestation activities was estimated using the parameters and rational presented on Section 3.2.2.3. The reforestation plan proposed to plant 930 ha each year, starting in 2008. The proportional removals for each planting year are presented below. The total removal estimated for the current monitoring period is 380,725 tCO_2e .

Table 37. Proportional removals for each planting year.

Planting ha/year	930	930	930	930	930	930	930	930	930	930		
Planting year / Monitoring Period	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total removals (tCO_2^e)**	**Total removals MR2 (tCO_2^e)**
2008	0	0	0	0	0	0	0	0	0	0	**0**	**0**
2009	-9,813	0	0	0	0	0	0	0	0	0	**-9,813**	**0**
2010	-9,813	-9,813	0	0	0	0	0	0	0	0	**-19,626**	**-8,980**
2011	-9,813	-9,813	-9,813	0	0	0	0	0	0	0	**-29,440**	**-29,440**
2012	-9,813	-9,813	-9,813	-9,813	0	0	0	0	0	0	**-39,253**	**-39,253**
2013	-9,813	-9,813	-9,813	-9,813	-9,813	0	0	0	0	0	**-49,066**	**-49,066**
2014	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	0	0	0	0	**-58,879**	**-58,879**
2015	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	0	0	0	**-68,692**	**-68,692**
2016	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	0	0	**-78,506**	**-78,506**
2017	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	-9,813	0	**-88,319**	**-47,910**
Total	**-88,319**	**-78,506**	**-68,692**	**-58,879**	**-49,066**	**-39,253**	**-29,440**	**-19,626**	**-9,813**	**0**	**-441,594**	**-380,725**

5.1.10 Net GHG Emissions for the baseline

The baseline net GHG emissions for planned deforestation was determined according to equation 01 from the VMD0006 v1.0:

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

Where:

ΔCBSL,planned Net greenhouse gas emissions in the baseline from planned deforestation; t CO2- e

D%planned,i,t Projected annual proportion of land that will be deforested in stratum *i* during year *t*. If actual annual proportion is known and documented, set to proportion; %

Aplanned,i, Total area of planned deforestation over the baseline period for stratum *i*; ha

L-Di Likelihood of deforestation for stratum *i*; %

ΔCBSL,i Net carbon stock changes in all pools in the baseline stratum *i*; t CO2-e ha-1

GHGBSL-E,i,t Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum *i* during project year *t*; t CO2-e year-1
i 1, 2, 3, … *M* strata
t 1, 2, 3, … *t** years elapsed since the projected start of the REDD project activity

Therefore, the baseline emissions for planned deforestation from this monitoring period are indicated in the table below (Table 38). Reinforcing that the emissions from the planned deforestation for the year 2010 have already been quantified in the previous MR, so they are not quantified in this monitoring report.

Table 38. Application of formula 1 of the VMD0006 v1.0 to calculate the *ΔCBSL,planned*

Year	Aplanned,i, (ha)		L-Di	ΔCBSL,i		$GHG_{BSL-E,i,t}$	ΔCBSL,planned
	FOD	FS	%	FOD	FS	tCO2	tCO2
2011	2,718	232	1	642	366	0	1,829,790
2012	27	2,813	1	642	366	0	1,045,591
2013	170	2,434	1	642	366	0	998,889
2014	2,722	0	1	642	366	0	1,747,702
2015	730	1,606	1	642	366	0	1,055,711
2016	2,943	0	1	642	366	0	1,890,031
2017	2,404	0	1	642	366	0	1,543,858
TOTAL	**11,714**	**7,085**				**0**	**10,111,571**

As explained in the sub-section 5.1.9, the offset planting was mandatory to carry out the suppression plan, so the final value for the baseline emissions was obtained by subtracting the carbon sequestered in the plantation from the emission of planned deforestation, as shown in Table 39. The values for carbon sequestration are shown in negative to make it clear that it is discounted from the baseline emissions.

To obtain the net carbon stock changes in the baseline (**Δ***CBSL,i), the equation 03 from the VMD0006 v1.0 was applied. The values are shown in the table below.*

Table 39. Final net greenhouse gas emissions in the baseline

Year	ΔCBSL,planned	Sequestered tCO2 from offset planting in the baseline	Wood Products CWP	CBSL,post,i	ΔCBSL
	tCO2	tCO2	tCO2	tCO2	tCO2
2010	0	-8,980	0	0	-8,980
2011	1,829,790	-29,440	16,942	61,622	1,721,787

2012	1,045,591	-39,253	16,314	59,338	930,686
2013	998,889	-49,066	14,957	54,403	880,463
2014	1,747,702	-58,879	15,634	56,866	1,616,322
2015	1,055,711	-68,692	13,419	48,803	924,796
2016	1,890,031	-78,506	16,908	61,497	1,733,120
2017	1,543,858	-47,910	13,811	50,234	1,431,904
TOTAL	**10,111,571**	**-380,725**	**107,985**	**392,763**	**9,230,098**

5.2 Project Emissions

The project emissions were calculated according to the formula 01 from the VMD0015 v2.0:

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

(1)

Where:

ΔCP Net greenhouse gas emissions within the project area under the project scenario; t CO2-e

$\Delta CP,DefPA,i,t$ Net carbon stock change as a result of deforestation in the project area in the project case in stratum *i* at time *t*; t CO2-e

$\Delta CP,Deg,i,t$ Net carbon stock change as a result of degradation in the project area in the project case in stratum *i* at time *t*; t CO2-e

$\Delta CP,DistPA,i,t$ Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum *i* at time *t*; t CO2-e

GHGP-E,i,t Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum *i* in year *t*; t CO2-e

$\Delta CP,Enh,i,t$ Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline2 in stratum *i* at time *t*; t CO2-e

i 1, 2, 3 …*M* strata

t 1, 2, 3, … *t** years elapsed since the start of the REDD project activity

5.2.1 Emissions from Deforestation ($\Delta C_{P,Def,i,t}$)

Forest cover change due to unplanned deforestation and natural disturbance was monitored through assessment of classified satellite imagery[47] covering the project area. During the period of this monitoring, 29.32 hectares of deforestation with not known causes have been identified within the project area, but apparently due edge effect of previously opened area (especially close to main roads). The edge effect causes loss of carbon induced by microclimatic changes, leading to increased tree mortality rates[48].

The calculation of emissions resulting from these deforestations were made according to equation 03 of VMD0015 v2.0:

$$(03)\ \Delta C_{\mathrm{P,DefPA,i,t}} = \sum_{u=1}^{U} (A_{DefPA,\mathrm{u,i,t}} * \Delta C_{\mathrm{pools,P,Def,u,i,t}})$$

Where:

$\Delta C_{P,DefPA,i,t}$: Net carbon stock change as a result of deforestation in the project case in the project area

in stratum i in year t; t CO_2-e

$A_{DefPA,u,i,t}$: Area of recorded deforestation in the project area stratum i converted to land use u in year t; ha

$\Delta C_{pools,Def,u,i,t}$: Net carbon stock changes in all pools in the project case in land use u in stratum i in year t; tCO_2-e ha^{-1}

u 1, 2, 3, ,...*U* post-deforestation land uses

I 1, 2, 3, ...*M* strata

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

Table 40. Deforestation in the project area

Year	ADefPA Deforestation (ha)			ΔCP,DefPA Emission tCO_2/year		
	FS	FOD	Total	FS	FOD	Total
July/2010	4,55	1,86	6,41	1,662.50	1,196.30	2,858.80
2011	1,47	3,33	4,8	537.4	2,138.30	2,675.60
2012	1,23	3,37	4,6	449.6	2,164.00	2,613.60
2013	1,8	5	6,8	658	3,210.60	3,868.60

[47] Landsat 7 and 8 collection, path 223 and row 62 and 63.

[48] ARAGÃO et al, 2020. < https://www.science.org/doi/10.1126/sciadv.aaz8360> Accessed July 25, 2022.

2014	0,62	2,28	2,9	226.6	1,464.00	1,690.70
2015	0,01	1	1,01	3.7	642.1	645.8
2016	0,15	1,45	1,6	54.8	931.1	985.9
July/2017	0,33	0,87	1,2	121.6	556.6	678.2
Total	10,16	19,16	29,32	3,714.20	12,303.00	16,017.20

However, applying the “Tool for testing significance of GHG emissions in A/R CDM project activities, version 1.0”, this deforestation is considered insignificant, as it represents less than 5% of the project's emissions, as described in the tool:

> *“The sum of decreases in carbon pools and increases in emissions that may be neglected shall be less than 5% of the total decreases in carbon pools and increases in emissions, or less than 5% of net anthropogenic removals by sinks, whichever is lower.”*

Thus, the emissions from these areas were considered zero for this monitoring report (Table 41).

Table 41. Data and Parameters Applied

Parameter	*Description*	*Monitored Value (July/2010-July/2017)*
$\Delta C_{P,Def,i,t}$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum *i* at time *t*	0 t CO_2-e
$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum *i* at time *t*	0 t CO_2-e
$A_{DefPA,u,i,t}$	Area of recorded deforestation in the project area stratum *i* converted to land use *u* at time *t*	0 ha
$A_{DistPA,q,i,t}$	Area impacted by natural disturbance in post-natural disturbance stratum *q* in stratum *i,* at time *t*	0 ha

Table 42. ΔCP,DefPA,i,t calculation

Year	ADefPA	$\Delta C_{pools,Def,u,i,t}$	ΔCP,DefPA
	(ha)	tCO_{2e}/ha	tCO_{2e}
July/2010	0	0	0
2011	0	0	0
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	0	0

2016	0	0	0
July/2017	0	0	0
Total	**0**	**0**	**0**

5.2.2 Monitoring Degradation ($\Delta C_{P,Deg,i,t}$)

According to the VMD0015 v2.0, the degradation will result from either selective logging from forest management areas holding a FSC certificate or illegal extraction of trees for timber or for fuel and charcoal:

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

Where

$\Delta C_{P,Deg,i,t}$ Net carbon stock change as a result of degradation in the project area in the project case in stratum *i* at time *t*; t CO2-e

$\Delta C_{P,DegW,i,t}$ Net carbon stock change as a result of degradation through extraction of trees for illegal timber or fuelwood and charcoal in the project area in the project case in stratum *i* at time *t*; t CO2-e

$\Delta C_{P,SelLog,i,t}$ Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum *i* at time *t*; t CO2-e

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

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

Table 43. ΔCP,Deg calculation

Year	ΔCP,DegW tCO2e	tCO_2 ΔCP,SelLog,i,t	ΔCP,Deg tCO2e
July/2010	0	150,729	150,729
2011	0	323,366	323,366
2012	0	372,336	372,336
2013	0	156,078	156,078
2014	0	20,483	20,483
2015	0	75,632	75,632
2016	0	0	0
July/2017	0	68,984	68,984
Total	**0**	**1,167,608**	**1,167,608**

In the following sections are described the steps to calculate the ΔCP,SelLog,i, described in the Table 43.

5.2.2.1 Emissions due to illegal degradation for illegal timber or fuelwood and charcoal ($\Delta C_{P,DegW,i,t}$)

As detailed in section 2.2, between September 2014 and May 2015, CBNS carried out a participatory mapping with the following communities that live in the surroundings of the Rio Capim Complex:

- Ararandewa Community
- Barreirinha Community
- Surubiju Community

These three communities are indigenous and use the area of the Rio Capim Complex to obtain resources for their subsistence, such as for hunting, fishing, collection of açai and non-timber forest products. No community reported taking wood from CBNS areas, when presenting the project and inviting them to participate in the verification process, the community members stated again that they do not collect wood for charcoal in CBNS' areas, preferring to buy charcoal or cooking gas. Thus, no indications were encountered that emissions resulting from degradation due to illegal logging ($\Delta C_{P,DegW}$) are occurring in the project area, based on negative results of these surveys. Because of that, ADegW,I,t and $\Delta C_{P,DegW}$ are considered zero (0) for this monitoring report (Table 44).

Table 44. Data and Parameters Applied.

Parameter	*Description*	*Monitored Value (July/2010-July/2017)*
$A_{DegW,i,t}$	Area potentially impacted by degradation processes in the project area	0 ha
$\Delta C_{P,DegW}$	Net carbon stock changes as a result of degradation in the project area	0 t CO_2-e

5.2.2.2 Emissions due to FSC-certified selective logging

Project emissions due to FSC-certified selective logging were monitored and estimated applying module VMD0015, version 2.0.

According to the VMD0015 v.2.0, "*Logging operations may only conduct selective logging that maintains a land cover that meets the definition of forest within the project boundary*". The FAO definition of forest[49] is:

- Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.
- Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of at least 10 percent and tree height of 5 meters or more. *It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice* or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used.

The Brazilian Forest Service, in the development of its work and in the elaboration of national and international reports on the country's forest resources, has considered as forest the types of woody vegetation that are closest to the definition of forests of the United Nations Organization for Agriculture and Food (FAO)[50].

In order for the exploration license (AUTEX) to be approved and issued by the competent body, it is necessary that sustainable forest management meets the criteria established in the regulations "MMA Normative Instruction No. 5 of November 12, 2006[51]" and "Normative Instruction No 2 of June 27, 2007[52]", such as:

- **Art. 5º:** The cutting intensity proposed in the SFMP will be defined in order to provide the regulation of forest production, aiming to guarantee its sustainability, and will take into account the following aspects:
    I. Estimate of the annual productivity of the managed forest (m^3/ha/year), for the group of commercial species, based on studies available in the region;
    II. Initial cutting cycle of a minimum of 25 years and a maximum of 35 years
    III. Estimate of the productive capacity of the forest, defined by the available commercial stock (m^3/ha)

49 FRA 2015. Accessed July 22, 2022

50 SNIF, 2019. Accessed July 22, 2022

51 Normative Instruction Nº 5 of November 12, 2006. Accessed July 22,2022.

52 Normative Instruction No. 5 of June 27, 2007. Accessed Jult 22,2022

- § 1 The following maximum cutting intensities to be authorized by the competent environmental agency are established:

  30 m^3/ha for SFMP with 35-year initial cutting cycle

  10 m^3/ha for the Low Intensity PMFS with an initial 10-year cutting cycle;

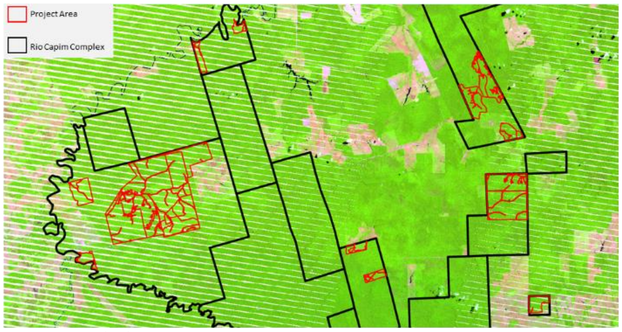
- **Art. 7º** The Minimum Cutting Diameter (MCD) will be established by commercial species managed, through studies, that observe the available technical guidelines.

  § 2 The MCD of 50 cm is established for all species, for which the specific MCD has not yet been established.

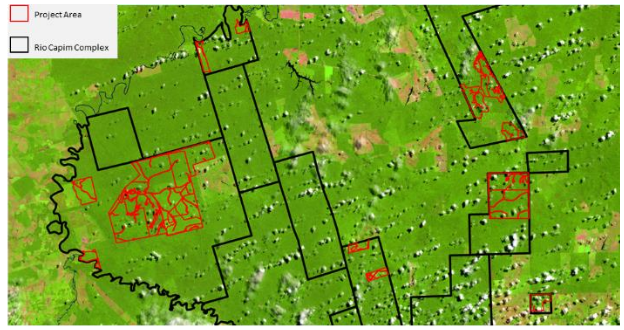
These and other rules described in the normative instructions guarantee that the vegetation cover of the managed forest will not be mischaracterized. In addition, the management areas are inspected by qualified technicians from the technical staff of IBAMA or competent state agencies in order to ensure compliance with legal requirements, otherwise the management plan may be suspended, and new licenses may not be issued[51].

According to a multi-temporal analysis (2010, 2013, 2017, 2020) of satellite images[53], it is possible to observe that the areas under sustainable forest management did not change their classification as Forest. The image composition of multispectral sensor such as Landsat 7 and 8 demonstrates the forest in Project Area maintains the same characteristic throughout the analyzed period.

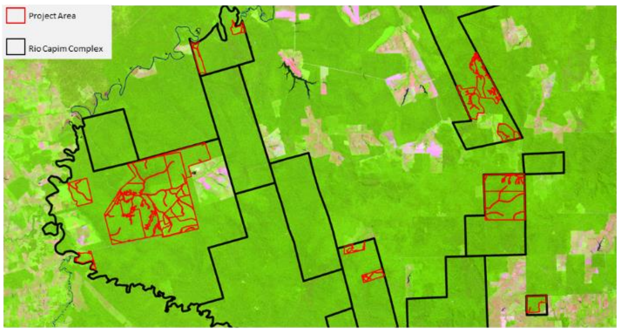
[53] Images available in https://earthexplorer.usgs.gov/, path 223, row 062 and path 223, row 063.



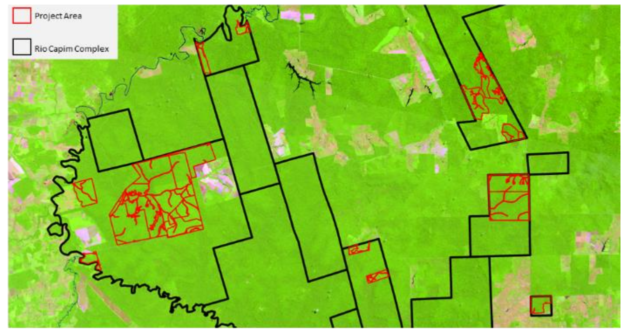
Landsat 7 – 12/08/2010 – Band composition (R5G4B3)



Landsat 8 – 27/07/2013 – Band composition (R6G5B4)



Landsat 8 – 06/07/2017 – Band composition (R6G5B4)



Landsat 8 – 14/07/2020 – Band composition (R6G5B4)

Actual harvests occurring in the project area are detailed in the Table 45, sourced from SISFLORA, which is an integrated system of SEMA (Secretariat for the Environment and Sustainability), which controls the commercialization and transport of forest products in the State of Pará.

Table 45: Volumes extracted within the PA.

Year	Harvest Area (ha)	Volume of timber extracted (m^3)	Volume of residues extracted (m^3)	Total volume extracted (m^3)
		$V_{EXT\ sawlog}$		
July/2010	1,130	33,693	116,184	149,877
2011	2,705.22	59,269	108,181	167,451
2012	2,726.57	80,450	121	80,571
2013	1,193	33,137	49,706	82,844
2014	218	3,937	5,609	9,545
2015	634	15,683	2,170	17,853
2016	0	0	0	0
July/2017	538	14,575	15,934	30,509
TOTAL	**9,145**	**240.744**	**297,905**	**538,649**

5.2.2.2.1 Monitoring degradation due to selective logging of forest management areas possessing a FSC certificate

Table 46: Parameters

Parameter	Value Applied (July/2010-July/2017)	Units	Source
D	0.674	t/m^3	Volume-weighted average basic wood density of commercial species in project area from suppression plan
$C_{dest,\ i}$ and $C_{BSL,i}$	642.12	tCO_2/ha	Sourced from FOD (only forest class where harvest took place) strata-level mean forest carbon stock estimates from forest carbon inventory of project area; conservatively assume that all stocks are emitted from within skid trails
C_{EXT}	642.12	tCO_2/ha	Average stocks for FOD forest class (only forest class where harvest took place)

The C_{BSL} and Cdest parameters in this case are equivalent, as they correspond to the FOD forest stratum, being the only stratum where forest management was carried out. As mentioned in section 3.2.2, carbon stocks values previously used for this project (PD and MR1) were maintained for the MR2. Those values come from field measurements of multiple forest inventories done from 2003 to 2011 for estimating forest carbon stock by the year 2007 (project start date).

To calculate the impact of infrastructure and forest management within the PA, the available post-exploratory reports from 3 FMU (Forest Management Unit) were considered:

- FMU 13 Caculé: Explored in 2010
- FMU 14 Rio Capim IV: Explored in 2011
- FMU 15 Rio Capim IV: Explored in 2012

For the FMUs mentioned above, the post-exploratory report details the open areas for decks, skid trails and roads, which were measured in sample areas within the respective FMU. The other FMUs do not have these values measured in post-exploratory reports due to a change in SEMA's requirement on the format of these reports. Thus, to obtain the impact of roads, decks, and skid trails for the other FMUs, an average density of impact was calculated and replicated for the other FMUs (Table 47). To calculate these average factors, the formulas a, b, and c below were used. Further details of the calculations are available for auditing[54].

$$(\boldsymbol{a})\ Intensity\ of\ Roads = \frac{Area\ of\ roads}{Volume\ explored}$$

Where:

Intensity of road: Intensity of roads within the managed area; ha / m³

Area of roads: Area of roads within the harvested forest management unit; ha

Volume explored: Volume of wood obtained through selective forest management; m³

$$(\boldsymbol{b})\ Intensity\ of\ Decks = \frac{Area\ of\ decks}{Volume\ Explored}$$

Where:

Intensity of decks: Intensity of decks within the managed area; ha / m³

Area of decks: Area of decks within the harvested forest management unit; ha

Volume explored: Volume of wood obtained through selective forest management; m³

$$(\boldsymbol{c})\ Intensity\ of\ Skid\ Trails = \frac{Area\ of\ skid\ trails}{Area\ Managed}$$

Where:

Intensity of skid trails: Intensity of skid trails within the managed area; ha / ha

Area of skid trails: Area of skid trails within the harvested forest management unit; ha

Managed Area: Total area of the forest management unit; ha

[54] Detailed in "Vol Explorado_Infra_2010 _2017" spreadsheet.

Table 47: Data from post-exploratory reports from forest management units

						Roads				Deck		W_{SKID}	Skid trail		
FMU	Propriety	Year	Area managed in the Post Exploration Report (ha)	Log Intensity (m³/ha)	Partial Volume Explored Log (m³)	Average Road Width (m)	Total length of road (m)	Total open area of road (ha)	Intensity of road (ha/m³)	Total open area of decks (ha)	Intensity of decks (ha/m³)	Mean width of Skid Trail (m)	Sampled area to measure the opening of skid trails (ha)	Total open area of skid trails (ha)	ha skid trail / ha managed
13	Caculé	2010	1,276.98	29,82	38,075.69	5,65	36,339	20,53	0,0005	8,63	0,0002	3,9	162,5	7,5	0,05
14	Rio Capim IV	2011	486,72	16,60	8,079.81	5,63	28	15,76	0,0020	5,58	0,0007	3,6	88,8	4,3	0,05
15	Rio Capim IV	2012	2,800.00	28,90	80,911.29	5,61	31,005	17,39	0,0002	8,49	0,0001	3,4	25,0	0,6	0,03

* The columns in blue are the data reported in the post-exploratory reports, the columns in green were calculated to obtain an impact factor for the other managed areas (Table 48).

Table 48: Average values used for FMUs that do not have a post-exploratory report.

Average of (ha skid trail / ha managed)	Average W_{skid} (m)	Average Road Intensity (ha/m³)	Average Deck Intensity (ha/m³)
0.0398	3.67	0.0009	0.0003

Applying these average factors to the other forest management units, the following areas open to infrastructure were obtained:

Table 49. Infrastructure areas of forest management within the PA.

						$ADECKS_{,i,t}$	$AROAD_{,i,t}$	
Exploration Year	UPA (FMU)	Propriety	Area Managed (ha)	Volume Explored (m³)	WSKID (meters)	Area of decks (ha)	Area of roads (ha)	Area of skid trail (ha)
2010	13	Caculé	1,130	33,693	3.93	7.6	18.2	51.9
2011	14	Rio Capim IV	1,564	25,967	3.63	17.9	50.7	71.9
2011	14	Caculé	1,141	33,302	3.67	11.4	30.0	45.4
2012	15	Rio Capim IV	3	81	3.44	0.008	0.02	0.1
2012	15	Sumal	2,724	80,369	3.67	27.4	72.5	108.4
2013	16	Rio Capim IV	1,193	33,137	3.67	11.3	29.9	47.5
2014	17	Rio Capim IV	218	3,937	3.67	1.3	3.5	8.7
2015	16	Sumal	634	15,683	3.67	5.3	14.1	25.2
2017	20	Cauaxi II	538	14,575	3.67	5.0	13.1	21.4
			9,145	**240,744**		**87**	**232**	**381**

According to the post-exploratory reports available for the 3 FMU mentioned above, the areas cleared for forest management infrastructure represent on average 5.93% of the total area of the FMU. Applying the average values described in Table 48, the average impact of forest management activities for this monitoring period was 7.65%.

Table 50. Average impact of the opening of areas for FSC-certified forest management infrastructure

FMU	*Caculé 13*	*Rio Capim 14*	*Rio Capim 15*	Current MR
Impact (%)	6.78	6.80	4.21	7.65
Average (%)		**5.93**		**7.65**

For estimating net ex post emissions and removals related to selective logging activities in the project case, the carbon stock changes arising from selective logging operations were calculated. The following formulas were applied according to the VMD0015 v.2.0:

(9)
$$\Delta C_{P,SelLog,i,t} = \sum_{t=1}^{t} \left(C_{LG,i,t} + C_{LR,i,t} - C_{WP,i,t} \right)$$

Where:

$\Delta C_{P,SelLog,i,t}$: Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum i in year t; t CO_2-e

$C_{LG,i,t}$: Actual net project emissions arising in the logging gap in stratum i in year t; t CO_2-e

$C_{LR,i,t}$: Actual net project emissions arising from logging infrastructure in stratum i in year t; t CO_2-e

$C_{WP\ i,t}$: Carbon stock in wood products pool from stratum i, in year t; t CO_2-e

t 1, 2, 3, … t years elapsed since the start of the project activity

The analysis conservatively assumes that all stocks are emitted from within skid trails (rather than limiting emissions to only stocks below a threshold diameter). Estimation of carbon stocks retained in long-lived wood products is limited to volumes of sawlogs (not residues, which will be converted to charcoal and emitted).

5.2.2.2.2 Emissions arising in the logging gap

In the project case, emissions occur as a direct result of the death of the timber tree and due to the death of trees killed when the timber tree is felled. Residues emissions were assumed within the parameter C_{LG} (Actual net project emissions arising in the logging gap), in formula 10 of VMD0015 v2.0:

$$(10) \qquad C_{LG,i,t} = \sum_{z=1}^{Z} (C_{EXT,z,i,t} + (LDF_{z,i} * V_{EXT,z,i,t} * \frac{44}{12}))$$

Where:

$C_{LG,i,t}$ Actual net project emissions arising in the logging gap, in stratum i in year t; t CO_2-e

$C_{EXT,z,i,t}$ Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t; t CO_2-e

$LDF_{z,i}$ Logging damage factor for logging stratum z, in stratum i; t C m^{-3}

$V_{EXT,z,i,t}$ Volume extracted from logging stratum z, in stratum i in year t; m^3

44/12: Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}

Z 1, 2, 3, …Z logging strata

i 1, 2, 3, … M strata

t 1, 2, 3, … t years elapsed since the start of the project activity

According to the VMD0015 v2.0, the logging damage factor (LDF) is a representation of the quantity of emissions that will ultimately arise per unit of extracted timber (m^3). These emissions arise from the noncommercial portion of the felled trees (the branched and stump) and trees incidentally killed during felling. Thus, we can infer that residues emissions are already quantified in this factor, so this factor was applied only to the commercial volume explored (sawnwood). As described in Table 70, the value of 0.53 tC/m^3 for the LDF was obtained from the VMD0011 v1.0.

To calculate the biomass of the total volume extracted from within each logging stratum, the following formula is applied:

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

(11)

Where:

$C_{EXT,z,i,t}$ Biomass carbon stock of timber extracted within the project boundary for logging stratum z, in stratum i in year t; t CO_2-e

$V_{EXT,j,z,i,t}$ The volume of timber extracted of species j for logging stratum z, in stratum i in year t; m^3

D_j Basic wood density of species j; t d.m.m^{-3}

CF_j Carbon fraction of biomass for tree species j; t C t^{-1} d.m.

44/12: Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}

z 1, 2, 3, ...Z logging strata

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

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

The basic wood density (D_j) represents a volume-weighted wood density across all species for the project area, referencing species-specific wood densities from the Forest Products Laboratory (LPF) of the Brazilian Forest Service database. The value of 0,674 g/cm^3 was applied according to the validated PD.

Applying the formula 11 above, the biomass carbon stock of timber extracted (Cext) obtained is described in the table below.

Table 51. C_{ext} calculation

Year	V_{ext}	Dj	CF	44/12	C_{ext}
	m³	g/cm³	t C t-1 d.m.		tCO_2
July/2010	33,693	0.674	0.470	3.667	39,133
2011	59,269	0.674	0.470	3.667	68,839
2012	80,450	0.674	0.470	3.667	93,440
2013	33,137	0.674	0.470	3.667	38,488
2014	3,937	0.674	0.470	3.667	4,572
2015	15,683	0.674	0.470	3.667	18,215
2016	0	0.674	0.470	3.667	0
July/2017	14,575	0.674	0.470	3.667	16,928
	240,744				**279,615**

Applying the formula 10 described above, the emissions arising in the logging gap described in Table 52 are obtained.

Table 52: Emissions arising in the logging gap

Year	C_{ext}	LDF	V_{ext}	44/12	C_{LG}
	tCO_2	tC/m^3	m^3		tCO_2
July/2010	39,133	0.53	33,693	3.7	104,611
2011	68,839	0.53	59,269	3.7	184,019
2012	93,440	0.53	80,450	3.7	249,780
2013	38,488	0.53	33,137	3.7	102,885
2014	4,572	0.53	3,937	3.7	12,222
2015	18,215	0.53	15,683	3.7	48,692
2016	0	0.53	0	3.7	0
July/2017	16,928	0.53	14,575	3.7	45,252
	279,615		**240,744**		**747,461**

5.2.2.2.3 Emissions arising through logging infrastructure

The emissions arising through logging infrastructure is equal to the sum of emissions resulting from skid trails, roads, and logging decks created for selective logging operations:

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

Where:

$C_{LR,i,t}$ Actual net project emissions arising from logging infrastructure in stratum i in year t; tCO_2e

$\Delta C_{SKID,i,t}$ Change in carbon stock resulting from skid trail creation in stratum i in year t; t CO_2-e

$\Delta C_{ROAD,i,t}$ Change in carbon stock resulting from logging road creation in stratum i in year t; t CO_2e

$\Delta C_{DECKS,I,t}$ Change in carbon stock resulting from logging deck creation in stratum i in year t; t CO_2e

i 1, 2, 3, …M strata

t 1, 2, 3, …*t* years elapsed since the start of the project activity

Emissions arising from skid trails (ΔCSKID,i,t)

The emission from the creation of skid trails is estimated by multiplying the total length of skid trails created and a skid trail emission factor:

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

Where:

$\Delta C_{SKID,i,t}$ Change in carbon stock resulting from skid trail creation in stratum i in year t; t CO_2-e

$L_{SKID,i,t}$ Length of skid trails in stratum i in year t; m

SK_i Skid trail emissions factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum i; t CO_2-e m^{-1}

t 1, 2, 3, … t* years elapsed since the start of the project activity

It is assumed that the machinery used to create the skid trail kills all aboveground and belowground tree and non-tree biomass located within the path of the skid trail. This biomass becomes deadwood and is assumed to be immediately emitted.

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

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

Where:

$SK_{,i}$: Skid trail emission factor (Average emissions resulting from dead wood created in the process of skid trail creation per length of skid trail) in stratum i; t t CO_2-e m^{-1}

$C_{dest,\ i}$: Mean live carbon stock of trees and non-tree biomass assumed to be killed per unit area in creation of skid trail in stratum i; t CO_2-e ha^{-1}

$\Delta C_{SOC\_sk,i}$: Carbon stock change in organic carbon resulting from skid trail creation in stratum i; t CO_2-e ha^{-1}

W_{SKID}: Mean width of skid trails in stratum i; m

$C_{AB\_tree\_dest,i}$: Carbon stock in aboveground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail in stratum i; t CO_2-e ha^{-1}

$C_{BB\_tree\_dest,i}$: Carbon stock in belowground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail in stratum i; t CO_2-e ha^{-1}

$C_{AB\_non-tree,i}$: Carbon stock in aboveground non-tree biomass in stratum i; t CO_2-e ha^{-1}

$C_{BB\_non-tree,i}$: Carbon stock in belowground non-tree biomass in stratum i; t CO_2-e ha^{-1}

1/10,000: Conversion of units from hectares to m^2

i 1, 2, 3, … M strata

As explained in the section 2.3 Carbon pools in the PD, the carbon pool from soil organic carbon was excluded in the baseline because significant changes in this pool are not expected to occur in the baseline – note that the IPCC default stock change factor for permanent grassland is 1.0, which signifies no change from original stocks (managed forest), which is also 1.0 (IPCC 2006GL Vol 4 AFOLU Chapter 6 Grassland Table 6.2 and IPCC 2006GL, Chapter 5 Cropland, Table 5.10). For that reason, the parameter ΔC_{SOC_sk} was considered 0 (zero) in the Equation 14 of the VMD0015 v2.0.

As described in the Table 46, the C_{dest} is 642.12 tCO_2/ha.

Table 53: Application of formula 14 of VMD0015 v2.0 to obtain the SK_i parameter

Year	Cdest	ΔC_{SOC_sk}	1/10000	W_{SKID}	SK_i
	tCO_2/ha	tCO_2/ha		m	tCO_2/m
July/2010	642.12	0	0.0001	3.9	0.25
2011	642.12	0	0.0001	3.6	0.23
2012	642.12	0	0.0001	3.6	0.23
2013	642.12	0	0.0001	3.7	0.24
2014	642.12	0	0.0001	3.7	0.24
2015	642.12	0	0.0001	3.7	0.24
2016	642.12	0	0.0001	0	0
July/2017	642.12	0	0.0001	3.7	0.24

The Lskid was calculated by dividing the total area of the skid trails (Table 49) by the width (Wskid), as shown below (Table 54).

Table 54. Calculation to obtain the Lskid

Exploration Year	FMU	Propriety	Area of skid trail (ha)	Total lenght of skid trails (m)	Wskid (m)	L_{SKID} (m)
2010	13	Caculé	52	519,452	3.93	132,176
2011	14	Rio Capim IV	72	719,062	3.63	198,089
2011	14	Caculé	45	454,095	3.67	123,844
2012	15	Rio Capim IV	0.1	706	3.44	205
2012	15	Sumal	108	1,084,011	3.67	295,639
2013	16	Rio Capim IV	47	474,928	3.67	129,526
2015	16	Sumal	25	252,277	3.67	68,803
2014	17	Rio Capim IV	9	86,654	3.67	23,633
2017	20	Cauaxi II	21	214,126	3.67	58,398
TOTAL			**381**	**3,805,311**		**1,030,313**

Applying the equation 13 described above, the emissions resulting from creation of skid trails are described in the table below:

Table 55: Emissions arising due to the creation of skid trails (ΔC_{SKID})

Year	L_{SKID}	SK	ΔC_{SKID}
	m		tCO_2
July/2010	132,176	0.25	33,355
2011	321,933	0.23	75,419
2012	295,845	0.23	67,502
2013	129,526	0.24	30,496
2014	23,633	0.24	5,564
2015	68,803	0.24	16,199
2016	0	0	0
July/2017	58,398	0.24	13,750
	1,030,313		**242,286**

Emissions arising from roads (ΔCROAD,i,t)

The emissions resulting from the creation of roads is determined by multiplying the area of roads created in each stratum by the carbon stock. The calculation of the total area of roads (A_{roads}) was described at the beginning of section 5.2.3.

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

Where:

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

$A_{ROAD,i,t}$ Area of roads in stratum i in year t; ha

$C_{BSL,i}$ Carbon stock in all pools in the baseline case in stratum i; t CO_2-e ha^{-1}

i 1, 2, 3, … M strata

t 1, 2, 3, … t* years elapsed since the start of the project activity

The $C_{BSL,I}$ value applied is 642.12 tCO_2/ha. The values obtained for A_{ROAD} are described in Table 56.

Applying equation 17 from VMD0015 v2.0 described above, the emissions from road openings are:

Table 56: Emissions arising due to the creation of roads (ΔC_{ROAD})

Year	A_{ROAD}	C_{BSL}	ΔC_{ROAD}
	ha	t CO_2/ha	tCO_2
July/2010	18	642.12	11,666
2011	81	642.12	51,815
2012	72	642.12	46,547
2013	30	642.12	19,188
2014	4	642.12	2,279
2015	14	642.12	9,081
2016	0	0	0
July/2017	13	642.12	8,439
	232		**149,016**

Emissions arising from decks ($\Delta C_{DECKS,i,t}$)

The emissions per unit of extraction from logging decks is determined by measuring the area of logging decks created in each stratum. The calculation of the total area of decks (A_{decks}) was described at the beginning of section 5.2.3.

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

Where:

$\Delta C_{DECKS,i,t}$ Change in carbon stock resulting from logging deck creation in stratum *i* at time *t*; t CO2-e

$A_{DECKS,i,t}$ Area of logging decks in stratum *i* at time *t*; ha

$C_{BSL,i}$ Carbon stock in all pools in the baseline case in stratum i; t CO2-e ha-1

i 1, 2, 3 … M strata

t 1, 2, 3 … t years elapsed since the start of the project activity

Applying equation 18 from VMD0015 v2.0 described above, the emissions from deck openings are:

Table 57: Emissions arising due to the creation of decks (ΔC_{DECKS})

Year	A_{DECKS}	C_{BSL}	ΔC_{DECKS}
	ha	t CO_2/ha	tCO_2
July/2010	8	642.12	4,904
2011	29	642.12	18,811
2012	27	642.12	17,596
2013	11	642.12	7,253
2014	1	642.12	862
2015	5	642.12	3,433
2016	0	0	0
July/2017	5	642.12	3,190
	87		56,047

After calculating the ΔC_{SKID}, ΔC_{ROAd} and ΔC_{DECKS} , formula 12 is applied to obtain the actual net project emissions arising from logging infrastructure, as described in the table below.

Table 58: Calculations of actual project emissions from infrastructure.

Year	Stratum: FOD	m3	tCO_2	tCO_2	tCO_2	tCO_2
	Harvest Area (ha)	VEXT sawlog	ΔC_{SKID}	ΔC_{ROAD}	ΔC_{DECKS}	C_{LR}
2010	1,130	33,693	33,355	11,666.3	4,904	49,925
2011	2,705	59,269	75,419	51,814.7	18,811	146,044
2012	2,727	80,450	67,502	46,547.4	17,596	131,646
2013	1,193	33,137	30,496	19,187.7	7,253	56,937
2014	218	3,937	5,564	2,279.4	862	8,705
2015	634	15,683	16,199	9,080.8	3,433	28,713
2016	0	0	0	0.0	0	0
2017	538	14,575	13,750	8,439.3	3,190	25,379
	9,145	**240,744**	**242,286**	**149,016**	**56,047**	**447,349**

5.2.2.3 Emissions from Harvested Wood Products (HWP)

Applying the module VMD0005 v1.0, the volume retained in long-lived wood products was calculated for sawnwood (*ty*), using the Option 1: Direct Volume Extraction Estimation because there are approved timber harvest plans.

The coefficients applied in the following formulas are described in the table below (Table 59).

Table 59: Coefficients applied to calculate HWP emissions

Coefficients	Value	Unit	Source
Dj	0.674	g/cm^3	Represents a volume-weighted wood density across all species for the project area, referencing species-specific wood densities from the Forest Products Laboratory (LPF) of the Brazilian Forest Service database.
CFj	0.47	dimensionless	VMD0005, Version 1.0
WWs	0.24	dimensionless	Derived by Winjum et al. 1998, according to VMD0005 CP-W v1.0
SLFs	0.2	dimensionless	Derived by Winjum et al. 1998, according to VMD0005 CP-W v1.0. Reference for sawnwood product class.
OFty	0.84	dimensionless	According to VMD0005 v1.0 for sawnwood class in tropical regions
V_{ext}	207,051	m^3	The total volume of commercial timber harvested was considered
A_i	8,015	hectare	Total area of forest management

Step 1: Identify the wood product class (ty) that are the anticipated end use of the extracted carbon: *Sawnwood*

Step 2: Calculate the biomass carbon of the volume extracted by wood product type ty from within the project boundary:

(01)

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

Where:

$C_{XB,ty,i}$: Mean stock of extracted biomass carbon by class of wood product ty from stratum i; t CO_2-e ha^{-1}

A_i: Total area of stratum i; ha

$V_{ex,ty,j}$: Volume of timber extracted from within stratum i (does not include slash left onsite) by species j and wood product class ty; m^3

D*j:* Mean wood density of species j; t d.m.m^{-3}

CF*j:* Carbon fraction of biomass for tree species j; t C t^{-1} d.m.

J: 1, 2, 3, … S tree species

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

44/12: Ratio of molecular weight of CO_2 to carbon, t CO_2-e t C^{-1}

Table 60. CXB,ty,i calculation

Stratum: FOD		m³	g/cm³	CF	44/12	tCO_2
Year	Harvest Area (ha)	Vext	Dj			CXB,ty,i
July/2010	1,130	33,693	0.674	0.47	3.67	39,133
2011	2,705	59,269	0.674	0.47	3.67	68,839
2012	2,727	80,450	0.674	0.47	3.67	93,440
2013	1,193	33,137	0.674	0.47	3.67	38,488
2014	217.734	3,937	0.674	0.47	3.67	4,572
2015	633.89	15,683	0.674	0.47	3.67	18,215
2016	0	0	0.674	0.47	3.67	0
2017	538.03	14,575	0.674	0.47	3.67	16,928
TOTAL	9,145	240,744				279,615

Step 3: Calculate the proportion of biomass carbon extracted that remains sequestered in long-term wood products after 100 years.

(2)

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

Where:

$C_{WP,i}$: Carbon stock in wood products pool (stock remaining in wood products after 100 years) from stratum i; t CO_2-e ha^{-1}

$C_{XB,ty,i}$: Mean stock of extracted biomass carbon by class of wood product ty from stratum i; t CO_2-e ha^{-1}

WW_{ty}: Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product ty; dimensionless

SLF_{ty}: Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product ty; dimensionless

OF_{ty}: Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product ty; dimensionless

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

i 1, 2, 3, … M strata

Table 61. CWP calculation

Year	tCO_2 CXB,ty,i	1 - WWtf	1 - SLFty	1 - Ofty	tCO_2 CWP	tCO_2/ha CWP
July/2010	39,133	0.76	0.8	0.16	3,807	3.37
2011	68,839	0.76	0.8	0.16	6,697	2.48
2012	93,440	0.76	0.8	0.16	9,090	3.33
2013	38,488	0.76	0.8	0.16	3,744	3.14
2014	4,572	0.76	0.8	0.16	445	2.04
2015	18,215	0.76	0.8	0.16	1,772	2.80
2016	0	0.76	0.8	0.16	0	0.00
2017	16,928	0.76	0.8	0.16	1,647	3.06
TOTAL	**279,615**				**27,201**	

After obtaining CLG,i,t, CLR,i,t and CWP i,t, it is possible to calculate ΔCP,SelLog, using formula 09 from VMD0015 v2.0:

Table 62. ΔCP,SelLog calculation

Year	tCO2 CLG	tCO2 CLR	tCO_2 CWP	tCO_2 ΔCP,SelLog,i,t
July/2010	104,611	49,925	3,807	150,729
2011	184,019	146,044	6,697	323,366
2012	249,780	131,646	9,090	372,336
2013	102,885	56,937	3,744	156,078
2014	12,222	8,705	445	20,483
2015	48,692	28,713	1,772	75,632
2016	0	0	0	0
July/2017	45,252	25,379	1,647	68,984
Total	**747,461**	**447,349**	**27,201**	**1,167,608**

It is important to mention that *ex-ante* the prediction of FSC certified forest management was lower than what actually occurred *ex-post*. This is due to the financial decisions of the CBNS company to carry out forest management to obtain income. The Table 63 below details the difference between predicted versus actual management.

Table 63: *Ex-ante* versus *ex-post* emissions from FSC certified forest management[55]

	Ex-ante (PD)					Ex-post (MR2)					Difference		
Year	Harvest Area (ha)	Volume of timber extracted (Sawnwood)	Volume of residue	Vext	ΔCP,SelLog	Harvest Area (ha)	Volume of timber extracted (Sawnwood)	Volume of residue	Vext	ΔCP,SelLog	Harvest Area (ha)	Volume of timber extracted (m³)	ΔCP,SelLog
		m³	m³	m³	tCO2		m³	m³	m³	tCO2		Sawnwood	tCO2
2010	1,122	18,417	0	18,417	116,917	1,130	33,693	116,184	33,693	150,729	8	15,277	33,812
2011	2,767	50,744	187,220	237,964	984,349	2,705	59,269	108,181	59,269	323,366	-62	8,525	-660,983
2012	0	0	0	0	0	2,727	80,450	121	80,450	372,336	2,727	80,450	372,336
2013	0	0	0	0	0	1,193	33,137	49,706	33,137	156,078	1,193	33,137	156,078
2014	0	0	0	0	0	218	3,937	5,609	3,937	20,483	218	3,937	20,483
2015	0	0	0	0	0	634	15,683	2,170	15,683	75,632	634	15,683	75,632
2016	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	538	14,575	15,934	14,575	68,984	538	14,575	68,984
TOTAL	**3,889**	**69,161**	**187,220**	**256,380**	**1,101,266**	**9,145**	**240,744**	**297,905**	**240,744**	**1,167,608**	**5,256**	**171,583**	**66,342**

5.2.2.4 Other emissions

Non-CO2 gas greenhouse emissions due to project activities, deforestation or degradation were excluded because are not relevant. As explained in the section 5.2.5 of the VMD0015 v2.0: "where deforestation or degradation occur within the project boundaries or in the leakage belt and fire is used as a means of forest clearance the non-CO_2 emissions may be significant", and that is not the case for the project because the deforestation was considered zero (0). Thus, $GHG_{P,E,i,t}$ is considered zero (0) for this monitoring report.

Carbon stock enhancement is not being considered, so $\Delta C_{P,Enh,i,t}$ = 0.

5.2.3 Result of the Project Emissions

After performing the calculations described in the previous sections (from 5.2.1 to 5.2.2), it is possible to apply formula 01 described in section 5.2 to calculate the net greenhouse gas emissions in the project case:

Table 64. Net greenhouse gas emissions (ΔCP) of the project

Year	tCO2e ΔCP,DefPA,i,t	tCO2e ΔCP,Deg,i,t	tCO2e ΔCP,DistPA,i,t	tCO2e GHGP-E,i,t	tCO2e ΔCP,Enh,i,t	tCO2e ΔCP
July/2010	0	150,729	0	0	0	150,729
2011	0	323,366	0	0	0	323,366
2012	0	372,336	0	0	0	372,336
2013	0	156,078	0	0	0	156,078
2014	0	20,483	0	0	0	20,483

[55] Positive values in column "Difference" mean that Ex-post (MR2) numbers are greater than Ex-ante (PD). Negative values in column "Difference" mean that Ex-post (MR2) numbers are less than Ex-ante (PD).

2015	0	75,632	0	0	0	75,632
2016	0	0	0	0	0	0
July/2017	0	68,984	0	0	0	68,984
Total	**0**	**1,167,608**	**0**	**0**	**0**	**1,167,608**

5.3 Leakage

Two sources of leakage were monitored: activity shifting and market leakage.

As described in the section 3.3 Leakage of the PD, activity-shifting leakage is treated by applying module VMD0009 LK-ASP v1.0. The "Option 1.2: Baseline deforestation based on historic deforestation average" was applied.

The market leakage is calculated according to the VMD0011 LK-ME v1.0.

5.3.1 Activity-Shifting Leakage

STEP 1: Determine the baseline rate of forest clearance for the deforestation agent

Option 1.2: Baseline deforestation based on historic deforestation average

Under this approach, the baseline annual deforestation by the baseline deforestation agent is assumed to be equal to the average deforested area, during the 5 years prior to the project start date.

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

Where:

$WoPR_{i,t}$ Deforestation by the baseline agent of the planned deforestation in the absence of the project in stratum i in year t;

$HistHa_{i,ag}$ The number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years prior to project implementation in stratum i by agent ag within the country; ha

i 1, 2, 3, … M strata ag 1, 2, 3, … ag agents of deforestation t 1, 2, 3, … t * years elapsed since the projected start of the REDD project activity

As explained in section 3.3 of the PD, the CBNS had not undertaken any forest conversion activities over the period 5 years prior to project start. As set in the VMD0009 v1.0, where there is no history of deforestation $WoPR_{i,t}$ should be set to planned baseline rate for the project (D%planned * Aplanned from the planned deforestation baseline module).

Table 65. Definition of the WoPRit according to the VMD0009 v1.0

Year	ha D%planned,i,t * $Aplanned_{i,t}$	ha $WoPR_{i,t}$
2011	2,949	2,949
2012	2,840	2,840
2013	2,604	2,604
2014	2,722	2,722
2015	2,336	2,336
2016	2,943	2,943
July/2017	2,404	2,404
Total	**18,799**	**18,799**

STEP 2: Estimate new projection of forest clearance by the baseline agent of deforestation with project implementation if no leakage is occurring

In this step, the total project area of planned baseline deforestation (D%planned,i,t * $Aplanned_{i,t}$) is subtracted from the historic area of deforestation to calculate the new area (NewRi,t). No cenário do projeto, como WoPRi,t = (D%planned,i,t * $Aplanned_{i,t}$), NewRi,t is zero (0), as set by the formula 4 from the VMD0009 v.1.0:

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

Where:

NewRi,t New calculated forest clearance in stratum i at time t by the baseline agent of the planned deforestation where no leakage is occurring; ha

WoPRi,t Deforestation by the baseline agent of the planned deforestation in stratum i in year t in the absence of the project; ha

D%planned,i,t Projected annual proportion of land that will be deforested in stratum i at year t; %

Aplanned,i, Total area of planned deforestation over the baseline period for stratum i; ha i 1, 2, 3, … M strata t 1, 2, 3, … t * years elapsed since the projected start of the REDD project activity

Table 66. NewRi,t calculation

Year	ha	ha	ha

	Aplanned,i,t	WoPRi,t	NewRi,t
2011	2,949	2,949	0
2012	2,840	2,840	0
2013	2,604	2,604	0
2014	2,722	2,722	0
2015	2,336	2,336	0
2016	2,943	2,943	0
July/2017	2,404	2,404	0
Total	**18,799**	**18,799**	**0**

STEP 3: Monitor all areas deforested by baseline agent of deforestation through the years in which planned deforestation was forecast to occur

As required by VMD0009 v1.0, all areas deforested by the baseline agent of deforestation should be monitored. Areas of deforestation may be anywhere in the host country. There is no requirement to track international leakage.

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

Where:

$LKA_{planned,i,t}$ The area of activity shifting leakage in stratum i at time t; ha

$NewR_{i,t}$ New calculated forest clearance by the baseline agent of the planned deforestation in stratum i at time t where no leakage is occurring; ha

AdefLK,i,t The total area of deforestation by the baseline agent of the planned deforestation in stratum i at time, t; ha

i 1, 2, 3, … M strata

t 1, 2, 3, … t * years elapsed since the start of the REDD project activity

Activity-shifting leakage was monitored by tracking forest cover change across all lands outside of the project area owned or under the management of CBNS ($A_{defLK,i,t}$), using land cover / land change data provided by MapBiomas. The properties that were monitored are:

- Rio Capim Complex;
- Property Jataituba: CBNS managed this property until 2011. This property belongs to the “Martins Agropecuária S/A”;

- Property ABC: CBNS managed this property until 2014. This property belongs to the “ABC Agropecuária Brasil Norte S.A. Prod. e Exp”.

These areas were monitored to assess whether there was leakage of planned deforestation from CBNS to other areas under its management, that is, if, due to the non-occurrence of the suppression plan in the project area, the company would choose to carry out the planned suppression in another area.

In the Rio Capim Complex, 82.4 hectares of deforestation were identified in the monitored period. The causes of these deforestation are uncertain but judging by the pattern identified by the satellite images, they seem to have occurred due to the edge effect of previously open areas (infrastructure regions or close to pastures inside or next to complex border), that is, they did not occur due to a suppression plan, because of that these deforestations will not be considered leakage. Furthermore, applying the “Tool for testing significance of GHG emissions in A/R CDM project activities, version 1.0”, emissions from this deforestation are insignificant as they represent less than 5% of project emissions.

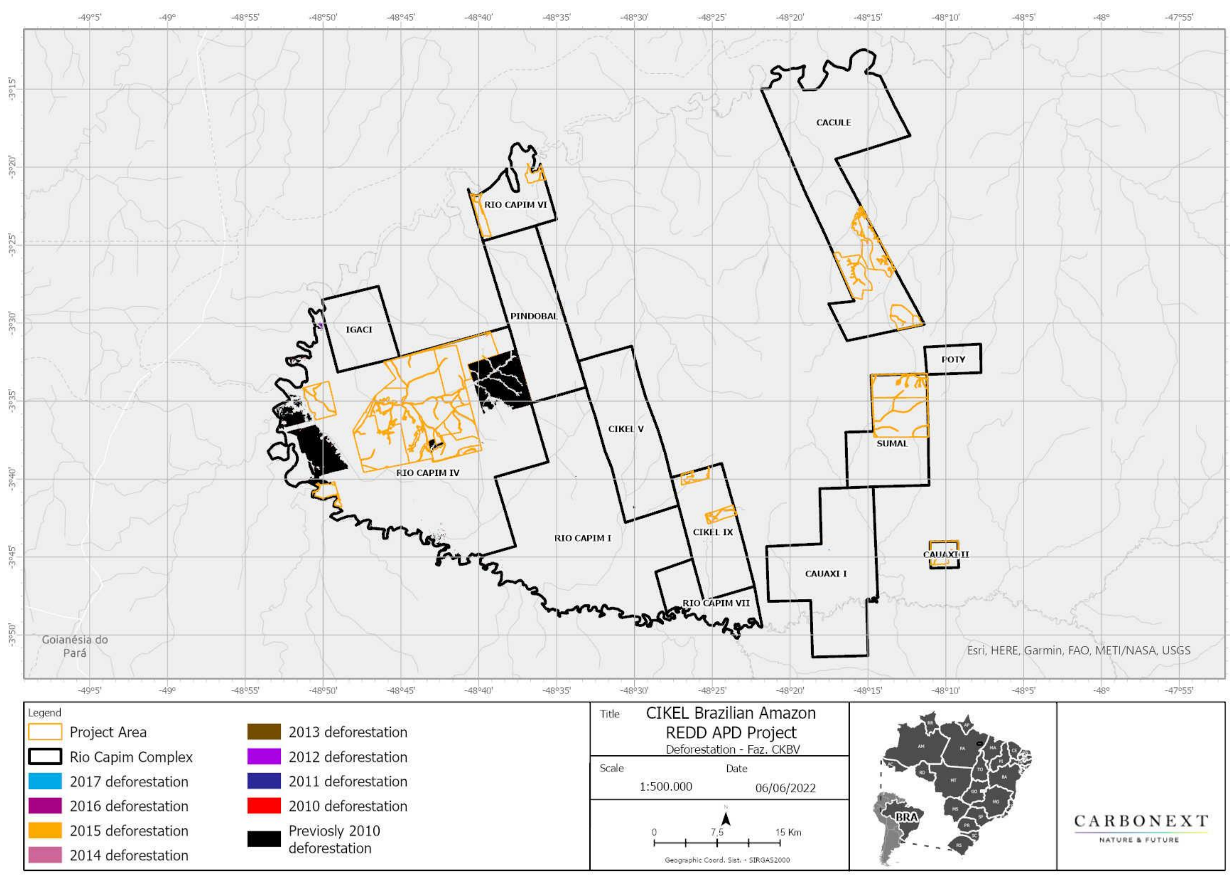


Figure 23: Deforestation map on Rio Capim Complex.

In the property ABC, between July/2010 – 2014 it was identified 1.902,73 hectares of deforestation, and in the property Martins it was identified 114.88 hectares between July/2010 and 2011, totalizing 2.017,61 hectares of deforestation.

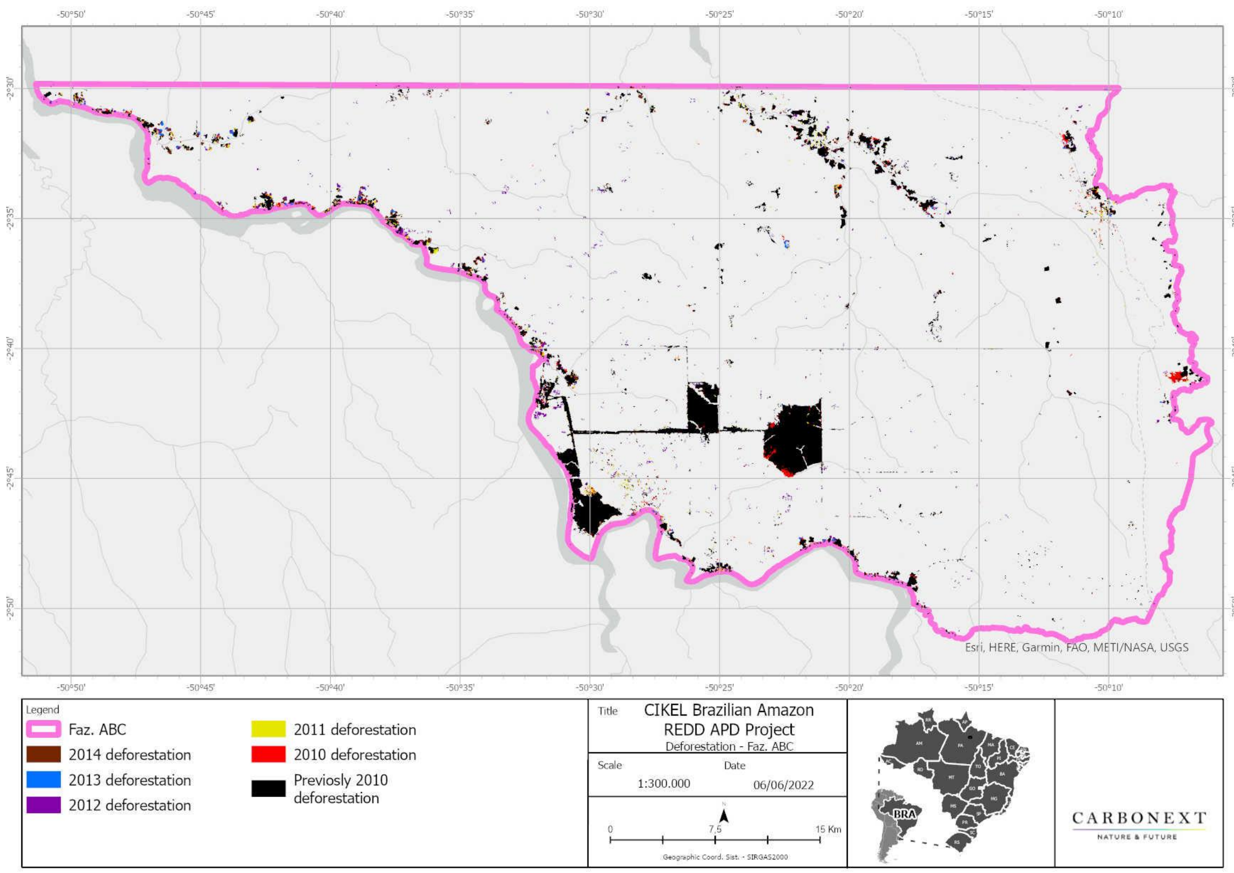


Figure 24: Deforestation map on ABC farm.

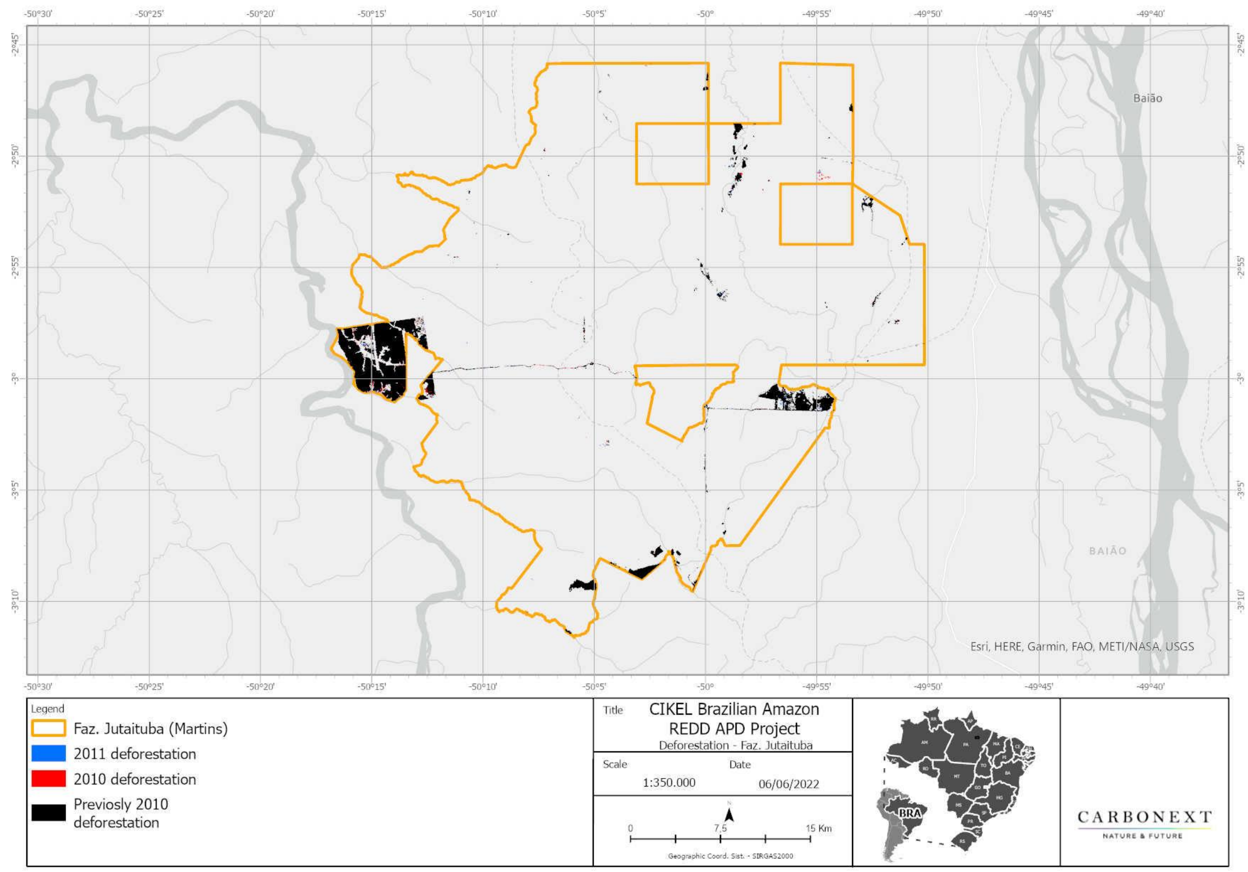


Figure 25: Deforestation map on Jataituba farm.

Considering the pattern of deforestation, it is noted that they do not originate from planned deforestation. The deforestations detected are next to rivers, have a disordered pattern and are relatively small areas (the average size is 0.4 ha), which indicates that they are more associated with the local community small scale activities, such as opening and maintenance of family swiddens than forest management activities. Thus, deforestation on these properties was not attributed to leakage from the Cikel REDD project.

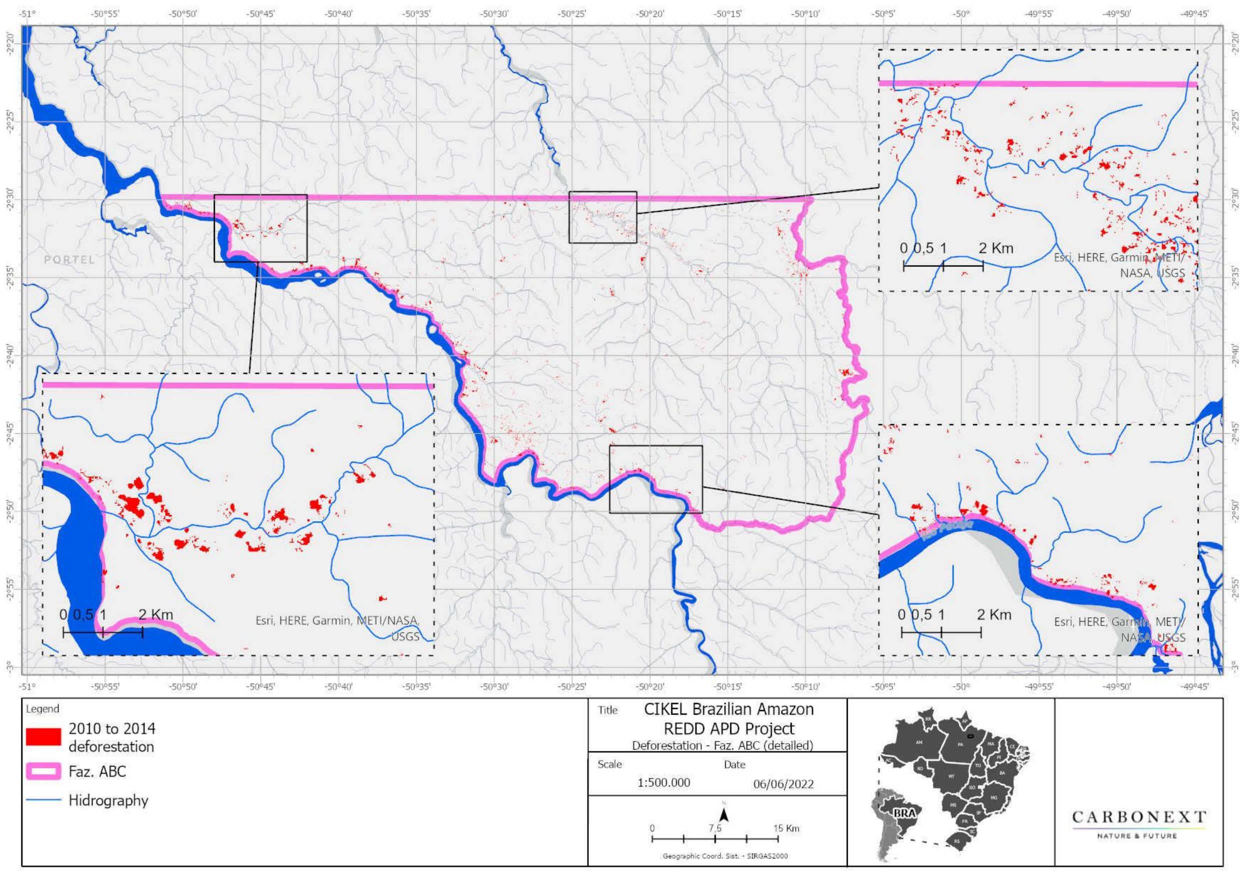


Figure 26: Detailed map on ABC farm showing the deforestation size and location pattern.

Table 67: Data and Parameters Monitored for Leakage Shifting.

Parameter	Description	Monitored Value (July/2010-July/2010)
$A_{defLK,i,t}$	The total area of deforestation by the baseline agent of the planned deforestation in stratum *i* at time, *t*	0 ha
$\Delta C_{BSL,i}$	Net carbon stock changes in all pools in baseline stratum *I;* sourced from mean forest carbon stock estimates from forest carbon inventory of project area for equivalent strata in area of activity shifting leakage	0 tCO_2-e ha^{-1}

To calculate the net greenhouse gas emissions due to activity shifting leakage (ΔCLK-AS,planned), the formula 01 from the VMD0009 v1.0 is applied:

(01)

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

Where:

ΔCLK-AS,planned Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation; t CO2-e

LKAplanned,i,t The area of activity shifting leakage in stratum i at time t; ha

ΔCBSL,i Net carbon stock changes in all pools in baseline stratum i; t CO2-e ha-1

GHGLK,E,i,t Greenhouse gas emissions as a result of leakage of avoided deforestation activities in stratum i in year t; t CO2-e

LKpeat,t Net greenhouse gas emissions due to leakage to peatlands as a result of implementation of a planned deforestation project at time t; t CO2-e

i 1, 2, 3, … M strata

t 1, 2, 3, … t* years elapsed since the start of the REDD project activity

LKpeat,t is not applicable because there is no peatland in the context of the project. GHGLK,E,is considered zero (0) because there were no deforested leakage area ($LKA_{planned,i,t}$ = 0), hence, there were no non-CO_2 emissions from biomass burning. Moreover, CBNS does not practice fertilizer application on any of the lands under its management.

Table 68: Leakage shifting in the monitoring period.

Year	ΔCBSL $t\ CO_{2\text{-}e}\ ha^{-1}$	$LKA_{planned,i,t}$ (ha)	$\Delta C_{LK\text{-}AS,planned}$ $t\ CO_{2\text{-}e}$
July/2010	642,12	0	0
2011	642,12	0	0
2012	642,12	0	0
2013	642,12	0	0
2014	642,12	0	0
2015	642,12	0	0
2016	642,12	0	0
July/2017	642,12	0	0

5.3.2 Market Leakage

Market leakage is calculated by applying module VMD0011 LK-ME v1.0. In this monitoring period, leakage due to market effects considered decreased timber harvest and decreased harvest of fuelwood and charcoal sold into regional and/or national market.

As described in the deviation 3.2.2.7 Market Leakage, during the conception of the PD, the main market for the wood explored by CBNS was international, so it was not necessary to monitor the emissions due to market- effects leakage through decreased timber harvest (LKMarketEffects,timber), only the emissions from decreased harvest of fuelwood and charcoal (LKMarketEffects,FW/C) was considered. However, after 2011 the company started selling the wood to the domestic market due to commercial reasons, so it is necessary to calculate the LKMarketEffects,timber for this monitoring period.

5.3.2.1 Market-Effects Leakage Through Decreased Timber Harvest

Total GHG emissions due to market-effects leakage through decreased timber harvest is equal to the summed emissions from timber harvest in the baseline case potentially displaced times a leakage factor:

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

Where:

$LK_{MarketEffects,Timber}$	Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO_2-e
LF_{Me}	Leakage factor for market-effects calculations; dimensionless
$AL_{T,i}$	Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO_2-e
i	*1,2,3,…M strata*

The leakage factor (LF_{ME}) is defined comparing the proportion of total biomass in commercial species that is merchantable (PMP) with the mean proportion of total biomass that is merchantable for each forest type (PML).

PMP calculation: PMP parameter was calculated from data measured on the forest inventory. Within each stratum, the summed merchantable biomass (DBH > 30cm) was divided by the summed total aboveground tree biomass. The weighted average of the two strata was calculated to obtain the parameter. The value obtained is 0.63.

PML calculation: The PML parameter was obtained from the literature by deduction from the Volume Expansion Factor (VEF) parameter for dense forest in the Legal Amazon. The VEF value presented by Brown, S., Lugo, A.E., 1992[56] for dense forest in the Legal Amazon is 1.25. From the PML=1/VEF deduction, the value obtained for the PML parameter is 0.8.

LF_{ME} calculation: Since the PML value (0.8) is 27% greater than PMP value (0.63), the leakage factor (LF_{ME}) was adopted as 0.2, as established in the table 1 of VMD0011 LK-ME v1.0 module:

PML_{FT} is equal (± 15%) to PMP_i	LF_{ME} = 0.4
PML_{FT} is > 15% less than PMP_i	LF_{ME} = 0.7
PML_{FT} is > 15% greater than PMP_i	LF_{ME} = 0.2

Figure 27: Deductions Factors as defined in table 1 of VMD0011 LK-ME v1.0 module.

[56] Brown, Sandra & Lugo, Ariel. (1992). Aboveground biomass estimates for tropical moist forest of the Brazilian amazon. Interciencia.

The following table summarizes the parameters applied on this monitoring period for market-effects leakage through decreased timber harvest.

Table 69: Parameters Applied.

Parameter	Value	Unit
LF_{ME}	0.20	Dimensionless
PML_{FT}	0.80	Dimensionless
PMP_{i}	0.67	Dimensionless

$AL_{T,i}$ calculation: The total emissions from timber harvest in the baseline case potentially displaced through implementation of carbon project is estimated as follows:

$$(3)\quad AL_{T,i} = \sum_{t=1}^{t}(C_{BSL,XBT,i,t})$$

Where:

$AL_{T,i}$ — Summed emissions from timber harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO_2-e

$C_{BSL,XBT,i,t}$ — Carbon emission due to displaced timber harvests in the baseline scenario in stratum i in time t; t CO_2-e

i — *1,2,3,…M strata*

t — 1, 2, 3, … t years elapsed since the projected start of the REDD project activity

$C_{BSL,XBT,i,T}$ calculation: The carbon emission due to the displaced logging has two components: the biomass carbon of the extracted timber and the biomass carbon in the forest damaged in the process of timber extraction:

$$(4)\quad C_{BSL,XBT,I,T} = ([V_{BSL,XE,i,t} * D_{mn} * CF] + [V_{BSL,XE,I,t} * LDF] + [V_{BSL,XE,I,t} * LIF]) * \frac{44}{12}$$

Where:

$C_{BSL,XBT,i,t}$ — Carbon emission due to displaced timber harvests in the baseline scenario in stratum i in time t; t CO_2-e

$V_{BSL,XE,I,t}$ — Volume of timber projected to be extracted from within the project boundary during the baseline in stratum i at time t; m^3

D_{mn} — Mean wood density of commercially harvested species; t d.m.m^{-3}

CF	Carbon fraction of biomass for commercially harvested species j; t C td.m.$^{-1}$
LDF	Logging damage factor; t C m^{-3} (default 0.53 t C m^{-3} for broadleaf and mixed forests)
LIF	Logging infrastructure factor; t C m^{-3} (default 0.29 t C m^{-3})
i	*1,2,3,…M strata*
t	1, 2, 3, … t years elapsed since the projected start of the REDD project activity

D_{mn} value applied is the validated data for the project, which represents the average basic wood density of the Forest Products Laboratory (LPF) of the Brazilian Forest Service database. LDF and LIF parameters were obtained from VMD0011 v1.0, and CF parameter from literature (IPCC, 2006) (Table 70).

Table 70: Parameters Applied.

Parameter	Value	Unit
D_{mn}	0.65	t/m^3
CF	0.47	Dimensionless
LDF	0.53	tC/m^3
LIF	0.29	tC/m^3

Total GHG emissions due to market-effects leakage through decreased timber harvest ($LK_{MarketEffects,timber}$) is presented in table below:

Table 71: Ex post calculations of market leakage applying equation 5 from module LK-ME v1.0 (Timber harvest).

Year	V_{BSL} m^3		V_{BSL} * D_{mn} * CF		V_{BSL} * LDF		V_{BSL} * LIF			44/12		$C_{BSL,XBT,i,t}$ tCO_2
2011	90,676	(	27,702	+	48,058	+	26,296	)	*	3.67	=	**374,204.84**
2012	63,938	(	19,533	+	33,887	+	18,542	)	*	3.67	=	**263,861.36**
2013	99,242	(	30,319	+	52,598	+	28,780	)	*	3.67	=	**409,556.73**
2014	134,437	(	41,071	+	71,252	+	38,987	)	*	3.67	=	**554,800.42**
2015	103,080	(	31,491	+	54,632	+	29,893	)	*	3.67	=	**425,392.09**
2016	149,643	(	45,716	+	79,311	+	43,396	)	*	3.67	=	**617,550.51**
2017	107,660	(	32,890	+	57,060	+	31,221	)	*	3.67	=	**444,293.66**
TOTAL	748,676		228,720		396,798		217,116					3,089,660

Applying the formula 03 above, the ALT obtained for each year is:

Table 72. ALT calculation

Year	$C_{BSL,XBT,i,t}$	ALT
	tCO2	tCO2
2011	374,205	374,205
2012	263,861	263,861
2013	409,557	409,557
2014	554,800	554,800
2015	425,392	425,392
2016	617,551	617,551
July/2017	444,294	444,294
Total	3,089,660	3,089,660

Applying the formula 02 from VMD0011 v1.0, the total GHG emissions due to market- effects leakage through decreased timber harvest was calculated:

Table 73. $LK_{MarketEffects,timber}$ calculation

Year	ALT	LFME	$LK_{MarketEffects,timber}$
	tCO2		tCO2
2011	374,205	0.2	74,841
2012	263,861	0.2	52,772
2013	409,557	0.2	81,911
2014	554,800	0.2	110,960
2015	425,392	0.2	85,078
2016	617,551	0.2	123,510
July/2017	444,294	0.2	88,859
Total	3,089,660		617,932

5.3.2.2 Market Effects Leakage Through Decreased Harvest of Fuelwood and Charcoal Sold into Regional and/or National Markets

For the estimation of market leakage, module VMD0011-LK-ME-v1.0. defines that "*the carbon emission due to displaced harvests is calculated from the volume that would likely be extracted in the baseline scenario minus any fuel wood supplied in the with-project scenario*".

Leakage due to market effects is equal to the emissions from fuelwood or charcoal harvests that are displaced outside the project area multiplied by a leakage factor:

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

Where:

$LK_{MarketEffects,\frac{FW}{C}}$	Total GHG emissions due to market-effects leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets; t CO_2-e
LF_{Me}	Leakage factor for market-effects calculations; dimensionless
$AL_{T,i}$	Summed emissions from fuelwood/charcoal harvests in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO_2-e
i	*1,2,3,…M strata*

<u>LF_{ME} definition:</u> As established in LK-ME v1.0, LF_{ME} is equal to 0.4 for fuel wood/charcoal in all circumstances.

<u>$AL_{FW/C,i}$ calculation:</u> The total emissions from fuelwood/charcoal harvests in the baseline case potentially displaced through implementation of carbon volume is estimated as follows:

(6) $AL_{FW/C,i} = \sum_{t=1}^{t}\left(C_{BSL,XBFWC,i,t}\right)$

Where:

$AL_{FW/C,i}$	Summed emissions from fuelwood/charcoal harvest in stratum i in the baseline case potentially displaced through implementation of carbon project; t CO_2-e
$C_{BSL,XBFWC,i,t}$	Carbon emission due to displaced fuelwood/charcoal harvests in the baseline scenario in stratum i in time t; t CO_2-e
i	*1,2,3,…M strata*
t	1, 2, 3, … t years elapsed since the projected start of the REDD project activity

<u>$C_{BSL,XBFWC,i,T}$ calculation:</u> In order to determine the parameter Likely carbon emission due to displaced fuelwood/charcoal harvests in the baseline scenario ($C_{BSL,XBFWC,i,t}$), the main monitored parameters are annual volume of fuelwood harvested from the project area ($FG_{LP,t}$), and Average projected annual volume of fuelwood to be gathered in the project area in the baseline scenario ($FG_{BSL,t}$) is also relevant, as defined by the following equation:

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

Where:

$C_{BSL,XBFWC,i,t}$	Likely carbon emission due to displaced fuelwood/charcoal harvests in the baseline scenario in stratum *i* at time *t*; t CO_2-e
$FG_{BSL,i,t}$	Average projected annual volume of fuelwood to be gathered in the project area in the baseline scenario in stratum *i* at time *t*; m^3 yr^{-1}
$FG_{LP,i,t}$	Volume of fuelwood gathered in the project area and in areas designated by the project for leakage prevention (i.e., fuelwood plantations) according to monitoring results in stratum *i* at time *t*; m^3 yr^{-1}
D_{mn}	Mean wood density of commercially harvested species; t d.m.m^{-3}
CF	Carbon fraction of biomass for commercially harvested species *j*; t C t^{-1}d.m.
i	*1,2,3,…M_B strata*
t	1, 2, 3, … *t** years elapsed since the projected start of the REDD project activity

$FG_{BSL,I,t}$ calculation: The values of $FG_{BSL,I,t}$ were obtained for the baseline scenario in suppression plan, as shown below:

Table 74: Wood volumes extracted in the baseline potentially subject to market leakage (FGBSL,i,t)

Year	Forest area	D%planned,i,t * Aplanned,i,t ha	FOD (ha)	FS (ha)	Sawlog m^3	Residues (bolts and firewood) ($FG_{BSLi,t}$) m^3
2011	Rio Capim	2,951	2,718	232	149,945	819,095
2012	Rio Capim	2,839	27	2,813	144,388	788,737
2013	Rio Capim	2,592	170	2,434	132,380	723,142
2014	Caculé	2,726	2,722	0	138,374	755,885
2015	Cauaxi	2,350	730	1,606	118,762	648,754
2016	Sumal	2,944	2,943	0	149,643	817,442
2017	Caculé, Sumal	2,392	2,404	0	122,235	667,722
TOTAL		**18,795**	**11,714**	**7,085**	**955,726**	**5,220,777**

***$FG_{LP,t}$* calculation:** *$FG_{LP,t}$* parameter was calculated from actual information of residues exploitation within Project Area, based in information available in AUTEFs (Authorization for Forestry Exploration), issued by SEMAS-PA (Secretariat for the Environment and Sustainability), as shown in the following table (Table 75).

Table 75: Fuelwood volumes harvested in the project area over the monitoring period through sustainable forest management (FG_{LP},t).

Year	Harvest Area (ha)	Volume of residues extracted (m^3) FG_{LP}
2011	2,705	108,181
2012	2,727	121
2013	1,193	49,706
2014	218	5,609
2015	634	2,170
2016	0	0
2017	538	15,934
TOTAL	8,015	181,722

D_{mn} value applied is the validated data for the project, which represents the average basic wood density of the Forest Products Laboratory (LPF) of the Brazilian Forest Service database.

The following table summarizes the parameters applied on this monitoring period for market-effects leakage through decreased fuelwood or charcoal harvest.

Table 76: Parameters Applied.

Parameter	Value	Unit
LF_{ME}	0.40	Dimensionless
Dmn	0.65	t/m^3
CF	0.47	Dimensionless

The carbon emission due to displaced harvests is calculated from the volume that would likely be extracted in the baseline scenario minus any fuel wood supplied in the with-project scenario, as set by the equation 7 from VMD0011 v1.0:

Table 77: $C_{BSL,XBFWC}$ calculation (Equation 07 from VMD0011 v1.0)

	(FG_{BSL}* Dmn * CF)			-	**(FG_{LP}* Dmn * CF)**			*	
Year	(FG_{BSL}	D_{mn}	CF)		(FG_{LP}	D_{mn}	CF)	44/12	$C_{BSL,XBFWC,i,t}$
	m^3 yr^{-1}	g/cm^3			m^3	g/cm^3			tCO2e
2011	819,095	0.65	0.47		108,181	0.65	0.47	3.67	796,342
2012	788,737	0.65	0.47		121	0.65	0.47	3.67	883,381
2013	723,142	0.65	0.47		49,706	0.65	0.47	3.67	754,360
2014	755,885	0.65	0.47		5,609	0.65	0.47	3.67	840,434
2015	648,754	0.65	0.47		2,170	0.65	0.47	3.67	724,282
2016	817,442	0.65	0.47		0	0.65	0.47	3.67	915,672
2017	667,722	0.65	0.47		15,934	0.65	0.47	3.67	730,112
TOTAL	5,220,777				181,722				5,644,582

According to the formula 6 from the module LM-ME 1.0, the summed emissions from fuelwood/charcoal harvests are:

Table 78. $AL_{FW/C}$ calculation

Year	$C_{BSL,XBFWC,i,t}$	$AL_{FW/C}$
	tCO2e	$tCO_2{}^e$
2011	796,342	796,342
2012	883,381	883,381
2013	754,360	754,360
2014	840,434	840,434
2015	724,282	724,282
2016	915,672	915,672
2017	730,112	730,112
TOTAL	**5,644,582**	**5,644,582**

The total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into national markets are then calculated according to the formula 05 from the module LK-ME v1.0 described above:

Ex post calculations of market leakage applying module LK-ME v1.0 (Harvest of Fuelwood and Charcoal).

Year	$AL_{FW/C}$	LF_{ME}	$LK_{MarketEffects,FW/C}$
	$tCO_2{}^e$		$tCO_2{}^e$
2011	796,342	0.4	318,537
2012	883,381	0.4	353,352
2013	754,360	0.4	301,744
2014	840,434	0.4	336,174
2015	724,282	0.4	289,713
2016	915,672	0.4	366,269
2017	730,112	0.4	292,045
TOTAL	**5,644,582**		**2,257,833**

5.3.3 Market Leakage Emissions

The total leakage due to market effects is equal to the sum of market effects leakage through decreased timber harvest and decreased harvest for fuelwood / charcoal production, as described in the formula 01 from VMD0011 v1.0:

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

(01)

Where:

$\Delta CLK\text{-}ME$ Net greenhouse gas emissions due to market- effects leakage; t CO2-e

$LK_{MarketEffects,timber}$ Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO2-e

$LK_{MarketEffects,FW/C}$ Total GHG emissions due to market leakage through decreased harvest of fuelwood and charcoal sold into regional and/or national markets; t CO_2-e

Therefore, the emissions due to market -effects leakage are 2,875,765 tCO_2e for this monitoring period, as described in the table below.

Table 79. Net greenhouse gas emissions due to market- effects leakage (ΔCLK-ME)

Year	LKMarketEffects,FW/C	LKMarketEffects,timber	ΔCLK-ME
	tCO_2e	tCO_2e	tCO_2e
2011	318,537	74,841	393,378
2012	353,352	52,772	406,125
2013	301,744	81,911	383,655
2014	336,174	110,960	447,134
2015	289,713	85,078	374,791
2016	366,269	123,510	489,779
2017	292,045	88,859	380,903
TOTAL	**2,257,833**	**617,932**	**2,875,765**

5.3.4 Total Leakage Emissions (ΔCLK)

The net greenhouse gas emissions due to leakage is calculated as described in the formula 03 from VM0007 v1.0:

$$\Delta C_{LK} = \Delta C_{LK-AS,planned} + \Delta C_{LK-AS,unplanned} + \Delta C_{LK-AS,degrad-FW/C} + \Delta C_{LK-ME}$$

(3)

Where:

ΔCLK Net greenhouse gas emissions due to leakage; t CO2-e

$\Delta CLK\text{-}AS,planned$ Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation; t CO2-e

$\Delta CLK\text{-}AS,unplanned$ Net greenhouse gas emissions due to activity shifting leakage for projects preventing unplanned deforestation; t CO2-e

$\Delta CLK\text{-}ME$ Net greenhouse gas emissions due to market-effects leakage; t CO2-e

$\Delta CLK\text{-}AS,degrad\text{-}FW/C$ Net greenhouse gas emissions due to activity shifting leakage for degradation caused by extraction of wood for fuel; t CO2-e

So, for the context of the project, net greenhouse gas emissions due to leakage (ΔCLK) is calculated by adding the ΔCLK-AS,planned and ΔCLK-ME, as show in the table below (Table 80).

Table 80. Net greenhouse gas emissions due to leakage (ΔCLK)

Year	ΔCLK-ME	ΔCLK-AS,planned	ΔCLK
	tCO2	tCO2	tCO2
2011	393,378	0	393,378
2012	406,125	0	406,125
2013	383,655	0	383,655
2014	447,134	0	447,134
2015	374,791	0	374,791
2016	489,779	0	489,779
2017	380,903	0	380,903
TOTAL	**2,875,765**	**0**	**2,875,765**

5.4 Net GHG Emission Reductions and Removals

As described in the VM0007 v1.0, the total net greenhouse gas emissions reductions of the REDD project activity are calculated as:

(1) $$C_{REDD,t} = \Delta C_{BSL} - \Delta C_P - \Delta C_{LK}$$

Where:

CREDD,t Total net greenhouse emission reductions at time t; t CO2-e

ΔCBSL Net greenhouse gas emissions under the baseline scenario; t CO2-e

ΔCP Net greenhouse gas emissions within the project area under the project scenario; t CO2-e

ΔCLK Net greenhouse gas emissions due to leakage; t CO2-e

Considering the values for ΔCBSL, ΔCP and ΔCLK detailed in Table 39, Table 64 and Table 80, respectively, the net greenhouse gas emissions reductions (CREDD,t) of the Cikel REDD Project for this monitoring period is 5,186,724tCO_2-e.

Table 81. Net greenhouse gas emissions reductions (CREDD,t) of the Cikel REDD Project

Year	ΔCBSL	ΔCP	ΔCLK-ME	CREDD,t
	tCO2	tCO2	tCO2	tCO2
2010	-8,980	150,729	0	-159,709
2011	1,721,787	323,366	393,378	1,005,043
2012	930,686	372,336	406,125	152,226
2013	880,463	156,078	383,655	340,730
2014	1,616,322	20,483	447,134	1,148,705
2015	924,796	75,632	374,791	474,373
2016	1,733,120	0	489,779	1,243,341
2017	1,431,904	68,984	380,903	982,016
TOTAL	9,230,098	1,167,608	2,875,765	5,186,724

After reviewing the non-permanence risk, the buffer for the current monitoring period is 10%, compared to 15.5% in the PD. The calculation of the VCS buffer is equal to the net emissions in the baseline (ΔCBSL) minus emissions from fossil fuel use and fertilizer use minus the net emissions in the project case (ΔCP). Leakage emissions do not factor into the buffer calculations (ΔCLK). Since emissions from fossil fuels and fertilizes are not considered in the project, the buffer is ΔCBSL minus ΔCP only:

Table 82: Buffer calculation for this monitoring period

Year	ΔCBSL	ΔCP	Buffer
	tCO2	tCO2	tCO2
2010	-8,980	150,729	0
2011	1,721,787	323,366	139,842
2012	930,686	372,336	55,835
2013	880,463	156,078	72,439
2014	1,616,322	20,483	159,584
2015	924,796	75,632	84,916
2016	1,733,120	0	173,312
2017	1,431,904	68,984	136,292
TOTAL	9,230,098	1,167,608	822,220

Due to the reduction of the buffer for this monitoring period, there was a reduction of 364,455 tCO2-e allocated to the buffer (Table 83).

Table 83: Ex-ante versus ex-post buffer comparison[57]

Year	VCU Buffer		
	Ex-ante (PD) 15.50%	Ex-post (MR2) 10%	Diference
July/2010[1]	-	0	-
2011	113,497	139,842	-26,345
2012	139,539	55,835	83,704
2013	127,372	72,439	54,933
2014	238,250	159,584	78,666
2015	126,234	84,916	41,318
2016	250,057	173,312	76,745
2017	191,726	136,292	55,434
TOTAL	**1,186,675**	**822,220**	**364,455**

[1] The buffer referring to the year of 2010 has already been fully contemplated in MR1

To estimate the number of Verified Carbon Units (VCUs) for this monitoring period, as set in VM0007 v1.0, the buffer is discounted from the net GHG emissions reductions of the project (CREDD,t).

Table 84: Eligible VCUs from this monitoring period

Year	CREDD,t tCO2e	Buffer tCO2e	VCU
2010	-159,709	0	-159,709
2011	1,005,043	139,842	865,201
2012	152,226	55,835	96,391
2013	340,730	72,439	268,291
2014	1,148,705	159,584	989,121
2015	474,373	84,916	389,456
2016	1,243,341	173,312	1,070,029
2017	982,016	136,292	845,724
TOTAL	**5,186,724**	**822,220**	**4,364,505**

[57] Positive values in column "Difference" mean that Ex-post (MR2) numbers are greater than Ex-ante (PD). Negative values in column "Difference" mean that Ex-post (MR2) numbers are less than Ex-ante (PD).

In the table below (Table 85) there is a compilation of emissions and removals foreseen ex-ante and ex-post.

Table 85: Estimated ex-ante GHG emission reductions and removals and the achieved emission reductions and removals for this monitoring period (before any deductions for buffer credits)[58]

Year	*Ex-ante emissions reductions/removals*	*Achieved emissions reductions/removals*	*Difference emissions reductions/removals*
19/July/2010	0[1]	-159,709	-159,709
2011	449,118	1,005,043	555,925
2012	546,845	152,226	-394,619
2013	497,742	340,730	-157,012
2014	1,198,410	1,148,705	-49,705
2015	523,725	474,373	-49,352
2016	1,247,001	1,243,341	-3,660
18/July/2017	937,756	982,016	44,260
Total	**5,400,598**	**5,186,724**	**-213,873**

[1]The APD emissions for the year of 2010 were considered in MR1

The main differences related to baseline emissions and sequestration are:

- The rationale for calculating the carbon sequestration of the offset planting was corrected: rationale explained in sections 3.2.2.3 and 5.1.9
- Inclusion of post-deforestation stock: explained in sections 3.2.2.8 and 5.1.5

The main differences related to project emissions are:

- Non-inclusion of the residue volume in the V_{ext} parameter used in formula 10 of VMD0015 v2.0, as the waste is included in the LDF parameter: rationale explained in section 3.2.2.6 and 5.2
- Larger area and volume of FSC certified forest management in the MR2 than expected in the PD: explained in section 5.2.2.2.

The main differences related to leakage emissions are:

- Inclusion of Market Effects Leakage Through Decreased Timber: explained in section 3.2.2.7 and 5.3.

[58] Positive values in column "Difference" mean that Ex-post (MR2) numbers are greater than Ex-ante (PD). Negative values in column "Difference" mean that Ex-post (MR2) numbers are less than Ex-ante (PD).

Table 86: Net GHG Emission Reductions and Removals of this monitoring report

	ΔCBSL	ΔCP	ΔCLK	CREDD,t		VCU
Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation	VCUs eligible for issuance
2010	-8,980	150,729	0	-159,709	0	-159,709
2011	1,721,787	323,366	393,378	1,005,043	139,842	865,201
2012	930,686	372,336	406,125	152,226	55,835	96,391
2013	880,463	156,078	383,655	340,730	72,439	268,291
2014	1,616,322	20,483	447,134	1,148,705	159,584	989,121
2015	924,796	75,632	374,791	474,373	84,916	389,456
2016	1,733,120	0	489,779	1,243,341	173,312	1,070,029
2017	1,431,904	68,984	380,903	982,016	136,292	845,724
TOTAL	9,230,098	1,167,608	2,875,765	5,186,724	822,220	4,364,505

[1]In the year 2010, the emissions referring to the area that would be suppressed were fully considered in the previous monitoring report (period from July 19,2007 to July 18,2010), i.e., all emissions from the baseline of that year were already accounted for previously. However, due to the adjustment in the carbon sequestration rate of the offset planting (section 3.2.2.3), the proportional carbon sequestration from July 19, 2010 to December 31, 2010 was accounted for (the proportional of the year 2010 that is contemplated in this monitoring period). Thus, the -8.980 tCO2e refers only to the carbon sequestration of the offset planting, which is discounted from the baseline and therefore the value is shown negative.

[2] Sustainable Forest management planned for 2010 was not included in the previous monitoring report, so the emissions of this activity were calculated in its totality in this monitoring report. As the baseline emissions foreseen for 2010 were fully considered in the previous report (explanation above), in this monitoring report the year 2010 Net GHG is negative because it only has project emissions to account for.

APPENDIX I: FAUNA INVENTORY

ID	Common Name	Genus	Species	Group	IUCN[59]	ICMBIO[60]
1	Cutia	*Dasyprocta*	*Dasyprocta sp.*	Mammal	-	-
2	Macaco Prego	*Sapajus*	*Sapajus sp.*	Mammal	-	-
3	Nambu Pé Vermelho	*Crypturellus*	*Crypturellus parvirostris*	Bird	-	Least Concerned
4	Jacamim	*Psophia*	*Psophia sp.*	Bird	-	-
5	Nambu Pé De Caraca	*Crypturellus*	*Crypturellus tataupa*	Bird	-	Least Concerned
6	Mutum	*Pauxi*	*Pauxi sp.*	Bird	-	-
7	Anta	*Tapirus*	*Tapirus terrestris*	Mammal	Vulnerable	Vulnerable
8	Arara Vermelha	*Ara*	*Ara chloropterus*	Bird	-	Near Threatened
9	Veado Fuboca	*Mazama*	*Mazama nemorivaga*	Mammal	-	Data Deficient
10	Guariba	*Alouatta*	*Alouatta guariba*	Mammal	Vulnerable	-
11	Nambu Tona	*Tinamus*	*Tinamus tao*	Bird	Vulnerable	Vulnerable
12	Quati	*Nasua*	*Nasua nasua*	Mammal	-	Least Concerned
13	Ararajuba	*Guaruba*	*Guaruba guarouba*	Bird	Vulnerable	Vulnerable
14	Caititu	*Pecari*	*Pecari tajacu*	Mammal	-	Least Concerned
15	Nambú Gogó De F.	*Crypturellus*	*Crypturellus sp.*	Bird	-	-
16	Cutia Bunda Preta	*Dasyprocta*	*Dasyprocta sp*	Mammal	-	-
17	Porcão/Queixada	*Tayassu*	*Tayassu pecari*	Mammal	Vulnerable	Vulnerable
18	Jabuti	*Chelonoidis*	*Chelonoidis sp.*	Reptile	-	-
19	Veado Vermelho	*Mazama*	*Mazama sp.*	Mammal	-	-
20	Macaco Sauim	*Callithrix*	*Callithrix sp.*	Mammal	-	-
21	Onça	*Panthera*	*Panthera onca*	Mammal	Near Threatened	Vulnerable
22	Jabuti Amarelo	*Chelonoidis*	*Chelonoidis denticulatus*	Reptile	-	-
23	Jabuti Vermelho	*Chelonoidis*	*Chelonoidis carbonarius*	Reptile	-	-
24	Veado	*Mazama*	*Mazama sp.*	Mammal	-	-
25	Jacú	*Penelope*	*Penelope sp*	Bird	-	-
26	Jacú Cabeça B.	*Penelope*	*Penelope obscura*	Bird	-	Least Concerned
27	Cancão	*Ibycter*	*Ibycter amercianus*	Bird	-	-
28	Papagaio	*Amazona*	*Amazona sp.*	Bird	-	-
29	Jacú Porco	*Neomorphus*	*Neomorphus geoffroyi*	Bird	Vulnerable	Vulnerable
30	Tucano	*Ramphastos*	*Ramphastos toco*	Bird	-	Least Concerned
31	Tatu Skili	*Not identified*	*Not identified*	Mammal	-	-
32	Quatipuru	*Sciurillus*	*Sciurillus pusillus*	Mammal	-	Least Concerned
33	Macaco Caiarara	*Cebus*	*Cebus kaapori*	Mammal	Critically Endangered	Critically Endangered
34	Macaco Cuxiú	*Chiropotes*	*Chiropotes satanas*	Mammal	Endangered	Critically Endangered
35	Nambú Peua	*Penelope*	*Penelope superciliaris*	Bird	Near Threatened	Least Concerned
36	Tatú Canastra	*Priodotes*	*Priodotes maximus*	Mammal	-	-
37	Mutúm Castan	*Pauxi*	*Pauxi sp.*	Bird	-	-

[59] https://www.iucnredlist.org/

[60] ICMBIO, 2018. Livro Vermelho. Accessed July 24, 2022.

38	Mambira/Tamanduá-Mirim	*Tamandua*	*Tamandua tetradactyla*	Mammal	-	Least Concerned
39	Arara	*Ara*	*Ara sp.*	Bird	-	-
40	Tucano Peito B.	*Ramphastos*	*Ramphastos tucanus*	Bird	Vulnerable	Least Concerned
41	Papa Mel/Irara	*Eira*	*Eira barbara*	Mammal	-	Least Concerned
42	Gavião Real	*Harpia*	*Harpia harpyjia*	Bird	-	-
43	Quati Verdadeiro	*Not*	*Not identified*	Mammal	-	-
44	Capelão	*Alouatta*	*Alouatta ululata*	Mammal	Endangered	Endangered
45	Nambú	*Crypturellus*	*Crypturellus sp.*	Bird	-	-
46	Tucano Vermelho	*Ramphastos*	*Ramphastos sp.*	Bird	-	-
47	Macaco Cara Br./Macaco-Aranha	*Ateles*	*Ateles marginatus*	Mammal	Endangered	Endangered
48	Jacú P. Verm.	*Penelope*	*Penelope sp*	Bird	-	-
49	Veado Branco	*Mazama*	*Mazama gouazouriba*	Mammal	-	-
50	Onça Parda	*Puma*	*Puma concolor*	Mammal	-	Vulnerable
51	Paca	*Cuniculus*	*Cuniculus paca*	Mammal	-	Least Concerned
52	Macaco Ganguim	*Not identified*	*Not identified*	Mammal	-	-
53	Nambu Pé De Caraca	*Crypturellus*	*Crypturellus sp.*	Bird	-	-
54	Tucado No Peito Lar.	*Ramphastos*	*Ramphastos sp.*	Bird	-	-
55	Nambú Preto	*Crypturellus*	*Crypturellus cinereus*	Bird	-	Least Concerned
56	Nambú Relógio	*Crypturellus*	*Crypturellus strigulosus*	Bird	-	Near Threatened
57	Nambú Urú	*Crypturellus*	*Crypturellus sp.*	Bird	-	-
58	Jabuti Perema	*Rhinoclemmys*	*Rhinoclemmys punctularia*	Reptile	-	Least Concerned
59	Papagaio Muleiro	*Amazona*	*Amazona farinosa*	Bird	Near Threatened	Least Concerned
60	Cutia Bunda Vermelha	*Dasyprocta*	*Dasyprocta sp*	Mammal	-	-
61	Tamanduá Bandeira	*Myrmecophaga*	*Myrmecophaga tridactyla*	Mammal	Vulnerable	Vulnerable
62	Veado Mateiro	*Mazama*	*Mazama americana*	Mammal	-	Data Deficient

APPENDIX II: RESEARCH CARRIED OUT IN PARTNERSHIP WITH UFRA

Lima, M., D., R. 2020. Segregação de Resíduos do Manejo Florestal Sustentável para Otimização da Produção Bioenergética na Amazônia Brasileira. Master's Dissertation. Programa de pós-graduação em ciências florestais. Universidade Federal Rural da Amazônia.

Lima, M., D., R. 2022. Classificação de Resíduos Madeireiros da Amazônia e Carvões Derivados por Espectroscopia no Infravermelho próximo. PhD's Thesis. Universidade Federal de Lavras.

Lima, M., D., R; Patrício, E., P., S; Junior, U., O., B; Assis, M., R; Xavier., C., N; Bufalino., L; Trugilho, P., T; Hein., P., R., G; Protásio, T. 2020a. Logging wastes from sustainable forest management as alternative fuels for thermochemical conversion systems in Brazilian Amazon. Biomass and Bioenergy 140: 105660. DOI: https://doi.org/10.1016/j.biombioe.2020.105660.

Lima, M., D., R; Patrício, E., P., S; Junior, U., O., B; Silva, R., C., C; Bufalino, L., Numazawa, S; Hein, P., Protásio, T. 2020c. Colorimetry as a criterion for segregation of logging wastes from sustainable forest management in the Brazilian Amazon for bioenergy. Renewable Energy 163 (792 – 806). DOI: https://doi.org/10.1016/j.renene.2020.08.078.

Lima, M., D., R; Ramalho, F., M., G; Trugilho, P., F; Bufalino, L; Júnior, A., F., D; Protásio, T. Hein, P., R., G. Classifying waste wood from Amazonian species by near-infrared spectroscopy (NIRS) to improve charcoal production. 2022. Renewable Energy 193 (584 – 594). DOI: https://doi.org/10.1016/j.renene.2022.05.048

Lima, M., D., R; Simetti, R; Assis, M., R; Trugilho, P., F; Carneiro, A., C., O; Bufalino, L; Hein, P., R., G; Protásio, 2020b. Charcoal of logging wastes from sustainable forest management for industrial and domestic uses in the Brazilian Amazonia 142:105804. DOI: https://doi.org/10.1016/j.biombioe.2020.105804.

Moreira, I., A. 2018. Quantificação das Perdas e dos Rendimentos na Carbonização de Resíduos da Exploração Florestal Sustentável na Amazônia. Monograph. Universidade Federal Rural da Amazônia.

Moreira, I., A; Patrício, E., P., S; Lima, M., D., R; Goulart, S., L; Protásio, T. 2019a. Rendimentos gravimétricos da carbonização de resíduos do manejo florestal sustentável na Amazônia. V Fórum Nacional sobre Carvão Vegetal. III Seminário de Energia da Biomassa Florestal. 15 a 16 de maio de 2019.

Moreira, I., A; Patrício, E., P., S; Lima, M., D., R; Trugilho, P., F; Protásio, T. 2019b. Densidade a granel do carvão vegetal de resíduos do manejo florestal sustentável na Amazônia. V Fórum Nacional sobre Carvão Vegetal. III Seminário de Energia da Biomassa Florestal. 15 a 16 de maio de 2019.

Pereira, A. A., Lima, M. D. R., Patrício, E. P. S., Numazawa, S., Goulart, S. L., & Protásio, T. P. (2020). Agrupamento de resíduos madeireiros do manejo florestal sustentável visando à geração de bioenergia. Scientia Forestalis, 48(127), e3157. https://doi.org/10.18671/scifor.v48n127.01.

Protásio, T; Bufalino, L; Silva, M., G; Soares, A., A., V; Trugilho, P., F; Carneiro, A., C., O. 2020. **Valorização de biomassas residuais, provenientes de manejo florestal sustentável, para geração de bioenergia na Amazônia Legal:** Parte 1 - Amostragem, identificação e caracterização dos resíduos florestais provenientes do manejo sustentável da Amazônia. Technical Report. Contract nº2018/193.

Protásio, T; Bufalino, L; Silva, M., G; Soares, A., A., V; Trugilho, P., F; Carneiro, A., C., O. 2021a. **Valorização de biomassas residuais, provenientes de manejo florestal sustentável, para geração de bioenergia na Amazônia Legal:** Parte 2 - A segregação de resíduos madeireiros melhora os índices da carbonização em fornos de alvenaria do tipo "rabo quente". Technical Report nº 2. Contract nº2018/193.

Protásio, T; Bufalino, L; Silva, M., G; Soares, A., A., V; Trugilho, P., F; Carneiro, A., C., O. 2022. **Valorização de biomassas residuais, provenientes de manejo florestal sustentável, para geração de bioenergia na Amazônia Legal:** Parte 3 – Qualidade dos resíduos madeireiros do manejo florestal sustentável e avaliação das propriedades do carvão vegetal. Final Technical Report.

Protásio, T; Goulart, S., S; Soares, A., A., V; Moreira, I., A; Rosário, W., A., S; Lima, M., D., R. 2018. **Quantificação das perdas e dos rendimentos na carbonização de resíduos da exploração sustentável**: 2ª prospecção na unidade de produção de carvão vegetal com fornos de alvenaria do tipo "rabo quente". Technical Report.

Protásio, T; Lima, M., D., R; Patrício, E., P., S; Sousa, E., M; Santos, E., V; Silva, E., R., O. 2021b. **Valorização de biomassas residuais, provenientes de manejo florestal sustentável, para geração de bioenergia na Amazônia Legal:** Parte 3 - Prospecção na unidade de produção de carvão vegetal com fornos de alvenaria do tipo rabo quente. Technical Report nº 3.

Protásio, T; Moreira, I., A; Rosário, W., A., S; Soares, A., A., V; Goulart, S., L. 2017. **Quantificação das perdas e dos rendimentos na carbonização de resíduos da exploração sustentável**: Parte 1- Prospecção inicial na unidade de produção de carvão vegetal com fornos de alvenaria do tipo "rabo quente". Technical Report.

Santos, E., V; Lima, M., D., R; Soares, C., R., A; Patrício, E., P., S; Silva, R., C., C; Protásio, T. 2019b Avaliação colorimétrica dos resíduos madeireiros do manejo florestal visando ao uso bioenergético na Amazônia. Anais do VI EMCA, 15 a 20 de setembro de 2019.

Santos, L., V., R; Silva, E., R., O; Silva, R., C., C; Dias, R., C; Lima, M., D., R; Protásio, T. 2019a. Densidade básica e umidade de espécies amazônicas utilizadas na produção de carvão vegetal. Anais do VI EMCA, 15 a 20 de setembro de 2019.